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Medical Education for YouTube Generation

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1. Introduction

There have been great changes in medical education environment during the 20th century due to advances in biological sciences, increasing demands from health services (Bleakley et al., 2011; Cooke et al., 2006), and in the past two decades dynamic development of information and communication technologies (ICT) (Masic et al., 2011). They have increased the efficiency of learning and promoted the implementation of evidence-based practice (Howick, 2011; Tilson et al., 2011). For the first time in the history of mankind electronic repositories of medical knowledge started to be available in the public domain (Cullen, 2006; Taylor, 2006; Westwood, 2001). At the end of a century of evolution and changes the scope of medical education had grown enormously (Platt et al., 1999; Koschmann, 1995). At present, most of medical students belong to the generation grown up with modern information and communication technologies, referred to as YouTube generation, Generation Y, Millennials, Generation Next, Net Generation (Borges et al., 2006; Farnan et al., 2008). Internet-based technologies have become part of our daily lives and dramatically changed the interaction between physicians-in-training, educators and the world of knowledge, thus offering new challenges and opportunities (Shamji & Law, 2011; Ruiz et al., 2006). At the global level, there are some attempts to propose a concept of global health education with key indicators to evaluate and monitor educational interventions (Bozorgmehr et al., 2011). Watching the phenomenon of globalization, one has to admit that healthcare services and medical education cannot escape its impact. A new concept of a global profession of medicine has been in the limelight for the past decade with an urgent need to specify a set of core competences for doctors, regardless of where they had been trained (Schwarz, 2001; Celletti et al., 2011).

This chapter is structured in sections covering three main issues. Section 2 reviews current trends in web-based medical teaching & learning with the emphasis on their efficiency, configurations and instructional methods. Web 2.0 is discussed separately in Section 3, demonstrating potential implementation of wikis and podcasting to make theoretical and pre-clinical subjects more attractive, but also pointing at controversies and pitfalls of this new technology in medical and healthcare contexts. In Section 4 the authors describe methods and procedures used to re-design a paediatric undergraduate curriculum in a European country (Czech Republic). The innovation of educational interventions was based on three cornerstones, ie. case-based reasoning, evidence-based medicine, and blended learning. The authors demonstrate all current arguments and opportunities to view medical education not as a sum of knowledge, but as a practical know-how. This approach should be

supported by information and communication technologies, eg. development of e-learning portals. We are presenting the educational portal Mefanet as a unique solution. The outcomes of the project including student feedback are presented as figures, graphs and verbatims. The section ends with a brief proposal for developers of case-based learning environment in medicine.

The methods used to compile this chapter included brain-storming, literature review, deduction, curriculum re-design, web-portal development, qualitative analysis of attitudes, and statistical analysis.

2. Online learning in medical education

Medicine is a sophisticated mix of knowledge, skills, behaviour and attitudes. Learning goals can be achieved by different modalities from face-to-face lecturing, bedside teaching & learning, mentoring, small-group learning, self-study, self-assessment etc. Since 1990, the rapid spread of internet-based technologies has been leading to the breath-taking metamorphosis of medical curricula, particularly due to e-learning. E-learning solutions can be implemented in most areas of undergraduate and continuing medical education, in particular knowledge acquisition, skills training, attitudes development, formative and summative assessment (Genn, 2001; Dent & Harden, 2009a, b).

Even though the core patient requirements and expectations of doctors remain more or less the same as they have been across the centuries, nowadays future doctors must get ready for changing conditions of healthcare services delivery with a patient as an important partner in the decision-making process (Dent & Harden, 2009b). A new profile of healthcare professionals is posing demands on educators and modes of knowledge delivery. It should be taken into consideration that future doctors need informed professional educators, not merely amateur tutors.

The newly developed, innovated, revised, and/or re-designed curricula are characterized by a decrease in volume of factual knowledge presented face-to-face, emphasis on adult learning styles, self-directed learning, problem-solving, critical thinking, shift from passive to active learning and performance (Choules, 2007). Their milestones include cultivation of communication skills, thorough and responsible preparation for professional life, efficient teamwork and readiness for implementation of evidence-based practice.

In 1998, Towle (Towle, 1998) formulated a set of future challenges in the process of both undergraduate and continuing medical education to make conditions to teach and learn traditional professional skills in information society era. In particular, he emphasized the following activities: teaching scientific behaviour, promoting use of information technology, respecting new doctor-patient relationships, enhancing educational competences of medical teachers, extending learning delivery modalities in medical curricula, and ensuring guided participation of students in clinical situations.

2.1 Efficiency of online learning

The implementation of online (internet-based, web-based) learning styles in medical education is relatively well-documented by plethora of articles. The first reports date back to the early 1990s describing new experience, outcomes, students' perceptions, advantages as well as controversies of this emerging trend in medical education.

In 2008 Cook and colleagues (Cook et al., 2008) published one of the first meta-analyses with the intention to analyze the existing studies and demonstrate educational outcomes of online instruction as compared to other teaching & learning modalities. They included practicing and student physicians, nurses, pharmacists, dentists and other healthcare professionals as target groups. The analysis of a total of 201 eligible studies clearly demonstrated that from the global point of view internet-based medical instruction had large positive effects compared with non-Internet or no interventions across medical disciplines irrespective of types of learners and concrete outcomes. It may be concluded that further research should be oriented on 2 key areas: (1) effective implementation of internet-based courses, and (2) definition of suitable learning contexts and objectives.

Wong and his team (Wong et al., 2010) used a “realist review” (qualitative systematic review) to identify and elucidate the relationship between context, mechanism and outcomes of internet-based courses for doctors and medical students. They focused on theoretical models how the Internet could support learning. This realist review included a total of 249 primary studies and brought about 3 key findings: (1) Internet courses must engage their target group of learners to use technology that should be perceived as “useful” (promote learning and save time) and “easy-to-use”; (2) Interactivity is highly valued by learners, ie. entering into a dialogue with the course tutor, fellow students and/or virtual tutorial to get feedback on their understanding and performance; (3) Course design is an important factor that has to interact properly with its content, didactic features, and types of learners.

The authors formulated suggestions for authors of internet-based courses to increase the educational outcome in the context of two basic issues, namely technology acceptance and interactive dialogue. Technology acceptance comprises such parameters as perceived usefulness, ease-of-use, suitable format, learners’ habits and expectations. Interactive dialogue deals with human-human interactions and human-technical interactions. Both of the modes of interaction include feedback and knowledge assessment.

2.2 Configurations and instructional methods

Cook and his team (Cook et al., 2010) performed another systematic review based on their previous experience about attitudes of medical educators towards internet-based courses. Most of them considered web-based learning as a set of similar activities with more or less homogenous effects, and obviously their studies did not properly describe the interventions used. This systematic review aimed at filling this gap and studied various configurations, instructional methods and presentation elements of web-based learning to help teachers define their instructional interventions. They identified 266 articles including 78 randomized controlled trials comparing web-based learning with no intervention or another educational intervention. The most frequent participants were medical students and postgraduate trainees.

The analysis produced enough data to make a list of most frequently used web-based learning configurations: at least some written text (89 %); multimedia (55 %); online communication via e-mail, threaded discussion, chat, videoconferencing (32 %); synchronous components (9 %).

It was interesting to see that up to about 60 % of the courses used a blended web-based learning method and non-computer-based instruction (eg. face-to-face lectures, small group activities), 32 % assigned reading, and 23 % clinical experience (ie. bedside teaching).

As far as instructional methods are concerned, it was fascinating to reveal that 77 % of the courses used specific methods different from the text with most common being patient cases (real, hypothetical), self-assessment questions and feedback; 30 % of the online instruction was characterized by a high level of interactivity. Other methods included eg. practice exercises and spacing of learning.

These findings are of practical importance for online course developers, because they offer a vast diversity of approaches to reach the educational goals, respecting learners' needs and learning contexts.

3. Web 2.0 applications

In the new millennium we have been witnessing outbreak and spread of new Internet technologies simply defined as the read/write web which is referred to as Web 2.0. The „early“ web (Web 1.0) may be characterized by a strong capability to connect people, search for materials, documents etc., whilst web 2.0 makes it easier to create and publish new content by the users. Moreover, social web is about discussion, interpersonal networking, personalization of learning activities, openness to new experience, sharing knowledge and ideas. It is people-centered web (Boulos & Wheeler, 2007).

Its popularity is spreading very fast, partly due to the fact that it is free and requires few technological skills. It encompasses blogs, podcasts, wikis, multimedia sharing, social bookmarking, instant messaging, really simple syndication (RSS), social networking etc. Users are no longer mere consumers, but they may edit, comment, create and share content with the others. Even though most of the activities are social, Web 2.0 is capable enough to substantially influence future online teaching and learning „anytime - any place“. Its exploitation for medical consultation, education and publication purposes is definitely increasing (Sandars & Schroter, 2007; Lemley & Burnham, 2009) even if at low speed.

Schreiber & Giustini (2009) published an overview of efficient implementations of Web 2.0 features to improve qualitative parameters of the existing popular medical sites (eg. Health Education Assets Library, MedEdPortal), prestigious medical journals with high impact factors (Archives of Internal Medicine, British Medical Journal, Cochrane Database of Systematic Reviews, Lancet, New England Journal of Medicine, Southern Medical Journal), or introduce new Web 2.0-based products (eg. Clinical Cases and Images Blog, Science Roll Blog, AskDrWiki and others).

3.1 Web 2.0 applications in medical education

An increasing number of authors have been reporting possible usage of web 2.0 applications in medical education (Boulos et al., 2006; Jham et al, 2008; Jalali et al., 2009; Wilson et al, 2009; Alikhan et al., 2010; Chretien et al., 2010; Logan et al., 2010; Vejrazka et al., 2010; Saarinen et al., 2011). On the condition that they are used effectively, wikis, blogs and podcasts could help students, clinician teachers and also patients enhance their learning performance, increase their engagement and improve collaborationware. Social media have

sufficient capacity to change academic medicine and attract not only trainees, but also educators irrespective of their will and readiness. Naturally, the faculty must accept their responsibility in preparing future doctors to use social media to communicate with their colleagues and patients.

Some authors (Saarinen et al., 2011) point out that learning course developers cannot integrate Web 2.0 technology without having surveyed students' familiarity with the applications and/or barriers to them. There may be barriers in overall perception of social media with their openness to share and exchange knowledge and ideas. The best way how to overcome controversies on the side of educators and learners is to start with small projects and integrate web 2.0 applications into the existing educational portals to enhance sharing documents, multimedia, distribute news, one-to-many communication, collaborative learning, synchronous and asynchronous discussion. Last but no least it requires a teacher commitment to take up a deal of responsibility for the quality of the content posted and distributed via Web 2.0 applications to show learners they can trust the learning materials (Vejrazka et al., 2010).

Further research should be conducted to define the best ways to integrate these tools into current undergraduate and continuing medical education e-learning courses. Web 2.0 can be regarded as a linking element for different forms of web-based learning activities.

Among Web 2.0 applications, podcasting and wiki are particularly suitable for undergraduate and continuing medical education, partly due to the fact that their content can be quality-controlled by professionals.

3.1.1 Podcasting

Podcasting is an example of mobile educational resources and its principle is the creation of audio and/or video for the target audience to access the information "where - when - how" they want (Jham et al., 2008). The advantages of distributing lectures, journal contents, presentations and procedures have been described in dental education, nursing and especially in clinical medicine (Boulos et al., 2006; Clauson & Vidal, 2008; Alikhan et al., 2010). There is much space for prestigious journals, conference organizers and large institutions to become more involved in developing informative, evidence-based podcasts at regular intervals and ensure access to archive collections.

3.1.2 Wiki

Wikipedia has acquired great popularity over the years and few users think about such attributes as quality, trustworthiness, reliability etc. Logan et al. (2010) claimed that it would need more scientists and educators to edit its contents regularly. They have proposed ten rules for anyone who is planning to add new facts, in particular: register an account - know your audience - do not infringe copyright - cite, cite, cite - share your expertise, but do not argue from authority - write neutrally and with due weight - ask for help.

Medical wikis should be controlled by qualified registered contributors, because many are open to modifications by anybody who can post incorrect content, copyrighted materials without citing the original, edit the content to produce erroneous document or even delete a good piece of information.

Some authors (Jalali et al., 2009) are calling for critical appraisal of information disseminated through wikis in situations when wikis are developed, edited and maintained by students themselves. If managed reasonably, integrated into the existing websites and containing knowledge targeted to faculty learning objectives, they can represent an invaluable learning tool (Vejrazka et al., 2010).

3.1.3 Controversies

In spite of enormous popularity of Web 2.0 applications among millennials and new challenges for medical professionals, legitimate concerns have been arising about integrity of these technologies for medical students. However, the complete depth of the problem has not yet been recognized.

A US survey (Chretien et al., 2009) revealed that out of 78 medical schools under study (ie. 60 %) reported incidents due to students' posting unprofessional content online, eg. violation of patient confidentiality, use of profanity, discriminatory language, sexually suggestive materials, communication about medical profession and patients in a negative tone, photos of drug use etc. In spite of its positive aspect, ie. user-generated content for healthcare and medical education, web 2.0 risks broadcasting unprofessional content online that can show medical profession in a negative light. Tradition and social contract between medicine and society are based not only on physicians' knowledge and skills, but also on their attitudes including behaviour, empathy, altruism and trustworthiness. It would be unforgivable to stand idly and watch erosion of these old values. Therefore, medical school administrators and teachers have to keep pace with advances in information technology and develop policies and procedures regarding professional use of Web 2.0 by medical students. It should be taken into consideration that students may not be aware of all the nets, traps and dangers of online posting of unprofessional information in terms of their future careers (Ferdig et al., 2008;

Other authors (Farnan et al., 2008; Garner & O'Sullivan, 2010) are even calling for protection of medical students by their educators who should familiarize themselves with possible pitfalls of the new technology, such as misrepresentation and misjudgement. The students must be well-aware of different ways of online behaviour that could spoil their future reputation of physicians, eg. unauthorized videos showing people in an uncomplimentary light, unprofessional personal contributions, patient stories violating patient confidentiality, communication about medical profession and patients in a negative way etc. Medical schools mission is now not only professional fitness of their future graduates but also professional behaviour in social media environment.

Santoro (2007) has revealed another important issue concerning the openness and ease of use of the Web 2.0 tools, namely reliability of the contents. The nature of these tools enables anybody to alter the document and re-post it without peer-review. In such a way the educational materials may become unreliable which poses a risk for medical education as a whole. Large-scale studies are needed to evaluate limits and benefits of Web 2.0 tools and look for practical solutions.

4. Transition to web-supported evidence based paediatric curriculum

In the beginning of each innovative educational process should be a vision followed by never-ending efforts to motivate and encourage both trainers and trainees to apply new

methods, features and tools. Palacky University Olomouc (Czech Republic) paediatricians undertook a project to implement an evidence-based healthcare approach around real-life scenarios, and develop a sound methodology including web-based learning materials.

4.1 Objectives

The cornerstone of the paediatric curriculum redesign was the intention to implement real case scenarios (Bell et al., 2009) and motivate students to make the cases evidence-based (Kiessling et al., 2011). The clinical education was supplemented with librarian-guided search skills training and information retrieval (Parkhill et al., 2011), selection and interpretation of papers to help students make correct clinical decisions with the assistance of their preceptors. The success of the curriculum re-engineering was dependent on the condition that the amount of contact hours remains unchanged; this was incentives to develop hypermedia learning environment and sets of instructional e-materials to substitute for traditional teaching methods. When developing online supports, priority was given to educational principles and included: relevance, reliability, validity of content, clarity of delivery, effective use of time and appropriate assessment.

4.2 Educational interventions

In accordance with the published experience three educational strategies were chosen to re-design the paediatric curriculum, namely case-based reasoning & learning, evidence-based medicine, and blended learning.

4.2.1 Case-based reasoning & learning

Learning through experience is an important approach employed by humans to comprehend new problems. Medical practice management is facing a challenge of knowledge discovery from the growing volume of information. Recently, there has been a hot debate about the role of casuistry in the context of evidence-based decision-making. Case-based reasoning (CBR) matches the natural reasoning model similar to that used by physicians (Marcus et al., 2004; Holt et al., 2005).

In 1996, R. Schank (Schank, 1996), one of the influential contributors to artificial intelligence and cognitive psychology, wrote: „Learning from experiences is the fundamental process of case-based reasoning. Taking case-based reasoning seriously as a cognitive model implies that experiences play a fundamental role in human learning as well. This has important effects on what and how to teach. Learning by doing works because it teaches implicitly rather than explicitly. Things that are learned implicitly need only be experienced in the proper way at the proper time. In order to make classrooms into learning-by-doing experiences we need to allow students to be in situations that are germane to their interests.“

A decade later, deMantaras and colleagues (deMantaras et al., 2005) confirmed that CBR was a procedure encompassing the significance of prior experience during future problem solving. New problems can be tackled by reusing, and if possible, *modifying* the solutions to similar problems that had been solved in the past. It became applicable in a wide range of disciplines and domains, including medicine. Case-based reasoning gave rise to case-based teaching that is generally considered a superior instructional methodology contrary to

lectures, because it motivates learners' critical thinking skills. Even though much is known about the role played by facilitators in case-based teaching, there are still numerous controversies on the impact of the format and structure of cases on teaching and learning (Kim et al., 2006).

This educational strategy offers medical students new efficient opportunities to improve their understanding of the theories and to develop necessary skills in clinical problem solving. From the practical point of view it seems obvious that case based learning promotes deeper attitudes to instruction and reduces reliance on surface approaches (Marcus et al., 2004; Nunn, 2011).

4.2.2 Evidence-based medicine

In early 1990s a team of experts named as Evidence Based Medicine Working Group defined a new trend in medical education and practice as follows: "Evidence-based medicine de-emphasizes intuition, unsystematic clinical experience, and pathophysiologic rationale as sufficient grounds for clinical decision making and stresses the examination of evidence from clinical research. Evidence-based medicine requires new skills of the physician, including efficient literature searching and the application of formal rules of evidence evaluating the clinical literature"(Evidence Based Medicine Working Group, 1992). Since then, it has been regarded as an approach to teaching practice of medicine (Ismach, 2004; Shuval et al., 2007; Swanwick, 2010). It was a lucky coincidence that the trend of evidence-based medicine started to develop at the same time period as the Internet. The skill of "efficient literature searching" thus appeared in the new light and circumstances due to the increasing availability of electronic databases. At present, with two decades of the existence of the Internet it might seem that efficient medical literature searching is part of information literacy, but actually it is not. As reported by some authors (Hadley et al., 2007; Ilic et al. 2011), a skill to efficiently retrieve best evidence still remains a crucial step in achieving competency in evidence-based practice. The integration of search skills training into evidence-based clinical curricula is a powerful tool to demonstrate students the importance and practical use of evidence-based medicine principles.

In this context, Tonelli (Tonelli, 2006) provoked a hot debate about integrating "real" evidence into practice as a substitute for standard evidence-based approaches. He introduced other kinds of medical knowledge, such as (a) empirical evidence, (b) experiential evidence, (c) pathophysiologic rationale, (d) patient goals and values, and (e) system features. He emphasized that none of the topics had a priority over others, and the relative importance of a topic would depend upon the circumstances of the particular case. The skilled clinician must weigh these potentially conflicting evidentiary and non-evidentiary aspects for action to employ both practical and theoretical reasoning and to make the best choice for a respective patient. His paper was followed by numerous thought-provoking comments (Buetow, 2006; Djulbegovic, 2006; Gupta, 2006; Lipman, 2006; Loughlin, 2006; Miettinen, 2006; Porta, 2006; SáCouto, 2006; Tanenbaum, 2006; Upshur, 2006) that are worth reading and considering for integrated evidence-based medicine curricula development.

4.2.3 Blended learning

In the beginning of the new millennium when evidence based medicine and Internet were firmly anchored in medical education and practice, new concepts were appearing for

integrated evidence based medicine curricula (Green, 2000). Some authors (Hmelo-Silver et al., 2000; Marcus et al., 2004) reported that traditional case-based instructional models could be re-designed to comply with evidence-based medicine principles exploiting most of the advantages of online technologies, but not in the pure format. This method is referred to as blended/hybrid learning, and it has been defined as the combination of face-to-face and online learning opportunities, while reducing classroom contact hours (Dziuban et al., 2004). At present (Donnelly, 2010; Kitchenham, 2011), blended learning represents a mainstream for universities and is seen as a leader in medical education. Learners can be flexible in their education, not constrained by time and distance and satisfied with information technology usage. In parallel, there are numerous advantages for the teachers (eg. better time management, cost savings), and particularly control over the main features of medical education, including dehumanization of medicine (Graham 2004; Harding et al. 2005; De Silva et al., 2010; Aronoff et al., 2010).

Other authors described advantages of blended learning as follows:

“Inherent in blended learning is a fundamental redesign of the instructional model, shifting from lecture to student-centred instruction, increasing all forms of interaction and incorporating formative and summative assessment” (Twigg, 2003; Dziuban et al., 2004).

„Blended learning is a combined and integrated use of e-Learning and face-to-face (F2F) learning activities to develop a community of learning“ (Schaffer & Small, 2004).

„Blended learning complements face-to-face classes with eLearning modules“ (Voos, 2003).

„It is possible to bring the advantages of face-to-face classes and online courses together“.

“It supports a wide range of learning models, such as situated, associative, systemic, simulative and constructivist learning which help to improve the quality of medical education” (Sharpe et al. 2006).

„Clinical education that uses blended learning for communication and reflection may provide flexibility to address clinical placement logistics and may enhance student learning“ (Gray & Tobin, 2010).

4.3 Process and outcomes

The process of redesigning the existing undergraduate paediatric curriculum of Palacky University Olomouc (Czech Republic) started as a pilot project in 2007 with the goal to introduce basic principles of evidence based medicine to the 5th-year students of general medicine.

The main change can be characterized as transition from the disease-oriented education (DOE) to patient-oriented evidence that matters (POEM). Besides traditional lectures, seminars, outpatient and bedside teaching the students take a real case scenario exercise. What does that mean? In pairs, the trainees get an actual patient, ask a clinical question, transform it into a PICO (patient-intervention-comparison-outcome) format and make a relevant PubMed search. Under careful teacher guidance and supervision they complete the patient file, and analyze at least one research paper to answer the assigned clinical question.

To follow the four basic steps of evidence-based medicine (1-ask a question, 2-acquire information, 3-appraise information, 4-apply evidence), clinical education is supplemented

with various formats of librarian-facilitated search skills training, ie. mandatory non-interactive online demonstration of PubMed search, elective small-group hands-on training, and web-based tutorial. Online learning materials are available through the Czech and Slovak educational network of medical faculties MEFANET (<http://www.mefanet.cz>). During case scenario exercise students get as much mentoring as necessary, both face-to-face and web-based, including the asynchronous communication service run by the university for registered users.

In the end students present their case reports at a mini-conference and their performance is evaluated according to a set of pre-defined criteria by an assessment committee nominated by the head of the Paediatric Department. The redesigned curriculum was approved by Palacky University Medical Faculty management and officially introduced since academic year 2008/2009. The portfolio of the main innovative educational features contains patient-oriented approach, evidence-based medicine workshop, evidence-based bedside teaching & learning, blended learning, technology-driven information gathering, library-facilitated interactive search skills training, real case scenario exercise, web-based information skills tutorial, e-mentoring, e-portal with a collection of medical education materials MEFANET - <http://mefanet.upol.cz>

4.4 Student feedback

The pilot version of the innovated paediatric curriculum was assessed by a cohort of 106 medical students during academic year 2007/2008. The questionnaire survey showed that up to 85 % of the respondents had expressed positive attitudes to the re-engineered curriculum, whilst 8 % had critical remarks and 7 % negative impressions (Fig. 1). Some of the student feedback issues were used by the curriculum developers to make minor changes and improvements.

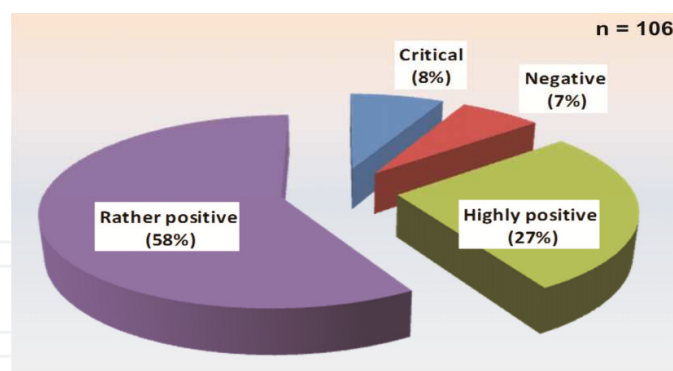


Fig. 1. Pilot version of redesigned paediatric curriculum : student feedback in academic year 2007/2008.

In the next two consecutive academic years 2008/2009 and 2009/2010 a total of 226 medical students who had completed the paediatric clerkship were surveyed by a questionnaire consisting of structured questions (1-to-5 rating + open-ended). The trainees expressed their opinion about perceived values of the curricular features, in particular value of practical training (Fig. 2), teachers' willingness (Fig. 3), and impact of instruction on increased interest in the discipline (Fig. 4). The results demonstrate the following best scored instructional features : teachers' willingness (score 1 by 72% respondents), quality of practical training

(score 1 by 44% respondents), and increasing interest in the specialty (score 1 by 32% respondents).

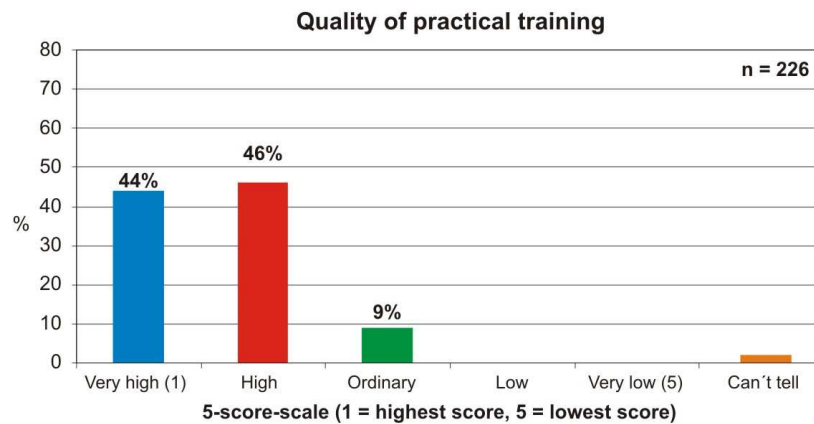


Fig. 2. Perceived value of practical training quality in the newly implemented paediatric curriculum in academic years 2008/2009 and 2009/2010.

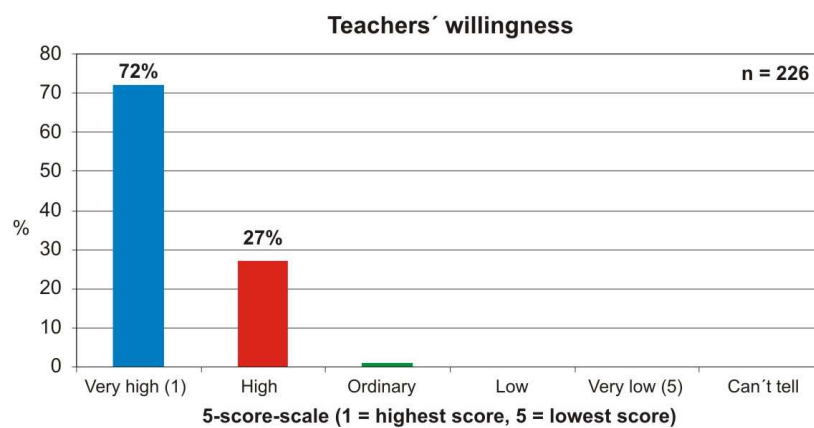


Fig. 3. Perceived value of teachers' willingness in the newly implemented paediatric curriculum in academic years 2008/2009 and 2009/2010.

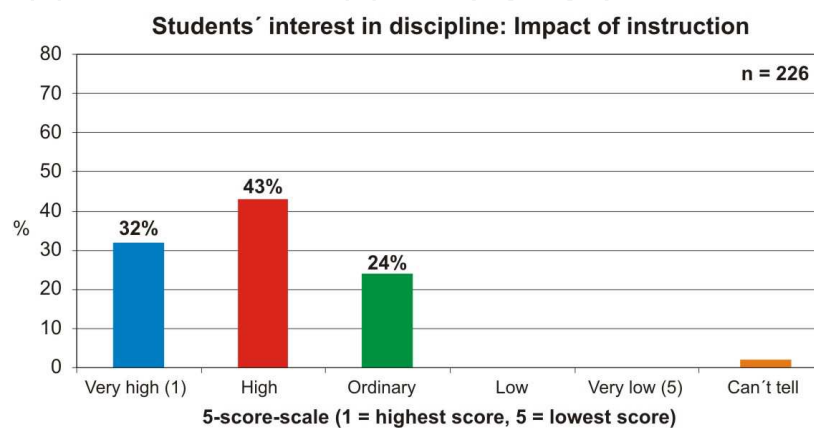


Fig. 4. Perceived value of increasing interest in the discipline due to the newly implemented paediatric curriculum in academic years 2008/2009 and 2009/2010.

Open-ended questions produced some thought-provoking verbatims:

„I found this learning activity refreshing, illustrative, enriching, BUT extremely time consuming...“

“For me, it was a waste of time, not a very efficient educational tool...I prefer textbooks.“

„In the beginning, I was hopeless, because I had no idea what it was going to be about. Later on I understood that searching databases should be always inevitable to find the best treatment option for my patients. Having completed the clerkship, I decided to become a paediatrician...“

„I was especially fond of the EBM workshop, including demonstration how and why to search for relevant literature.“

“I am very happy that I had an opportunity to be trained how to search PubMed, even if the beginnings were not very easy. Now I feel competent enough to find what I need.“

There was a separate questionnaire survey among the same cohort of the students ($n = 226$) focused on their perceptions of 3 modes of information skills training that included mandatory non-interactive demonstration of a PubMed search, elective interactive small-group hands-on classes and online tutorial with animations, fulltext examples of various study designs, templates for study design interpretation etc. There were 4 structured questions to reply. Up to 70 % of the students self-reported their post-training level of search skills as average, but satisfactory to accomplish the task, 82 % of the respondents were fully satisfied with the hybrid instruction package consisting of a non-interactive PubMed search demonstration supplemented with the web-based search skills tutorial, whilst 14% did not find this package sufficient without subsequent interactive hands-on sessions. In this context, the survey data showed that nearly 62 % of the respondents regarded subsequent hands-on training as important, whilst a total of 45 % did attend the sessions. Fisher's exact test confirmed the statistically significant correlation ($p < 0.0001$) between these two perceived values: 89 % of the hands-on session participants agreed on its efficiency, as well as up to 39 % of those who had not actually attended the interactive classes (Fig. 5).

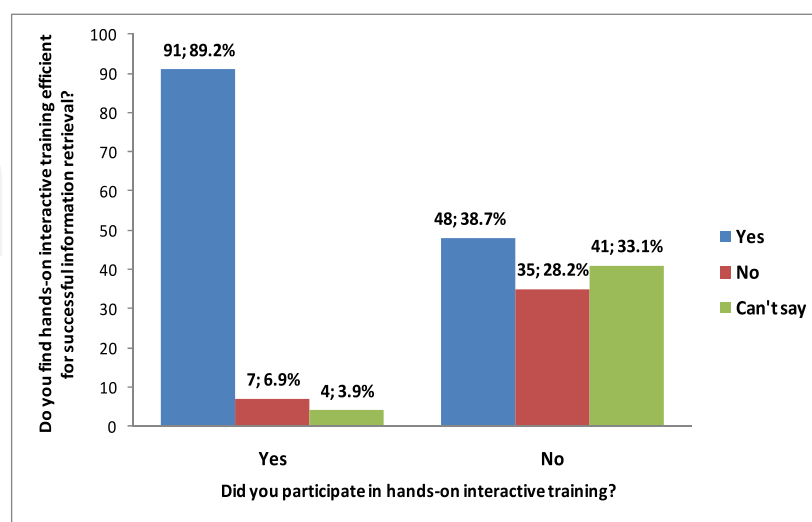


Fig. 5. Correlation between perceived value of hands-on search skills training and attendance in the training sessions (Fisher's exact test) among a cohort of medical students ($n = 226$) in academic years 2008/2009 and 2009/2010.

4.5 MEFANET portal platform

As already mentioned, all of the multimedia online materials with various configurations (text, images, audio, video, PowerPoint presentations, databases, asynchronous discussion facilities) promoting implementation of a blended learning method for evidence-based paediatric clinical instruction are available from one peer-reviewed portal MEFANET (<http://www.mefanet.cz>)

In 2007, the MEFANET project (MEDical FACulties NETwork) initiated an international, effective and open cooperation among 11 medical faculties in the Czech Republic and Slovakia. One of the elementary goals of this educational network has been to advance medical teaching with the use of modern information and communication technologies. As an instrument, the MEFANET team decided to develop an original and uniform solution to publish and share digital educational content. There are 3 fundamental principles across the portal platform: (1) medical disciplines linker, (2) federative framework for user authentication, (3) four-dimensional quality assessment (Schwarz et al., 2011).

Authors of online instructional materials have the right to manage user access privileges. The access can be either free or requires authentication.

The main gateway contains a collection of hundreds of digital learning materials developed by educators from different universities relevant to a total of 48 medical specialties. Currently, the network provides services to about 4,000 teachers and almost 22,000 medical and health sciences students.

4.6 A proposal for developers of case-based learning environment in medicine

- a. Select attractive, authentic clinical problems to place students *in medias res* and motivate them to take responsibility for learning through decision-making;
- b. Encourage learners to solve the clinical problem in a way consistent with professional practice and methodologies (eg. include search skills training and journal clubs as educational interventions);
- c. Offer students as much support and guidance as possible; apply mentorship, but promote creative approaches, such as critical thinking, and keep them far from fragmented solutions and memorizing mere facts.

5. Conclusion

Two decades have been enough for the Internet to become an integral part of our daily activities. Current students, often called YouTube generation, Millennials, Generation Y, Net Generation, are unlikely to be satisfied with traditional teaching and learning methods. Medical students often prefer more visual and hands-on methods of information and knowledge acquisition (Ashraf, 2009).

Based on our experience, we can argue that innovative clinical curricula should be a mixture of tradition, modern medicine, technology, and humanity. In such a way they have the power to increase students' interest in the specialty if integrated with evidence-based practice, information literacy training, and supported by online learning materials (Fieschi et al., 2010; Trukhacheva et al., 2011; Motteram & Sharma, 2009).

Case-based learning belongs to the traditional educational interventions in medicine (Williams, 2005). We are in concert with the published opinions that a revival of case method, in particular with real patients and evidence-based, offers an effective alternative of interactive learning (Tarnvik, 2007). Medical students can get the authentic experience how best evidence is implemented at the point of care, including published research (Harden, 2001). These aspects contribute to better motivation for their future jobs. In parallel, clinical teachers become more involved in evidence-based practice, their knowledgebase is improving and the usage of fee-based institutional information resources is more efficient. It is urgently needed that schools incorporate learner-centered teaching and medical educators implement innovative techniques engaging students and delivering them learning content in a time- and resource-efficient manner.

The blended learning approach has been proven practical for medical instruction and opens new horizons for introducing Web 2.0 technologies in a reliable manner to support medical professionalism of future doctors. In our setting, we have had little experience with Web 2.0 apps, so far limited to podcasting lectures (audio synched with PowerPoint). According to other authors, students appreciate online media as review of lectures or a substitute to attending a class (Brittain et al., 2006).

Online learning & teaching requires a reliable ICT support, either to assist teachers, or enable e-publishing of the courses. E-publishing of medical learning materials is a specific issue due to teacher-student-patient relationships including ethical and law aspects. Our 5-year- experience with MEFANET has confirmed the benefits of the centralized ICT support provided across academic networks. Our solution is applicable to other networks, both at national and international levels.

Evidence-based medicine has been acknowledged as a dominant competency in modern health care services delivery. The capability to retrieve and critically appraise the published research has now an irreplaceable position in the portfolio of clinical skills. These information skills must be taught at the undergraduate level. Large-scale studies are needed to compare curricula with evidence-based instruction during pre-clinical and clinical years in terms of practical applicability and sustainability of the acquired skills (Khader et al., 2011).

In spite of technological advances in the digital era (Web 1.0, Web 2.0 apps), medical education should and hopefully will retain its traditional humanistic feature through case-based teaching/learning and peer-guided format, guaranteeing affective, pedagogic, and organizational support. While students find, filter, and focus, their teachers must be ready to act as guides, facilitators and mentors (Schichtel, 2010).

The authors of this chapter had no ambition to encompass all aspects of Web 1.0 and Web 2.0 apps in medical education worldwide. However, the recent WHO report emphasizes necessary multi-sectoral reforms in low- and middle-income countries to improve alignment between educational institutions and health services delivery (Celletti et al., 2011). Used in proper time, online teaching and learning will definitely be of the same value as in other regions.

General visions to shape Generation Y medical education comprise above all (1) progress towards competency-based curriculum, (2) reduced fragmentation in clinical clerkships, (3) case-based and patient-oriented learning with implementation of evidence-based medicine principles, (4) reasonable use of online learning strategies combined with face-to-face

instruction, (5) regular monitoring, update and innovation of the web-based learning materials.

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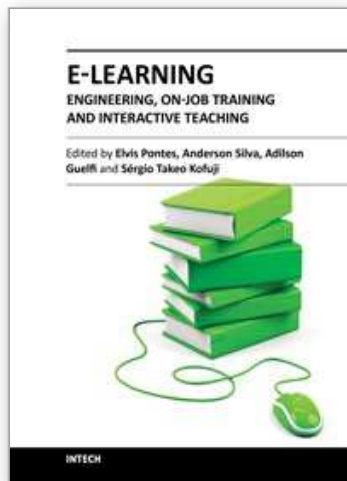
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Adaptive E-learning was proposed to be suitable for students with unique profiles, particular interests, and from different domains of knowledge, so profiles may consider specific goals of the students, as well as different preferences, knowledge level, learning style, rendering psychological profile, and more. Another approach to be taken into account today is the self-directed learning. Unlike the adaptive E-learning, the Self-directed learning is related to independence or autonomy in learning; it is a logical link for readiness for E-learning, where students pace their classes according to their own needs. This book provides information on the On-Job Training and Interactive Teaching for E-learning and is divided into four sections. The first section covers motivations to be considered for E-learning while the second section presents challenges concerning E-learning in areas like Engineering, Medical education and Biological Studies. New approaches to E-learning are introduced in the third section, and the last section describes the implementation of E-learning Environments.

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