

Future Challenges in Medical Education System in COVID-19 Pandemic: Scenario Planning

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Abstract

Background: With the outbreak of the COVID-19 pandemic, all the aspects of educational institutions such as universities have been affected. Trainings have changed from face-to-face and physical to online and digital. Therefore an educational reform has been recognized as a priority toward adaptation of universities with the current situation and transition to third-generation universities in order to synchronize with global trends. This study evaluated the preparedness of universities to manage the outbreak and moving toward a new generation, using the scenario planning approach.

Methods: A mixed method design was used including three phases: 1) Identifying the variables affecting the future of medical education, 2) Prediction and building scenarios (future estimates), 3) Building the future (scenario-making).

Results: The COVID-19 pandemic represents an enduring transformation in education with the advancement of smart universities, telehealth, adaptive research protocols, personalized and self-controlled learning and flexible approaches to achieve solutions.

Conclusions: It is inevitable that in this situation, the future of this path, must be clarified and a joint vision (scenarios) must be created. It is suggested that educational and environmental key factors should be constantly monitored to keep up with the process of managing the situation, globalization and the expansion of entrepreneurial universities.

Background

Universities have a considerable impact on accelerating the growth of society by training and empowering the workforce which is the axis of constant development. In this path universities have always been exposed to internal and external changes affected by economic, political, social, cultural, national and international developments [1–3].

With the outbreak of the Corona Pandemic from the end of 2019, all the aspects of personal, social and educational life of individuals were affected. Educational institutions have also been affected and higher education institutions have been closed. Trainings have changed from face-to-face and physical to online and digital. This paradigm, changes all aspects of education Learning, evaluation and researches. Online education, in addition to the many benefits, has faced with challenges in the educational path due to the unpreparedness for this paradigm, especially in developing countries. These challenges include a lack of digital education infrastructure, computer literacy, faculty readiness, and student readiness to learn online [4, 5].

Covid 19 pandemic in addition to all the negative socio-economic effects, has a profound effect on universities. Evidence suggests that the Covid 19 pandemic has acted as a catalyst and facilitator in a major transformation at the universities and it has doubled the need to move towards digitalization and create a platform for an interactive model move from their traditional role - merely the production of

knowledge (second-generation universities), toward entrepreneurship universities to transform knowledge and ideas into action (Third Generation Universities) [6, 7]. Hence, an educational reform has been recognized as a priority toward adaptation of universities with the current situation and transition to third-generation universities in order to synchronize with global trends [8].

While the first-generation university is based on education, second and third-generation universities are based on research, entrepreneurship/business, respectively [9]. The third-generation university is composed of education, research, and innovation that is compatible with the needs of the current environment and production of scientific and technological innovations, to explore and solve the real-world issues. The third-generation universities consider adaptability and creativity as a key driver, enabling students to sell their ideas, contribute to entrepreneurial motivation and the endeavor to generate new knowledge [10, 11]. Third-generation universities have the ability to innovate, recognize and create opportunities, develop teamwork, take risks and respond to challenges. By doing so, they can compete in global markets by creating economic growth [12, 13].

According to the importance of an educational reform toward adaptation of universities with this situation. This study evaluated the preparedness of Shiraz University of Medical Sciences (SUMS) to manage the outbreak and moving toward a new generation, using the scenario planning approach.

Methods

A mixed method design was used in this study. The scenarios for SUMS in moving to the third-generation university were developed using the exploratory futures approach and attitude towards past trends [14]. This study was carried out in three phases:

Phase 1: Identifying the variables affecting the future of health education

A structured interview was used to collect data and identify the variables affecting the future of health education. Participants (n = 15) were managers of the vice-chancellor for research of SUMS, instructors and specialists in health education, and health policymakers. Snowball sampling with maximum diversity and consistency was used (First, the most known individuals were identified, followed by the recognition of other experts). Participants were chosen based on their expertise/experience in the relevant area, and their familiarity with the factors affecting health education. Objectives of the study and the interview questions were provided to participants, and consent was obtained. All interviews were recorded and transcribed. Transcribed texts were shared with the participants and their feedback was received in order to validate the data.

Data analysis was performed deductively and via a five-step analysis of the framework, including familiarization, identifying a thematic framework, indexing, charting, and mapping and interpretation [15]. Familiarization stage carried out through repeated listening to the audio files/reading of the transcripts, to identify the general perspectives, key ideas and overlapping themes. STEEPV and SWOT frameworks were considered as the framework for environmental analysis in three main categories of instructor,

student, policy and infrastructure, to generate the conceptual framework. In the third stage (indexing), the manuscripts were studied line by line and based on the conceptual framework, and parts of the data that were related to the particular theme were identified and indexed. Following that, the identified codes were summarized in the form of tables. Data analysis was performed using MAXQDA-11 software. The method designed by Lincoln YS, Guba EG was exploited to evaluate the quality of analysis, while considering four criteria of credibility, transferability, consistency/dependability, and confirmability [16].

Phase 2: Finalizing key factors for prediction and building scenarios (future estimates)

Cross-impact analysis and future signals sense-making framework were applied to select the most important factors identified in the previous stage (expert interviews), using a square matrix questionnaire. Afterwards, experts shared their views of the level of mutual impact of factors on each other, selecting the most important proponents after determining the role of each factor (based on a Likert scale). In addition, the future signals sense-making framework was exploited to determine the impact and probability of occurrence of identified factors. In this technique, new domains and latent key factors that make changes in the domain were identified, and a list of information about the future of the environment around the organization was provided (Table 1). The researcher achieved participants' consent for sending the questionnaire (reminder emails were sent, in case of no response). After the completion, the mean views of responders for each question were estimated to analyze the questionnaires (the factors with the most impact and the highest probability of occurrence were selected). It should be noted that megatrends designed in this area in the Iranian Academy of Medical Sciences, as well as upstream documents and education transformation documents, were applied to finalize the key factors for predicting and constructing scenarios in health education (see Table 1. Future Signals Sense-Making Framework (FSSF)).

Table 1
Future Signals Sense-Making Framework (FSSF)

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

Phase 3: Building the future (Scenario-making)

Scenarios were developed and strategies and requirements for the implementation of the scenario were explained to build future plans. Cross-impact balance analysis was exploited to construct scenarios for moving toward third-generation universities (entrepreneurs). In this method, the probable situation (ranging from desirable to unfavorable status) of the selected factors was considered, based on the opinions of experts. Afterwards, another matrix questionnaire was designed, in which the effect of the

occurrence of each situation on the occurrence or lack of occurrence of another situation was determined, according to experts' opinions and based on three features: strengthening, ineffective, and restrictive (scores between - 3 and 3). Scenario Wizard software was used for analysis.

Results

The results of this study are presented based on three phases shown in the methodology section [17]. Figure 1 showed the process of foresight in health education.

Phase 1: Monitoring and identifying effective factors

In the first phase, we recognized the effective variables and factors in health education at SUMS (with regard to the pyramid rule in the above model). At this stage, based on SWOT analysis, four categories of strengths, weaknesses, opportunities, and threats were identified, based on experts' comments. These categories were categorized into four levels: instructor, student, policy and infrastructure (Table 2).

Table 2

SWOT analysis (Strengths, Weaknesses, Opportunities, and Threats) to identify effective factors on health education at SUMS

Main Classes	Levels	Codes
Strengths	Instructor	<p>Full-time, Experienced and Committed faculty members</p> <p>Presence of experienced managers with a history of ministry and management at the ministry level</p>
	Student	<p>Enrolling intelligent students with the highest ranks in the national university entrance exam</p> <p>High admission statistics of students in levels of master's degree, residency, and PhD</p>
	Policy-making	<p>Presence of new educational methods (e.g.blended learning and e-learning) and new evaluation methods</p>
	Infrastructure	<p>The coherent, strong and planned education system</p> <p>The high number of articles and citations</p> <p>Presence of the Health Sciences Research Center</p> <p>Presence of supportive educational groups</p> <p>The existence of fully updated laboratory equipment and departments, such as virology and immunology</p>
Weaknesses	Instructor	<p>Lack of transparency in job descriptions and promotion and financial issues</p> <p>Being under pressure from three sides of education, research, and treatment, and neglecting education, which has fewer profits for instructors</p> <p>Injustice in payments to clinical and basic sciences instructors, which causes a lack of motivation</p> <p>Lack of openness to criticism</p>
	Student	<p>Disruption of the pyramid of human resource training (our freshmen are very vulnerable and weak)</p> <p>The increase of specialism and excessive number of specialists and subspecialists</p> <p>A decline in motivation and creativity of students</p> <p>Failure to observe patients' rights by students</p> <p>The lack of openness to criticism</p> <p>Lack of optimal use of the results of student theses and conversing them to technical knowledge</p>

Main Classes	Levels	Codes
	Policy-making	<p>Impact of pre-revolutionary decisions on medical education</p> <p>Lack of attention to the upstream documents of the country</p> <p>Priority of treatment over education in the country</p> <p>Lack of adequate understanding of about the nature and function of the university by policymakers</p> <p>Confusion in the current medical education and making spontaneous decisions</p> <p>The existence of a mass student production approach in the current medical education of the country</p> <p>Providing intensive medical education courses so that students could acquire welfare</p>
	Problems related to the philosophy of medical education	<p>Imported nature of medical education philosophy in the country</p> <p>Training physicians who mostly think about income rather than ethics</p> <p>The existence of an industrial and mechanical approach to medicine</p> <p>The lack of a complied philosophy of education in medical education</p> <p>Strengthening the spirit of individualism in the current medical education system</p> <p>Lack of fit between religious philosophy and educational approach in the country</p>
	Problems related to limiting others	<p>Imported nature of medical education approaches in the country</p> <p>Imported nature of medical education curriculum in the country</p> <p>Lack of return on western approaches to medical education in the country</p> <p>Imitating the west in predicting medical education</p> <p>Being behind the west in terms of the time of implementing the medical education programs</p> <p>Lack of existence of proper texts in the country and translations of texts</p>

Main Classes	Levels	Codes
Threads	Economic	<p>Instability in economic issues</p> <p>High taxes (35%) on instructors' incomes</p> <p>The inability of long-term planning to invest in improving the education system and training infrastructures</p> <p>The inability of the system to fund and motivate full-time instructors to maintain their social status for achieving academic authority</p>
	Social, cultural, and value-related	<p>Emigration of talented students due to dissatisfaction with the social environment</p> <p>The pattern of rewards and punishments of sovereignty is not in a way that people who have a scientific reference in a particular area pay attention to policy and targeting in that area (lack of meritocracy)</p>
	Political	<p>The improper political condition of the country for training elites</p> <p>Emigration of elites abroad</p> <p>Instability in the region</p>
	Technological	<p>The lack of cultural, financial infrastructures and skilled human resources for the use of new technologies</p> <p>Wasteful use of new technologies that cause:</p> <p>Excessive costs on the shoulders of people</p> <p>The weakening of the spiritual relationship between the physician and the patient</p> <p>Endangering of the privacy and security of patients using advanced technology</p>
	Structural	<p>Consolidation of the ministry of health and medical education</p> <p>Excessive centralization in the ministry and lack of managerial power and authority at the level of university</p> <p>Lack of localization of imported models and the use of old models of advanced countries (our compliance with advanced countries)</p> <p>Lack of multi-disciplinary forces and lack of attention to interdisciplinary sciences</p> <p>Lack of economic infrastructures and political and managerial potentials</p> <p>Excessive attention to subspecialized training and disregard for the needs of the community</p>

Main Classes	Levels	Codes
Opportunities	Environmental	Having a suitable geographical location and access to free waters for the activity of foreign students

Phase 2: Finalizing factors for future estimation and scenario building

In the second phase, the effect and probability of occurrence of any of the factors affecting the future of health education in SUMS, which were identified in the previous stages, were evaluated. Five factors which had high impact and possibility of occurrence were selected as the final key factors in the movement of SUMS toward the third-generation university (Table 3). These include: funding; stabilization of long-term policy-making towards the realization of third-generation university; cultural and attitudinal infrastructures; improving hardware (equipment) and software (educational contents and processes) infrastructures.

Table 3

Impact and the probability of occurrence of factors affecting the movement of health higher education at SUMS toward a third-generation/entrepreneur university

Factors	Impact	Probability
The ability of the system to financially support the university in order to realize third-generation universities	5	3
The decision of the ministry of health for moving toward an entrepreneurial and third-generation university	5	5
Cultural and attitude infrastructures of instructors, students, and the staff of university in order to realize third-generation universities	5	3
Distance education to decrease the government custody charge	5	3
Improving the hardware (equipment) and software (educational processes and contents) facilities and infrastructures in order to realize third-generation universities	5	3
System's inability to create motivation	4	3
An improper awarding system that leads to a lack of meritocracy	4	3
The inability of long-term planning	4	3
Emigration of elites abroad	3	3
Stop of associate degrees and MScs and creation of specialized and subspecialized courses	2	2
Inaccurate and uncontrolled use of new technologies	2	3
Instability in economic issues	4	3
Educations be (Education is?) divided into two normal and subspecialized classes for elites	4	2
Private (with costs) and public (free of charge) educations	3	3
The mitigating effects of the ministry of health and medical education on education: the nature of the profitability of treatment and the lack of profitability of education	3	4
The coherent, robust and planned training system	4	2
Excessive centralization	3	3
Lack of localization of imported models	2	2
Disregarding interdisciplinary sciences	3	3
Excessive attention to subspecialized training and disregard for the needs of the community	3	3
Changing the evaluation and rating of instructors in line with third-generation universities	2	3

Factors	Impact	Probability
Increasing the interactions between a university with industry and branding and patents	4	2
Possibility to continue postgraduate and doctoral studies	3	3
The high number of articles and citations	2	3
The existence of scientific and advanced research poles	3	3
The existence of completely updated laboratory equipment	3	3
The ability of activities of foreign students	3	3
The unfavorable political condition of the country in training elites: bureaucracy, slow working process	3	4
Resistance to change	3	2
Excessive government roles	3	3

Phase 3: Building the future (Scenario-making)

The five key factors presented in Table 4 were used to structure research scenarios. The basket of scenarios was compiled from the combination of different states of these factors and their possible situations using a cross-impact balance analysis. Four compatible scenarios, a network of direct and indirect effects and possible situations which were not rejected by experts, were extracted using the Scenario Wizard Software (Table 4).

Table 4
Key Factors and Possible Situations of Each Factor in 2020 Vision

Key Factors	Code	Possible situations for Iran until 2028	Considered Impact
A: The ability of the system to funding the university in pursuit of the third-generation university	a1	University financing in order to realize the third-generation university	Favorable
	a2	Lack of financing university in order to realize the third-generation university	Unfavorable
B: The decision of the ministry of health to move toward the entrepreneurial university and third-generation university: stabilization of long-term policy-making towards the realization of third-generation university (while changing the governments and parliaments)	b1	Stability of long-term policy-making in order to realize third-generation university	Favorable
	b2	Lack of stability of long-term policy-making in order to realize third-generation university	Unfavorable
C: the cultural and attitudinal infrastructures of university instructors and students in order to realize the third-generation university	c1	The tendency of students to realize the third-generation university and the reluctance of instructors and employees	Favorable
	c2	The tendency of students and instructors to realize the third-generation university and the reluctance of employees	Preserving the status quo
	c3	The tendency of students, instructors, and university staff to realize the third-generation university	Favorable
D: Status of hardware (equipment) and software (educational contents and processes) infrastructures in order to realize the third-generation university	d1	Availability of hardware and software infrastructures in order to realize the third-generation university	Favorable
	d2	Lack of availability of hardware and software infrastructure in order to realize the third-generation university	Unfavorable

Key Factors	Code	Possible situations for Iran until 2028	Considered Impact
	d3	Availability of hardware infrastructures and lack of availability of software infrastructures in line with the realization of third-generation university	Preserving the status quo
	d4	Lack of availability of hardware infrastructures and the availability of software infrastructures in line with the realization of third-generation university	Preserving the status quo
E: Electronic education	e1	Expanding distance education in various university disciplines, with advanced educational technology	Favorable
	e2	The limited realization of distance education (less disciplines) with advanced educational technology	Preserving the status quo
	e3	The limited realization of distance education (fewer disciplines) without advanced educational technology	Unfavorable

The first scenario: quick movement toward the third-generation universities. This scenario is the most desirable future for SUMS, in which conditions and strategies have been described in detail as following.

The second scenario: opening the wing of e-learning and virtual schools.

The third scenario: turtle movement, indicating very slow progress of university.

The fourth scenario: danger of moving backward to first-generation universities.

Discussion

Universities have one key principle in common, which is meeting the needs of the community by creation of knowledge-based wealth, and articulating entrepreneurship. In this regard, third-generation universities have opened up new horizons in the field of entrepreneurship, defining new career areas and creating

wealth for the society [18, 19]. The results of the study showed that there are four different scenarios and challenges in Medical Education System in COVID-19 pandemic.

First Scenario: quick movement towards third-generation universities

In this scenario, the focus of teaching and learning is on nurturing entrepreneurial and creative students. This requires more collaborations between universities, and industries for research and development. In this case, universities will be creators of new ideas, new jobs, and profit. In this way the COVID-19 epidemic may represent an enduring transformation in medicine with the advancement of telehealth, adaptive research protocols, and clinical trials with flexible approaches to achieve solutions [20].

The Covid19 Pandemic Crisis has facilitated the digitization of universities. Under normal circumstances, this path toward achieving this goal has required more time and the complex administrative rules and bureaucracy. But in this special condition the potential to move universities towards digitalization and the importance of information technology has increased [21].

Some evidence suggests that students' attitudes toward e-learning are not positive. The most influential variables are learning environment, the degree of interactivity of the learning platform, students' knowledge and information about online communication. It seems that the growth of adopting approaches to correct these attitudes can be helpful [22].

The strategic actions for the success of this scenario are:

- Reform in financing educational system, both private and public
- Reform in recruitment of faculty members, on the basis of entrepreneurship and modern knowledge of electronic marketing
- Re-design of the educational curriculum (specialized courses in entrepreneurship, creativity, critical thinking, innovation, marketing, project management)
- Enhancing university internationalization

Second scenario: laying the foundation for e-learning and virtual Schools

This scenario focusing on expanding virtual health education into more diverse fields and with more advanced equipment and facilities. The university could then expand its virtual school and extensively collaborate with universities in other parts of the world to hold joint courses. This will enhance the opportunity for more enrolments, nationally and internationally, and enhance the exchange of knowledge and ideas. Expanding e-health courses are paramount due to emerging megatrends in health education, such as: expansion of borderless health care, improvement of health/bioinformatics information technology, development of fourth-generation smart hospitals with advanced intelligence and management systems in clinical and non-clinical settings. In this situation online education is a possibility that should be considered compatible with or replaced by face-to-face and physical education. Benefits such as the flexibility of online education, personalized and self-controlled learning, and cost savings cannot be ignored. Therefore, the implementation of smart universities will benefit all

stakeholders. These smart universities will not only be more cost-effective than traditional one, but will also be more useful for students because a wider range of courses will be available compared to traditional universities and then different career paths are created [23]. Evidence suggests that the challenges of online education, especially in developing countries and low-income countries are lack of adequate Internet infrastructure, teachers' lack of competency in online education, and students' low knowledge in this regard. Meanwhile, medical and clinical education has more challenges especially in teaching hospitals due to the health of patients that the constant presence of an observer is a basic need. This issue emphasizes the importance of conducting researches in this field and reducing administrative bureaucracy for an effective transition toward e-learning [24]. Potts in his study suggested that allow and foster greater use of tele supervision were adopted by the ACGME Board of Directors in February 2020 were to become effective July 1, 2020. As the pandemic unfolded in the US, it became clear that tele supervision of residents/fellows could positively affect the delivery of care to patients while mitigating the risks to those residents, fellows, and other healthcare providers [25].

The strategic actions for the success of this scenario are:

- Changes in recruitment based on the expertise in e-health
- Incorporate information communication literacy in the curriculum as well as investing in intelligence information systems
- Increase online courses and support for the production of electronic curriculum content

Third Scenario: Turtle Movement

This scenario is similar to the current situation, including some main issues, such as: low motivation, inappropriate system of payment to educators, lack of evidence-based teaching and learning. This situation discourages those who are actually competent and scientific references in their own specialized fields to contribute to the area of policy-making and targeting (lack of meritocracy).

In this scenario, there will be an expansion of an industrial approach to medicine, which could have the following consequences: unbridled and non-expert use of new technologies; excessive increase in costs; harm to the spiritual relationship between physicians and patients; disregard for the spiritual dimension of human beings; lack of attention to ethics; violation of patients' privacy; and lack of localization of new educational models, approaches and technologies will lead to the backward movement of the university in terms of achieving scientific authority in health education.

It is notable that even under these conditions, there can be opportunities to enhance the quality and improve the situation. with regard to the strategic geographical location of the universities in south of Iran and presence of experienced instructors in these universities, there will be proper conditions for growing and expanding medical tourism industry, which will lead to import of currency and improvement of financial support of the university.

The strategic actions for the success of this scenario are:

- Society-based education tailored to the needs of community members and the use of indigenous models in education.
- Improve the support and motivational system for distinguished students to maintain and reduce their migration (e.g., offering financial and intellectual support for converting innovative industrial-scale ideas; patent registration; international conferences attendance).
- Monitoring the purchase and evaluation of advanced health and education technologies. The lack of proper rules and adequate supervision for the suitable application of advanced technologies or referrals tailored to the patient's treatment process causes a heavy financial burden on healthcare system, patients and families.

Fourth Scenario: Alert for Moving Backward to First-generation Universities

Along with the Covid-19 pandemic, unstable economic and political conditions, Universities will not be able to finance a new educational system, research projects, support staff and national/international students. University may be unable to establish the distance education in more diverse fields, and the inability to use more advanced teaching technologies. This process will lead to less collaboration among university and industries, less staff retention, and ultimately poor education, and ineffective future human resources. In this regard, a case study by WSB (Visa Skola Biznisa) proposed a model that is a product of the joint investment with the National Louis University. In this model, the key mission of entrepreneurial universities is to help create the opportunity and capacity for local and regional development, create a knowledge-based society, encourage the development of industry, commerce, services, urban development, and technological citizenship in an active and action-oriented form [26, 27]. Moreover, the results obtained by Etzkowitz showed that the goals of entrepreneurial universities will be realized when the results and achievements of some particular research or innovation are revealed. In addition, it was noted that value-adding occurs by the university itself operating the result of the research or innovation [28].

Conclusions

It is Inevitable that in this situation, the future of this path, The COVID-19 epidemic, must be clarified and a joint vision must be created. It is suggested that educational and environmental key factors should be constantly monitored to keep up with the process of managing the situation, globalization and the expansion of entrepreneurial universities. By doing so, the authorities will be able to make more appropriate decisions about the future with a clearer vision. Also they will lay the foundation for developing opportunities to establish an electronic global market, attracting students and researchers seeking the best occupational opportunities in the global academic market. On the other hand, this COVID-19 crisis represents an enduring transformation in medicine with the advancement of telehealth, adaptive research protocol and clinical trials with flexible approaches to achieve solutions. In this way students should improve their ability to fulfill themselves through electronic learning tools and social media and other online models.

Abbreviations

COVID-19: Coronavirus Disease of 2019; SUMS: Shiraz University of Medical Sciences; SWOT: Strength, Weakness, Opportunities and Threats; FSSF: Future Signals Sense-making Framework; US: United States

Declarations

Ethics approval and consent to participate

This study is approved by Shiraz University of Medical Sciences ethics committee with the ID number of IR.SUMS.REC. 1396. S1063. All methods were performed in accordance with the relevant guidelines and regulations. All participants provided written informed consent.

Consent for publication

There was no difficulty in publishing the results. All the included databases and materials are available for public use.

Availability of data and material

Data is available in an endnote library. The datasets analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests

There is no competing interest.

Funding

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Authors' contributions

KP and AGh, designed the study and its overall methodology; they also finalized the data synthesis and the article itself. NB, HSh and MM searched all the databases, retrieved the sources and prepared the initial draft of the article. KP, NS and JK contributed to data analysis and edited the article. The study was supervised and finalized by RR. All authors have read and approved the manuscript.

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Figures

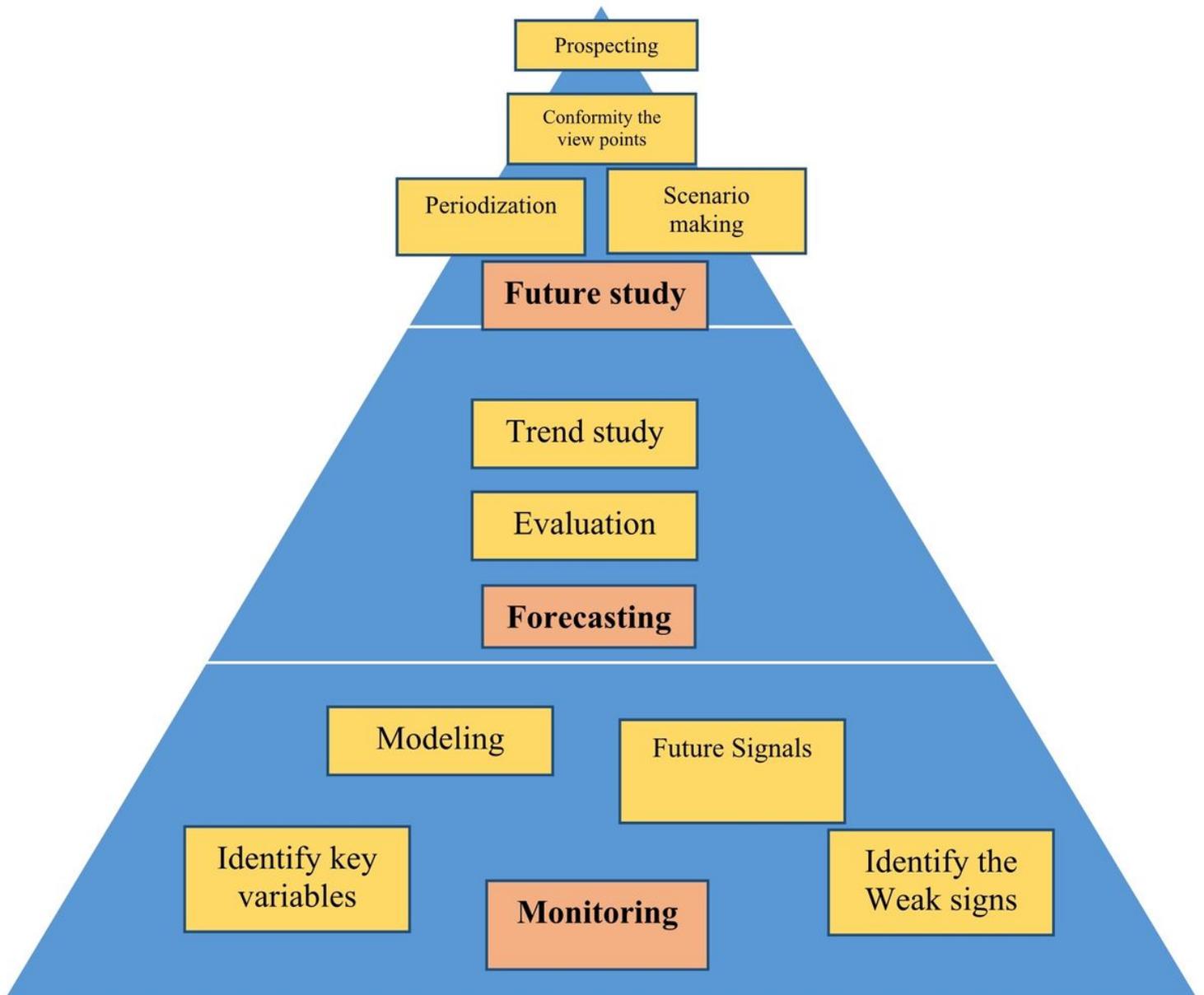


Figure 1

Process of Foresight in Medical Sciences Education