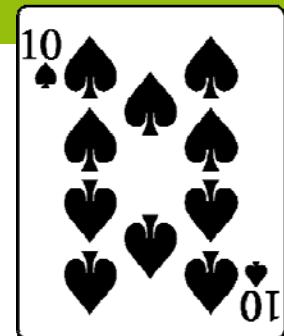


MEFANET after 10 years of networking: state of the union

Daniel Schwarz & MEFANET community



MEDICAL
FACULTIES
NETWORK



Outline



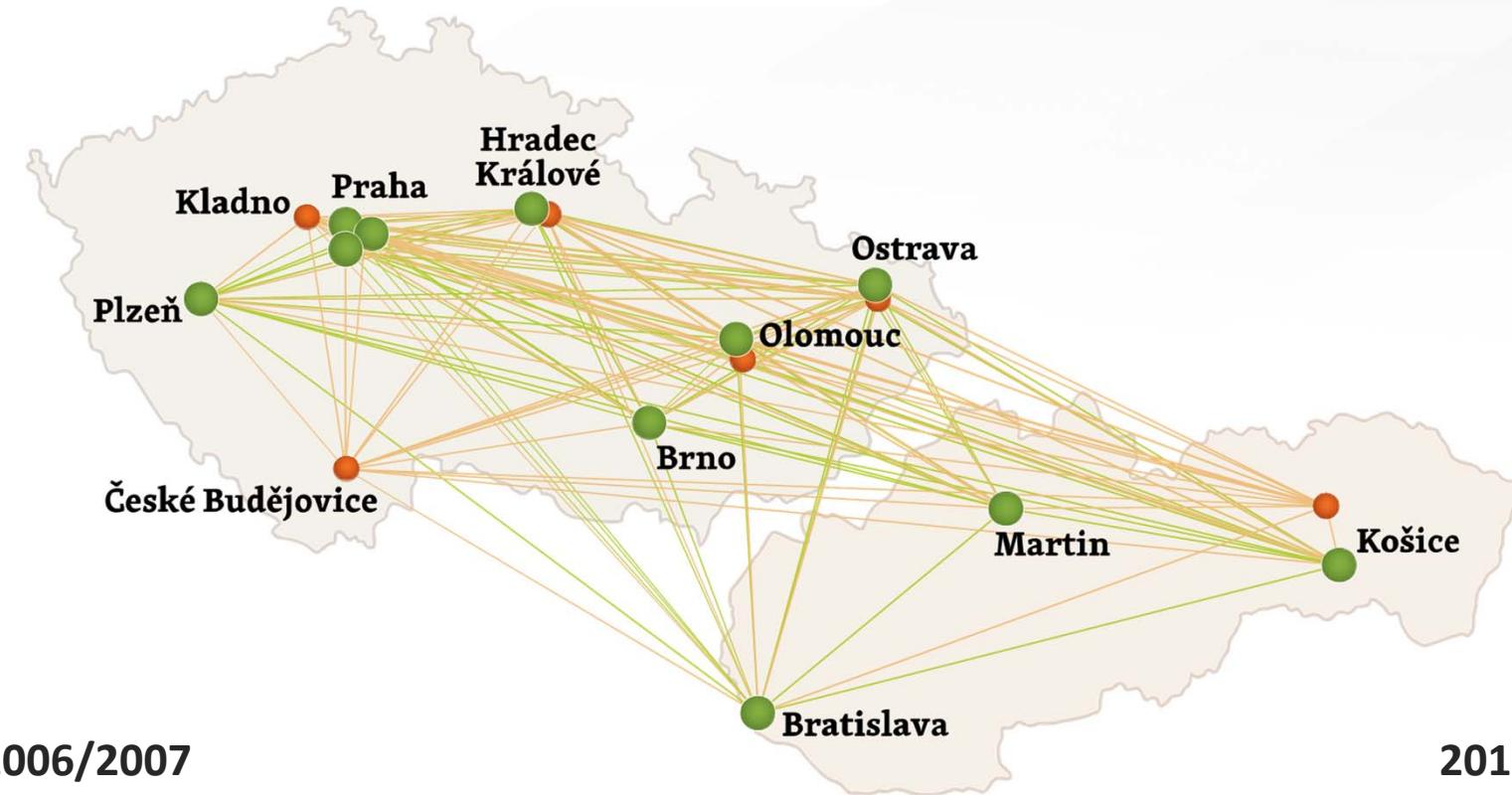
1. MEFANET: history of the movement
2. Our achievements
3. What's next?



A cloud-shaped arrangement of various terms related to medical education and healthcare, including:

- student
- translational curriculum
- curriculum
- Communication
- educators
- clinicians
- assessment
- doctors
- scientists
- Health
- interdisciplinary
- community
- bioscience
- settings
- selection
- health
- Educational healthcare research
- Curriculum
- Medical
- tutorial
- design
- Healthcare
- social
- teaching
- Education
- collaborators
- learning
- future
- Unit clinical Practice

MEFANET: history of the movement





26. 05. 2006

CPR.3: 2815

mefanet



UNIVERZITA KARLOVA V PRAZE
1. LÉKAŘSKÁ FAKULTA
121 08 PRAHA 2, KATERINSKÁ 32
DĚKAN FAKULTY

Č. j.: 823/06, 710 - 68 658

V PRAZE

24. 5. 2006

Vážený pane děkane,

především dovolte, abych vyslovil velké uznání vašim pokrokům při zavádění multimediální výuky lékařských a zdravotnických studijních programů. Vedení naší fakulty sleduje výukové konference a vývoj výukového portálu vaši a přírodovědecké fakulty MU s velkým pochopením a zájmem, neboť zjištuje, že kromě stejných cílů máme i více nebo méně podobné metody přístupu v řešení tohoto úkolu. 1. LF UK získala několik finančních dotací na eLearning a výukový SW i HW, modernizuje počtačovou síť, nakoupila zajímavé vývojové prostředí a vytváří výukový portál, řeší legislativní a vydavatelské otázky.

Obracím se na Vás s návrhem spolupráce v této oblasti. Mohli bychom začít na koncepční úrovni. Pokud byste s takovou spoluprací souhlasil, navrhoji, aby se naši odborníci (předseda naší eLearningové komise, vedoucí našeho oddělení výpočetní techniky a jeden až dva specialisté odpovědní za výukový server sešli s Vámi určenými odpovědnými pracovníky, informovali se o aktuálním stavu věci a předložili nám návrh na případnou spolupráci. Pokud by se koncepční spolupráce ukázala prospěšnou pro obě strany, mohli bychom následně přistoupit k hlubší koordinaci multimediální výuky.

Věřím, že naše společné úsili by bylo prospěšné pro učitele i studenty našich škol.

S přáním mnoha úspěchů a se srdečným pozdravem

Prof. MUDr. Tomáš Zima, DrSc.

Vážený pan
Prof. MUDr. Jan Žaloudík, CSc.
děkan
Lékařská fakulta Masarykovy Univerzity
Komenského náměstí 2

Seminář RITM 2006: Moderní metody výuky lékařských oborů pomocí informačních technologií a telemedicíny

RITM

Dne 15. listopadu 2006 se v přednáškové místnosti Psychiatrické kliniky Lékařské fakulty MU a Fakultní nemocnice Brno konal 2. ročník semináře RITM (Rady pro informační technologie v medicíně) - letos i s aktivní účastí kolegů z Lékařské fakulty Univerzity Palackého v Olomouci a z 1. Lékařské fakulty Univerzity Karlovy v Praze. V následující reportáži jsou shrnutы příspěvky jednotlivých přednášejících.



Dohoda o spolupráci lékařských fakult v sítí MEFANET

Niže uvedeného dne, měsice a
Masarykova univerzita, Lékařská fakulta,
Komenského nám. 2, 662 43 Brno
IČ 00216224
Zastoupená prof. MUDr. Janer

Univerzita Karlova v Praze,
Károlyho nám. 32, 121 08 Praha 2
IČ 00216208
Zastoupená prof. MUDr. Tomáš

Univerzita Karlova v Praze,
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IČ 00216208
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IČ 61989592
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Univerzita Komenského v Bratislavě
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IČ 00397865-01
Zastoupená Prof. MUDr. P. I.

Univerzita Komenského v Martine
Záborškého 2, 036 45 Martin
IČ 00397865-02
Zastoupená doc. MUDr. Dušan

dále zaregistrována doména www.MEFANET.eu. Existence portálů nijak neomezuje rozvoj portálů jednotlivých fakult prezentací.

Čl. VI. Pravidla scílení autorských

Díla vzniklá v rámci činnosti projektu MEFANET vyjádřená grafickým zpracováním, budou užívána na základě smlouvy ve smyslu platných právních předpisů, o právu autorském, o právech souvisejících s právem, zák. č. 527/1990 Sb., o vynálezech a zlepšovacích návrzech,

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1. Tato smlouva nabývá platnosti dnem, v němž ji akceptuji a účinností dnem 1.3. 2009 nebo dnem nabytí platnosti, a to s nimiž souhlasí všechny smluvní strany.
2. Tuto smlouvu lze měnit a doplňovat pouze formou psaného souhlasu všechny smluvní strany.
3. Rozhodné-li se některá z fakult ukončit členství v sítí MEFANET, se některá z fakult dohodou o spolupráci, je požádáno předsedovi Koordinační rady nejpozději do posledního dne příslušného kalendářního roku o odchodu z členství MEFANET a smluvní stranou této dohody o ukončení členství v sítí MEFANET a druhá věc je nebyt spolupráci.
4. Dohoda se vyhotovuje v 10 stejnopisech s platností z účastníků náleží po jednom.
5. Zástupci oprávněni jednat a podepisovat jménem či za sobsahem této smlouvy, její obsah je jim znám a je důkaz své svobodné, pravé a určité vůle uzavřít tuto dohodu.

V..... dne
za Masarykovu univerzitu, Lékařskou fakultu
MASARYKOV
Lékařská fakulta
662 43 Brno-Kožice
S. Štěpán

V..... dne
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306 05 Plzeň, Husova 3
IČO: 00216208 DIČ: CZ00216208
tel.: 377 593 400, fax: 377 593 449

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PLZNI

V..... dne
za Univerzitu Palackého v Olomouci, Lékařskou fakultu
Olomouc



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Košice

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Trieda SNP č. 1, 040 11 Košice

MEFANET: reasons & motivation



To support a process in education
of medical and health care
disciplines using modern ICT.

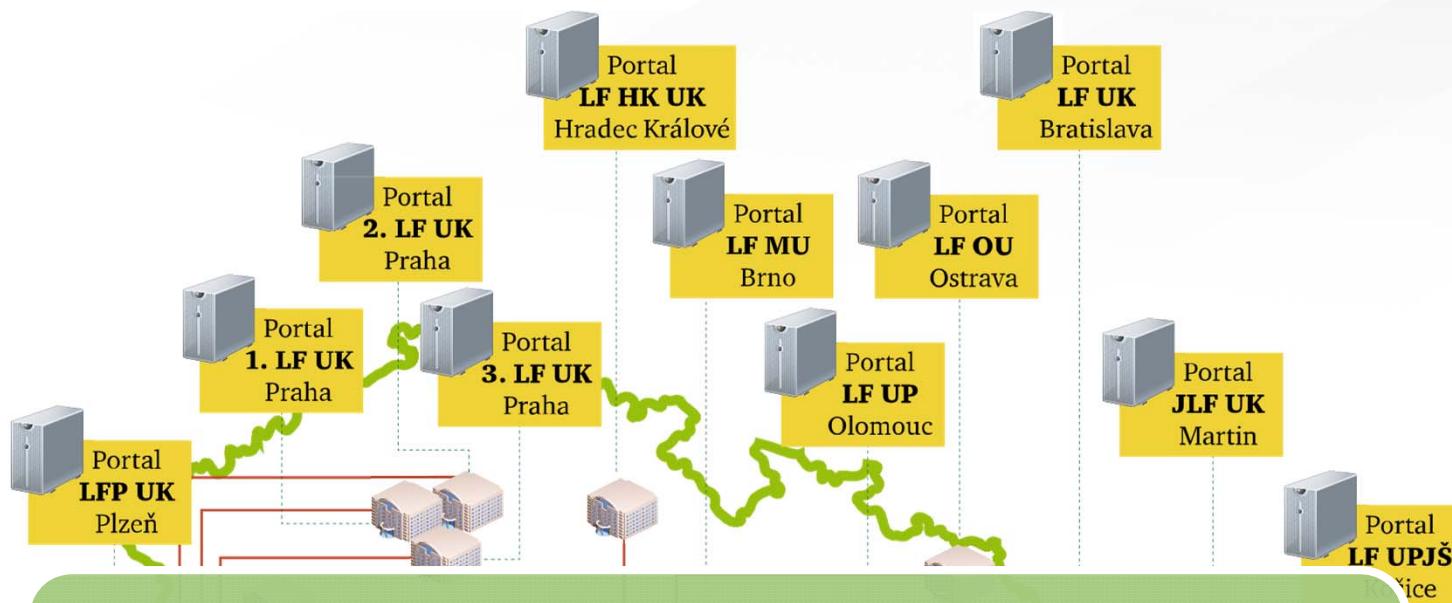
To ensure a horizontal
accessibility of electronic
teaching and learning tools
for both teachers and
students.

To facilitate the cooperation
among teams from
different schools.

Czechs and Slovaks are
traditionally academic
partners with similar
languages.



How do we share educational resources?



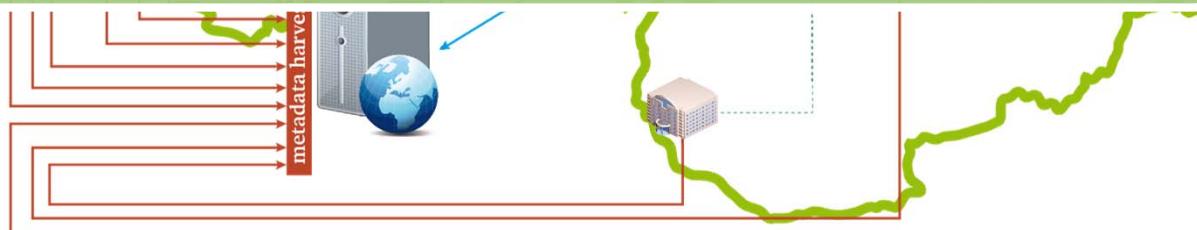
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<input type="checkbox"/> Biology (130)	<input type="checkbox"/> Haematology (20)	<input type="checkbox"/> Neurosurgery (0)	<input type="checkbox"/> Public Health Care, Social Medicine (0)
<input type="checkbox"/> Biophysics (1208)	<input type="checkbox"/> Health Care Sciences (463)	<input type="checkbox"/> Nuclear Medicine (0)	<input type="checkbox"/> Radiology and Imaging (21)
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<input type="checkbox"/> Dentistry (469)	<input type="checkbox"/> Immunology, Allergology (762)	<input type="checkbox"/> Occupational Medicine and Toxicology (0)	<input type="checkbox"/> Respiratory Medicine (0)
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<input type="checkbox"/> Emergency Medicine (1754)	<input type="checkbox"/> Laboratory Diagnostics (0)	<input type="checkbox"/> Other (0)	<input type="checkbox"/> Surgery, Traumatology and Orthopaedics (1178)
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<input type="checkbox"/> Epidemiology, Preventive Medicine, Hygiene	<input type="checkbox"/> Medical Chemistry and Biochemistry (3)	<input type="checkbox"/> Paediatrics, Neonatology (682)	
<input type="checkbox"/> Gastroenterology and Hepatology (5)	<input type="checkbox"/> Medical Informatics and Information Science (0)	<input type="checkbox"/> Pathology and Forensic Medicine (37)	
<input type="checkbox"/> General Practice Medicine (0)	<input type="checkbox"/> Microbiology (0)	<input type="checkbox"/> Pharmacology (928)	

select all

medical disciplines filter



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MEDICAL
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moodle

SCHWARZ Daniel, DUŠEK Ladislav. A uniform platform for electronic publishing and sharing the educational content in the network of medical faculties MEFANET [online]. Masaryk University, [2008], [cited 2016-11-28]. Available from WWW: <<http://portal.mefanet.cz>>. Version 1.9 [2014].



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Keeping the MIX appropriate

Czech academic identity federation



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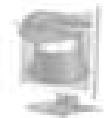
Textbooks and manuals



Educational websites and atlases



Digital video



Presentations and animations



Casuistics in images



E-learning courses (LMS)



Reviewed information



Undergraduate level



Graduate



Advanced Graduate



Complex

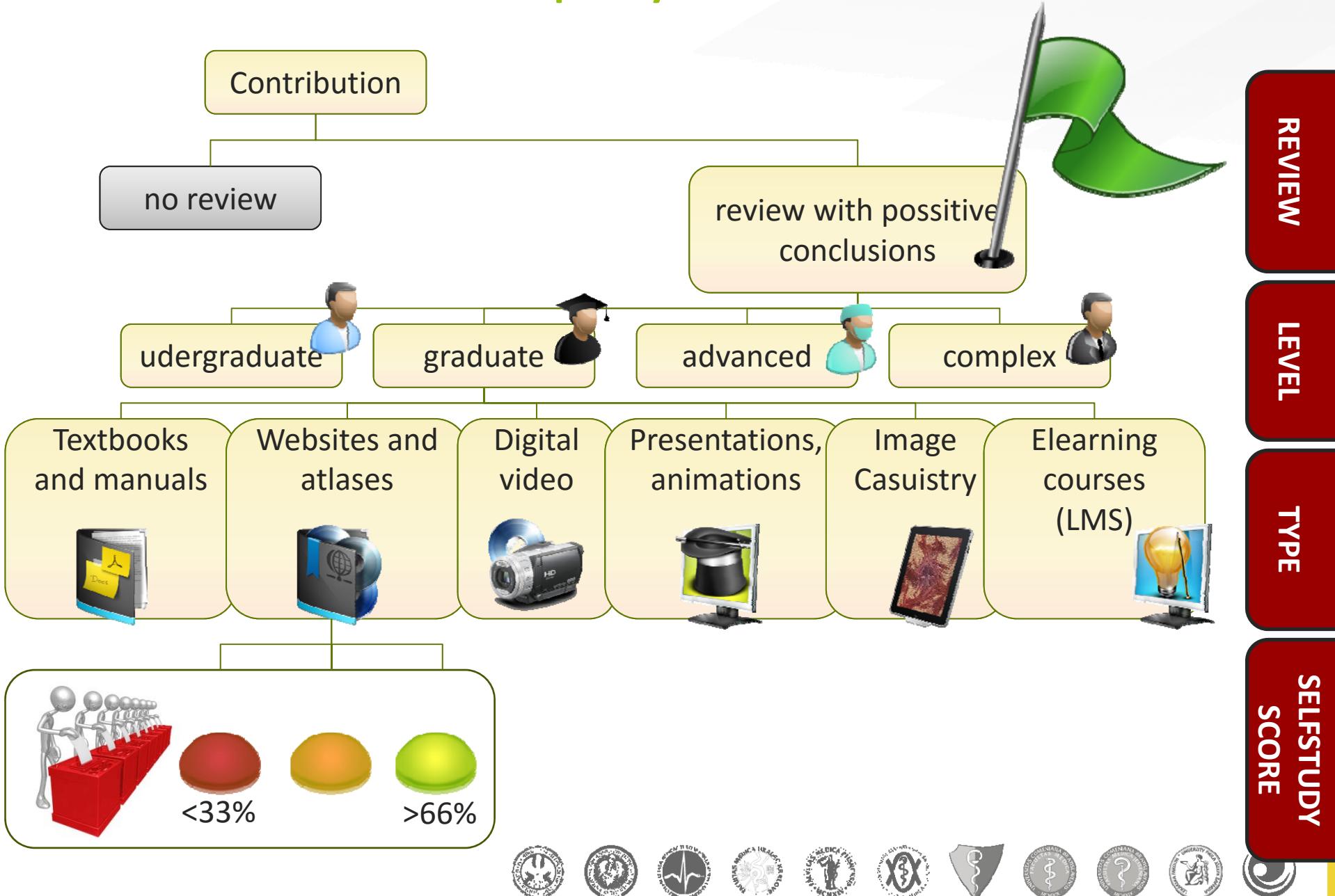


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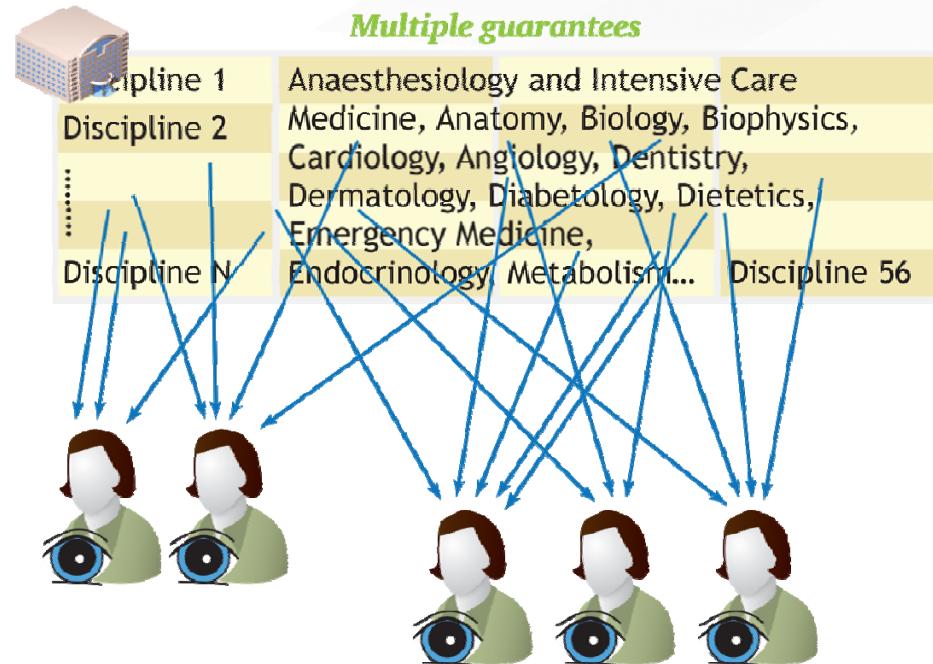
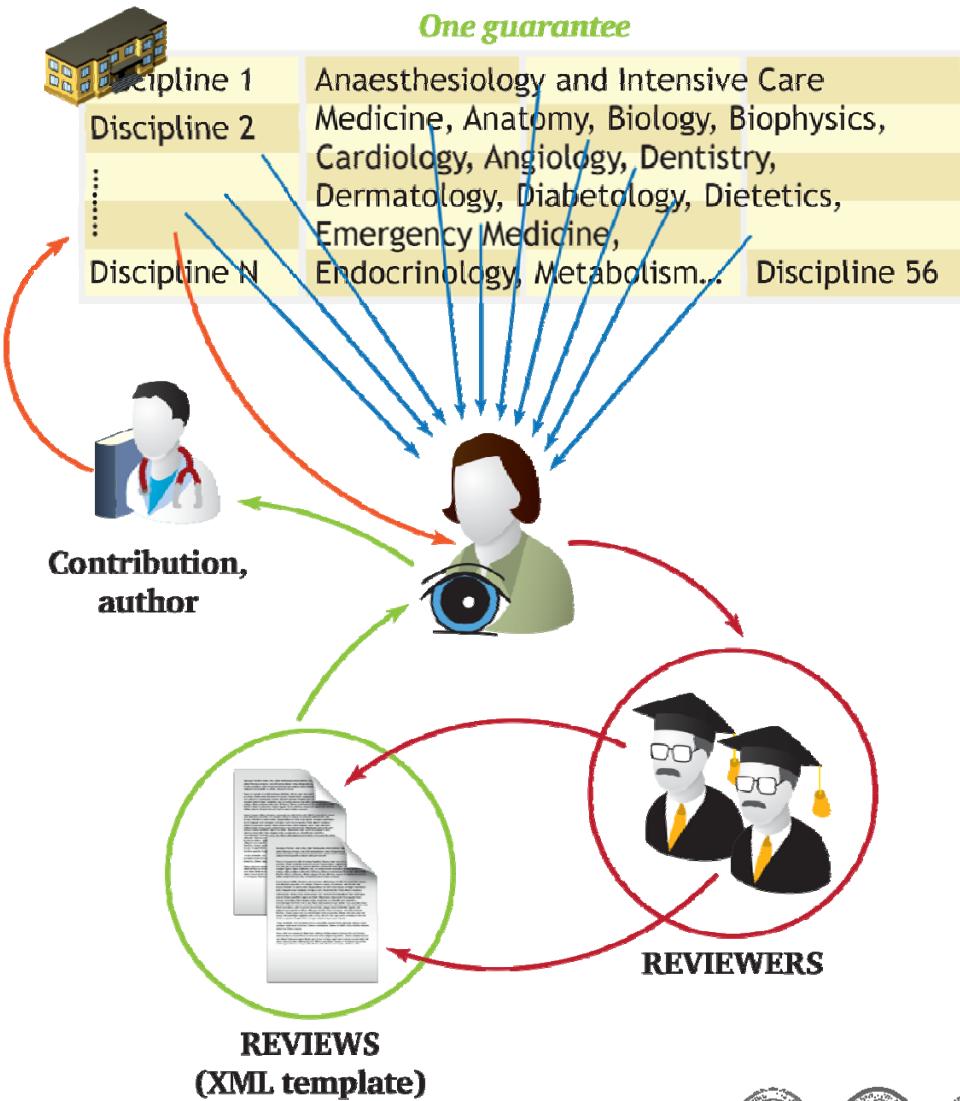




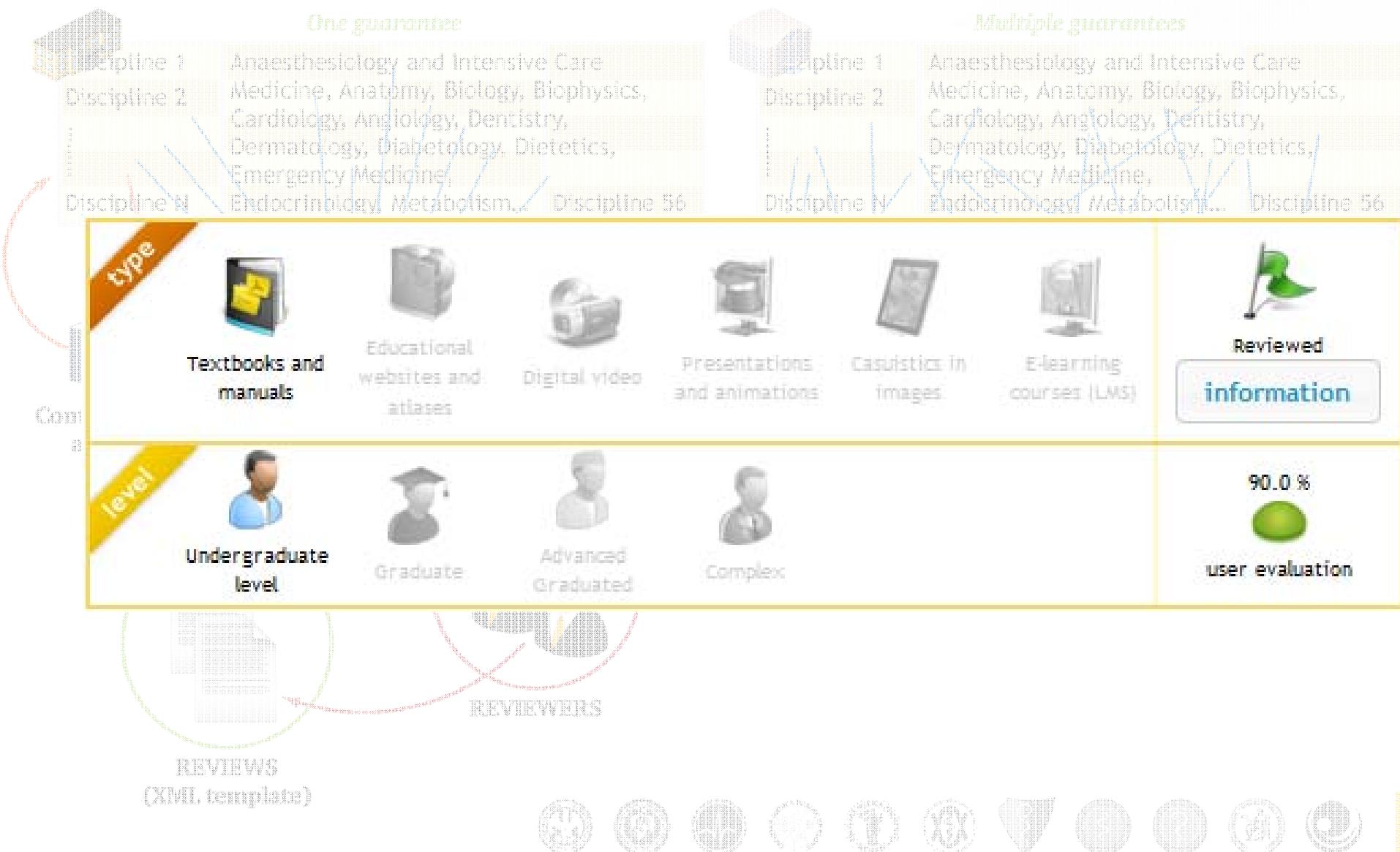
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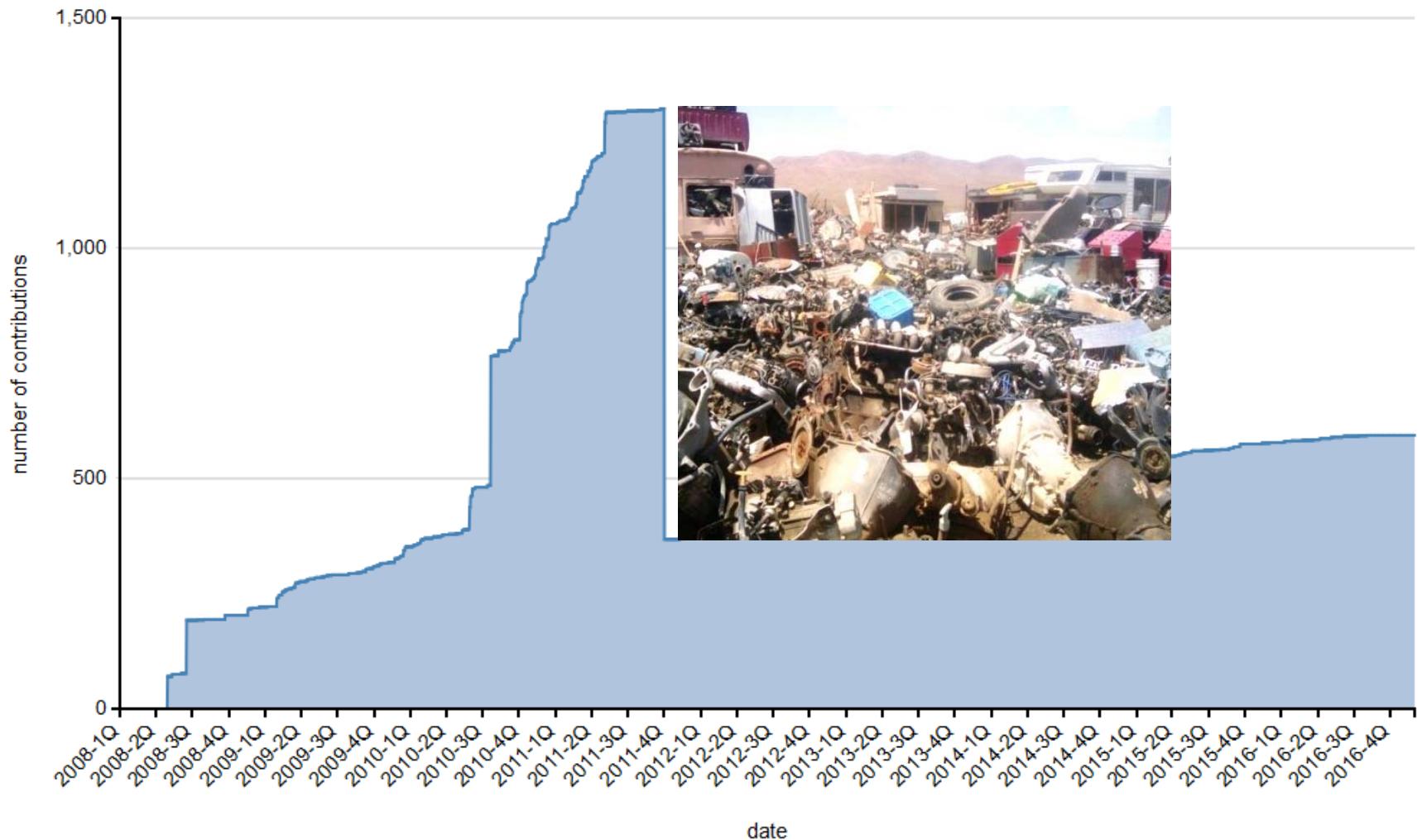
Quality assessment: guarantors, reviewers, authors



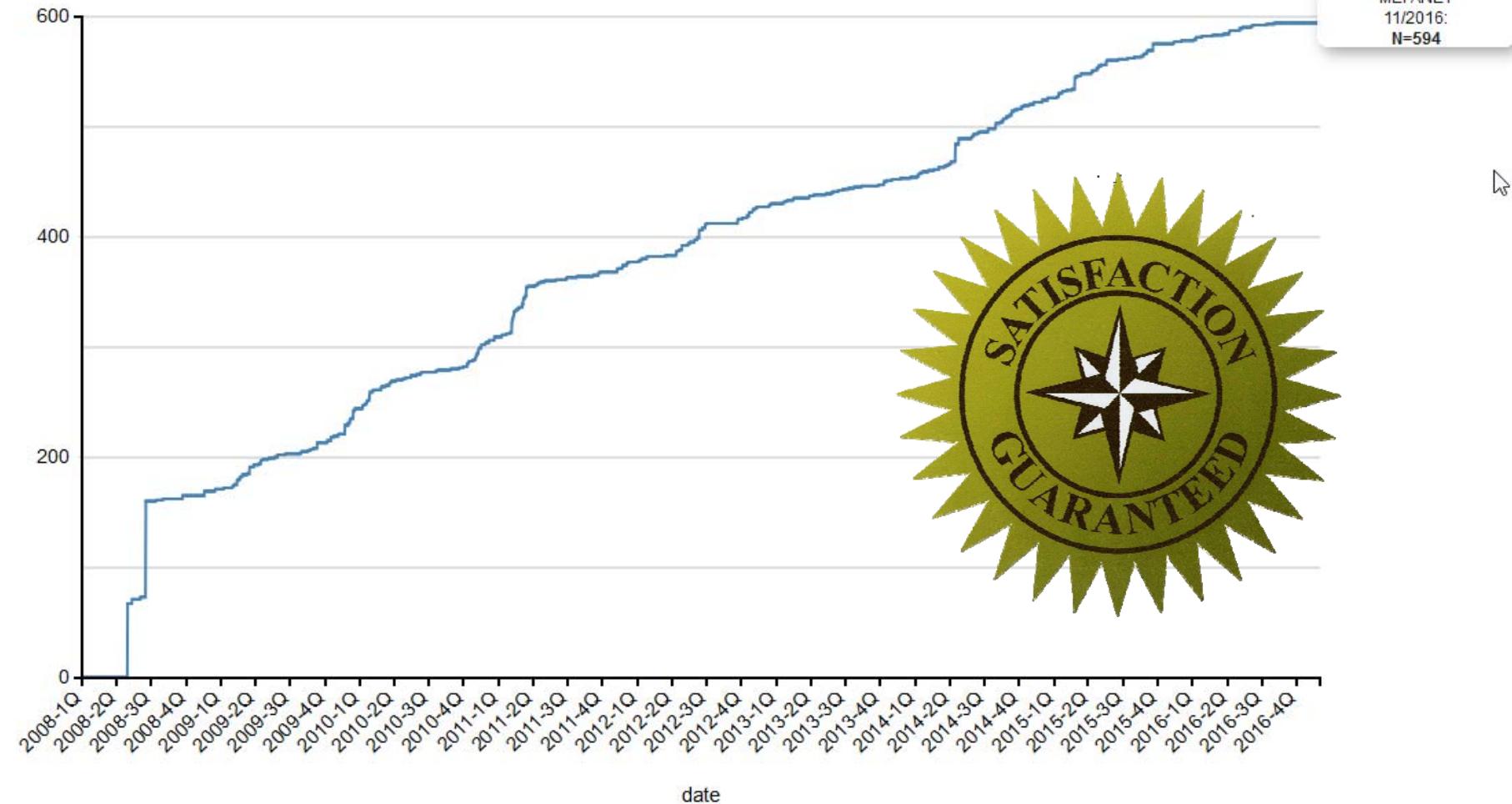
Quality assessment: guarantors, reviewers, authors



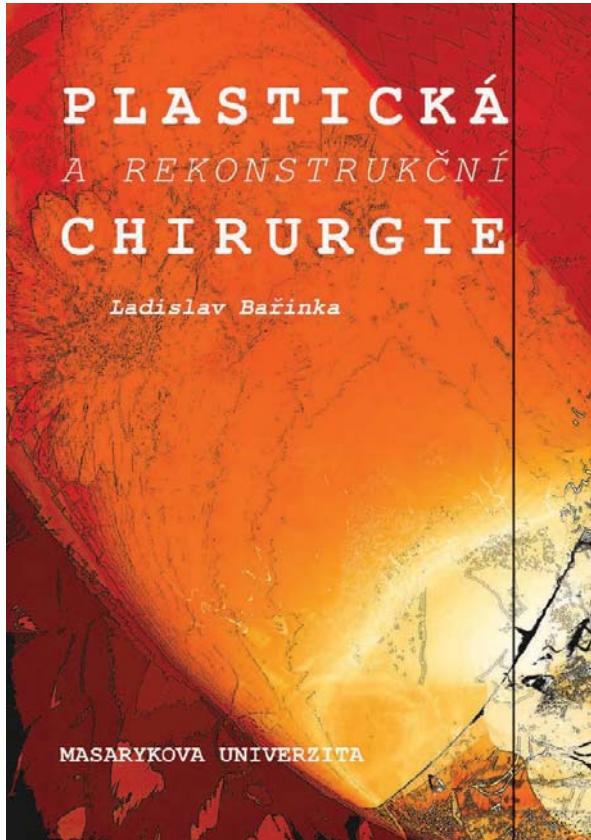
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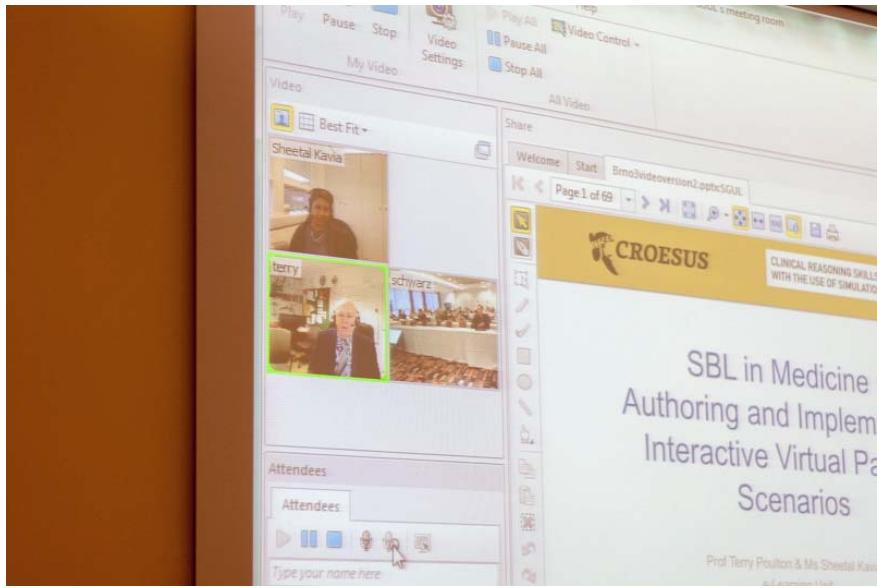
When teaching kills learning.....

© Randy Glasbergen.
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"The kids don't listen, so I have to repeat myself. I'm always repeating myself. You know, always saying the same thing more than once. I say it once, and then they make me say it again..."

Simulations in medical education





Brána MEFANET

česky | english

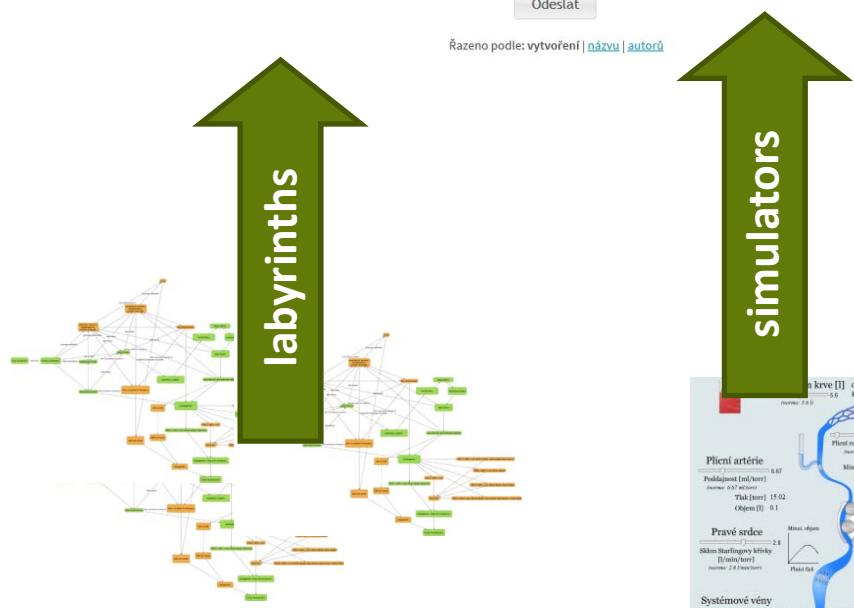
Games MEFANET

Filtrovat podle disciplín

<input type="checkbox"/> Akutní medicína (74)	<input type="checkbox"/> Hematologie (0)	<input checked="" type="checkbox"/> Kardiálně zdravotnické vědy (1)	<input type="checkbox"/> Psychiatrie, psychologie, sexuologie (8)
<input type="checkbox"/> Anatomie (0)	<input type="checkbox"/> Histologie, embryologie (0)	<input type="checkbox"/> Neurochirurgie (0)	<input checked="" type="checkbox"/> Radiologie a zobrazovací metody (1)
<input checked="" type="checkbox"/> Anestesiologie a intenzivní medicína (1)	<input checked="" type="checkbox"/> Chirurgie, traumatologie, ortopedie (4)	<input checked="" type="checkbox"/> Neurologie (1)	<input type="checkbox"/> Rehabilitace, fyzioterapie, ergoterapie (0)
<input type="checkbox"/> Biophysika (0)	<input checked="" type="checkbox"/> Immunologie, alergologie (1)	<input type="checkbox"/> Nuklární medicína (0)	<input checked="" type="checkbox"/> Revmatologie (1)
<input type="checkbox"/> Biologie (0)	<input checked="" type="checkbox"/> Infekčníologie (1)	<input checked="" type="checkbox"/> Oftalmologie, optometrie (2)	<input type="checkbox"/> Tělovýchovné lékařství (0)
<input type="checkbox"/> Dermatologie (0)	<input checked="" type="checkbox"/> Kardiologie, angiologie (2)	<input type="checkbox"/> Onkologie, radioterapie (0)	<input type="checkbox"/> Urologie (0)
<input type="checkbox"/> Diabetologie, dietetika (0)	<input type="checkbox"/> Laboratorní diagnostika (0)	<input type="checkbox"/> Ostamt (0)	<input type="checkbox"/> Všeobecné zdravotnické, sociální lékařství (0)
<input checked="" type="checkbox"/> Endokrinologie, metabolismus (2)	<input type="checkbox"/> Jéanská etika a právo (0)	<input type="checkbox"/> Otorinolaryngologie (0)	<input checked="" type="checkbox"/> Vnitřní lékařství (10)
<input type="checkbox"/> Epidemiologie, preventivní lékařství, hygiena (0)	<input type="checkbox"/> Jéanská genetika (0)	<input type="checkbox"/> Patoologie a soudní lékařství (0)	<input checked="" type="checkbox"/> Všeobecné praktické lékařství (1)
<input type="checkbox"/> Farmakologie (0)	<input type="checkbox"/> Jéanská chemie a biochemie (0)	<input checked="" type="checkbox"/> Pediatrie, neonatologie (3)	<input checked="" type="checkbox"/> Zubní lékařství (5)
<input checked="" type="checkbox"/> Fiziologie a patologická fiziologie (1)	<input type="checkbox"/> Jéanská informatika a informační věda (0)	<input checked="" type="checkbox"/> Pneumologie (1)	
<input type="checkbox"/> Gastroenterologie, hepatologie (2)	<input type="checkbox"/> Mikrobiologie (0)	<input type="checkbox"/> Porodnictví a gynekologie (0)	
<input type="checkbox"/> Geriatrie (0)	<input checked="" type="checkbox"/> Nefrologie (2)	<input type="checkbox"/> Pracovní lékařství a toxikologie (0)	

Odeslat

virtual cases



algorithms



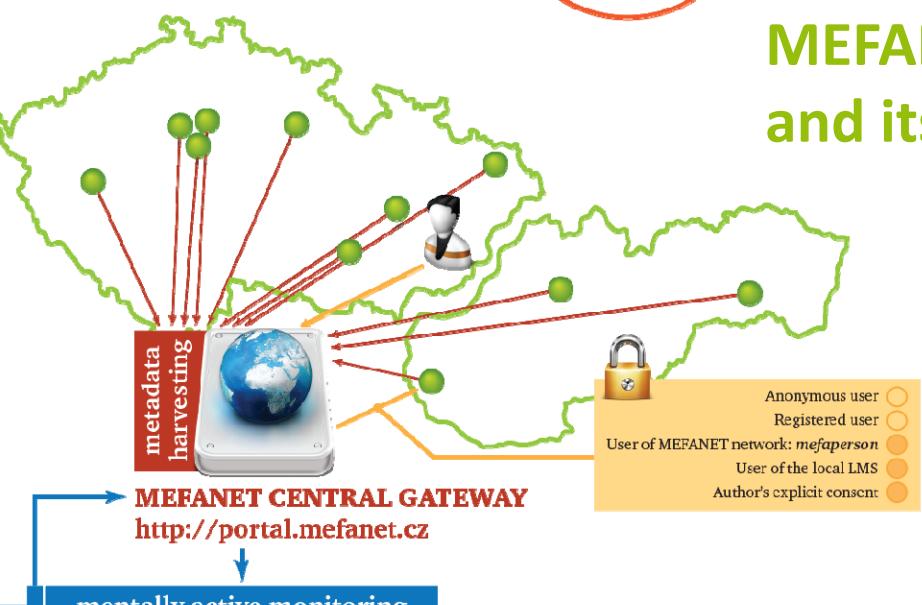
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LOCAL PORTAL INSTANCES

4D QUALITY ASSESSMENT

MEFANET portal platform and its extensions

MEFANET portal platform



SERIOUS GAMES
<http://games.mefanet.cz>



Sandbox
<http://sandbox.mefanet.cz>



WIKILECTURES
<http://www.wikilectures.cz>



MOODLE-MEFANET
<http://moodle.mefanet.cz>

Index Summary

Index Size	201.77 MB
Num Docs	15175
Dostupnost	
Access for MEFAPERSON	13307
Access for all	11802
Nedostupné výsledky	15175
Díla s recenzí	172
Level:	
Undergraduate level	8444
Graduate	350
Advanced Graduated	232
Complex	97
Language:	
czech	11887
slovak	1709
english	1579
Multimedia:	
Textbooks and manuals	8453
Presentations and animations	799
Educational websites and atlases	407
E-learning courses (LMS)	361
Digital video	225
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WikiSkripta	7883
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Portal MEFANET	1884
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MEFANET Games	167



content?



Attracting the interest of students...



Attracting the interest of students...



Attracting the interest of students... ...& TEACHERS!

Intensive training program

- A) Virtual cases authoring in OpenLabyrinth
- B) PBL session tutoring



Attracting the interest of students... ...& TEACHERS!

Intensive training program

- A) Virtual cases authoring in OpenLabyrinth
- B) PBL session tutoring



Attracting the interest of students... ...& TEACHERS!

Intensive training program - feedback

- A) Virtual cases authoring in OpenLabyrinth
- B) PBL session tutoring

If you learned any new skills which will be useful in your general teaching, what were they?

- „To transfer the responsibility for learning outcomes on the student.“
- „To work with more difficult students.“

What, if anything, did you “take away” from the educational activity?

- „It is possible and still not too hard.“
- „Knowledge about another educational system.“
- „A new approach to students with more space for their learning and expression.“
- „How to get students’ attention and how to give it back to them.“

Promoting the network



<http://mj.mefanet.cz>

The cover of the mefanet JOURNAL. At the top right, it says "1" and "VOLUME 1 | NO. 1 | 2013". The title "mefanet JOURNAL" is centered below. Four main articles are listed with brief descriptions:

- Web-based interactive learning programs for dentistry concept and its evaluation
- Clinical decision support system in dental implantology
- A long-term student's evaluation of the new e-learning method of teaching histology practical
- Video gallery of educational lectures integrated in faculty's portal
- Progress of information technology in healthcare, current state, outlook toward future
- 6th year of the MEFANET conference brought new ideas for the education of future health professionals

At the bottom, it lists the ISSN (print) 1805-9163 | ISSN (on-line) 1805-9171, indexing information (Indexed in Bibliographia Medica Čechoslovaca, Bibliographia Medica Slovaca), and the website mj.mefanet.cz.

2

VOLUME 1 | NO. 2 | 2013

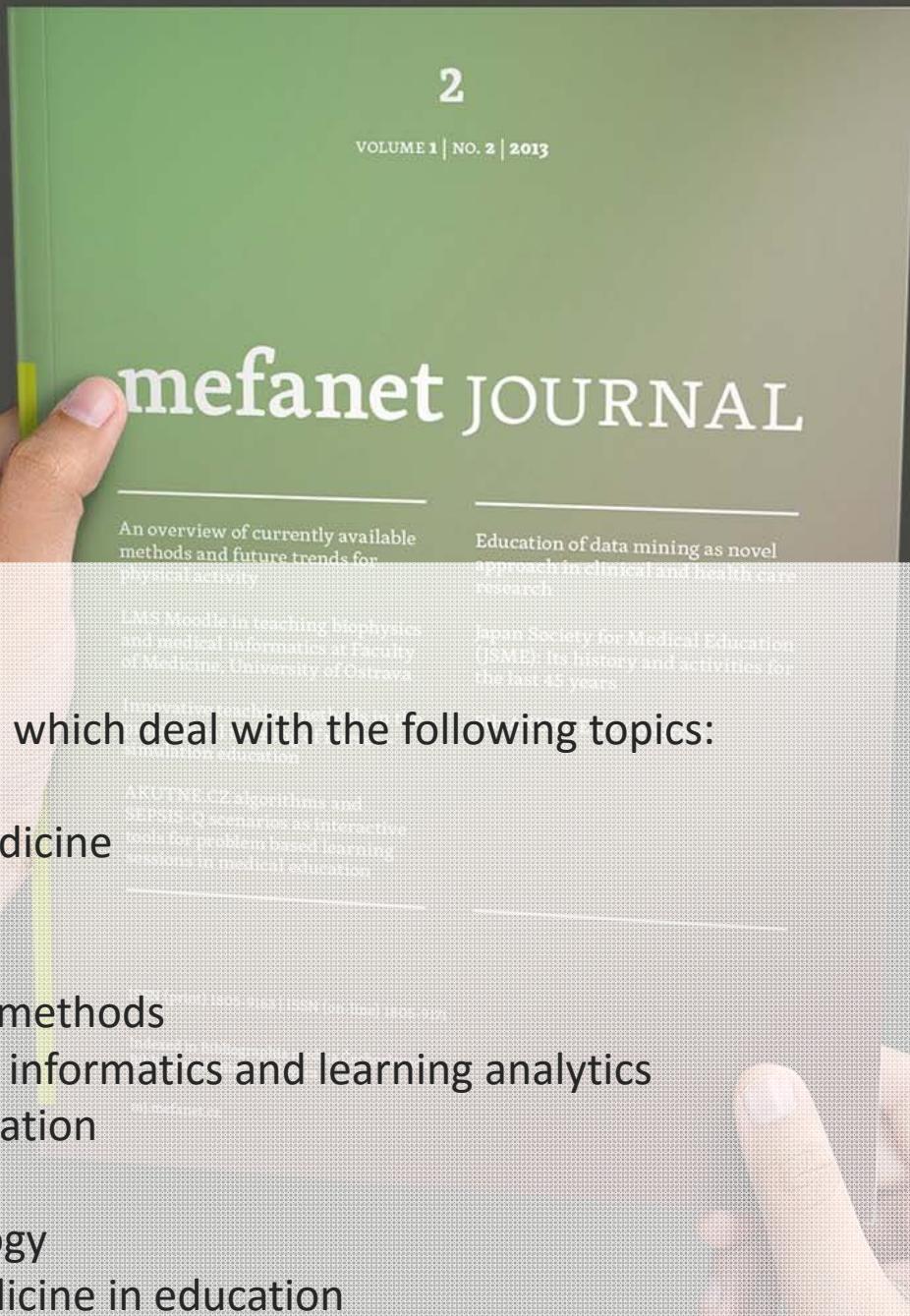
mefanet JOURNAL

No. of papers per type	Vol. 1 nr. 1 JUN 2013	Vol. 1 nr. 2 DEC 2014	Vol. 2 nr. 1 JUN 2014	Vol. 2 nr. 2 DEC 2014	Vol. 3 nr. 1 JUN 2015	Vol. 3 nr. 2 DEC 2015	Vol. 4 nr. 1 JUN 2016
ORIGINAL ARTICLE	4	4	3	5	2	3	5
REVIEW	1	1	1	0	2	0	1
EDITORIAL	2	3	2	2	1	3	2
	7	8	6	7	5	6	8

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Scope of the journal

Manuscripts are invited which deal with the following topics:

- E-health and telemedicine
- E-learning
- Information science
- Innovative teaching methods
- Medical educational informatics and learning analytics
- Modelling and simulation
- Multimedia
- Social media pedagogy
- Evidence-based medicine in education



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The Mefanet J accepts following types of articles:

- Reviewed: original article, review
- Not reviewed: comment, editorial, tutorial

becoming acutely unwell [6]. This type of education has lots of benefits in professional training of nurses. It is realized in safe, controlled and realistic environment of simulation laboratories reflecting real hospital and community care environment (specific clinical environment) with no risk of harming patients. Simulation can also assist to train individuals in the context of team working, creating a more realistic clinical environment. It contributes to creation of learning environment that is supportive, challenging, constructive, motivated, engaging, skilled, flexible, inspiring and respectful [14]. Thus simulation education is effective, interactive, interesting, efficient and modern way of nursing education. Use of simulation as a teaching strategy can contribute to patients' safety and optimum delivery of care, providing learners with opportunities to experience selected clinical situations in clinical situations within a safe, supervised setting without posing a risk to a patient [4]. This is excellent teaching strategy for many

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AKUTNE.CZ ALGORITHMS AND SEPSIS-Q SCENARIOS AS INTERACTIVE TOOLS FOR PROBLEM BASED LEARNING SESSIONS IN MEDICAL EDUCATION

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INTRODUCTION

Acute/intensive care/critical care/emergency medicine is a dynamic and time-pressure environment with high demands on a team communication and leadership, accurate clinical reasoning and rapid, immediate decision-making. Simulating such environment offers good techniques for training interdisciplinary medical teams, facilitating drilled practices and coordination, and enabling the team functioning as an effective unit [1]. The Internet education resources for critical care medicine have been recently reviewed by Kleijberg et al. [2]. The authors state that the majority of these resources are only electronic forms of textbooks and articles rather than interactive algorithms and dynamic simulations. Gómez et al. [3] described an interactive web-based simulation in which the user treats patients with hypotension and mild heart failure, selects therapeutic

and dosage, and obtains immediate feedback as the treatment results. The GOLEM system devised at the Charles University in Prague (Kofránek et al.) simulates many different clinical situations (e.g., circulatory insufficiency, read disorder, diarrhoea, etc.) enabling students to learn by experimenting with the mechanics of physiology [4]. A recent trend in the authoring of virtual patients is to make them as 3D-characters in virtual worlds, as the case of Second life [5], where the user has the option of working on the cases via the Internet.

Apart from the cited studies, medical education is undergoing significant shift from traditional methods (textbooks, lectures) towards a more comprehensive approach, which includes modern ICT tools (e-learning, interactive algorithms, computer simulations, virtual patients). The new approach has been shown to improve the learning skills of medical students and residents.

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becoming acutely unwell [6]. This type of education has lots of benefit professional training of nurses. It is realized in safe, controlled and realistic environment of simulation laboratory or in real hospital and medical environment (specific clinical environment) with no risk of harming real patients. Simulation can also be used to train individuals in the context of team activities, creating a more realistic clinical environment. It contributes to creation of learning environment that is supportive, challenging, constructive, motivated, engaging, skilled, flexible, inspiring and respectful [14]. Thus simulation education is effective, interactive, interesting, efficient and modern way of medical education. The use of simulation as teaching strategy can contribute to patients' safety and optimize outcomes of care, providing learners with opportunities to experience scenarios and intervene in clinical situations within a safe, supervised setting without posing a risk to a patient [4]. This is excellent teaching strategy for many

skills, particularly in critical care nursing. It can be used in professional training of nurses to teach the knowledge and critical thinking [4].

The EU RADAR IP programme approach enables both the students and the teachers. It allows students to gain new knowledge and practical skills and competencies in a post-European patient society (multicultural), and to make new friends. For us it was a great opportunity to acquire new knowledge and skills in the field of acute medicine to involve an implement progressive teaching methods to improve professional training. More details about the project are presented on the EU RADAR IP project webpage (<http://euroradar.org>). In case of the project will continue at the Fakultas Applied Sciences in Germany, in February 2014.

http://dx.doi.org/10.5196/MEFANET.1204

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ORIGINAL ARTICLE

AKUTNE.CZ ALGORITHMS AND SEPSIS-Q SCENARIOS AS INTERACTIVE TOOLS FOR PROBLEM BASED LEARNING SESSIONS IN MEDICAL EDUCATION

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ABSTRACT — This paper describes the interactive tools of the AKUTNE.CZ (part of MEFANET) and SEPSIS-Q portals for Problem Based Learning (PBL) sessions in medical education. The portals aim to be a comprehensive source of information and educational materials, containing concepts of acute medicine for undergraduate medical students and health professionals. Our focus is mainly on simulator-based tools for medical students to practise a hypothesis in acute patient care, the backbone of the AKUTNE.CZ and SEPSIS-Q portals. Over the last few years, more than 30 interactive algorithms in the Czech and English language (<http://www.akutne.cz>) have been developed and published online allowing users to test and improve their knowledge and skills in the field of acute medicine. Additionally, we have created six SEPSIS-Q interactive scenarios in the convalescence. The peer-reviewed algorithms were used for conducting PBL-like sessions in General Practice (First Aid, Assessment and Pain Management, Emergency Medicine) and in Nursing (Obstetric Analysis and Anaesthesia for Midwives, Intensive Care Medicine). The interactive scenarios serve to demonstrate interview cases, with preference for Intensive Care Medicine sessions in General Medicine and Nursing.

INTRODUCTION

Acute/intensive care/critical care/emergency medicine is a dynamic and time-pressure environment with high demands on crisp team communication and leadership, accurate clinical reasoning and often, immediate decision-making. Simulating such an environment offers good techniques for training multi-disciplinary medical teams, facilitating detailed interaction and coordination, and enabling the team to function as an effective unit [1]. The Internet education resources for critical care medicine have been recently reviewed by Kleplapil et al. [1]. The authors deduce that the majority of these resources are only electronic forms of textbooks and articles rather than interactive algorithms and dynamic simulations. Davis et al. [2] described an interactive web-based simulation in which the user treats patients with electrolyte and acid-base disorders, selects therapies and dosage, and obtains immediate feedback on the treatment results. The COLEM system devised at the Charles University in Prague (Kofránek et al.) simulates many different clinical situations (e.g. circulatory insufficiency, renal disorders, diarrhoea, etc.) enabling students to learn by experimenting with the basics of physiology [4]. A recent trend in the authoring of virtual patients is to embed them as 3D-characters in virtual worlds, as in the case of Second Life [5], where the user has the option of working on the cases jointly with fellow students via the Internet.

Apart from the cited studies, medical education in general is undergoing significant shift from traditional methods (textbooks, lectures, bedside teaching) to a more comprehensive approach, which includes modern ICT tools (e-learning, interactive algorithms, computer simulations, virtual patients). The new approach has been shown to improve the learning skills of medical students and residents

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Evaluation of data mining as a novel approach in clinical and health care practice | 75

EDUCATION OF DATA MINING AS A NOVEL APPROACH IN CLINICAL AND HEALTH CARE PRACTICE

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databases



ABSTRACT Data mining (DM) is a widely adopted methodology for analysis of large datasets which is on the other hand often overestimated and considered as a universal solution. This statement is also valid for clinical research in which large and heterogeneous datasets are often processed. DM represents standard methods available in common statistical software and combines into a complex workflow methodology covering all the steps of data mining from data acquisition through pre-processing and data mining to interpretation of the results. The whole workflow is aimed at one final goal - finding interesting, non-trivially hidden and potentially useful information. To prove the concept of data mining was adopted in our educational course of the Faculty of Medicine at the Masaryk University accessible from its e-learning platform (med.muni.cz/klnak-jis-zavedeni-tehnologie-data-mining-a-genotypy-expremissich-map-do-vyuky.html).

INTRODUCTION

The term "data mining" (DM) is currently widespread in all areas related to data analysis. Clinical research belongs to them as well and the application of complex computational methods has become very popular in this area because of increasing amount of available data. The DM concept is nevertheless often overestimated or incorrectly considered as a universal solution for all problems. Although data mining seems to be well defined, the opposite is true. Even its definition is problematic and there are many definitions books and web portals dealing with the data mining. There are two probably the most popular definitions: "The nontrivial extraction of implicit, previously unknown, and potentially useful information from data" [1] and "The science of extracting useful information from large data sets or databases" [2].

In the article we would like to introduce our educational materials presenting concepts and approaches of data mining for clinicians and other researchers in clinical and health care fields.

DM is mostly considered in the relation to large datasets; its usage in the commercial applications is

common as well. In fact, the DM is a general methodology applicable to any data analysis and is not "owned" by any area of science. So far it has been adopted in wide area of applications, not a strict ranking of risk clients, non-legal usage of credit cards, e-mail classification and spam messages removal, text and speech recognition or molecular analysis. Therefore, the DM is the area of science which development is multidisciplinary but some methods applicable in commercial applications can be applied in any other research area and vice versa.

Data mining is often connected to *data mining* machine mining previously unknown information from the data and the methodology often presented as a "black box" with simplified description. The quality of course more refined. Good knowledge of mathematical background of the DM methods and their limitations is crucial for the correct application of the DM; the most important is expert knowledge and long-term experience. Methods used in DM are principally multivariate and have a little all rules of multivariate data analysis. The benefit of multivariate methods are as follows [3]:

- Visualization of data with multiple variables
- Searching of meaningful views on multivariate data, identification of importance and hierarchy of variables
- Identification of correlations among variables, simplification of their structure
- Analysis of similarities between analysed subjects, their stratification, classification and predictions

The question is whether the data mining is in any way different from the commonly adopted statistical methods? The answer is both yes and no. DM uses methods available in common statistical packages and "mining" can be sometimes used as a marketing term only. On the other hand, even common statistical methods are used in novel, complex and logically joined context. The real DM is a standardized complex methodology covering all the steps of data analysis from data acquisition through pre-processing and data analysis to interpretation of the results; the example is CRISP-DM, JDIM (Java Data Mining) or complex methods of model description such as PMML (Predictive Model Markup Language). The data mining thus brings new quality in data analysis which is more related to innovative combination of methods than to any single method. DM in the hands of experienced data analyst is an important tool of scientific data analysis to be applied on complex heterogeneous multivariate data.

The workflow of data mining can be separated into simple individual steps from data storage and pre-processing to their description and predictive modelling. The individual steps can be performed in various software, such as Statistica, SPSS, SPSS Modeler, S+, Matlab, WEKA or R.

METHODS

Workflow of data mining

As already mentioned, data mining can be considered as an innovative connection of various methods of multivariate data analysis. Methodology of the complex DM approach always incorporates process workflow of analytical steps. Example of such approach is the CRISP-DM methodology describing life cycle of DM project and their interconnections [4]; this methodology as one of the most general approaches available was also adopted in our article and educational materials.

According to CRISP-DM methodology the DM project life cycle consists of six phases; their order and direction of crossing between them is not strictly given and the movement in the scheme is based on the results of the previous phase (the arrows in the scheme shows the most common paths). The outer circle symbolizes cyclical nature of data analysis which is

repeated until the solution is found. The knowledge gained in one cycle can generate new questions and new cycles utilizing experiences from the previous cycles.

Understanding

This initial phase focuses on understanding the analysis objectives and requirements, and then converting this knowledge into a data mining problem definition and a preliminary plan designed to achieve the objectives. For example, in clinical data analysis this is the preliminary phase of literature review of given clinical problem (terminology, cut-offs, known correlations of variables etc.). Although it looks rather simple, this information is strategically important during the multivariate analysis. Limited knowledge on importance and meaning of variables resulted into biased or uninterpretable results and during multivariate analysis these problems should not be necessarily revealed. Part of preliminary phase should be also the power analysis and assessment of the necessary sample size.

Data Understanding

The data understanding phase starts with an initial data collection and proceeds with activities in order to get familiar with the data, to identify data quality problems, to discover first insights into the data, to detect interesting subsets to form hypotheses for hidden information. Wide set of univariate and multivariate analyses can be adopted for this exploratory analysis (Figure 2).

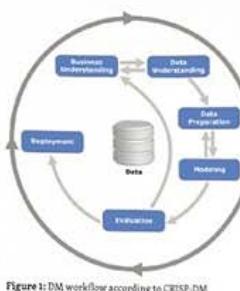


Figure 1: DM workflow according to CRISP-DM methodology (taken from CRISP-DM)

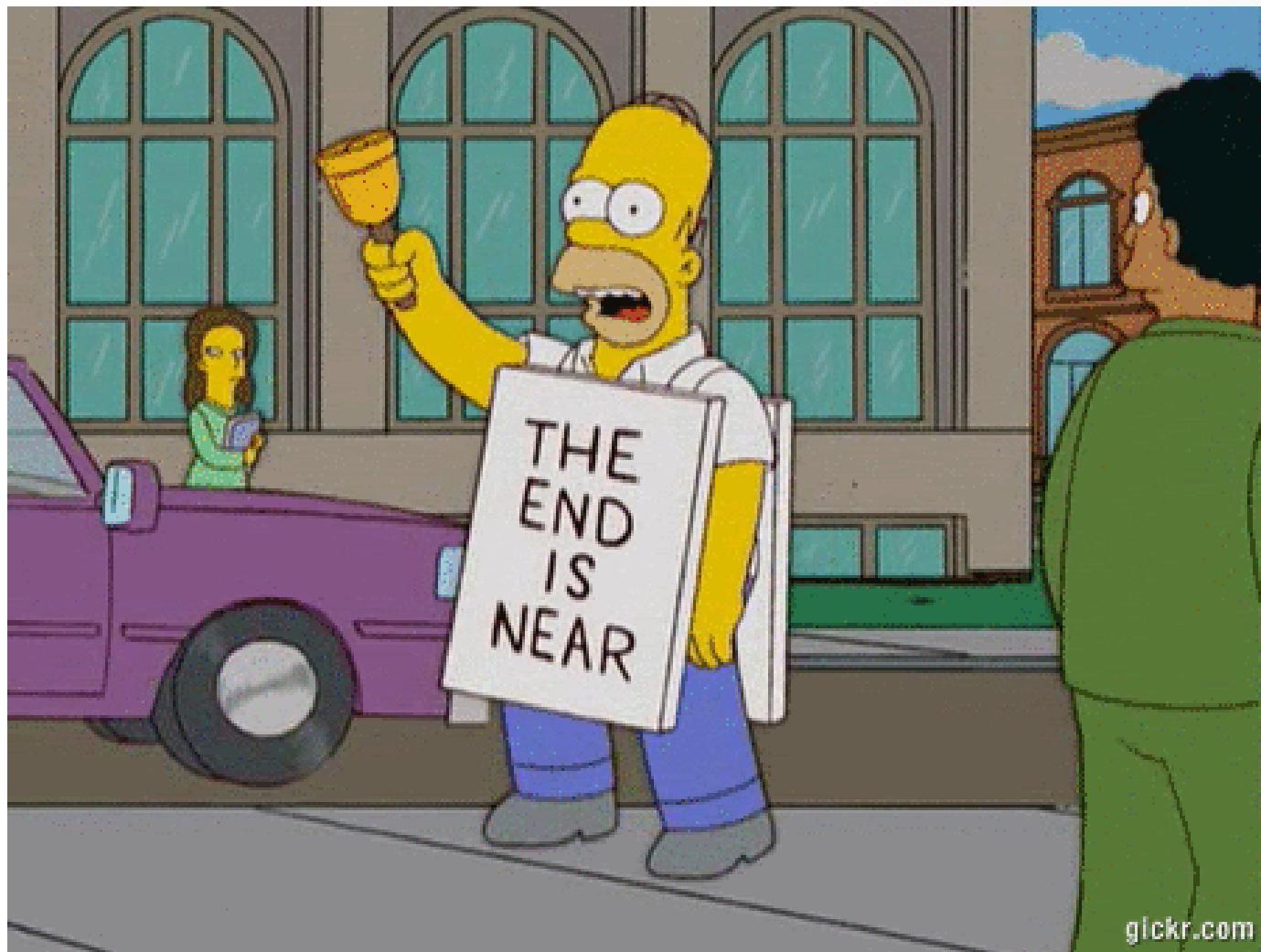
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Conclusions I: achievements

1. Development, implementation and maintenance of the uniform educational portal at the participating institutions
2. Wide range of shared digital education material with controlled quality
3. A comprehensive set of virtual patients and other types of virtual scenarios to support development of critical thinking and clinical reasoning skills in medical students.
4. Initiation of student movements: WikiLectures & Akutne.cz
5. Training delivered to a substantial part of academics:
 1. creators of labyrinths, algorithms, virtual cases;
 2. developers and analysts of assessment instruments;
 3. PBL tutors.
6. Established cooperation with other institutions, projects and businesses
 1. at the European level: CROESUS, MEDCIN, WAVES, TAME, ModeHED, etc.
 2. worldwide: MedBiquitous



Conclusions II: ~~institutionalization~~

1. MEFANET is a voluntary network of academics without any institutional identity.
2. We appreciate the support from the deans of medical faculties and from the university managements.

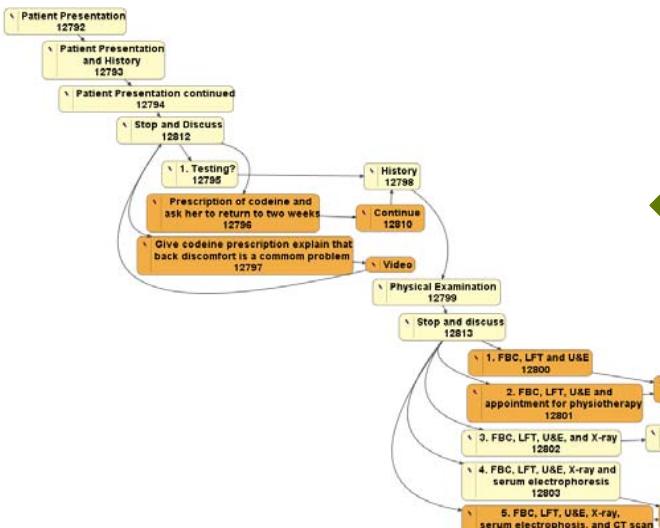


Conclusions III: what's next?

21st CENTURY PEDAGOGY

- learning by doing
- problem solving using real world scenarios
- collaborative environment
- self-directed learning
- virtual patients
- MOOCs
- assessing students clear and transparent objectives & appropriate feedback

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LOBs

ENABLING TECHNOLOGIES

- SBL: authoring & playing toolkits
- collaborative media
- medical simulation modalities
- (data) academic analytics
- curriculum mapping systems

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