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Original Article

Universities' Strategic Directions for Advancing Health and Medical Education: A Scenario-Based Qualitative Delphi Study

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ABSTRACT

Background: Higher education, particularly in the field of medical sciences, has always been influenced by ongoing scientific, technological, and social changes. The emergence of new technologies, the expansion of virtual environments, and unforeseen events such as the COVID-19 pandemic have presented universities with fundamental challenges over the past two decades. In order to adapt to this rapidly evolving world, it is essential for institutions to adopt new orientations and implement innovative, entrepreneurial strategies that leverage flexible and technology-enhanced learning methods. This study aimed to develop strategic recommendations for Iranian medical and health education institutions.

Methods: A qualitative Delphi study was conducted in 2020, involving semi-structured interviews with 15 experts across three phases to identify future-oriented directions in medical education, taking into account the challenges posed by the pandemic and its profound effects on educational priorities. In the first phase, an environmental analysis was performed to determine the internal and external factors shaping the future of health education. The second phase focused on forecasting potential trajectories for health education between 2020 and 2030, with the goal of informing possible educational reforms. In the third phase, coherent strategic directions were formulated using structured scenario-building techniques. Thematic content analysis was applied to the interview data, which were analyzed at the levels of statements, components, and categories to extract key themes and insights.

Results: The study showed four possible future scenarios. The first scenario advocates for a transition toward an entrepreneurial and research-oriented academic model addressing real-world challenges. The second focuses on integrating flexible and advanced innovative learning systems. The third scenario reflects a gradual adoption of educational technologies and innovative pedagogies. The fourth envisions a regression to conventional education models, solely foundational knowledge without promoting innovation.

Conclusion: To support future-oriented, innovation-driven health education systems, universities need to continuously monitor global trends and implement strategic planning frameworks that support adaptable and sustainable educational reform.

Keywords: Medical, Education, Health, Internationality, Entrepreneurship, Scenario, Future Studies

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Introduction

Universities have a key role in generating collective impacts for thriving societies (1-3). Similar to other organizations, they are influenced by a wide array of internal and external factors, including leadership and management, organizational structure and strategy, personnel, operational processes, and broader financial, political, social, cultural, national, and international trends. Recent shifts in the expectations of both graduates and employers has resulted in challenges as well as opportunities for educational providers (4). However, this swift transition primarily emphasized the ability to provide content online, rather than leveraging the pedagogical benefits of more sophisticated delivery methods or adopting transformative teaching and learning strategies. This issue is especially significant in developing countries, where challenges such as limited digital infrastructure, lower computer literacy, and insufficient preparedness among both educators and students for advanced, flexible platforms are more pronounced (5, 6).

It is time for educational institutions to now place an increasing emphasis on which curriculum concepts to retain from the pandemic delivery modes and which to cease. This task is likely less difficult than it might have been in the past, as the pandemic has driven educational systems to become more integrated, collaborative, adaptable, and innovative than ever before. Universities are moving from their traditional role, merely the production of knowledge, toward entrepreneurship universities, to transform knowledge and ideas into action (7, 8). This shift is essential because simply imparting knowledge is no longer enough to prepare graduates for a constantly changing post-graduate landscape. For instance, graduates are now expected to possess digital competencies, be workplace-ready, and emerge as innovative leaders capable of driving sustainable change (9). To meet these modern demands, universities must emphasize entrepreneurship, collaboration, research, and development to generate advanced solutions for real-world challenges (7, 8, 10). This educational evolution has been recognized as a priority toward the adaptation of universities to the ever-changing environment to synchronize with global trends to stay competent and competitive (10, 11).

University models can be divided into three distinct categories. Traditional or first-generation universities concentrate exclusively on teaching and learning. Second-generation universities expand their focus to include research alongside teaching and learning. Third-generation, or modern universities, emphasize not only teaching, learning, and research but also integrate entrepreneurship, innovation, and creativity into their core activities (12, 13). For institutions currently classified as first- or second-generation, transitioning to a modern university framework enables them to meet evolving demands, help students address real-world challenges, facilitate knowledge exchange, and develop innovative and creative solutions to contemporary problems. It is essential for universities to prioritize adaptability and creativity, empowering students to market their ideas, foster entrepreneurial spirit, and produce new knowledge through diverse approaches (14, 15). Embedding these principles into academic programs is crucial for universities to effectively produce graduates who are ready for the workforce and entrepreneurship. By adopting a modern approach, universities can also enhance their competitiveness in the global arena, driving social and economic progress (16, 17).

The core problem addressed is the urgent need to transform health and medical education from traditional knowledge-based models to entrepreneurial, innovative, and real-world skill-focused approaches. Current health and medical education often emphasize content delivery over developing critical competencies such as creativity, problem-solving, and adaptability, which are essential for graduates to thrive in rapidly evolving healthcare environments. Although the pandemic hastened the adoption of online learning, this shift largely concentrated on

content transmission instead of advancing teaching methods or enhancing hands-on skill development. Consequently, there is a gap between the capabilities of graduates and the evolving requirements of contemporary healthcare systems, including digital proficiency, interdisciplinary collaboration, and entrepreneurial mindsets (18, 19).

The necessity of transforming health and medical education to emphasize entrepreneurship, creative problem-solving, and real-world skills has become increasingly urgent in today's rapidly evolving healthcare landscape. Traditional education models, which focus primarily on knowledge transmission, no longer suffice to prepare graduates for the complex challenges they will face in their professional careers. Graduates must be equipped not only with theoretical knowledge but also with practical skills such as digital literacy, critical thinking, collaboration, and innovation to thrive in dynamic and interdisciplinary healthcare environments. This shift is essential to enhance graduate employability, enabling them to become job-ready and entrepreneurial leaders capable of driving sustainable social and economic development. Furthermore, the pandemic highlighted both the potential and the limitations of rapid shifts to online education, underscoring the need for pedagogical reforms that go beyond content delivery to foster adaptability and creativity. By aligning curricula with these modern demands, universities can increase their global competitiveness, contribute meaningfully to societal transformation, and address disparities in educational resources, particularly in developing countries. Accordingly, this work is crucial for guiding educational institutions toward a future-oriented model that integrates innovation and entrepreneurship as core components of medical education.

Cultivating academic leadership and methods that encourage critical thinking is essential for adopting a more ecological, system-wide perspective on education. This approach helps establish a strategic framework to boost the competitive edge of universities. It can guide traditional institutions toward a contemporary model by defining clear channels for inputs, processes, outputs, outcomes, and impacts. Given the significance of educational reforms and changes prompted by the recent pandemic, this study evaluated the readiness of Shiraz University of Medical Sciences (SUMS) in Shiraz, Iran, for a new generation, utilizing scenario planning as the analytical method.

This study answers three main questions with a prospective approach:

- Environmental analysis to identify influential factors
- Forecasting the medical and health education
- Formulating strategic directions for improving medical and health education

Methods

Study Design and Setting

This study employed a qualitative approach, using semi-structured interviews with 15 experts across three stages. It was carried out by gathering experts' insights to identify future-oriented directions in medical sciences, taking into account the challenges posed by the pandemic and its significant influence on the future trajectory of education. A two-round Delphi method was used to systematically extract and refine experts' consensus on the topic. The Delphi method offers a repetitive, anonymous procedure that helps progressively clarify experts' opinions, enabling the identification and ranking of the most important influencing factors (20).

Initially, a SWOT analysis—examining Strengths, Weaknesses, Opportunities, and Threats—was performed to evaluate SUMS's internal and external competitive advantages. Following this, scenario planning was utilized to determine strategic pathways for educational development at SUMS between 2020 and 2030 (Figure 1). Scenario planning proves useful in situations where the future is uncertain, as it examines potential influential factors to develop strategic directions that aid in forecasting and enable

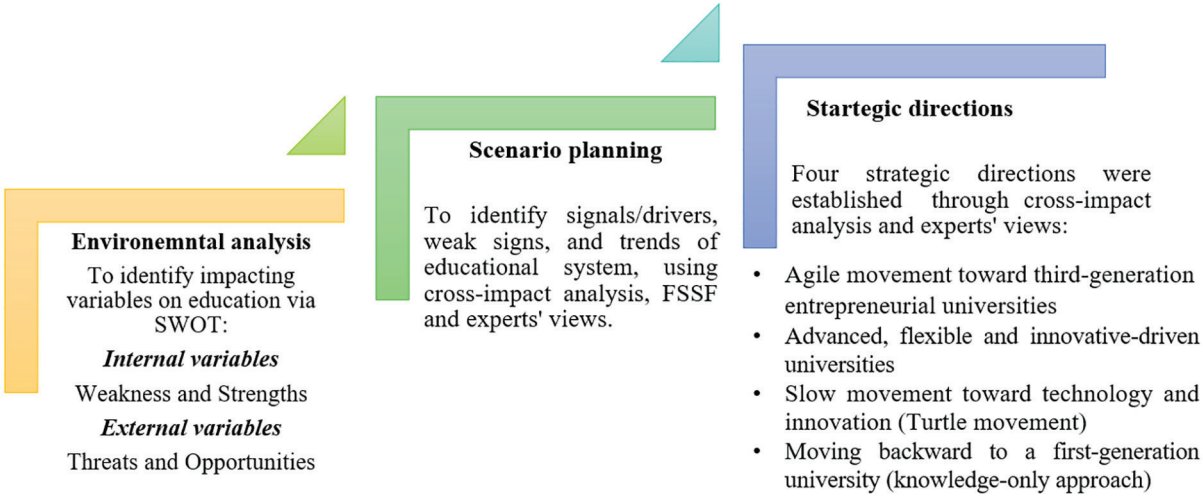

Figure 1: The procedure for scenario planning utilized in health education within the study. FSSF: Futures Signals Sense-making Framework; SWOT: Strengths, Weaknesses, Opportunities, and Threats

better decision-making and preparedness for various possible outcomes (21). Finally, four strategic directions were established to guide the future of the educational system.

Phase 1: Environmental Analysis to Identify Influential Factors

In the initial phase, a situation analysis was carried out using the SWOT approach. A total of 15 experts in clinical sciences, basic medical sciences, medical education, and e-learning were interviewed using a semi-structured questionnaire. Thematic analysis was conducted to synthesize the information. Internal and external factors were analyzed using External Factor Analysis (EFA) and Internal Factor Analysis (IFA) matrices, and then classified into four groups: strengths, weaknesses, opportunities, and threats.

Phase 2: Forecasting the Future of Medical and Health Education by Developing Scenarios

The most significant factors identified during the earlier phase (expert interviews) were chosen using Cross-impact Analysis and the Future Signals Sense-Making Framework (FSSF), implemented through a square matrix questionnaire. Developed by Theodore Gordon and Olaf Helmer in 1966, Cross-impact Analysis helps to understand the interactions and relationships among key variables, aiding in future forecasting (22). Meanwhile, FSSF was applied to classify weak signals, drivers, and trends. Subsequently, experts evaluated these key factors using a Likert scale through a questionnaire. The FSSF then assessed the likelihood and impact of the factors. This approach also uncovered new areas and hidden key factors driving changes within the domain, ultimately generating a comprehensive overview of future environmental influences relevant to the organization (Table 1).

After the survey was completed, the average responses from 15 participants for each question were calculated to analyze the questionnaires, focusing on identifying the factors with the greatest influence and highest likelihood of occurrence. Additionally, megatrends from the Iranian Academy of Medical Sciences and documents on educational transformation were utilized to supplement the key factors in developing scenarios for medical and health education.

Phase 3: Formulating strategic directions for improving medical and health education

Scenarios were developed, and corresponding implementation strategies were outlined to develop plans for medical and health education. The scenarios were constructed using cross-impact balance analysis. This approach involved evaluating the likely conditions of selected factors—ranging from favorable to unfavorable—based on the insights of 15 experts.

Table 1: Future Signals Sense-Making Framework

Probability / Impact	Low	High
Weak	Insignificant	Weak signs (surprises)
Strong	Original trends	Ultra-trends

Additionally, a matrix questionnaire was developed to assess how the occurrence of one situation might influence the occurrence or non-occurrence of another, according to expert opinions. The interactions were categorized into three types: reinforcing, neutral, and restricting, with scores assigned on a scale from -3 to 3. The analysis was conducted using Scenario Wizard software.

Participants and Sampling

A total of 15 participants took part, including managers from the Vice-Chancellor for Research office, five instructors from health and medical basic sciences, four from clinical sciences, three specialists in medical and health education, and two health policymakers. Purposeful sampling was utilized to enhance both diversity and consistency among the participants. Selection criteria required individuals to have at least three years of academic experience and a solid understanding of factors affecting medical and health education. The interviews were audio-recorded, transcribed, and the transcripts were returned to the participants for review to confirm the accuracy and validity of the data.

Tools/ Instruments

A semi-structured interview involving 15 participants was conducted to determine the factors influencing the future of medical and health education.

Main questions:

1. Based on your experience, how effectively do current educational policies at SUMS align with the actual needs of students and the healthcare system?

2. What do you see as the most significant internal challenges in advancing health education toward a more innovative and entrepreneurial model at SUMS? How do you evaluate the role of cultural and technological readiness in implementing educational reforms within your institution?

Follow-up questions:

1. Can you provide an example where a lack of policy integration or strategic direction created barriers for educational development? ***(Follow-up to Question 1)***

2. In your view, how does the current curriculum balance between treatment-focused content and prevention/public health education? ***(Follow-up to Question 2)***

3. What kind of support (technical, cultural, or financial) do you believe is necessary to successfully implement new educational technologies at SUMS? ***(Follow-up to Question 3)***

Trustfulness - The quality of analysis was evaluated considering four criteria of credibility, transferability, consistency/ dependability, and confirmability (23). After transcribing the interviews, the interview transcripts and the extracted themes were sent to the participants for their review. Their feedback, including confirmations or corrections, was incorporated into the study. For the thematic analysis, the opinions of two peers were also utilized to ensure inter-rater agreement. Additionally, during the thematic analysis, careful attention was paid to the integrity of sentences and paragraphs as well as the meanings derived from them.

Data Collection

The interviews were conducted both in-person and online. For experts located remotely, Adobe Connect was utilized. Before starting the interviews, all participants were informed about the research goals. Two days before the sessions, the questionnaire along with an overview of the study was emailed to the participants. Interview schedules were arranged individually in advance.

In-person interviews were audio-recorded, whereas virtual sessions were captured using recording software, with prior consent obtained. Each interview lasted between 60 and 95 minutes.

Data Analysis

The data were analyzed inductively using thematic analysis within a five-step framework, which included familiarization, developing a thematic framework, indexing, charting, mapping, and interpretation (24). During the familiarization phase, the researchers repeatedly listened to audio recordings and reviewed transcripts to grasp overall viewpoints, key concepts, and recurring themes. To identify influential factors affecting medical and health education at SUMS, the Social, Technological, Economic, Environmental, Political, and Value (STEEPV) and SWOT analyses were applied. The SWOT analysis focused on three primary categories: instructors, students, and policies/infrastructure, which helped shape the conceptual framework. In the third step, indexing, a literature review aligned with the conceptual framework was conducted to locate and code data segments relevant to the themes. These codes were then organized and summarized in tables. The data analysis process was facilitated using MAXQDA-11 (VERBI Software, Berlin, Germany).

Ethics - This study was carried out in accordance with the protocols and guidelines established by the Research Deputy of Shiraz University of Medical Sciences, Shiraz, Iran. Participants provided informed consent prior to their involvement, with the study's aims clearly explained to them beforehand. Their information was handled anonymously and kept confidential throughout the research, and they had the freedom to join or leave the study at any point.

Results

The findings of this research are organized according to the three stages outlined in the methodology section (25).

Environmental Analysis

To determine the key factors affecting medical and health education, an environmental analysis was conducted. Through this environmental scanning and subsequent SWOT analysis, internal and external strengths, weaknesses, opportunities, and threats were identified. These factors were then grouped into four categories: instructor, student, policy, and infrastructure (Table 2).

Table 2: SWOT analysis to identify influential factors of health education

Category / Levels	Codes
Category 1: Strengths	
Instructor	1. Competent faculty members 2. The highly experienced management team
Student	3. Admission of top students based on the national university entrance examination 4. A large enrollment of students at the postgraduate level, including master's, residency, and doctoral programs
Policymaking	5. Advanced educational methods and approaches (e.g. blended learning and E-learning) 6. Effectively integrated learning into your institution's policy-making framework
Infrastructure	7. A systematic and coherent approach to the educational system 8. A high output of publications 9. Providing assistance to research institutions (e.g., Health Sciences Research Center) 10. Supporting educational groups 11. Advanced laboratory equipment (e.g., virology and immunology)

Category / Levels	Codes
Category 2: Weaknesses	
Instructor	12. Lack of transparency in professional development 13. More focus on treatment and diagnosis, rather than on education, and research, as they are more profitable 14. Unfair payment system 15. Lack of psychological safety (e.g., openness to criticism)
Student	16. Excessive enrolment in specialized educational programs 17. Low creativity and motivation 18. Lack of attention to patients' safety 19. Lack of psychological safety (e.g., openness to criticism) 20. Absence of connection between theoretical knowledge and practical application, especially regarding the outcomes of students' dissertations
Policymaking	21. Insufficient focus on the society's strategic educational requirements 22. Emphasizing treatment over educational priorities 23. Policymakers' insufficient comprehension of the university environment 24. Absence of coherent and unified decision-making processes 25. Policies leading to excessive student enrollment 26. Demanding medical training that may reduce the thoroughness of learning
Philosophy of medical education	27. Insufficient adaptation of the medical education philosophy to specific contexts 28. Excessive focus on profit-making 29. Treating education like an industrial or mechanical process 30. Absence of a guiding educational philosophy 31. Focus on individualism 32. Inconsistency between educational methods and the needs of the community
General Limitations	33. Insufficient adaptation of medical education methods, such as directly implementing Western educational models without modification 34. Absence of updated and globally recognized textbooks
Category 3: Threats	
Economic	35. Financial instability 36. Elevated income tax rate (35%) 37. Absence of clear strategic guidance for the education system 38. Insufficient funding and financial incentives to keep top-tier teachers
Social, cultural, and value-related	39. Elevated influx of student immigrants 40. Absence of a system based on merit
Political	41. The country's political instability affecting elite training 42. Elevated rate of elite migration 43. Regional instability
Technological	44. Insufficient cultural and financial frameworks, along with a shortage of skilled personnel, to effectively utilize advanced technologies 45. Absence of effective methods for technology application, leading to unequal access to services 46. Neglect of safeguarding information privacy and confidentiality
Structural	47. Integration of the Ministry of Health with medical education 48. Over-centralization within the ministry and insufficient autonomy at the university level 49. Failure to adapt educational methods imported from other countries to local contexts 50. Absence of multi-, inter-, or cross-disciplinary educational strategies 51. Inadequate financial support systems 52. Political and managerial instability 53. Excessive emphasis on specialized medical training
Category 4: Opportunities	
Environmental	54. Iran's advantageous geographical position facilitates diverse regional partnerships. 55. Partnerships in the fields of medical and health education

The main strengths were a highly qualified and experienced staff in both human resources and academics, a substantial student population, a competitive student cohort, effective strategies for e-learning and blended learning, well-equipped facilities such as laboratories, and access to educational hospitals for practical training and placements. Notable weaknesses included a lack of transparent systems and processes, unclear communication channels, heavy workloads, low student motivation and engagement, insufficient quality and accountability measures for patient safety, an oversupply of medical students—especially specialists—beyond actual needs, limited focus on preventive care with an overemphasis on treatment, and a strong focus on cost-efficiency in teaching hospitals. The primary threats stemmed from instability in Iran's political, financial, and social environment. On the other hand, key opportunities included Iran's strategic central location, both globally and within the Middle East, which could help attract more talented individuals.

Table 3: Impact and probability of major factors influencing the development of a third-generation and/or entrepreneurial university

Factors	Impact	Probability
	Range: 1-5	
• Financial support	5	3
• Ministry of Health support	5	5
• Cultural and attitude	5	3
• Distance education to decrease the government custody charge	5	3
• Advanced infrastructures and educational approaches	5	3
• System's inability to create motivation	4	3
• Absence of a system based on merit	4	3
• Absence of clear strategic guidance for the education system	4	3
• Elevated influx of student immigrants	3	3
• Overvalue of specialized medication education due to its profit-making	2	2
• Absence of effective methods for technology application, leading to unequal access to services	2	3
• Financial instability	4	3
• Division of education into broad and specialized categories intended for the elite	4	2
• Private (with costs) and public (free of charge) education	3	3
• Underestimation of education and overvaluing treatment/diagnosis due to profit-making	3	4
• Systematic educational system	4	2
• Excessive centralization	3	3
• Insufficient adaptation of implemented educational models to local contexts	2	2
• Absence of multi-, inter-, or cross-disciplinary educational strategies	3	3
• Overvaluing specialized training without attention to the community's needs	3	3
• Adjusting the educators' evaluation/rating system based on the third-generation universities	2	3
• Enhancing collaboration across universities and industry for enhancing creativity	4	2
• Chance to advance toward master's and doctoral degrees	3	3
• Substantial knowledge creation evidenced by numerous publications and frequent citations	2	3
• Well-established scientific and cutting-edge research centers	3	3
• Availability of modernized laboratory instruments	3	3
• Admission prospects for students from abroad	3	3
• Political instability affecting the education and retention of talented individuals	3	4
• Resistance to change	3	2
• Overextended government involvement	3	3

Forecasting the Future of Medical and Health Education

During the second phase, both the impact and likelihood of various influential factors were assessed. The five factors deemed most significant—based on their influence and probability—were identified as the primary drivers for SUMS transitioning from conventional methods toward becoming a third-generation university (Table 3). These key factors are: establishing a strategic vision to guide policies and actions, securing funding, fostering cultural transformation, and adopting advanced educational technologies.

Strategic Directions of Medical and Health Education

The five key factors outlined in Table 4 served as the foundation for developing the research scenarios. A set of scenarios was created by combining various conditions of these factors and their potential interactions through cross-impact balance analysis. Using the Scenario Wizard Software, four coherent scenarios were identified which are presented in Table 4.

Formulating Strategic Directions for Improving Medical and Health Education

In this study future-oriented strategies were developed based on scenario planning which includes analyzing key environmental factors, identifying trends, and forecasting potential developments. This approach integrates environmental scanning, expert opinions, and stakeholder input to develop flexible strategies. These strategies are intended to support long-term objectives, allowing for adaptability as educational needs and technology change. They provide guidance on various potential directions

Table 4: Key drivers toward third generation and entrepreneurial universities

Key Factors	Code	Possible situations for Iran until 2028	Considered Impact
Financial support	a1	• Financial support	Favorable
	a2	• Lack of financial support	Unfavorable
Ministry of Health support	b1	• Strategic decision making	Favorable
	b2	• Lack of strategic decision making	Unfavorable
Cultural and attitude across the partners	c1	• Students' tendency toward third-generation university, and the reluctance of instructors and employees	Favorable
	c2	• Tendency of students and instructors toward third-generation university, and, the reluctance of employees	Preserving the status quo
	c3	• Tendency of students, instructors, and university staff toward third-generation university	Favorable
Advanced infrastructures and educational approaches	d1	• Availability of advanced infrastructures and educational approaches	Favorable
	d2	• Insufficient access to modern facilities and innovative teaching methods	Unfavorable
	d3	• Availability of advanced infrastructures, but lack of advanced educational approaches	Preserving the status quo
	d4	• Insufficient advanced infrastructures, but availability of advanced educational approaches	Preserving the status quo
Advanced e-learning and virtual platforms	e1	• Expanding e-learning across various disciplines, using advanced technology	Favorable
	e2	• Availability of advanced technology, but absence of progress in adopting e-learning	Preserving the status quo
	e3	• Insufficient knowledge of e-learning and absence of advanced technology	Unfavorable

a) Financial support; b) Ministry of Health support; c) Cultural and attitude across the partners; d) Advanced infrastructures and educational approaches; e) Advanced e-learning and virtual platforms

the university might pursue, from rapid innovation to gradual change, or even falling behind if new technologies are not adopted.

The first scenario describes a fast transition to a Third-Generation University, which is the most preferred future for SUMS, focusing on entrepreneurship and innovation. The second scenario involves shifting toward e-learning and virtual schools. The third scenario shows very slow progress, like a turtle's pace, in adapting to change. The fourth scenario represents moving backward to a First-Generation University model.

1. Agile movement toward third-generation entrepreneurial universities

In this scenario, SUMS rapidly transforms into a third-generation university, focusing on nurturing entrepreneurial and creative problem solvers within medical and health education. The emphasis shifts from traditional, passive learning to active, innovative, and hands-on approaches that prepare students for real-world challenges. E-learning platforms, along with blended learning models, are integrated into the curriculum to foster entrepreneurial thinking and a solution-oriented mindset. Students engage in real-world case studies, research projects, and collaborative ventures that encourage them to develop critical thinking, leadership, and business skills. The university also builds strong ties with the healthcare industry, ensuring that students gain exposure to innovative practices and have opportunities to work with entrepreneurs and startups in the health sector. This approach prepares SUMS to be a leader in shaping the future workforce of health professionals.

2. Advanced, flexible and innovative-driven universities

In this scenario, SUMS embraces advanced virtual learning modes as a core feature of its medical education. By integrating cutting-edge technologies such as Artificial Intelligence (AI), gamification, simulations, and animated learning environments, SUMS provides students with immersive, interactive learning experiences. Students can engage in complex virtual medical scenarios, practice diagnostic and surgical skills through simulations, and use AI-driven tools to receive personalized feedback on their progress. This model provides greater flexibility, enabling students to learn at their own pace while having access to global resources. Advanced online educational platforms allow for international collaboration, enabling students and faculty to work with peers from universities around the world. SUMS becomes a pioneer in adopting technology that enhances both the depth and reach of education, making it more accessible and engaging.

3. Slow movement toward technology and innovation (Turtle movement)

In this scenario, SUMS adopts a slow and careful strategy for incorporating technology into its educational framework. Although there is an understanding of the importance of updating and embracing modern methods in medical and health education, the integration of technology proceeds at a gradual pace. The university continues to rely on traditional teaching methods, with minimal incorporation of digital learning tools. E-learning platforms and virtual classrooms are introduced on a limited scale, and the faculty and students face challenges in adapting to new technologies. The emphasis remains primarily on in-person interactions and hands-on clinical training, with technology serving as a supplementary aid rather than a transformative force. Despite acknowledging the benefits of online education, challenges such as inadequate infrastructure, financial limitations, and resistance to change hinder the university's progress toward establishing a fully digital learning environment.

4. Moving backward to a first-generation university (knowledge-only approach)

In this scenario, SUMS faces significant challenges in adapting to the evolving landscape of medical and health education. Their inability to modernize could result in reverting to a traditional, lecture-only format with minimal technology use. Failing to adopt contemporary methods such as e-learning and blended learning, along with insufficient support for tech-savvy students, places them at a competitive disadvantage. While other

universities move toward flexible, technology-enhanced education, SUMS may face a drop in global rankings and struggle to attract top students. This scenario underscores the importance of adaptability and innovation for the university's continued success in medical education.

Discussion

The scenario-planning approach identified four main scenarios through which universities can develop a system emphasizing entrepreneurship, innovative problem-solving, and practical skills in health and medical education.

First scenario – Teaching and learning should go beyond simply acquiring and reinforcing information. Greater importance must be placed on developing students' entrepreneurial abilities and creative problem-solving skills. Achieving this involves fostering collaborations that span multiple, interdisciplinary, and cross-sector partnerships, including universities, industries, communities, and societal groups. Such cooperation among diverse partners at various levels helps identify real-world challenges and generate innovative solutions (26). The pandemic played a significant role in broadening educational approaches beyond traditional classroom settings. It triggered a transformation in education by leveraging telehealth, adaptable research methods, and flexible clinical trials to find effective solutions. Moreover, the pandemic pushed universities to move away from rigid bureaucratic systems toward more flexible and open models that embrace advanced educational concepts, personalized learning, and practical application of knowledge (27).

When adopting this approach, it is essential to coordinate services and the resources that provide functional support to ensure effective implementation. This may include modifying the learning environment, enhancing the interactivity of the learning platform, improving computer and Information and Communication Technology (ICT) literacy, and developing communication skills (28). Key strategic measures for success involve revamping the educational financing system—both public and private—hiring talented and skilled personnel, redesigning curricula with an entrepreneurial focus, promoting university internationalization, and fostering partnerships with industries to address real-world challenges. Additionally, establishing flexible and practical connections among stakeholders—such as faculty (both teaching and research), students, industry partners, policymakers, and the community—is vital for achieving a cohesive transformation. This integrated approach will greatly facilitate collaboration between students, academics, industry, and the public to identify real-world problems and develop sustainable solutions to various ongoing health issues.

Second scenario – This scenario focused on advanced online educational platforms such as artificial intelligence, gamification, simulations, and animations. Leveraging technology allows the learning journey to be engaging, interactive, and immersive, enhancing a deep learning journey. In addition, it will provide opportunities for a higher level of creativity through the exchange of ideas and experiences. Furthermore, advanced virtual learning modes provide opportunities for emerging megatrends in medical and health education, such as the expansion of borderless health care, improvement of health/bioinformatics information technology, and development of fourth-generation smart hospitals with advanced intelligence, and management systems in health, social, and community care settings.

Modern developments in artificial intelligence offer remarkable opportunities to deliver practical clinical degrees either through blended formats or entirely online. Adopting smart universities will advantage all parties involved by enabling personalized learning experiences, greater flexibility, and more affordable education over time (29). For instance, the pandemic led to an increased focus on integrating online supervision for residents and fellows. This is especially relevant in Iran, given the large number of

teaching universities that rely heavily on medical residents and interns (30). This approach has already been adopted in the United States, where it has improved patient care delivery while reducing risks for residents, fellows, and other healthcare workers (30, 31).

Transforming into smart universities can be challenging, especially in low-income countries, due to limited infrastructure and preparedness. However, this transformation can be achieved through effective strategic planning. Key strategies for success include hiring technology-proficient staff, integrating information and communication literacy into the curriculum, investing in intelligent information systems, expanding online courses, and providing support for developing electronic curriculum materials.

Third scenario – It reflects the consequences of a slow adoption of technology combined with the continued use of traditional methods in medical and health education. It poses risks such as low staff motivation, high employee turnover, and a deficiency in evidence-based teaching and learning. This situation stifles creativity and innovation, reducing universities' competitive edge. Additionally, this scenario may lead to a more industrialized model of medical and health education, which could cause regression characterized by uncontrolled and unskilled use of new technologies, soaring costs, damage to the spiritual connection between healthcare providers and patients, neglect of the spiritual aspects of human beings, ethical oversights, breaches of patient privacy, and failure to adapt new educational models to local contexts.

Despite the challenges, there remain opportunities to improve the quality of medical and health education. Given the strategic location of universities in southern Iran and the presence of experienced faculty, there is potential for further development. For instance, expanding the medical tourism sector could enhance the financial status of SUMS. Key strategies for achieving this include implementing community-focused education that addresses local needs and strengthening support and motivation systems to retain talented students and reduce brain drain. Examples of such support include providing financial and intellectual resources for entrepreneurial projects, facilitating patent registration, encouraging participation in international conferences, and overseeing the acquisition and assessment of advanced health and educational technologies. Additionally, incorporating technological educational tools can make learning more interactive and engaging.

Lastly, progressing slowly and with minimal disruption throughout a course may negatively impact students overall. In health and medicine, where there is a rapidly changing postgraduate landscape, developing adaptability and resilience within students is beneficial. In this way, embedding industry or corporate interventions may disrupt the normal pattern of their education but will also teach them to pivot and adapt to changing environments. This can help prepare students for the transition from university to the clinical workplace (20, 32).

Fourth scenario – This scenario indicates that those universities which are not able to adapt and adjust may not survive. Such universities struggle to identify their weaknesses or recognize external threats, which prevents them from developing effective strategic plans to remain competitive. Consequently, they risk falling behind more progressive educational systems and practices, leading to decreased engagement and lower retention rates among both faculty and students. This issue has become especially significant during and after the pandemic, which served as a powerful reminder of the necessity for continuous environmental monitoring, flexibility, and adaptation—not just to survive, but to prosper.

The evolution of higher education: embracing entrepreneurship and innovation – The pandemic, despite its difficulties for medical and health education, spurred universities to become more adaptable and relevant. To maintain this, ongoing

environmental analysis (like SWOT and scenario planning) is crucial for understanding the future, allocating resources effectively, and setting clear strategic goals. This proactive approach enables timely decisions, potentially even leading to a global online academic marketplace for students and researchers. Ultimately, the post-pandemic period marks a continuous evolution in medical education, embracing telehealth, flexible research, and personalized learning to foster innovation. The key mission of entrepreneurial universities is to help create the opportunity and capacity for local and regional development, create a knowledge-based society, and encourage the development of industry, commerce, services, urban development, and technological citizenship in an active and action-oriented form (33). Developing mutual connections with industries, through active practical collaborations, ensure more financial sustainability enhancing universities recognition, improve graduate employability, and contribute more effectively to a sustainable future (33). The responsibility of entrepreneurial universities is highlighted to make education more practical and enhancing the translation of knowledge to practice (34).

Traditional, first-generation universities that concentrate solely on knowledge creation may find it difficult to thrive in today's competitive landscape. It is crucial for these institutions to be highly adaptable to unpredictable social, cultural, and legislative shifts, as well as to operate efficiently with limited resources. Therefore, the concept of entrepreneurial universities has gained significant importance across all university levels, emphasizing the need to address societal demands rather than producing knowledge in isolation (7). Entrepreneurial universities not only improve human resource skills and creativity but also foster entrepreneurial mindsets and attitudes. They promote continuous reflection, critical thinking, and situational analysis among individuals, empowering them to become change agents in their fields and contribute meaningfully to their communities and society (7).

The major shift in the educational system during the last decade resulted in shifting from traditional universities towards entrepreneurial universities, and entrepreneurship has become a key focus in academic science. This approach aims to strengthen the link between academy, practice, and industries, resulting in social, cultural, and economic transformations (34). This growing trend in academia can contribute significantly to patenting, startups, and technology transfer. In addition, it motivates industries to provide further support and funding to academia to find real-world issues and translate the knowledge into practice. This approach to universities and academia resulted in some sort of transformations and evolutions across universities, the educational system as well as the practice of science overall (23).

Entrepreneurial universities prioritize research that facilitates technology transfer and the creation of new businesses, shaped by their surrounding environment, including innovation networks. This dynamic illustrates an ecological, system-level perspective. Changes in social, cultural, financial, and political conditions that favor entrepreneurship can influence educational policies, leading universities to restructure and redesign themselves. These structural adjustments help clarify their vision, mission, and objectives, thereby promoting entrepreneurial initiatives. At the same time, universities themselves can influence policies and practices that encourage entrepreneurial ecosystems. Altogether, these interactions boost the real-world application of scientific knowledge and amplify its benefits to society (21).

Human capital, including all the relevant partners such as academia, students, and policymakers, plays a vital role in driving and managing the development of entrepreneurial universities. This process begins by shifting mindsets and perceptions, followed by changes in behaviors and actions. To support this, universities must enhance the quality of education they provide, emphasizing both personal and professional development,

fostering entrepreneurial experiences, and improving incentive mechanisms. Moreover, collaboration among universities, industry, and government is vital for cultivating an environment that encourages creativity and innovation within knowledge-based societies (34). Therefore, strong social capital is necessary to increase the extent and effectiveness of partnerships with external stakeholders and industries, since entrepreneurial ideas alone cannot drive transformation without industry support. A mutually beneficial collaborative approach ensures that all parties involved contribute meaningfully and gain from the impact created (7).

Universities have a key role in knowledge-based development and empowering students to identify and resolve real-world issues. Third-generation universities have opened up new horizons in the field of entrepreneurship, resulting in advanced practical solutions for societal impacts (23, 35). To advance toward third-generation universities, we recommend a proactive, critical framework using an ecological system-level approach for a holistic view of education. This involves continuous environmental scanning to identify facilitators and barriers at individual, organizational, and societal levels, and crafting innovative strategies for navigating the unpredictable future and limited resources. The outcomes of our study suggest adopting agile academic leadership to capitalize on opportunities and mitigate threats and weaknesses. This approach necessitates a restructuring or redesign of universities, generating new policies and practices to enhance both tangible infrastructure and intangible social support channels (34).

This study highlights three essential steps for implementing a systems-level approach in third-generation universities. First, it is crucial to establish strong educational leadership and management that can create and execute a strategic plan utilizing technology and contemporary teaching methods. Second, developing integrated networks that connect industry, community partners, students, and universities is vital to improve the practical use of knowledge. Such collaboration is necessary because education and practice often function separately. Promoting open and constructive communication encourages the sharing of experiences, which can drive innovation. Third, providing mentorship from both academic and industry professionals to educators and students supports a comprehensive approach that links theoretical learning with practical application. This combined mentorship approach boosts critical thinking, entrepreneurial abilities, and engagement, making education more relevant, effective, efficient, and accessible for everyone involved.

There are several challenges involved in shifting towards entrepreneurial universities. Universities that emphasize technology and maintain strong partnerships with industry tend to be more suited for entrepreneurial activities. It is important to understand that a uniform strategy is ineffective; each institution must tailor its approach based on a range of internal and external factors, such as the educational framework, academic viewpoints, attitudes of students and policymakers toward entrepreneurship, leadership styles, and organizational strategies. Moreover, external financial, social, and political environments also influence this transition. A three-stage model—comprising application orientation, product orientation, and business orientation—is suggested for effective implementation. Recognizing the distinct types of universities is vital for selecting appropriate entrepreneurial strategies. Furthermore, there is concern that this emerging scientific approach might discourage academics from engaging in open science due to worries over intellectual property rights related to their research (23).

Limitations and Suggestions

This study has several limitations that need to be recognized. Firstly, the research was carried out within the specific institutional setting of SUMS, which may limit the applicability of the results to other

medical universities in Iran or worldwide. Although scenario planning is a valuable tool for anticipating possible futures, it relies on assumptions that could change over time due to unexpected political, economic, or technological developments, especially in unstable regions. Secondly, there was limited access to comprehensive institutional data, particularly concerning digital infrastructure readiness, faculty digital skills, and long-term strategic plans. This limitation may have influenced the thoroughness and precision of the environmental assessment and scenario development. Thirdly, while expert opinions were incorporated, future research could benefit from broader stakeholder involvement. Including insights from a wider variety of participants such as students, IT professionals, curriculum developers, and community health collaborators would improve the credibility and depth of the scenarios.

Considering these limitations, future research should aim to perform comparative scenario planning across multiple universities to identify wider trends and contextual differences. It should also integrate mixed-method approaches, combining quantitative data on student performance, e-learning participation, and faculty effectiveness. Longitudinal studies are recommended to evaluate the success of implemented strategies over time. Additionally, fostering interdisciplinary partnerships with industry, healthcare providers, and international academic institutions will help develop e-learning models that are both innovative and adaptable to local needs.

Conclusion

The management of health and medical education is undergoing rapid transformation, especially with the growing adoption of digital learning models. The pandemic has highlighted a critical need for proactive change, particularly in resource-limited and uncertain environments like those faced by Iranian medical universities. Insights from scenario analysis at SUMS demonstrate that embracing entrepreneurial and innovation-focused educational approaches is not merely a choice but a necessity.

The future of medical education depends on creating adaptable, technology-integrated curricula that foster innovative problem-solving and entrepreneurial mindsets—capabilities that are vital for today's healthcare systems. Universities must move beyond traditional content delivery to develop learning environments that are flexible, engaging, and aligned with international standards. The incorporation of advanced virtual tools such as artificial intelligence, simulations, and gamification can enhance learning depth and accessibility. Nonetheless, the success of these initiatives relies heavily on institutional dedication, clear strategic planning, and a culture open to change.

Furthermore, partnerships with industry and community stakeholders are crucial to maintaining the relevance and practicality of education. Empowering faculty, staff, and students as active contributors and change agents ensures that learning extends beyond the classroom into real-world healthcare challenges.

In summary, establishing a resilient and forward-looking medical education system requires institutions like SUMS to prioritize innovation, invest in technological resources, and implement flexible, learner-focused strategies that address the changing needs of society.

Abbreviations

FSSF: Futures Signals Sense-making Framework
SUMS: Shiraz University of Medical Sciences
SWOT: Strengths, Weaknesses, Opportunities, and Threats

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Authors' Contribution

RR, KP, and AGh designed the study and its overall methodology, performed the data synthesis, and finalized the article. KP and NS carried out the database searches, gathered the sources, and prepared the initial draft of the manuscript. KP, CM, and NS contributed to the critical writing and revision of the paper. The study was supervised and finalized by RR and JK. All authors have reviewed and approved the final manuscript.

Conflict of Interest

The authors declare no conflict of interest.

Ethical Considerations

This study was carried out in accordance with the protocols and guidelines established by the Research Deputy of Shiraz University of Medical Sciences, Shiraz, Iran. All participants provided informed consent after being fully briefed on the aims of the research prior to their involvement. Their personal data were handled with strict confidentiality and anonymity throughout the study. Participation was entirely voluntary, with individuals free to withdraw at any point without any consequences. The study received ethical approval from the National Committee for Ethics in Biomedical Research under the registration number IR.SUMS.REC.1396.

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Availability of Data and Materials

The data and materials supporting this study are provided within the manuscript.

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