



Education that allows South Korean Colleges of Dentistry to teach Emergency Care

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As the medical environment and dental services change, the importance of educating dentists in responses to systemic emergencies is increasing. The current student-oriented education paradigm is moving towards training students in the abilities required to address the daily crises they will face, while also providing them with the ability to deliver knowledge. Before addressing a patient's situation, emergency physicians begin by diagnosing symptoms. As they must decide on the tests and treatments that are immediately required and must solve problems through interdisciplinary treatment, emergency physicians require additional skills and communication abilities besides clinical knowledge. Since dentistry colleges provide education that emphasizes the skills dentists require to treat oral diseases, they do not have sufficient time to teach emergency care. Additionally, because their professors lack expertise in pedagogy, dental students also have insufficient motivation to study the pathophysiology of systemic diseases. This review proposes a direction of teaching that can help dental students recognize problems and situations in emergency cases and that can help them develop their capability to immediately make a decision and resolve the problem. To do this, the author surveyed the educational philosophy and knowledge provided in the instructional design of clinical professors who give lectures on emergency care, and also examined the teaching methods of the learner-oriented education paradigm.

Keywords: Students, Dental; Education; Emergency treatment.

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INTRODUCTION

Dentistry shares the majority of its history with medicine; however, over the last 100 years, it has taken a different path from medicine and developed strategies for treating oral and perioral diseases. Thus far, this change has been successful, and dentists have been able to solidify their status as independent medical professionals.

Dental practitioners began to provide more comprehensive medical services to satisfy the demands of society. The population of elderly people is continuing

to grow as medical treatment improves and, accordingly, more patients with systemic diseases are receiving dental-care services. Dental practitioners are required to correctly identify the systemic conditions of patients and, since they have begun administering oral or intravenous sedation to make patients comfortable, are now encountering more systemic emergencies before, during, and after treatment.

This change has created calls for dentistry colleges to provide in-depth teaching on systemic emergencies. Despite this, however, when the entire curricula of the colleges are taken into account, the time and budget

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allocated to teach emergency care is insufficient. In particular, the students do not have an opportunity to intensively study the pathophysiology of systemic diseases, even though knowledge in this field must be considered a prerequisite.

In Korea's current situation clinical professors of dentistry colleges are not educated in the basics of pedagogy and the students are focused on the dental care. We should review the education principles and curriculums to teach students in general, and then focus on how to teach systemic emergencies that may arise from dental treatment appropriately.

EDUCATION PRINCIPLE

Education is defined as a comprehensive process that can intentionally change human behavior in a desirable way and is composed of a subject (emergency medicine), teacher (instructor or professor), and student (learner or dental student) [1]. The teacher determines what to teach and plans lectures depending on the characteristics of the subject. The student chooses a subject they want to learn and the teacher they want to learn from and these different levels of engagement also affect the teaching subject. Teaching and learning occur through direct/indirect commutations between the teacher and student. Therefore, to teach correctly, the teacher must be very aware of how students study.

Although many learning theories have been proposed to date concerning education, they can be largely divided into two categories: behavioral perspective and cognitive perspective.

The behavioral approach, one of the stimulus-response theories, states that, if a learner repeatedly practices responses to the stimuli in question his knowledge will improve and, as a consequence, learning occurs.

The cognitive theory considers the mental processes of learners, such as perception, insight, and cognition, to be important and states that learning is an intellectual process in which individual ideas and environmental phenomena

interact. The learning theory describes the learning process of an organism, but the theory of instruction concerns how the learner can best be educated. Bruner states that instructional theory is prescriptive and normative [2]. Applying a specific method under a specific condition to obtain a certain result constitutes a prescriptive instructional theory. This in turn prescribes a specific teaching method to produce an intended result that meets a specific content and condition based on a descriptive instructional theory. It is also referred to as normative because it presents standards that are crucial for the composition and evaluation of teaching.

Gagne wrote that teaching activity is a systemic manipulative process that enables the learner to achieve learning goals by understanding the interaction of stimuli that exist in his internal condition and external environment [3]. This means that it should be planned in such a way so that learning can occur effectively through interaction between the learner, teacher, and the environment. Simply sitting in a classroom listening to a clinical practice class provides a different learning environment from personally witnessing doctors cooperating to treat patients and, accordingly, the education experience differs between the two situations. In the case of the latter, students can observe skills besides acquiring knowledge; learn of the mutual respect, manners, and exchanging of ideas between doctors; and can also receive emotional education through observing communication between the doctor and patient.

1. Student (learner)

Students remember not only what the teacher says during a class but the teacher himself.

The focus of education does not lie with the instructor but with the learner. No matter how good a teacher may be, education that fails to change the learner cannot be good. The behavioral perspective defines learning as a set of responses to stimuli from the environment. However, the cognitive perspective regards the learner as an information processor who places an emphasis on the process of thinking and who also believes that learning

should be an active activity performed through subjective interpretation of the environment. In this context, in order to teach the educational content of a clinical subject, teachers should help students experience effective clinical practice based on sound knowledge. The learning effect will be greater when the education is more strongly related to clinical situations that the learners will be required to address in the future.

Since dental schools place an importance on teaching intervention-oriented guidelines and skills, they allocate most of their classes and educational materials to teaching these guidelines. Such school education forces the learners or dental students to study oral diseases intensively and, as time passes, this causes them to lose their motivation to learn systemic diseases.

Dental students are adult learners; Knowles describes some characteristics of “adult learning”: Adults are responsible for their own lives [4]; therefore, they do not like forced learning and are motivated to learn what they believe they need. They also have their own learning styles and different learning paces depending on the environment. The time devoted to learning is particularly important to them. They tend to choose learning that helps them spend time effectively, and this leads them to allot more time to a subject that provides more credits. Understanding these features of adult learners before designing a curriculum for dental students will help generate good educational outcomes.

2. Professor (instructor)

Medical professors in Korea are equally responsible for medical care, education, and research. However, as they put a greater emphasis on the performance of medical care and the academic achievements that are required for promotion evaluations, educating students naturally becomes less significant to them than their own career progression. Additionally, most of them are not trained to be teachers. Since they have never been educated in effective theory of instruction, they try to model their teaching practices on the professors who inspired them.

As a content professional, a clinical professor deter-

mines educational goals and the topics of his/her subject to teach, selects proper teaching-learning methods, plans evaluations that correspond to learning contents, and decides the overall course of education.

The education philosophy of the professor is an important point in this process. As the Tyler model suggests, an authoritative professor can establish the educational goal and teaching methods independently and can convince students to agree with his choices [5]. This unidirectional form of teaching weakens the learners' will to participate and undermines their desire to learn. The alternative is the constructivist approach of Dewey [6], which sees the learner and teacher build a collaborative relationship; adult learners find this form of relationship preferable.

Good clinical teachers communicate with, inspire, and support their students. They motivate the students to learn more and enlighten them emotionally through proactive involvement [7].

Irby argues that good clinical teachers build a case-based script and apply it for teaching students. They use a script that contains a general teaching-learning theory, educational understanding of learners, and knowledge of patients other than medical knowledge [8]. Irby also explained that experienced teachers in particular are

Table 1. Comments from medical school faculty regarding elements that contribute to success Medical School Faculty Comments Regarding Success Contributing to Teaching Improvements

	N
Planning and anticipatory reflection	
Involving learners	17
Creating a positive atmosphere	13
Considering learners	12
Innovating	12
Engaging learners	10
Adequate preparation	10
Limits content	5
Teaching and reflection-in-action	
Maintaining flexibility in action	5
Reflection-on-action	
Engaging in thoughtful analysis	6
Using appropriate strategies	2

N=number of respondents citing this type of success.

Pinsky L, Monson D, Irby D. How excellent teachers are made: Reflecting on success to improve teaching. *Advances in Health Science Edu* 1998; 3: 207-15.

aware of many teaching strategies that they can utilize when they teach a certain concept [9].

Therefore, good teachers present students with instruction in all domains of education, such as knowledge, skills, and the attitude required to promote their learning.

Pinsky conducted observations on good clinical teachers and determined that they have nine things in common [10] (Table 1):

They involve, consider, build relations with, and engage the learners in planning clinical education, and also adjust, continue preparing, and improve the teaching content. They also maintain flexibility in teaching and, after teaching, engage in thoughtful analysis and use appropriate strategies. The students should be made to feel that the teachers are making efforts not only to deliver medical knowledge, but also to develop the students' personalities, as they will be the doctors and teachers of the future.

3. Curriculum

A curriculum is defined as planning, practicing, and evaluating teaching goals and education content.

Based on teaching conditions, teachers must select suitable teaching methods to achieve goals and must also build diverse strategies in order to effectively achieve teaching outcomes. They should consider all circumstances that can affect the course of learning and adopt systemic approaches to the entire course of teaching. This is generally modeled in the following order, which is based on constructivist education philosophy: instructional design, instructional strategy, learning domain, teaching method, and evaluation.

3.1. Instructional design

Instructional design is a series of processes to determine the characteristics of learning, to identify and apply teaching methods that can promote academic achievement, and to evaluate whether learning has occurred as intended. In the stage, theories or knowledge about learning are reflected.

As stated before, the instructional design of Gagne

(1992) is a logical procedure based on the principle of human learning that concerns constructing and proposing learning goals by recognizing the internal and external conditions that may occur [3].

Conditioning of learning is basically the arrangement of external events that can support the process that occurs within the psychological worlds of learners [3]. Although a class consists of a group of students, individual learning occurs internally. Therefore, systemic approaches that can assist individual learning are required. The instructional-design model consists of five basic steps: analysis, design, development, implementation, and evaluation.

The analysis process analyzes educational needs and environment, identifies learner characteristics, and defines contents; the design process, which specifies teaching methods based on the analysis result, selects the instructional strategy and media; the development process produces teaching materials; the implementation process applies them to actual classes; and, finally, the evaluation process evaluates the effect and efficiency of the teaching programs or materials before reflecting the result in the following instructional design through feedback.

3.2. Instructional strategy

The field of medicine is developing new curricula as patients' expectations of medical care, medical systems, medical knowledge, doctors' work, and the level of new students change rapidly [11]. This trend reduces the time required to teach fragmented medical knowledge, creates a learning atmosphere for adult learners, and includes selective education and early clinical practice. The SPICES model of educational strategies presented by Harden et al. (1984) comprises a continuum of six strategic items: student-centered/teacher-centered, problem based/information gathering, integrated/discipline-based, community-based/hospital-based, elective/uniform, and systematic/apprenticeship-based [12]. The instructors can use the model to create teaching strategies to suit the situations they face by determining the positions on each continuum they are working on. Hence, by applying the model, they can develop and evaluate a new education

program, solve problems related to it, and propose a yardstick for teaching methods and evaluation.

The strategy of student-centered/teacher-centered has recently experienced its most dramatic change. The existing educational strategy was directly teacher-centered, under which the teachers delivered knowledge while the learners remained passive; the student-oriented strategy, on the other hand, promotes the active participation of the students as a means of helping them obtain knowledge independently in settings such as exams or project-based classes. However, this method also has a weakness in that it is not perfect for knowledge acquirement. The two strategies can be supplemented by engaging an instructional strategy, through which the teachers can direct and encourage the students to participate in settings such as discussions or collaborative classes. In order to apply this strategy, the teachers should have strong expertise and should also bear in mind that it may fail depending on the level of engagement of the students.

3.3. Learning domain

The learning domain of any subject has a cognitive, psychomotor, and affective domain. To place them in simpler terms, these can also be described as knowledge, skill, and attitude domains, respectively.

A. The knowledge domain, which, as explained by Bloom (1956), is known to have six taxonomies, was partially modified by Anderson and Krathwohl [13,14]. It is relatively easy to define. Academic societies of various disciplines and relevant institutes generally define the width and depth of the knowledge that undergraduates and interns should acquire. Times have changed and, as a result, education for the knowledge domain has become more specific and detailed and the contents are growing rapidly. This means that the students are required to spend more time in order to completely learn the knowledge domain, which causes them to focus less on other domains. However, simply remembering what is taught will

rarely be the goal of higher education. Rather, integrated knowledge in relation with other subjects is important, and applying it to a field to address problems that change depending on each individual situation is more critical.

- B. In the skill domain, skill is functional behavior and improves qualitatively with repeated training. Dave (1975) classified it into five aspects based on the skill levels and classifications of the WHO (Table 2) [15]. Nevertheless, no general classification for teaching universal-skill exists because there are so many medical skills that have greatly different qualities.
- C. In the medical field, the attitude domain mainly concerns interpersonal relationships. However, it also concerns communication skills and includes doctors' attitudes toward patients and their families, or doctors' collaborative relations with other professionals. This domain was classified into five categories by Krathwohl: reception, response, valuation, organization, and value internalization [16]. This implies that they are not hierarchical, but that a certain attitude develops for each characterization (Table 3).

Teachers are passionate about teaching topics related

Table 2. Classification of skill domains

Dave version	WHO version
Imitation	Imitation
Manipulation	
Precision	Control
Articulation	
Naturalization	Automation

Dave RH. (Armstrong RJ. (ed.)) *Developing and Writing Behavioral Objectives*. Tucson: Educational Innovators Press. 1970.

Table 3. Learning taxonomy – Krathwohl's affective domain

Receiving
Responding
Valuing
Organization
Characterization by a value or value set

from Krathwohl DR, Bloom BS, Masia BB. *Taxonomy of Educational Objectives, the Classification of Educational Goals. Handbook II: Affective Domain*. New York: David McKay Co., Inc. 1973.

to the knowledge and skill domains but less attentive to teaching those of the attitude domain. However, education on attitude is being conducted regardless of their feelings toward it. When, in practical education with doctors, students see patients or their families, the students are not only able to observe the knowledge and skill level used by the doctors to treat the patients, but are also able to learn emotional aspects by sensing their professor's sincerity and sympathy toward patients. When they work with medical professionals from other disciplines to treat patients, the students can learn how to cooperate and exchange ideas with others based on mutual respect for different disciplines. Therefore, teaching topics related to the attitude domain is important for the students to develop the essential ability to communicate and collaborate in an increasingly complicated medical environment.

3.4. Teaching method

Teachers often find themselves asking about the role they provide for the class and how they should create a quality class.

Once assigned to a subject, above all, the teachers consider whom, what, and how they will teach.

There is no such thing as the best teaching method. They simply must choose the best options available depending on the content to deliver and students they must teach.

At the preparation stage, the teachers may ask themselves:

- a) What am I trying to teach?
- b) What academic goals have I established?
- c) What academic achievement do the students desire?
- d) What is the optimal method of fulfilling the academic goals?
- e) What are the strengths and weaknesses of the teaching methods I choose?
- f) How well can I apply the teaching methods?
- g) What are my shortcomings?
- h) How can I evaluate whether the academic goals are reached or not [17]?

Before deciding on the teaching methods to apply, the teachers should understand the characteristics, needs, and capabilities of the learners as well as the teaching goals and content. This is the next step in considering whether a lecture or small-group discussion is better or if writing on the board or using slides and computer programs is more appropriate for teaching a specific concept. The basic questions about education philosophy must be addressed before appropriate teaching methods for specific teaching goals can be selected.

Once the teachers determine logical grounds on pedagogical philosophy and teaching methods, they must once again contemplate individual teaching methods. It is the teachers' sole responsibility to apply various teaching methods such as lectures, small-group discussions, questions, skill practices, and problem-solving involving real patients, and also to use diverse education media such as a computer, slides, and video and audio materials effectively.

Numerous teaching methods exist and there are many classifications. These include teacher-oriented or student-oriented, depending on who leads the class; knowledge or problem-solving, depending on the content in question; lecture-based, personal-instruction-based, lab-based, and discussion-based or self-learning-based, depending on the form of communication; and large group-based, of over 50 students, or small group-based, of fewer than 50 students, which depends on the size of the learning groups.

The review will briefly lists the teaching methods applied to medical education and examines more closely some learning methods which are widely acknowledged to be effective for clinical education.

- a) Lecture-based teaching is older than any other method and is widely accepted. It allows the conveyance of large amounts of information to many students in a short time, although it is unidirectional and involves sending information and concepts as they are. However, as it is a passive teaching method, it is difficult for the learners to become motivated, individualize, or socialize

through this method.

- b) Demonstration-based teaching is often applied to teaching skills that are difficult to learn alone. It is effective when words cannot appropriately describe the knowledge in question. Also, when applied to a large class, this results in very different academic achievements by individuals.
- c) Team-based teaching enables multiple teachers to professionally give a dynamic lecture; however, they frequently find it difficult to reach an agreement in their teaching.
- d) Lab-based teaching helps the students learn abstract theories through experiments. It is self-directed and immediately provides them with feedback. However, it is difficult to apply it to a large group, as this requires large amounts of time and equipment. Hence, it should be demonstrated by a small number of relatively superior learners.
- e) Case-study teaching encourages the learners to make a decision to solve a problem and to actively participate in learning. It improves the ability to analyze, judge, and communicate through discussion. However, preparing for it takes a considerable amount of time, developing a proper case is challenging, and those who make strong arguments may dominate the class.
- f) Field training provides an opportunity to apply knowledge taught in a class to a field and is widely used to teach skills. However, finance has a significant impact on the learning effect, and the objectives of schools are often different from those of enterprises.
- g) Cooperative learning requires the learners to perform a group task, giving them the opportunity to develop the ability to cooperate and communicate through positive mutual learning, learn more than when they are learning alone, and nurture a wider and deeper capability to think than ever before. However, it demands considerable time and effort and causes them to have different levels of participation depending on their competency. It is

also possible that the class will focus on information other than what was originally intended.

- h) With discussion-based teaching, learners express their ideas and listen to others, and such interactions help them reach agreements and eventually solve problems. Through this teaching style, they can develop democratic communication skills. However, only a small number of people can gain control of the class and some may be uncomfortable about the evaluation and become socially negligent.
- I) Individualized teaching is learner-oriented, as it attempts to provide customized education. However, applying it to a large group is very difficult. It is also costly and time consuming.

3.4.1. Small-group learning

Small-group learning is performed with approximately 10 students. As they exchange ideas and collaborate to solve problems within the group, they actively participate in learning. The method largely consists of three strategies [18]. First, all students are autonomously assigned to the same task and learn within the group. Second, they are assigned to different tasks for autonomous learning and discuss them together in order to generate one result. Third, all members of the group that are given one task participate in all processes and produce one result. The second and third strategies are typically referred to as cooperative learning.

Small-group learning has many advantages, for example:

- 1) The students obtain much knowledge by sharing it through autonomous learning
 - 2) The students are well motivated because they study together
 - 3) The students learn to listen to others and reflect others' opinions
 - 4) The students find their own strengths and weaknesses while understanding those of others
 - 5) The students know the importance of each member's role and develop a sense of responsibility
- The students develop interpersonal skills, communi-

cation skills, and team-work skills through interaction. It also has disadvantages, for example:

- 1) The students may simply focus on quickly producing answers in a competitive manner instead of learning how to solve problems
- 2) A handful of students can take control of the class and cause the rest of the students to take a different educational path than that which was intended.
- 3) Less competent students may feel omitted and become passive towards participating in the discussion.
- 4) Students who are excellent learners or have prior experience in this field may not contribute to the discussion.

Methods such as team-based learning (TBL), jigsaw models, case-based learning (CBL), buzz-group discussion, critical debating, and role-playing are recommended as methods of teaching small groups medical education [17].

3.4.2. Problem solving or problem-based learning (PBL)

Problem solving, which is widely used in small-group learning, was first introduced by the medical school of McMaster University, Canada, in the late 1960s. It was developed for medical education and is used in many academic areas such as management, law, and engineering. Under this method, the teachers serve as guides and facilitators while the learners teach themselves by making efforts to solve problems that arise between doctors and patients. They achieve this through clinical thinking, where they collect and analyze appropriate medical information. This is a form of student-oriented teaching that motivates the learners to learn voluntarily [19, 20]. This method allows the learners to take the initiative and emphasizes the learning process over the outcome.

With its basis in cognitive psychology that relates to the thinking process and the problem-solving process of human beings, the method states that, by attempting to address ill-defined medical problems, the learners gain an understanding of the thinking process of clinicians.

This method is generally conducted with a small group

of seven to nine students. They analyze problems through group discussion in order to establish learning goals and then engage in autonomous learning to achieve the goals. Then, they return to the group discussion to generate outcomes and decide either to finish the learning session or begin with a new issue, using feedback to determine whether the matter has been completely resolved [21].

PBL helps the learners improve their ability to study independently, think comprehensively before applying basic medicine in clinical situations, address similar issues, and communicate [22].

Teachers have a significant role to play in this method. They must serve not as deliverers of knowledge but as assistants. In this regard, Kim S. produced the “C-O-I-Q” strategy, which is: 1) mediate the class climate, 2) focus on observing rather than interfering, 3) facilitate students’ involvement, and 4) apply a various questioning strategy [23].

However, PBL requires a great deal of money. When there are 40 to 50 students, the cost is similar to that of traditional learning methods. If there is an even higher number, the cost rises in proportion to the number of students. It also gives the professors a high workload; they would be forced to spend more time tutoring small student groups than giving lectures to large groups. Since the academic achievements may vary depending on the quality of the tutoring, education of the same quality cannot be provided for all learners.

3.4.3. Simulation-based learning

Simulation-based medical learning is an integrated education method that is modeled after the simulated flight training of the 1920s. It provides learners with opportunities to experience to play role in very dangerous situations or to manipulate cost-expensive equipment under simulated conditions. Depending on the level and volume of information, the learners can practice decision-making through the problem-solving process and can also improve their skills through repeated training. With such advantages, the method is applied to technical education, math, and science.

Simulation-based learning equipped with 3D software as well as hardware such as mannequins is being increasingly applied to medicine to train students in various surgeries, endoscopy, and airway maneuvers.

Simulation-based learning must satisfy the three “F”s described below.

1. Facilitator: Teachers must create an educational atmosphere that exactly replicates real settings and they must help the learners adapt to it. They should have sufficient knowledge and experience and should also provide positive encouragement. They must give a debriefing after each simulation, and they must ensure that the learners concentrate on it.

2. Space and facilities

The teachers should establish a realistic environment, including the arrangement of mannequins, and ensure that there are no communication barriers with the students. A recording device would simplify debriefing. Space is the most important aspect and it is good to have simulation equipment like mannequins and computers at all times to best use the time for learning. Simulation software that is designed to record learning results will make it easy to determine changes in the learning effect.

3. Fund

The simulation equipment should be within the budget and should be installed and operated efficiently.

Scenarios are vital for efficient simulation-based learning. They should be developed from a basic to advanced level, depending on learning content. As some of these may require prior learning or the practice of different skills before class, students are required to properly prepare for the class in order to enjoy the full learning effect.

A de-briefing following the simulation maximizes the learning effect. Voluntary and active de-briefing is required because specific knowledge is delivered and this step intellectually motivates students.

The greatest advantage of simulation-based learning is

that both the learners and patients are exposed to a lower level of risk. This enables the student to engage in repeated training, feedback, and retraining until they achieve the education goals that have been set. Through scenarios that replicate crises that rarely occur, they can learn how to address problems arising from complicated situations. Team training is also possible and, as a consequence, they learn communication skills through this. It is also worth noting that the learning level of the learners can be evaluated directly through simulation [24].

3.4.4. Case-based learning

Case-based learning, or CBL, also involves a small group of eight to 10 students with one tutor, but this can be applied to teaching a large group.

In this style of teaching, the cases used for learning must be fact-based and complex and able to promote in-class discussion and collaboration. They must present a real situation that requires just-in-time decision-making that triggers deep-thinking processes such as brainstorming.

Under the CBL setting, the instructors notify the students of the learning goals before showing them the case, and they then provide them with the lecture transcript containing necessary information so that the students can teach themselves before the class. However, the knowledge given before the class is not sufficient for the students to fulfill the class goals. Along with discussion on the provided case, they must also cover many other cases in order to achieve the objective.

The students analyze fact-based information from the case, establish a hypothesis, and draw a conclusion that matches the new situation. Through the active discussion, they acquire knowledge, learn partnership skills, and improve their communication skills. Cases sourced from the real world make it easy to motivate the students to learn.

The CBL has a very similar process to the PBL. The students continue to analyze and discuss the case until they solve the problem, understand it and, in the process,

acquire problem-solving knowledge.

The students can encounter multiple cases that conform with the learning goals because, in clinical settings, the same disease can cause a variety of situations [25].

Teaching methods are determined by considering learning content, learners, expectations from organizations or society, and education resources. Different methods can be applied depending on whether the learning content concerns finding an answer, is controversial, sets a standard, or seeks a solution, and on whether the knowledge level is conceptual or specific. The number, learning style, and the level of experience and the expectations of students are also important factors. As education resources are also vital, constraints imposed by time, space, and education resources are clear. Different teaching methods are also required to meet the overall learning goals that an organization expects from education as well as to meet the desired evaluation and measurement methods.

3.5. Evaluation

Evaluating educational outcomes is more important than the process. Their evaluation is reflected in the next instructional design, which involves feedback.

Miller (1990) proposed four steps of assessing clinical skills. Although it is possible to assess “what we know,” written tests that cannot evaluate “what is performed” in real clinical settings represent over half of students’ scores. Doctors must be required to demonstrate not only their strong medical knowledge base but also ability to competently perform [26].

Let us examine assessments of learning areas. Written tests allow us to evaluate simple knowledge that has been acquired, while oral tests enable the assessment of a higher knowledge level. The attitude domain can also be assessed using the latter method; however, it is less objective. The objective of the oral test is to determine whether the students have the ability to use their knowledge to plan treatment, to make a medical decision that suits given circumstances, and whether they can demonstrate how to put the decision into action, com-

municate with others, and organize the treatment logically.

There is an objective structured clinical examination (OSCE) and a clinical performance examination (CPX), which are designed to objectively evaluate how learners perform. After a standard patient program was adopted, these clinical examinations were widely applied. The standard patient plays the role of a grader and promotes learning through feedback.

Harden and Glessen (1995) designed the OSCE to become a model of clinical exams that assess the clinical performance of doctors. The learners perform clinical skills following a specific clinical scenario and the evaluators observe and evaluate them in person using a standard score sheet. It is generally agreed that the OSCE is more reasonable than the written or oral test. However, some argue that its reliability can be secured when 20 or more assessment items are used [27].

Clinical education is gradually accepting the concept of outcome-based education, which is not so much concerned with what learners are expected to achieve after they finish the education course, but whether they can actually practical elements of medicine that exceed what they have studied. In this context, clinical performance exams are related to outcome-based education.

EDUCATION IN EMERGENCY MEDICINE AT MEDICAL SCHOOLS

It is true that medical emergencies can occur in any location, including the home, local community, and in hospitals. As a result, American society demanded that all doctors be capable of addressing unexpected emergencies and of also treating patients. Under these circumstances, the Macy Foundation held a symposium in 1994 and this served as an opportunity to reform the emergency medicine education to medical students [28]. A series of research was conducted concerning the best method of providing undergraduates with emergency-

medicine education that would allow them to develop competency in treating acute diseases or injuries. As a result, an emergency medicine curriculum was established for medical students, along with contents and objectives for each school year. The Society for Academic Emergency Medicine proposed an outline of the curriculum and emphasized the level required [29]:

- 1) Basic life support
- 2) Differential diagnosis and treatment of emergencies
- 3) Treatment of patients that are difficult to diagnose

1. Basic life support

The most important objective of emergency-medicine education is to teach learners the ability to recognize when a patient is in a critical condition and the ability to save his/her life. In this case, students should be able to understand the emergency, prioritize the steps and, if necessary, perform the first step of life support such as opening the airway, rescue breathing, chest compression, venipuncture, fluid infusion, or hemostasis. The most important thing is to immediately take steps that accord with the basic guidelines, although this may vary depending on conditions.

To achieve the learning goal, students are required to attend a lecture on basic knowledge and to practice repeatedly with mannequins and simulation equipment. They can also experience various emergency situations and learn how to cope with them through practice in emergency medicine and clinical practice. In this case, the students can even learn topics relating to the attitude domain through collaboration with doctors as well as interactions between doctors and patients.

Under this domain, knowledge on certain emergencies can be assessed using written and oral tests. Besides the oral test, skills can also be evaluated using mannequins and simulation equipment.

2. Differential diagnosis and emergency treatment

Doctors should have a wide range of basic knowledge on frequently occurring emergencies. When patients are concerned about chest pain, headache, burns, stab

wounds, or fractures, they want a good doctor's advice. Although many cases are not too serious for general practitioners to manage, at the least proper and effective treatment should be provided to avoid unnecessary complications.

The competencies required in this domain are determined by each emergency case. Students should be able to explain the treatment options that are available for given conditions and the kind of complications that patients may encounter for each situation. If the initial treatment fails, they should also suggest the next step.

3. Treatment of patients that are difficult to diagnose

When a certain disease or injury is properly diagnosed, treatment can be performed in accordance with the accepted guidelines. Therefore, the most challenging situation is when it is difficult to perform a general diagnosis. That is why it is critical to teach doctors the basic skills required to understand their patients' conditions. For this, the students require training in diagnosing diseases in random patients. One of the biggest goals of medical education is the recognition and differentiation of acute clinical issues, and students must learn these by analyzing patients' symptoms. Since illnesses in different organs can have similar symptoms, students' involvement in providing primary medical care to a patient on their first visit to a doctor with the complaint in question helps achieve the best outcome. Determining the cause just by analyzing patients' symptoms is not only important but also a race against time and, therefore, the thinking process for decision making is crucial. In this context, the CPX is the most effective method for evaluation.

CIRCUMSTANCES OF DENTAL SCHOOLS

When the two are compared, emergency medicine in medical schools is quite different from that in dental schools. Medical emergencies can occur systemically, affecting all organs, and the differentiation and treatment

of symptoms requires a very extensive range of knowledge and experience with numerous patients.

However, dental emergencies often concern injuries such as tooth fractures or luxation, acute pain from periodontal abscesses, and oral, head, and neck symptoms such as neck cellulitis; these are generally not life-threatening, even though patients may feel a sense of urgency and pain, except for the diseases treated by oral and maxillofacial surgeons. This can mean that performing a differential diagnosis based on patient symptoms or deciding an appropriate treatment method based on diagnosis is easy. It is also very notable that dentists are not usually pressed for time to select an accurate treatment.

Except for emergencies caused by trauma, Dentists can encounter almost every form of medical emergency in their offices, such as the fluctuation of consciousness, unconsciousness, issues relating to chest pain, hypoglycemia, generalized convulsion, adverse drug reactions, etc. [30]

However, people rarely come to dentists if such life-threatening medical emergencies occur outdoors. Dentists generally experience these medical emergencies mostly from the patients they have provided dental treatment services for.

According to Matsuura, medical emergencies constitute 19–44% of all dentistry cases over five years. Of these, 90% are of a mild degree while 8% are serious. Of this 8%, 35% of the patients have systemic diseases and 33% of them have a cardiovascular disease [31].

Society regards the situations above, in which a patient receives a simple local dental treatment when he feels his life is systemically threatened, as malpractice and this will very likely lead to a medical dispute. Therefore, it is very important to prevent such incidents from happening and also to recognize and discriminate the circumstances causing it.

Emergencies can be prevented when the dentists know their patient's detailed medical history and, therefore, can adjust the dental treatment plan accordingly. The most critical treatment in emergency situations is to supply

oxygen to vital organs, which is part of basic life support. Dentists require sufficient competency for this. They must also be able to manage most medical emergency skills and, if necessary, secure the airway, breathing, and circulation by assessing patients.

However, a large constraint is that such events do not occur frequently enough for dental instructors to be able to demonstrate exemplary practices for treating actual patients, the practices for appropriately responding to emergencies, or for such cases to be used for teaching students [32].

EDUCATION ON SYSTEMIC EMERGENCIES AT DENTAL SCHOOLS

Teachers of dentistry should plan to teach self-directed learning to students instead of simply delivering knowledge. They must also guide the students on developing their communication skills, judging skills, and decision-making skills as well as the ethics and character that a medical professional must have.

The learners have to find “doing” more interesting than “knowing.” Learning for themselves by doing is more realistic and prompt than learning through listening and reading.

In the meantime, the teachers responsible for classes are required to understand the characteristics of the dental students, who are adult learners, and must also have a deep interest in teaching and, based on pedagogical learning theory, evaluating students' abilities and their skill in the attitude domain.

Under the current medical environment and dental circumstances, it is very challenging to conduct education on systemic emergencies. As explained before, however, this is becoming increasingly necessary because society demands safe treatment and the systemic danger caused by sedation is increasing. Thus, it is imperative that the teachers provide the best education despite the circumstances.

It is believed that teachers will be able to give appro-

appropriate lectures, despite time constraints, by doing the following: motivating future dentists to learn emergency care; strengthening education on the pathophysiology of systemic diseases by forming partnerships with medical professors; teaching emergency-care topics relating to the knowledge domain through lectures; planning for students to learn and practice basic life-support skills through simulation-based learning that involves the use of mannequins; constructing problem-solving lectures, including demonstration-based and case-based teaching concerning addressing emergencies; and evaluating clinical practice performance through the form of a written test and simulation. Accomplishing these goals requires efforts in the three main pillars of education. The schools are responsible for creating an appropriate atmosphere for lectures while the teachers must plan and conduct classes that are consistent with the educational trend. The students, for their part, must study independently and actively participate in the classes.

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