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1.2 Cognition and learning

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This theme is concerned with the relevance and efficacy of educational methods adopted in dental schools while recognizing the influence of geopolitical issues in different countries and regions. Particular emphasis will be given to examples of best practices and innovations. Cognition and learning are dealt with in many different research areas such as education, psychology, cognitive sciences, brain research, neurolinguistics, gender, etc. and comprise the theoretical foundation for the philosophies, principles and methods underlying the dental education system. Educational methods are many and mixed. This group has used existing knowledge, personal experiences and current literature together with some of the material from the DentEd visits.

Key words: cognition and learning; scientific evidence; educational methods and principles and effect on cognitive processing; curriculum content and different structures; information and communication technology; examples of best practices.

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Introduction

'It depends...'

THIS statement describes the difficulty encountered when discussing this theme as learning depends on the context in which the material is discussed. Within the context there are many aspects to consider, e.g. the social economic environment, the cultural setting within the school, the content of the curriculum, the different parts of the educational system.

The more a situation in which something is learned resembles the situation in which it is applied the better the performance. When new information is stored in the brain, information about the context takes place simultaneously. This is relevant to dental education.

Our ambition is that the reader of this section will understand the complexity of the subject. Our aim is to deliver a guide which is not a dogmatic approach to cognition and learning.

Parameters within which the section decided to work

For the purposes of this section (1–3):

1. *Cognition* is defined as the ways in which humans reason, understand, diagnose, solve problems and otherwise engage in mental processes.
2. *Learning* is the cognitive processes whereby an individual acquires the professional and ethical values, the biomedical, behavioural and clinical knowledge, and the reasoning and psychomotor skills necessary for professional competence. There is a variety of learning methods that may be employed toward the development of professional competence. Moreover, professional competence must be defined in such a way as to allow for empirical verification of the extent to which learning has occurred.
3. *Teaching* is a means of facilitating and supporting learning. As with learning, there is a variety of teaching methods. The responsibility of the teacher is to create good circumstances for teaching.

It is possible for the human brain to amass large amounts of information in a short time period. This is how students pass examinations in anatomy, biochemistry and so forth. However, much of this information is lost rapidly after the examination. It

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could be questioned whether this information is ever utilized in clinical practice for the benefit of our patients. Today this type of education is questioned. One of the key elements in education is rather how the content is made accessible to learners. The point in education is to enable learners to learn more effectively.

Best practices and innovations

These are educational processes, procedures, systems, innovations and programmes which are designed to deliver a specified set of desired outcomes in the most effective way. We have decided to organize these 'best practices' into the following categories: educational philosophy, educational principles, educational methods, educational strategies and the educational learning environment (4–10).

Educational philosophy
- Student-centred learning.
- Problem-based learning.
- Context learning.
- Competency-based learning.

Comments
These philosophies of education are theories that are implemented through educational principles and methodology. When discussing learning the philosophy should be explained by examples of best practices. These are dependent upon a number of factors involving cultural, socio-political, economic and motivational factors affecting the academic dental institution. Competency-based learning requires the outcomes to be defined. An interrelated aspect is the philosophy of whole patient care. Contained within the philosophy is the empowerment of students to take control of their learning. The describing of learning outcomes under the heading of competence includes knowledge, skills and values.

Educational principles
- Holistic and integrated approach towards patient care.
- Active learning.
- Encouragement of reflection.
- Evaluation by teachers of students performance by giving feedback.
- Self-directed learning that comes from different methods.
- Students being involved in research.
- Clear overall aims and objectives for each part of the course.

Comments
Educational principles can be adopted without being tied to one specific educational philosophy. For example, 'encouragement of reflection' can be initiated during a lecture in a traditional system as well as in a PBL-group session. However, a traditional disciplinary, lecture-based curriculum is not based on the same educational philosophy as a PBL curriculum. As another example, 'clear overall aims and objectives for each part of the course' is a good principle for every curriculum. Some educational philosophies, however, include some of the principles more clearly, such as 'context learning' that includes 'holistic and integrated approach towards patient care'.

Educational methods and instructional tools
- Modelling.
- Early clinical experience for the students.
- Bedside teaching as another experience in addition to chairside teaching.
- Logbooks.
- Small group teaching;
- Integrated courses with other areas (e.g. behavioural science, biological science, biomaterials).
- Students having 24-hour access to learning materials.

Comments
Small-group teaching is an instructional technique which allows task-based, log-based or problem-based learning to take place. Different educational methods are employed to achieve different objectives and types of learning. Implementation of new educational methods will often require reconsideration of methods of student assessment.

Educational strategies
- Continuous staff development programmes.

Comments
Continuous staff development programmes leading to a degree of knowledge of basic educational philosophies and theories are necessary to give the teachers in dentistry competence as educators so as to use the circumstances and resources available in the best possible way. Development of staff competence and their acceptance of educational philosophies and theories is a prerequisite for successful implementation of innovative techniques and best practices.

Educational learning environment
- Problems with different languages in different countries;
- Working within existing resources.

- Rewards and recognition.
- Responsibility to the institution and accountability.
- Academic freedom within the framework of the mission and goals of the university.

Comments
Academic freedom has a different meaning in different institutions and to different people. At a minimum, it should include the freedom to explore innovative strategies for teaching and learning, the success of which should be measured by predetermined objectives. Application of principles of learning and cognition will have the greatest chance for success when they are consistent with the mission and goals of the university.

Impact of information and communication technology

Some have suggested that information technology (IT) systems such as Blackboard or Web CT, in which the teacher communicates with students and students with each other, will replace many of the traditional methods of teaching (e.g. classroom-based teaching) during the coming years. However, we suggest that while ICT can facilitate teaching and learning in dental education as an adjunct to other tools and strategies, it should not be seen as replacing the physical presence of dental teachers—nor should it be seen as a substitute for curriculum content. It is neither a goal in itself nor is it a panacea for all the problems of a school, but rather a means to the end of educating a competent graduate.

ICT at its best can comprise a set of tools for educational use; these tools include the ability:
- to make communication easier;
- to search for information;
- to employ educational technology;
- to apply technology to dental practice, having used it as a dental student;
- to promote evidence-based dentistry in both education and practice;
- to provide and deliver teaching, e.g. online courses;
- to facilitate case-based discussions (including web-based and online, as well as supporting live teaching);
- to enable remote teaching., e.g. grand rounds online, case presentations, etc.
- to provide digital lectures (PowerPoint plus images);
- to support self-directed learning, revision and recall;
- to mount a digital syllabus;
- to support continuing education and professional development (CDE and CPD);
- to facilitate improvement of performance without teacher presence (e.g. such as a video in a clinical skills centre);
- to act as a back-up to face-to-face teaching (e.g. for the students who have missed teaching, or needs to review teaching); and;
- teledentistry can save patients having to travel some distance, and can be more cost-effective for all concerned while allowing intraoral examination and diagnosis to take place at a distance.

It should be recognized that the levels of IT ability vary considerably for both students and teachers. Therefore, when considering the adoption or expansion of ICT in one's own school, consideration should be given to:
- the balance of resources versus benefits;
- the preparation of faculty and students;
- the socio-political infrastructure of the organization;
- the physical infrastructure of the institution;
- security and ethical considerations;
- policy development;
- strategic collaborative partnerships; and;
- the potential for revenue generation.

How to converge towards higher global standards

Convergence to higher standards globally is something that cannot be forced. It can be achieved only through speaking to each other in conferences, through action such as DentEd, visits and through guidelines that are general enough that every school can benefit from them. These guidelines should become stronger throughout the years. An intrinsic motivation for change in teachers is necessary to improve quality, but this must be gradual to prevent opposition. We must encourage those individuals in the schools who are involved in educational development.

In general, change will come with persuasion, endurance and experimentation. If academics and dental teachers within institutions see that change is occurring outside then they will not wish to be seen as falling behind. A way forward is to use evidence to support the changes.

The concept of evidence-based medicine and dentistry is generally accepted in all parts of the world and this can be used as the unifying teaching principle and standard to assist our students' learning. This is especially important in the clinical disciplines, where it is important for our students to learn how to search for evidence and how to evaluate it. If existing evidences for good diagnostic and treatment principles are used,

for example, it will result in a common knowledge base for these areas (11, 12).

An educational philosophy such as contextual learning can help different regions of the world to secure dentists that are trained for the oral health needs of the population they are going to serve. If the learning contexts are derived from the oral health situation and the socio-economic circumstances in the surrounding society, the competences of the graduates will fit those oral health needs in a more effective way.

Internationalization, in terms of learning and understanding about each other, sharing between countries and institutions and learning together about learning. This internationalization can be facilitated by student and staff exchange programmes with other dental institutions.

It is important to communicate globally about desired outcomes of the dental education system/programmes. This will lead to exchange of ideas and discussion of those methods (best practices) that lead to the most efficient and effective learning outcomes. It is recognized that desired outcomes and best practices will vary, but global communication will lead to more uniform outcomes and methods with time.

Important regional and continental differences

The way that students adapt to educational methods and the structure in which education is offered is influenced strongly by culture. The general attitudes to learning will differ between countries that have a strong ethos of respecting the teacher to others where the teacher is not held in the same regard. Social status, e.g. socio-economic status, gender and race, may influence learning and motivation for learning.

Another important difference both regionally and continentally is in the way that dental care is funded and delivered—and who it is that receives the majority of care (e.g. lower or higher socio-economic groups, urban or rural dwellers). This will depend on whether the delivery or care is a state-funded dental service, or a predominantly private dental care system, or a hybrid of the two.

Also, it is recognized that the attitude to students (and teachers) varies considerably from country to country from the very didactic to the very learner-centred. Also, the social and professional status of dentists varies considerably. These variations have a direct effect on the motivation of both students and teachers. For example, if the main aim is to earn a great deal of money from dentistry (profit-driven), it follows that the attitude to patients and patient care will differ from that of the dentist who perceives his or her role primarily as being part of the primary or secondary health-care team (the vocationally/altruistically orientated), with earnings being placed lower on the scale of priority. Economic circumstances may play a role in how students learn; economic motivation may lead to superficial learning. These students may not necessarily want to be lifelong learners. These outcomes may be the same for students who are only exam orientated. Such circumstances may be regionally applicable. Regional and cultural differences exist but are not insurmountable, if given the right environment and teacher guidance.

Considerations not otherwise covered

Cognition and learning is a complex and far-reaching field that impacts on every other section. Assessment is linked very closely to cognition and learning and these two must be considered together for effective learning outcomes.

Implications and potential for emerging countries

Learning issues must be put into a context that is relevant for the nation or region in question. The principles of contextual learning will require agreement but the matters that are learnt (except general principles and basic knowledge) could differ depending on their relevance for the society in question.

It should not be assumed that western culture and western ways of thinking or standards represent the superior model. There is no one single good relationship between teaching and learning or one best philosophy or educational principle. What might work in one culture may not work in another. What is important is that educational methods are consistent with philosophy and principles and based on sound educational theory. The difference between students' feelings about learning between western and eastern European countries are perhaps not as significant as those between the western world and developing countries. On the other hand, it should not mean that developing countries have to follow the same track as western and eastern countries. DentEd may play an important role in such developments. Educational goals and principles may be similar but actual methodology and implementation must be tailored to fit different societal needs.

Core values applicable to all

Core values should include the following question:

'What is it that a dental school is aiming to produce, and hoping to achieve via its curriculum?'

The following thoughts should begin to answer the question:

Dental students should display the following core values:

- Humanity and compassion.
- Patience and gentleness.
- Emphasis on humanity.
- Competence (skill and knowledge, values).
- Ethical attitudes.
- Confidence and integrity.
- Personal standards (including personal hygiene and appearance).
- Professional ethics and responsibility to society.

It is important that dental students receive a sound theoretical dental knowledge (and learning) in the world.

A student should also understand the methods involved in research trials, clinical observations, statistics and the basis of scientific truth. However, it is important that the dentist uses this knowledge in combination with an ability to relate to both patients and colleagues (13).

Dentists should be aware of the need for a caring approach to patients and this has to be displayed and demonstrated every day, with every patient—even those whom the dentist may not wish to treat.

Conclusions

The area of cognition and learning is evolving and this report shows that there are many different influences on the dental student.

The recommendations outlined in this document show that educational theories must be used when developing a teaching philosophy for one's school. There are many different methods of teaching that fit educational philosophy and principles. It would seem appropriate to aim to develop one that promotes a learning environment whilst finding a balance between knowledge, skills and attitudes and one that fits your staff, student population, culture and available resources.

Building and growing a thematic network

Each person in the theme will contact people within their own school and professional organizations; then each person will contact another school which has not participated in this congress. The requirement is that this school should be in a different country than their own.

Recommendations, realistic goals and a time frame

Recommendations to DentEd:

- Continue the website for the working group to make it possible to enhance the exchange of ideas and knowledge and to extend the network with those schools not yet involved.
- Organize a DentEd meeting before the Washington meeting in a place outside Europe or North America. Recommendations to teachers and administrators:
- Involve all members of the academic community in curriculum development.
- When starting to think about the curriculum consider, first, the role and interrelationship of teaching and learning.
- Try to develop a philosophy on your school's teaching on the goals of teaching, the way of learning and the interrelationship. Use educational theories to support this.
- Add principles to the philosophy on the way you want to model your curriculum.
- Choose different methods of teaching that are appropriate to the philosophy and principles in the school.
- Create a learning environment that supports optimally the teaching methods and learning principles.
- When ICT is incorporated into teaching, it should be seen as an adjunct to other tools and strategies. Do not see it as a goal or a panacea for all your curriculum problems.
- Develop the availability of hardware and software for ICT at the same pace.
- Try not to catch up with other schools in one single move: stay realistic, be patient but determined.
- Find a balance between knowledge, skills and attitudes that fits your staff, student population, culture and available resources.

Goals

Learning more about this subject and exchanging ideas
This will be achieved by the establishment of a chat room/server list. Each member of the group will contribute references with a comment on the material. Examples of best practice will be shown and critical comments on the work invited from the Network. There will be a strict rotation on a monthly basis where each member of the group will chair the list.

Additional reading

The following are useful online resources for further reading around this subject.

http://www.meducation.com

http://www.med-ed-online.org

ERIC—clearing house on higher education website at http://www.eriche.org/DentEdEvolves

http://www.dented.org/dentedevolves.php3

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