

Education of Forensic Medicine and Toxicology 20/20

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Objectives

- 1. Introduction**
- 2. Principles of Egyptian Medical Schools Development 20/20.**
- 3. How to distribute and integrate Forensic and Toxicology Curriculum?**
- 4. Blueprint for Forensic and Toxicology Curriculum 20/20.**
- 5. How to introduce the new curriculum to the students?**
- 6. How to assess the students in new Curriculum?**
- 7. Appendix**
- 8. References**

Section 1

Introduction

There are many triggers factors before the occurrence of any change. These factors are motivators and the leader towards the change. According to the scope of medical education development, these factors are series of the troubles issues related to the medical student and graduate such as loss of educational experience enjoyment, ineffectiveness and inefficiency of many learning skills (decision making, problem solving, and clinical reasoning), inability to perform self-assessment and correct weakness through self-initiation continuing education, deficiency of the graduate ability for health maintenance and prevention of diseases.

There are two main steps of the change process. The first is a perception of the need for the change which is supported by dissatisfaction with the current situation or intrinsic factors such as competition, solicitation, and social trends. The second step is a decision to perform the change. The change process has three phases; the first phase is frozen (the status quo) which is moved towards the second phase (unfrozen) by initiating factors such as reflecting negative feedback for the program or inability to get national accreditations. Unfrozen phase is characterized by instability, emotional stress and conflict until determination the leading direction towards new structure (refrozen) where the integration of innovation needs with the social context to accommodate the change. Refrozen phase is the third phase which completes macroscopic model of the change.

The level of the Egyptian medical school graduate reflects the need for the change. The graduate is not able to meet the societal needs because of the missed skills such as communication, problem solving, decision making and teamwork skills. After the recognition of the need for the change due to the previous impact, the teamwork of the faculty members should be started to revise the curriculum for determination the weak points and diagnose curriculopathy to enlist the specific problems.

The curriculum is a reflection of the educational objectives and the planned learning experiences of educational organization. There are three levels of the curriculum; the planned, the delivered and the experienced. The planned curriculum is intended objectives which are constructed by the designer; the delivered curriculum is the

content of teaching and organization which is held by the administrator while the experienced curriculum is output which students learned.

The medical curriculum should be related to the health service and community to improve this health service. The curriculum consists of four main elements; content, teaching and learning strategy, assessment process and evaluation process. It has two types; prescriptive model which indicates what the curriculum designer should do and descriptive model which refers what the curriculum designer actually do. Thus, the first step of the curriculum development should be the problem identification and general needs assessment.

The key to the success of any curriculum depends on its implementation. Aspects of implementation need facilities and support such as resources, administrative strategies, political and financial support. Resources include human resources such as faculty members, patients, and administrators. Time, funding, other facilities such as space and equipment are considered the part of resources. Achievement of curriculum relies on internal support from inside the institution or external support from out of the institution. Administrative authority and faculty members are the main sources of internal support of the curriculum. External support from the government agencies and professional societies is essential if there is a deficiency of institutional support for the curriculum development. Coordinator of curriculum is the moderator for communication lines among participated stakeholders for more congruence teamwork of curriculum and more accurate implementation of curriculum. Preparation and distribution of schedules are one of the major operations of curriculum application which depends on the mechanism of communication between stakeholders. Determination of anticipating curriculum barriers is an important issue for successful curriculum accomplishment. The introducing method of the curriculum determines the correct direction towards the qualified achievement. The pilot study is the reflection and feedback of different opinions for the curriculum revision before the application. Phasing-in of curriculum means that implementation is step by step to increase acceptance and lessen the resistance. We sometimes decide full implementation without pilot test and phasing-in if there is an urgent need for an immediate full implementation. In this case, the first cycle of curriculum represents a pilot study for an improvement in the next cycle. Continuous of curriculum improvement means the success.

Section 2

Principles of Egyptian Medical Schools Development 20/20

Background

According to the world federation for medical education (WFME) and the institute of international medical education (IIME), there are global minimum essential requirements of undergraduate medical programs; it consists of seven main domains

1. Professional values, attitudes, behavior and ethics
2. Scientific basic of medicine
3. Clinical skills
4. Communication skills
5. Population health and health systems
6. Management of information
7. Critical thinking and research

Seven main domains of the essential requirements of undergraduate medical programs were classified into competency categories as the following:-

- 1- Medical knowledge
- 2- Patient care
- 3- Professionalism
- 4- Communication skills
- 5- System based practice (health care management- health service delivery)
- 6- System based learning (identification of the medical literature quality - utilization of the positive attitude for active educational process participation)

To judge the quality of learning in the educational organization; it should identify the requirements of ideal learning. Based on the various researches, the requirements of ideal learning are the following:-

1. It should transform the student into a flexible thinker.
2. It should produce epistemologist who has the ability to construct unique ways of knowing actively.
3. It should able to give a learning opportunity for the student at all time in all situations.
4. It should present in the interpersonal and problem context.
5. It should reinforce the learning effects using the feedback frequency

Egyptian Medical Schools Development 20/20

Principles of Egyptian Medical Schools Development 20/20 are based on two main components, the first is an integrated organ system while the second is credit hours policy.

Integrated organ system

Integrated organ system is a module (block) based where every module is a collection from the different medical branches that are related to one organ system such as nervous and respiratory system. Integrated organ system increases the effectiveness of the teaching-learning process because it makes the knowledge more easy to understand in contrast with the teaching in the traditional system where it is a subject based. The integration process results in facilitation the attainment of knowledge, skills and attitudes to the theoretical subjects in a clinical context. This enables the students to relate the clinical data taught in clinical subjects to the biological principles and mechanisms as presented in the basic sciences. In addition, this enforces a deeper understanding, which means that the learning is associated with curiosity, personal interest and lack of external pressure leading to internal motivation in the students ultimately. For integrated curriculum to be effective and to achieve its purpose, every staff members from the various departments are required to coordinate, plan and give the adequate time. Thus planning and collaborative efforts is a vital necessity prior to the designing integrated modules.

Integration between the different medical branches are classified into many types or directions such as the following:-

1- Horizontal Integration

The integration is within the basic science subjects or within the clinical science subjects of the curriculum.

2- Vertical Integration

The integration is between the basic and clinical science sections of the curriculum.

3- Spiral integration (Ideal Form)

It is a combination of both horizontal and vertical integration.

Integrated system is divided into two or three phases (spirals) as the following:-

1- The first phase - foundation “1 year”

It is an introduction to the basic medical information.

2- The second phase “2 years”

It is based on organ system module whereas it applies the basic knowledge to the study of clinical disease.

3- The third phase “2 years”

It is devoted to clinical aspect.

4- Internship

It is a training period which lasts for two years.

However, some medical integrated schools have two phases or spirals only as the following:-

First spiral: (2 - 2.5 years)

It contains 70 % basic science and 30% clinical science.

Second spiral:

It contains 70% of clinical science and 30% of basic science.

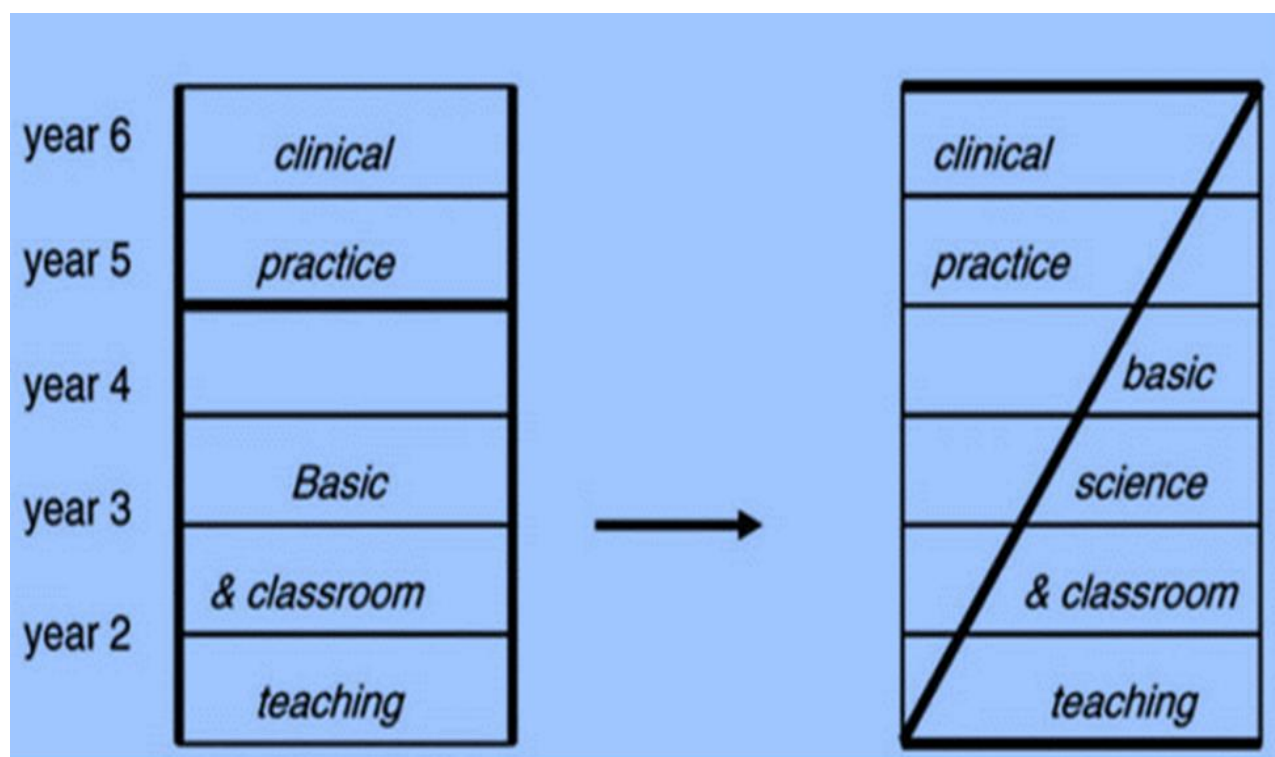


Fig (1): shows the difference between the traditional curriculum and the integrated curriculum where ‘H’ shaped curriculum (traditional) is converted into ‘Z’ shaped curriculum (integrated).

Flaws in the integrated system curriculum

- 1) Fragmentation of the learning subjects of the curriculum.
- 2) Missed of some learning subjects of the curriculum.
- 3) Dissatisfaction the staff members about the allotted time & knowledge in the modules.
- 4) Absolute complete integration up to 100% is not possible.
- 5) It is an exhausted for the efforts.
- 6) It is a difficult task during the implementation.

Credit Hours System

Credit hours of the course or module depend on the unit of the semester credit hours where the semester credit hours are based on the contact hours which are the spent time of the student with an instructor whether face-to-face such as the lecture or virtual such as the video conference. Duration of the semester is 15 weeks of the instruction plus one week for the final examinations.

Credit hours system has many features where it contains obligatory, elective and pre-requisite courses beside the university requirements such as computer and English while the college requirements such as medical statistics, research methodology and medical ethics where these courses are mandatory for every student to graduate from specific college or university. There are many objections against the elective courses in the medical schools claiming that all medical subjects should be mandatory and the student should not have the right to choose from the basic and clinical sciences where all these subjects are considered obligatory but the other opinion adopts another view that is based on creating the new courses such as medical nutrition and patient safety as an elective course far from the basic and clinical sciences which should be are an obligatory. Pre-requisite course is a preparatory obligatory course where the student should register and pass it successfully if he decides to register a specific course, for example, histology is considered the pre-requisite course for the pathology course while chemistry is the pre-requisite course for pharmacology, etc.

Academic monitoring is considered one of the main characters of the credit hours system where every group of students has a facilitator who is a guide to this group during the educational process to solve and overcome their educational problems

which they faced. Every student has validity and ability to register, add or delete any course through an electronic system beside his ability to withdraw, postpone any course also according to specific rules.

Section 3

How & When to Integrate and Distribute Forensic and Toxicology Curriculum inside the educational phases and modules?

Distribution and Integration of Forensic and Toxicology Curriculum inside the educational phases and modules should be based on the following rules:-

- 1) The chosen subject that is inserted inside the module should be in agreement with intended learning objectives "ILOS" of the educational module.
- 2) It should represent a common forensic and toxic issue in the community according to the general needs assessment.
- 3) It should have an impact on the patient and society.
- 4) It should be clarified in cognitive, affective, and psychomotor domains .
- 5) It should be in harmony with the credit hours policy of the module and the medical branch.
- 6) Using the longitudinal courses for some subjects that are missed during the integration.

At the first, the intended learning objectives (ILOS) should be written by well qualified persons in a teamwork manner where it should include all staff members from different departments that are related to the educational module under the umbrella of the medical education department according to specific rules.

Any written educational objectives should be specific and measurable. It should contain five basic components (who, how, How much, what, when). These objectives should be written by using a verb which leads to few explanations such as demonstrate or define. Use of more explanations verbs such as learn or teach is undesirable. There are many types of objectives; it may be related to the learner achievement, educational process or outcomes of the curriculum.

Learning objectives may be related to cognitive, attitude and psychomotor domain. Cognitive objectives are called knowledge objectives which include a spectrum of cognitive functioning related to the curriculum goals from simple to the high level of knowledge. Affective objectives are called attitudinal objectives which affect learning in relation to attitude, value, belief, emotion, and bias. Psychomotor objectives are called skill objectives; it is related to specific actions by hand, speech,

hearing, and vision such as communication skills, physical examination, and technical skills. Writing psychomotor objectives may be competence (expectation for skill achievement) or behavioral (expectation for incorporation skill into behavior). Process objectives are related to the implementation of curriculum and indicators to expected degree of the learner participation and his response. It indicates to the faculty response to the curriculum also. Outcomes objectives are related to the patient health outcomes or physician qualification.

Examples for specific learning objectives in toxicological curriculum

A- Cognitive objectives

By the end of curriculum, every student should be able to:-

- 1-List common toxicological problems in the community.
- 2-Demonstrate common drug abuse in the community.
- 3-Identify the mode and mechanism of toxicity of common toxicological problems
- 4-Identify the outlines of first aid and management of common toxicological cases.
- 5-Identify antidotes of common toxic agents.
- 6-Demonstrate the rationale of toxicological cases referral to the higher specialized toxicological centers.

B- Affective objectives

By the end of curriculum, each student should be able to:-

1. Identify proper attitude and behavior towards the intoxicated patient.
2. Identify proper attitude and behavior towards the relatives of intoxicated patient.
3. Identify proper attitude and behavior towards the drug abuser patient.
4. Demonstrate common wrong beliefs of the patient towards the management of toxicological cases.
5. Demonstrate effective counseling for prevention and the first aid of emergency toxicological cases.

C- Psychomotor objectives

By the end of curriculum, each student should be able to:-

1. Perform qualified history taking of the intoxicated patient.
2. Perform qualified complete physical examination of the intoxicated patient.
3. Demonstrate appropriate investigations for each toxicological case.

4. Interpret the results of investigations and how to use it for the diagnosis.
5. Demonstrate toxidromes of common toxicological health problems.
6. Demonstrate the skills of the first aid and management of the intoxicated patient.
7. Demonstrate appropriate decontamination technique for each toxicological case.
8. Perform the qualified technique of gastric lavage skill.

The chosen subjects should be common in the national and local community according to the general needs assessment where addiction and drug abuse is considered the first priority in our community in contrast to arsenic poisoning that may be considered the first priority in other desert communities which depend on the underground water while the traffic accidents may be the first priority in our country in contrast to the sexual offences. The chosen issues should have an impact on the patient and society such as household poisoning.

The chosen subjects should be in harmony with the credit hours policy of the educational module and the medical branch. The medical sector in supreme council of universities determines the weight of every medical branch as credit hours per all five educational years where the national medical graduation certificate contains the calculated credit hours for the different medical branches according to its scientific load. The distribution of credit hours of every medical branch inside the educational phases and modules may be the responsibility of the College Board or the scientific committee in a collaboration with the specialized departments.

The missed subjects are considered one of the main defects of the integrated system during its implementation whereas there are many subjects that are not addressed during the integration process such as medical ethics, medical nutrition, and the patient safety. Longitudinal curricular themes (courses) are independent courses which are created to manage one of the flaws of the integrated system where it runs within the multiple modules autonomously.

Section 4

Blueprint Forensic and Toxicology Curriculum 20/20

According to the above-mentioned rules and the previous cumulative experiences in some medical integrated schools, the following curriculum was designed.

| | | | | | | |
|-------------------------|---------------------------|---|--|--|-----------------------------|------------------------|
| 1 st year | Module 1 st | Anatomy | Biochemistry | Physiology | Histology | Medical terminology |
| | Module 2 nd | Pathology | Pharmacology | Microbiology | Study skills | Medical Statistics |
| 2 nd year | Module 1 st | Musculo-Skeletal Identification of age & sex | Hematology Blood stains DNA printing | Research Methodology* | Communication Skills* | |
| | Module 2 nd | CVS Death Sudden natural death Digitalis Salicylate | Respiratory Asphyxia Inhalation poisoning Kerosene poisoning Nicotine (smoking) Oph | GIT Food poisoning Corrosives Arsenic Anticholinergic Hepatotoxicity | Community Medicine* | |
| 3 rd year | Module 1 st | Urinary Nephrotoxicity | Reproductive Pregnancy & delivery Abortion | Endocrinology | Medical ethics * | |
| | Module 2 nd | Head and neck Head injuries Neck injuries | CNS Animal poisoning Addiction & drug abuse Opiate & Cocaine Barbiturates Alcohol & Cannabis Strychnine & Aconitine Lead | Special senses | Research ethics* | |

| | | | | | |
|----------------------------|---------------------------|---|--|---|--|
| 4 th year | Module 1 st | Medicine 1 | Surgery 1 | ENT Ototoxicity Barotruma | Dermatology Physical injuries Wounds Firearm |
| | Module 2 nd | Pediatric 1 Infanticide Sudden infant death Common household poisoning Paracetamol | Gyn. & Obst. 1 Sexual offences Impotence | Ophthalmology | Patient safety* Medical Malpractice |
| 5 th year | Module 1 st | Medicine 2 | Surgery 2 | Family Medicine | Orthopedic Road traffic accident injuries |
| | Module 2 nd | Pediatric 2 Child abuse Childhood lead poisoning | Gyn & obst. 2 | Psychiatry Medico-legal approach of psychiatric patient Hallucinogens Tricyclic antidepressants | Emergency General Toxicology & Management of poisoning Cases Toxic Coma |
| 6-7 th years | Internship | | | | |

* longitudinal courses

Section 5

How to introduce the new curriculum to the students?

Curriculum objectives achievement is done by educational strategies which consist of content and educational methods. Content is the specific material of curriculum which is presented by the educational methods. The selection of educational methods should be depending on the congruence between objectives and methods, and its feasibilities for the learning resources. The use of multiple different educational methods is important to overcome the different learning styles problems, to reinforce the learning and maintain the interest of the learner. There are many educational methods such as lectures, discussion, readings, problem based learning, learning projects, programmed learning, role models, artificial models, role plays, standardized patient, clinical experiences, group learning, and audiovisual reviews. The designer of the curriculum has a challenge for the educational strategy selection and the objectives achievement of his curriculum if there are restricted learning resources such as time, space, clinical material, staff members of college and money.

Educational Methods

Lectures

1. It is an applied method for addressing the cognitive objectives.
2. It is suitable for a large number of learners and the structure presentation for the complex subjects.
3. It teaches many audiences in a little time.
4. It is a low technological method.
5. Characters of successful lecturer are the ability to perform material organization, to control physical environment, to make a summary statement, to use audiovisual aids, to present examples and facilitate effective question and answer time.
6. **Shared lecture** is a modified type of the lecture that is dynamic and interactive because it is presented by two lecturers from two different branches who introduce two different views related to one subject.

Self-study (Readings from electronic and written references)

1. It develops self-learning using the searching to get the information by the learner.
2. It is a low cost method and needs a low preparation time.

3. It is an efficient method for information presentation.
4. It addresses cognitive objectives efficiently.
5. It is used to complete other educational methods.

Audiovisual materials

1. It is used within the lecture context and other contexts to reinforce the presentation of content.
2. It conserves the staff members if there is a need for a repeated lecture to many times.
3. It is used for a technical demonstration such as videotapes (virtual autopsy).
4. It is a self-observation method because it provides perfect performance feedback.

Clinical Experiences

1. It is a real life.
2. It develops motivation, responsibility, skills, performance of learning and attitude.
3. It promotes high cognitive levels.
4. Supervised clinical experiences are chance for the learner to practice the skill under observation with feedback receiving for his performance and then he can teach skill to another generation.

Small group discussion (problem-based learning)

Problem based learning is a corner stone of the modern medical education. Principles of PBL are the construction of knowledge, prior knowledge activation, the organization of knowledge, elaboration of knowledge, stepwise transfer across the contexts and cooperation with other learners.

Well-designed the problem is considered one of the fundamentals to achieve the success in the integrated system that is based on the problem based learning, thus there are many steps which should be applied for constructing the educational problem:-

1. Identify the learning objectives according to the aims of the educational module and involve these objectives in the problem.
2. Construct the case template.
3. Adjust the problem according to the needs of the learners and the stage of the curriculum.

4. Build a systemic, integrated and logical flow of the problem with authenticity.
5. Construct the starting point as a trigger point to encourage discussion among the learners with the application of the deductive approach.
6. Involve some information such as age, occupation, and investigations to initiate and moderate thinking process (brainstorming).
7. Make the problem in the present tense.
8. Construct a tutor guide for the problem.
9. Make revision for the problem before its release to the learners.
10. Create a feedback system from the students and facilitators for more qualification of the problem.

Advantages

1. It is active learning method.
2. It is an applicable method because it gives the learner the choice to apply the acquired knowledge.
3. It provides the learners with many skills such as processing new knowledge for identifying specific information deficiencies and using the effective interventions such as focus maintaining, questioning, generalization, and summarization.
4. It promotes teamwork.
5. It develops problem solving skills and clinical decision making.
6. It is a tool for performing the affective objectives
7. It incorporates the objectives across domains.
8. It promotes self-directed learning.

Team-based learning (Group learning)

1. It is active learning method.
2. It encourages the learner to work as a team.
3. It allows multidisciplinary approaches.
4. It is a suitable method for the problem-based learning and community-based projects.

Simulation (Artificial model - role play - standardized patient)

A. Artificial model

It is a safe method for the skill practice and simulates the real clinical situation.

B. Role play

It provides different roles experiences for the learner.

It is useful for interview skills and physical examination technique.

It is efficient and portable method.

It permits trying, observation and discussion for good performance achievement of the learner.

It may be used to show and act the roles of the assailant and the victim beside the circumstances of the crime.

C. Standardized patient

It permits the learner to try a new technique, make mistake and repeat for the skill achievement.

It needs less staff supervision.

Learning projects

1. It promotes self-directed learning.
2. It is active learning method and suitable for high order cognitive objectives.
3. It is an opportunity for the learner to establish the individual objectives learning.

Programmed learning

1. It is programmed textbook or computerized program.
2. It presents an organized sequential material model such as computer-based patient questions which help the learner to receive an immediate feedback for knowledge, efficiency and the cost effectiveness.

Seminar (tutorial)

Students consult the staff members about a specific topic or the staff member gives a task to the students as a group or individually such as presentation or review article about a collective material such as hepatotoxicity or nephrotoxicity for discussion.

Section 6

How to assess the students in this new Curriculum?

Background

Assessment should be integrated with the instruction process; it is used as a tool for determining the instruction extent of the intended learning outcomes achievement by the students. Well integrated designed assessment provides more effective instruction. The achievement assessment of the student leads to student motivation, instructional effectiveness evaluation, student self-evaluation development, retention and transfer of the learning. There are principles or standards for the teacher competence in the student assessment; the teacher should be skilled in the following:-

- 1- Selection of appropriate assessment methods for the instructional decision.
- 2- Developing of appropriate assessment methods for the instructional decision.
- 3- Administration, scoring and interpretation of assessment methods results.
- 4- Using the assessment results for the curriculum development, college improvement, and planning to teach.
- 5- Development of the valid student grading procedures.
- 6- Communication of the assessment results to the students, parents and other educators
- 7- Recognizing of unethical, illegal, inappropriate assessment methods and assessment information uses.

There are many types of assessment which are classified according to the timing. Placement assessment is a given test at the beginning of the course to identify the necessary prerequisite skills of instruction success. It is a pretest which determines entry assessment and covers the intended learning outcomes of planned instruction. Formative assessment (process focused) is the used tests to monitor the learner progress during the instruction by identification the strength and weak points of student performance. Its design depends on measuring the mastering extent of the learning outcomes for the limited section of instruction by the learners; its results are the method of learning improvement. We can make instruction and learning adjustment according to the successes and failures in the learning of learners. We need more concentration on the difficulties of students learning if the formative

assessment and its corrective prescriptions fail to overcome the learning problems of the students. Diagnostic assessment can detect the error and then learning difficulties are identified and retreated. But there is difficult for diagnostic test application in the most instruction areas. In the end of instruction, the extent of learning outcomes achievement and terminal performance of students should be measured by summative assessment (outcome focused). It is a comprehensive method to identify the mastering or assign the grades. It aims to provide the student's feedback and the evaluation of instructional effectiveness.

Formative and Summative Assessments

There is a comprehensive exam that includes all different subjects from the different medical branches which represent the educational objectives of the module. This exam is held in the mid-module as a formative assessment to give a feedback to the students and the other stakeholders about the progress of the education process and show the defects that should be corrected in the future while the final exam at the end of the module is considered summative assessment to show the final level of the student.

Distribution of questions according to the intended learning objectives (ILOS) and the given time of every subject (Table of specification "TOS").

Table of the specification is a blueprint of the test; it identifies the types of test items which are included in the test according to the spent time and the cognitive level of every objective. The validity of judgments for the learning and the students' knowledge is fundamental for any assessment. Table of the specification improves the validity of the test which is based on the quality evidence (test content and response process). Test content is the studied subject matter while the response process is the kind of thinking which is required for the test. There are many approaches to develop and use the table of specification (TOS); we will choose one approach to design the table of specification according to it.

The table of specification (TOS) means that a load of every medical subject in the exam depends on the number of the credit hours of the subject and its percentage of the total learning objectives which is translated into a number of the questions as shown in the figure (2). For example, if the decision is made by the educational authority in the college that a load of every teaching credit hour is two questions in

the exam; the number of questions will be 4 for any subject that has two credit hours. Some medical integrated schools calculate the number of questions based on the learning objectives thus if the learning objectives of the specific subject such as head injuries represent 10 % of the total objectives that equals 50 questions, the number of questions for head injuries in the comprehensive exam will be 5.

| Subject | Dr. | Topics | Hour | Total Qs. No |
|--------------------------------|-----|--|------|--------------|
| Histology | | Cerebrum | | 2 |
| Pathology | | CNS neoplasm L | | 4 |
| | | vascular diseases of CNS | | 3 |
| | | CNS Infections L | | 3 |
| | | Diseases of myelin L | | 2 |
| | | Poly Neuropathy L | | 2 |
| Toxicology & Forensic Medicine | | Lead poisoning | | 2 |
| | | Organophosphorus poisoning | | 2 |
| | | skull Injuries | | 3 |
| | | Brain and meningeal injuries | | 3 |
| | | Diagnosis of Death & PM changes | | 3 |
| | | Neurological manifestation of animal poisons | | 2 |
| | | Toxic coma | | 2 |
| Shared Lecture | | CSF SL | | 6 |
| | | Functional area of brain | | 6 |
| | | Cerebellum | | 6 |
| | | Addiction | | 6 |
| | | CNS imaging | | 6 |
| Tutorial | | Upper & Lower motor neuron disorders | | 4 |

Fig (2): shows the table of specification

Assessment Methods

Choice of the assessment method choosing should be depending on using the most efficient and appropriate method for the intended learning outcomes assessment. The student learning improvement is the main objective of any assessment program. Integration of assessment with the instruction should be depending on essential principles for the effective assessment; these principles are the clear intended learning outcomes, use of the different assessment procedures, the relevance of procedures to the instruction, adequate sample of the student performance, fairness of procedures, judgment of successful performance according to specific criteria, feedback about the strength and weakness of performance to the students for the correction, comprehensive grading and reporting system

1. Multiple Choice Questions (MCQs)

It is the selection type items for the learning outcomes measurement from simple to complex. It consists of the stem (problem situation) and several options (choices); the stem is a question or incomplete statement while the options are several answers (correct answer and plausible wrong answers which are called distracters).

The best answer form is another type of multiple choice item for more complex achievement, all options are partially correct but one option is clearly better than others. To prepare the effective multiple-choice items, we should use the following rules:-

- 1- Design of the item for one intended learning outcome measurement.
- 2- Stem of the item is a single clear problem formulation with a simple and clear language.
- 3- Much wording in the stem of the item with avoidance of the repeated same material in the options.
- 4- A positive form of item stem.
- 5- Intended answer should be correct or clearly best.
- 6- All options should be consistent with item stem grammatically and parallel in the form.
- 7- Verbal clues should be avoided to prevent discrimination of correct or incorrect answer such as similarity of wording in stem and correct answer, stereotyped phraseology of correct answer, great detail of correct answer, absolute terms in

distracters (always never, all, none), two inclusive responses and two responses have the same meaning.

8- Distracters should be plausible and attractive to the uninformed by the following:-

- A. Distracters are stated in the student language.
- B. Distracters are common misconceptions or errors of the students.
- C. Distracters are good sounding words as well as the correct answer.
- D. Distracters are similar to the correct answer (length and complexity of wording).
- E. Distracters are homogenous.
- F. Distracters have extraneous clues without overusing.

9- Correct answer length should be varied for length elimination as a clue.

10- Use the (all of the above) should be avoided as an alternative, but the (none of the above) should be used with an extreme caution.

11- Position of the correct answer should be varied randomly.

12- Difficulty of the item should be controlled by the complexity of the stem problem or by the homogeneity of alternatives.

13- Each item should be independent of the other items in the test.

14- Efficient item format should be used.

15- Normal rules of grammar should be applied.

Notice: breaking any one of the above rules may be encouraged if it will improve item effectiveness according to the experiences of the test maker in the item writing.

2. Extended matching question (EMQ)

It is different from the single best answer multiple choice questions and the superior to it for the assessment of the problem solving and clinical reasoning skills of the students. It consists of the theme (symptom, diagnosis, treatment); option list (answers), lead in statement (question) and two stems (two clinical problems).

3. OSCE

It means objective structured clinical examination for the competence assessment (content skills, process skills and clinical management). According to millers pyramid, OSCE measures the category which is called shows how. Competence is a

clinical skill such as history taking, physical examination, and technical procedures. It consists of multiple stations and a wide sampling of clinical and communication skills with a lot of examiners and patients within the limited time by checklist using or global rating scale. So, it has high reliability. There is acceptability for this exam because every student does the same task. It is valid exam depending on content (good sampling of matching skills with learning outcomes), construct validity and authentic length of the station. The success of OSCE depends on availability of facilities such as manikins and other tools, examiners, real patients, actors, technical and administrator team, and training. We can design OSCE by the following steps:-

- 1) Determination of the examined skills types in alignment with the learning objectives of the module.
- 2) Determination of the types of assessment tools (ex. Checklist).
- 3) Determination of the stations number (10-15 stations).
- 4) Determination the time of station and the length of examination "10 minutes * 10 stations = 100 minutes".
- 5) Preparation of the resources "examination rooms, manikins, examiners, patients, volunteers, marking sheets".
- 6) Construction of marking scheme depending on the discrimination actions to distinguish between good and poor performance.
- 7) Preparation of the instructions for the examiner, patient and for the student:-
 - A. **For the student:** outline the required task exactly at every station.
 - B. **For the examiner:** outline the marking scheme instructions about the action and performance of the student at every station.
 - C. **For the patient:** outline the dealing approach between the patient and the student.
- 8) Evaluation of the exam after finishing.

4. OSPE

It means objective structured practical examination; it uses subjects or materials instead of the patient such as a photo or x-ray. It allows greater objectivity and consistency than the written work. It consists of the circuit of standardized assessment stations that are tasks based on clinical situations. The evaluation is achieved by the checklist where each skill or practical step is weighted at different levels according to the importance and difficulty. It is effective, valid, reliable

assessment method. A large number of the students effectively are examined in relatively short time where all students are exposed to same standardized questions.

5. Portfolio

Assessment usually gives the evidence that the learning was carried out and the learning objectives were achieved. The portfolio is one of the useful and popular assessment tools of the student performance in undergraduate and postgraduate medical education. It aims to link the objectives of the instructional course with the clinical experience which is recorded in a standardized manner to facilitate the learning, teaching, and assessment. It is a collection of purposeful, selected and organized student work (materials) to show the personal ability of every student (evidence of performance) and his professional development. The content of portfolio (evidence of learning achievement) is clinical tutor reports, selected student assignments, list of attained skills, evidence of communication skills, assessment results and the reflective diary. It is divided into two types; developmental and showcase portfolio. Developmental type is used throughout the instructional course (formative) and assesses the student learning progress while showcase type is used at the end of the course (summative) and shows the student best work samples and the final level of performance. There are many advantages of portfolios such as learning progress assessment over the times, positive effect of the best student work coverage, providing the greater motivation due to the comparison between present and past work, improvement in self-assessment skills of the student, providing a reflective learning, individual differences adjustment, providing the connection between theory and practice, an increase of collaboration between the student and teacher. For fair judgment, we should be reminded that portfolios have some disadvantages such as the time consuming because of the portfolio entries selection, periodic revision, and providing the feedback.

For successful portfolio, its planning should be constructed according to the following steps:-

- 1-** Determination the purpose of the portfolio.
- 2-** Determination the involved entries types.
- 3-** Determination the guidelines for the entries selection and evaluation.
- 4-** Determination the procedures for portfolio maintenance and use.
- 5-** Determination the criteria for portfolio evaluation.

We should be discriminate between portfolio evaluation as a structure and the student evaluation as a performance progress. Structural evaluation of the portfolio depends on makeup, organization and the content while overall evaluation of the student performance progress which is shown in the portfolio is determined by the rating scale based on the learning outcomes assessment. Holistic rubrics of each the involved areas in the portfolio determine the final level of the student performance.

6. Logbook

It is an assessment tool for the psychomotor domain; it includes many clinical cases, one case should be performed every week for a definite time of weeks. It may include many x-rays or different medical photos for writing a report about the findings with description, interpretation and making a differential diagnosis.

Appendix

Examples

Of

Educational and Assessment Methods

Problem solving (Forensic Scenario without Task)

The male patient came to the hospital complaining of a contused scalp wound but he was conscious. He received the first aids and discharged according to the decision of physician. After 6 hours, he returned to the hospital in a deep coma, MRI revealed a mild type of skull fracture and intracranial hemorrhage. He died within three hours.

First session: Brainstorming

Group of students discusses the above-mentioned scenario under the guidance of the tutor or facilitator to deduce and determine specific learning objectives.

Second session: Debriefing

The same group debriefs the knowledge according to the previous learning objectives after searching in the different sources within one week.

Forensic Scenario is associated with the definite tasks

Two patients came to Emergency department after a quarrel between them. The first patient had a left black eye and contused wound in his forehead but it simulates cut wound. The second patient had various bruises at different areas of his body. On examination, the physician diagnosed the contused wound of first patient as a cut wound and the bruises of second patient as a pattern bruises with different ages.

Tasks

- 1- How can you differentiate between the cut wound and contused wound?**
- 2- Mention the mechanism of bruises? How can you identify the age of bruises?**
- 3- Mention the causes of black eye?**
- 4- Mention the complications of wounds?**

Toxicological Scenarios

Scenario 1

A 3 year old child had a rapid and deep respiration associated with attacks of convulsions after ingestion a lot of salicylates tablets. Gastric lavage was done after 12 hours from the ingestion. His investigations showed that the plasma salicylates level was 40 mg /dl while Ph of blood was 6.9 and HCO₃ was 13 MEq /L

Scenario 2]

A 23 year old male, had pin-point pupils, fasciculation, wheeze and crepitation all over the chest. He received atropine until atropinization manifestations were appeared. After three days of intoxication, he received pralidoxime. His condition was deteriorated and received packed red blood cells transfusion.

MCQs based on Scenario

A patient was admitted to ICU because of hepatic coma. He had an apnea for three minutes without respiratory support. After few hours of the admission, the nurse noticed the clinical ocular sign of death and the bluish red areas on his back. She called the physician who decided that the patient died and wrote a death certificate showing the manner, cause and the mode.

1- The death certificate shows that the mode of death for this patient is

- A. Hepatic failure
- B. Circulatory failure
- C. CNS failure.**
- D. Respiratory failure
- E. CNS, circulatory and respiratory failure

2- According to Harvard criteria , this case was diagnosed as

- A- Somatic death
- B- Molecular death
- C- Persistent vegetative state
- D- Brain death**
- E- Suspended animation

3- Early prominent clinical ocular sign of death is

- A. Exaggerated pupil reflex
- B. Sluggish corneal reflex
- C. Fixed dilated pupil**
- D. Segmentation of retinal arteries
- E. Kinking of retinal veins

4- Time passed since death for this case is approximately

- A. Four hours
 - B. One to two hours**
 - C. Four to eight hours
 - D. Twelve hours
 - E. Eight hours
-

Extended matching question (EMQ)

Option list

- A. Throttling
- B. Manual strangulation
- C. Smothering
- D. Hanging
- E. Strangulation
- F. Choking
- G. Drowning
- H. Traumatic asphyxia

For each clinical scenario described below, select the most likely diagnosis from the above list of options, each option should be used once.

Scenario 1

During one of the football games, which was attended by a large crowd, and while scrambling the public out of the stadium after the game, one person was died after he fell on the ground from the intensity of the hustle and large number of people fell on him. During external examination of the body, it is noted the presence of violet discoloration of the face, neck and upper part of the body.

Scenario 2

Guard of residential building discovered dead man in his apartment. He informed the police who called forensic expert to examine the body and diagnose the cause of death. During external examination, forensic expert noticed deep cyanosis and edema of the face, eyes bulging and complete, transverse, circular ligature mark around the neck.

OSPE Station

Father came with his daughter to the forensic medicine organization to obtain the certificate of her age determination for the marriage contract. Forensic medicine expert requested the following radiological investigation for her long bones.



1- What is the most accurate age of his daughter?

Portfolio

Components of portfolio (content)

Section 1: Assignments

Section 2: Case studies

Section 3: Project

Section 4: Clinical tutor reports

Section 5: Presentations

Section 6: Log book

Section 7: Attendance of module activities

Section 8: Assessment results (Mid-module exam – Final module exam)

Time table of task achievement

Assessment sheets of portfolio

References

- 1- Gronlund, NE. (2006).** Assessment of Student Achievement. 8th Edition. Pearson, USA. Chapters 1 and 2.
- 2- Amin, Z., Seng, C., & Eng, K. (2006).** Practical Guide to Medical Student Assessment. World Scientific Publishing Co. Pte. Ltd., Singapore. Chapters 1-5.
- 3- Alberta, E. (1993).** Principles for Fair Student Assessment Practices for Education in Canada Joint Advisory Committee. http://www2.education.ualberta.ca/educ/psych/crame/files/eng_prin.pdf
- 4- Wolming, S., & Wikstrom, C. (2010).** The concept of validity in theory and practice. Assessment in Education: Principles, Policy & Practice, 17, 117-132.
- 5- Jayasimha VL., Patil SS., Raghukumar KG., Vinodkumar CS., & Basavarajappa KG. (2015).** Objective Structured Practical Examination for Gram stain - An effective tool in formative assessment. Journal of Educational Research and Medical Teacher 3:16-18.
- 6- David P. (2003).** Curriculum Design, ABC of Learning and Teaching in Medicine. BMJ.326.7383.268; 326; pp. 268-270.
- 7- Isaacs, G. (1996).** Bloom's Taxonomy of Educational Objectives, Teaching and Educational Development Institute, the University of Queensland.
- 8- Kristina, T.N., Majoor, G.D., & van der Vleuten, C.P.M. (2006).** A survey validation of generic objectives for community-based education in undergraduate medical training. Education in Health (Abingdon); 19: 189-206.
- 9- Talaat, W., Khamis, N., & Abdel Aziz, A. (2011).** Ten Frequently Asked Questions on Community- Oriented/Based Medical Education. Medical Journal of Cairo University, Vol. 79, No.2, Sep.2011.
- 10- Basic Medical Education WFME Standards for Quality Improvement. (2003).** WFME office, University of Copenhagen, Denmark: Educational outcomes (page 9).

- 11- Hung W. (2006).** The 3C3R model: A conceptual framework for designing problems in PBL. *Interdiscipl J Prob Based Learn* 1:55–77.
- 12- Kim S., Phillips W.R., Pinsky L., Brock D., Phillips K., & Keary J. (2006).** A conceptual framework for developing teaching cases: A review and synthesis of the literature across disciplines. *Med Educ* 40:867–876.
- 13- Roberts D., & Ousey K. (2003).** Problem based learning: Developing the triggers. Experiences from a first wave site. *Nurse Educ Pract* 3:1–5.
- 14- Azer S.A., Petersonr, Guerrero P.S. & Eedgren G. (2012).** Twelve tips for constructing problem-based learning cases. *Med Teach*; 34: 361–367.
- 15- Hamilton J. (2005).** The voice of experience. *The Problem-based Learning. The Clinical Teacher*, 2:1:45-48.
- 16- Johnson S. & Finucane P. (2000).** The Emergence of Problem-based Learning in Medical Education. *Journal of Education In clinical Practice*, 6, 3:281-291.
- 17- Moust J.H., Bouhuijs P.A. & Schmidt H.G. (2007).** Introduction to problem based learning, A guide for students. Wolters- Noordhoff Groningen/ Houten, Netherlands.
- 18- Bryant L.H. & Tech V. (2011).** Re- examination of the argument against problem based learning in the classroom. *Journal of research in education*, 21(2): 157-170.
- 19- Helen E.R. (2007).** Objective structured clinical examination (OSCE): Review of literature and implications for nursing education. *Nurse Education Today*, 27(5): 481-490. <https://doi.org/10.1016/j.nedt.2006.08.009>
- 20- Bandiera G., Boucher A., Neville A., Kuper A. & Hodges B. (2013).** Integration and timing of basic and clinical sciences education. *Med Teach* 35(5):381–387.