

MHeL

Millennium Hospital / E-Learning

***Deliverable / R17
Report***

Analysis of potential impact on university and post university education

Editor AUTH

Work Package WP7

Dissemination level Public

Status Final

Date 30-09-2015

Il Consorzio di MHeL The MHeL Consortium

Beneficiary Number	Beneficiary name	Beneficiary short name	Country
1	Società Italiana di Endoscopia Ginecologica	SEGI	Italy
2	Imaginary srl	IMA	Italy

3	Aristotelio Panepistimio Thessalonikis	AUTH	Greece
4	Tracoin Quality BV	TQ	Netherlands
5	Associazione Ostetrici e Ginecologi Ospedalieri Italiani	AOGOI	Italy
6	Società Italiana di Ginecologia e Ostetricia	SIGO	Italy

Document History

Versione	Data	Autore/Editore	Descrizione/Commenti
0.1	16.08.2015	Panos Bamidis	Preparation of index
0.2	24. 08.2015	Panos Bamidis	Content editing
v1.0	15. 09.2015	Panos Bamidis	New sections addition
v1.1	25. 09.2015	Panos Bamidis	Content editing – Finalize draft
V1.2	27. 09.2015	Dalia Morosini	Italian traslation

Autori

Nome	Istituzione
Panagiotis Bamidis	AUTH

Revisori

Nome	Istituzione
F. Gilardenghi	SEGI
R. Ackema	TQ

Legal Notices

The information in this document is subject to change without notice.

The Members of the MHeL Consortium make no warranty of any kind with regard to this document, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose. The Members of the MHeL Consortium shall not be held liable for errors contained herein or direct, indirect, special, incidental or consequential damages in connection with the furnishing, performance, or use of this material.

Executive Summary

This document refers to notions and attributes of Undergraduate and Post-graduate medical education as well as continuing or life long medical education and learning. It attempts to compare what is happening globally in this area with what kind of practice has been followed in the MHeL project. The case of MHeL partner AUTH is taken as an example to drive the specificities of how the developments of MHeL might have been pushed forward for direct application into a Medical School (undergraduate) curriculum as well as its life-long learning programme. Emphasis is drawn on the qualities of the used MHeL technologies (media-rich environments, metadata standards, repurposing capacity and certification) in the light of worldwide medical education developments and standradisation of e-learning evolutions and agreements such as the Bologna process. Numerous evaluations and focus groups that have been conducted at AUTH are reported herein for this purpose.

Index

1	University and post university education system description. Current state.	6
2	Main questions about using MHeL distance solutions in university and post university education system	9
3	MHeL solutions descriptions and necessary requirements to use them in university and post university education environment	11
	References	19

Table of Figures

Figure 1: Characteristics of PMT	8
Figure 2: Simulations, cases and virtual environment technologies with their potential roles in contemporary medical education when it comes to competencies (from [9]).	9
Figure 3: new UMC at AUTH. A detailed design of contact hours and credits are required for each thematic unit and for each combined topic area.	13
Figure 4: a snapshot of the Quality Assurance system at AUTH where course details are entered and checked.	14

1 University and post university education system description. Current state.

Medicine has a reputation as a 'conservative' discipline: a characterization like this does not refer to the disciplinary content, which has been always at the forefront of scientific innovation [1], [2]; It refers to how learning and teaching is supported via policies and educational practices and this is clearly reflected in current/recent educational research [3]. The rather conventional nature of medical education is evidenced by educational practice that consists mostly of:

- Big lecture theatre sessions, where non-interactive lectures are the dominant practice in many countries (including the United Kingdom);
- End of term/assessment period examinations and summative assessment as most common methods of assessing student knowledge;
- A hierarchical model of operation that can prevent effective interactions and exchange of knowledge between experts and novices;
- Lack of links to expert healthcare professional communities to support and sustain communities of learners.

On the other hand, research [4] has highlighted aspects of the 'hidden curriculum' for healthcare practitioners-to-be that are not part of traditional medical educational practice. Leinster [4] points out that clinical and communication skills are common to a range of healthcare professionals and that developing proper attitudes is a major educational goal for all healthcare professionals. Technologies offer opportunities to innovate in these areas and medicine appears to be one of the most appropriate disciplines to become the test bed for alternative educational experiences that are supported by new learning technologies. These technologies and online social learning, which involves lifelong learners drawing together resources and connections from across the Internet to solve real-life problems, often without access to the support of a skilled teacher or accredited learning are a perfect match for a virtual environment that combines meaningful interaction with realistic challenges ([5], [6]). Contemporary medical education has progressively been extended to include a wide variety of learning resources and domain-specific educational activities that are becoming increasingly digitized, the inherent driving force behind this being the need for worldwide access to clinical skills development, independent of time and place [7].

But before going any further let us refer and describe the basis for undergraduate medical curriculum (UMC) and post-graduate medical training (PMT). The aim of any UMC according the General Medical Council is to produce graduates who "will make the care of patients their first concern, applying their knowledge and skills in a competent and ethical manner and using their ability to provide leadership and to analyse complex and uncertain situations". PMT in contrast may be summarised as "education, exposure and experience leading to expertise, evidence-based practice and excellence.[8] The following figure shows the "high-stakes" education and practice case for PMT. The ultimate goal has to be that the trainees will be able to progressively receive the appropriate clinical exposure to gain the necessary expertise required.

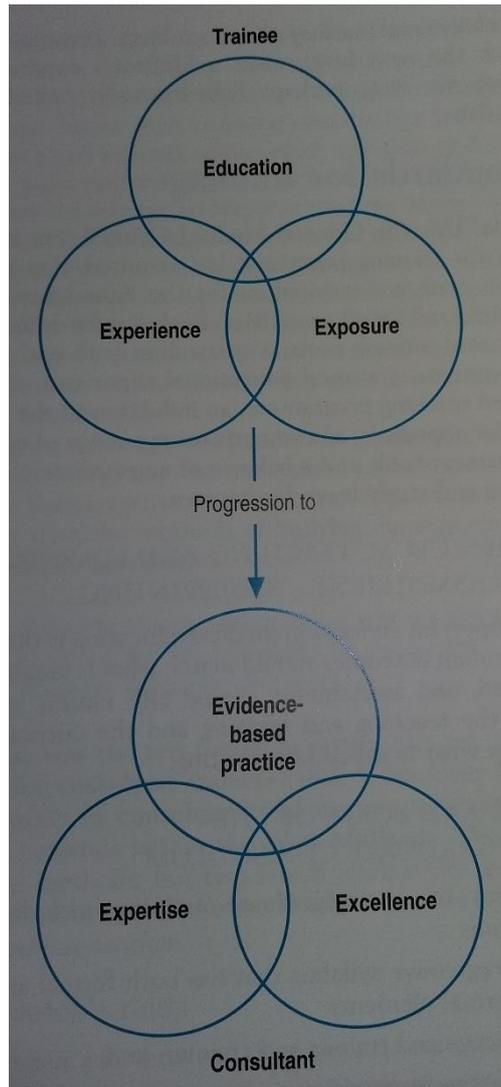


Figure 1: Characteristics of PMT

Many Curricula in medicine are now built around interactive virtual environments and specifically scenarios (so called virtual patients), where students can explore, manage or solve a case/problem, including opportunity to make mistakes and correct actions. Nevertheless there is still a large gap between formal university-based training which teaches how the students supposed to manage patients in the regular, appropriate way and real practice with their challenges and threads. Medical schools around the world do not have much experience in training against errors for example. Virtual environments may ease and facilitate the accumulation of knowledge, skills qualification in these areas as required.

Evidence suggests that the learning of clinical reasoning is to an extent case-specific. e.g. competence in managing one case of breathlessness does not necessarily help with managing another, though it will help with closely related cases. Compelling evidence suggests that the clinical reasoning of experts relies on 'pattern recognition' through extensive engagement with a broad range of examples.

Virtual environments are ideally suited to develop expertise in clinical reasoning through exposure to either a large number of cases, or a smaller number of cases with the possibilities for a variety of diseases built into the case narrative and virtual management opportunities. Such environments would allow students to experience for example medical error processes,

often by making the wrong decision but in a safe environment, having the opportunity to discuss why it is happened.

Kononowicz et al [9] have mapped the existing differences and similarities between systems and efforts like the ones mentioned above and supported in the MHeL project.

Class label	Predominant competency	Predominant technology	Short description
Case Presentation	Knowledge	Multimedia systems	Interactive multimedia presentation of a patient case to teach primarily basic medical knowledge
Interactive Patient Scenario	Clinical reasoning	Multimedia systems	Interactive multimedia presentation of a patient case to teach mainly clinical reasoning skills (e.g. VPs created for the eViP project)
VP Game	Clinical reasoning or Team training	Virtual worlds	Virtual world to simulate high risk scenarios and team training situations (e.g. Second Life VPs)
High Fidelity Software Simulation	Procedural or basic clinical skills	Dynamic simulations or mixed reality	Real-time simulation of human physiology to teach mainly procedures or skills such as surgical simulations. Non-standard devices (e.g. haptic technology) can be included.
Human Standardized Patient	Patient communication skills	Multimedia systems	Video-recorded actors who role-play a patient to train patient communication skills.
High Fidelity Manikin	Procedural and basic clinical skills, / Team training	Manikins or Part Task Trainers	Manikins with realistic anatomy to train complex procedures such as endoscopy.
Virtual Standardized Patient	Patient communication skills	Conversational characters	A virtual representation of a human being using artificial intelligence technologies and natural language processing to train communication skills.

Figure 2: Simulations, cases and virtual environment technologies with their potential roles in contemporary medical education when it comes to competencies (from [9]).

Now back into UMC design one could say that UMCs need to define the learning outcome, the setting in which it should be performed and the standard to which it should be performed. The core curriculum should reflect the consensus views of specialists and generalists, with the former being restricted in their defining core activities and themes in their own discipline. In Miller's schematic this is accompanied with the so called "skills-triangle" where the students first "know what", then proceed to "know-how", then they "show-how", then they "do" finishing off by demonstrating "mastery".

To this extent and given the above reasoning, we believe that the achievements of the MHeL project has the capacity to allow to intrusion of the media-rich environments into the medical curricula (both UMC and PMT) but also to cover for an active involvement and good promise of combining all levels of the skills triangle, i.e. from simple knowledge acquisition (know-what) to mastery of a certain skill, based on the encapsulation of realistic scenarios that can be effortlessly simulated.

2 Main questions about using MHeL distance solutions in university and post university education system

During the last decades the inclusion of digital tools in health education has rapidly lead to a continuous enlarging digital era. All the online interactions between learners and tutors, the description, creation, reuse and sharing of educational digital resources and the interlinkage between them in conjunctions with cheap storage technology led to an enormous amount of educational data. Medical education is a unique type of education due to accuracy of information needed, continuous changing competences required and alternative methods of education used [10].

The state-of-the-art for professional medicine is changing at an extraordinary pace [11]. To stay current, medical professionals must continuously update their skills and knowledge. This proves a nearly impossible task for the majority of medical professionals who already feel overloaded by the pressures of increased clinical workloads and decreased reimbursement.

The established methods of continuing education for the health professions have been largely ineffective in helping medical professionals maintain their clinical knowledge and competence.

In 2003 a report called “Health Professions Education: A Bridge to Quality,” by the Institute of Medicine [12] urged for a “major overhaul” of health professions education, one which focuses on a set of core competencies and allows clinicians to employ the expanding evidence base into their practice. In parallel, the Council of Medical Specialty Societies in the US and many others were urging educators to redefine the current systems of Continuing Medical Education (CME) in ways that support the physician as a self-directed, lifelong learner.

Addressing the current problems in medical education will require collaboration on a common solution that connects educators and supports clinician learning in new ways. To achieve these goals requires a broadly implemented technology solution that is embraced by numerous educators, certifiers, and other key stakeholders. For example, the current maintenance of certification initiatives, which seek to ensure physician competence, require physicians to complete self-assessments and other performance improvement activities. Technology provides the only scalable means to administer and track these new activities for the large number of physicians seeking recertification in one or more specialty. The distributed nature of medical education and the number of physicians with cross-specialty certification require that a solution work across multiple organizations.

Technology standards are the key to fostering this type of collaboration and making education more accessible and effective. Just as with telephones and fax machines, standards are essential for enabling communication among multiple entities. Standards provide a common language and cost-effective means for exchanging relevant information and resources. With a common language around medical education, the best educational resources can be reused in a variety of environments, reaching beyond the boundaries of the organization that created them. MedBiquitous plays the critical role of developing technology standards that support collaboration and support the efforts of those organizations seeking to innovate medical education and physician competency initiatives.

It is those standards that were fused as best practice from the mEducator project into the MHeL platform and trialled practice too.

Before going any further, we iterate here that our vision on how the technologies developed in MHeL and how would one maximise benefits from the efforts spent on trials with users in MHeL, coincides with that of the Medbiquitous consortium as paraphrased below:

To be most effective, distance medical education should be a seamless part of the clinician's work environment. Instead of requiring a medical learner to leave a clinical encounter to seek learning, opportunities will be embedded within clinical systems, delivering the right information and education at the time of need. For learners seeking more comprehensive information after a clinical encounter, medical education must be ubiquitous, available at any time from any Internet-connected device to which they have access. Clinical learners of all types/levels (undergraduate, post-graduate, continuing) should receive credits for both types of activities without having the administrative burden of printing a certificate and submitting it to the appropriate certifying body. With the ability to track educational activity, educators will be able to conduct outcomes studies to determine the effectiveness of medical education and its impact on clinician behavior and patient care.

To that respect, the MHeL project has done a good step forward in that it combined different approaches and technological standards that are already enabling the seamless integration of the technological platform (i.e. the virtual media-rich environment) with the curriculum design process and ready-to-teach practice.

3 MHeL solutions descriptions and necessary requirements to use them in university and post university education environment

The need for standardized curriculum particularly in medical education is indispensable. Today a comprehensive platform that would cover all necessary instruments for easy in-depth curriculum management is still missing [13]. For any platform to achieve these goals, it is essential that data standards are used to enable the systems to communicate across organizations and implementations.

A good intention would be to focus these standards developments through MedBiquitous Consortium, the leading organization in the development and promotion of technology standards for the health professions. Formed from a wide ranging group of professional associations, universities, commercial, and governmental organizations, MedBiquitous develops set of proven standards to advance lifelong learning, continuous improvement, and better patient outcomes for the health. It covers wide range of XML (eXtensible Markup Language) and web service standards including Competency Framework for interacting competency frameworks into educational technologies like curriculum management systems, Curriculum Inventory for aggregation of curriculum data for research and benchmarking purposes, and Medical Education Metrics for collecting validation data for standardized survey items. All these standards go through rigorous ANSI-accredited development process. From the perspective of international, systematic, effective and long-term approach, the MedBiquitous outputs necessarily must be taken into account.

Quality in Higher Education Institutions is the subject of several debates in the academic community in a worldwide basis and various efforts are made towards identifying ways to quantify it [14]. But recently, and following the Bologna process and consensus, all Universities have agreed to a set of standard practical points. One of them is associated with the task of defining specific qualities in every undergraduate or post-graduate module/class/programme like has been normal practice when CME.

So, what is required before a program/module or even some content formally enters the curriculum is the detailed description in terms of hours of contact, teaching weeks and overall workload. This, according to the Bologna process, defines the actual credits of any undergraduate course. In the following we will use the case of the MHeL partner AUTH just to showcase the procedure to be followed for introducing such innovations as well as content in the UMC.

We start by showing a simple snapshot of the new medical curriculum at AUTH Medical School as a means to demonstrate the detailed requirements for undergraduate formal education.

Εγκριμένο Πρόγραμμα Σπουδών ακαδημαϊκού έτους 2013-14								
(συνεδρίαση 21/09.7.2013 της Συνέλευσης της Ιατρικής Σχολής)								
1ο Εξάμηνο (Υποχρεωτικά)								
1	ΙΑΤΡΙΚΗ ΒΙΟΛΟΓΙΑ	ΙΑ0273	4	2	6	78	6	9
2	ΙΑΤΡΙΚΗ ΦΥΣΙΚΗ	ΙΑ0279	4	2	6	78	6	5
3	ΙΑΤΡΙΚΗ ΣΤΑΤΙΣΤΙΚΗ	ΙΑ0276	2	1	3	39	3	2,5
4	ΙΑΤΡΙΚΗ ΕΠΙΧΕΙΡΗΣΙΑ	ΙΑ0276	2	1	3	39	3	2,5
5	ΕΙΣΑΓΩΓΗ ΣΤΗ ΒΙΟΧΗΜΕΙΑ	ΙΑ0284	3	1	4	52	4	6,5
6	ΕΙΣΑΓΩΓΗ ΣΤΗΝ ΑΝΑΤΟΜΗ	ΙΑ0413	2	1	3	39	3	2,5
Σύνολο							23	28
2ο Εξάμηνο (Υποχρεωτικά)								
7	ΙΑΤΡΙΚΗ ΓΕΝΕΤΙΚΗ	ΙΑ0255	4	2	6	78	6	9
8	ΒΙΟΧΗΜΕΙΑ 1	ΙΑ0249	4	1	5	65	5	8,5
9	ΕΙΣΑΓΩΓΗ ΦΥΣΙΟΛΟΓΙΑ	ΙΑ0256	2	2	4	52	4	5
10	ΕΠΙΧΕΙΡΗΣΙΑ	ΙΑ0284	2	0	2	26	2	2
11	ΕΠΙΧΕΙΡΗΣΙΑ ΑΝΑΤΟΜΗΣ 1	ΙΑ0245	1	2	3	39	3	5
Σύνολο							20	29,5
Σύνολο 1ου έτους								57,5
3ο Εξάμηνο (Υποχρεωτικά)								
12	ΒΙΟΧΗΜΕΙΑ 2	ΙΑ0250	4	1	5	65	5	8,5
13	ΕΠΙΧΕΙΡΗΣΙΑ ΑΝΑΤΟΜΗΣ 2	ΙΑ0311	3	3	6	78	6	7,5
14	ΦΥΣΙΟΛΟΓΙΑ 1	ΙΑ0342	4	2	6	78	6	9
15	ΕΠΙΧΕΙΡΗΣΙΑ	ΙΑ0414	2	2	4	52	4	5
16	ΑΙΤΙΑΣΗ ΙΑΤΡΙΚΗΣ ΠΡΟΛΗΨΙΑΣ 1	ΙΑ0306	3	0	3	39	3	2
Σύνολο							28	32
4ο Εξάμηνο (Υποχρεωτικά)								
17	ΦΥΣΙΟΛΟΓΙΑ 2	ΙΑ0343	4	2	6	78	6	9
18	ΕΠΙΧΕΙΡΗΣΙΑ	ΙΑ0415	3	2	5	65	5	7
19	ΕΠΙΧΕΙΡΗΣΙΑ ΑΝΑΤΟΜΗΣ 3	ΙΑ0332	4	1	5	65	5	8,5
20	ΑΙΤΙΑΣΗ ΙΑΤΡΙΚΗΣ ΠΡΟΛΗΨΙΑΣ 2	ΙΑ0311	3	0	3	39	3	2
Σύνολο							19	26,5
Σύνολο 2ου έτους								58,5
5ο Εξάμηνο (Υποχρεωτικά)								
21	ΕΙΣΑΓΩΓΗ ΕΜΒΙΟΛΟΓΙΑΣ ΚΑΙ ΕΜΒΙΟΛΟΓΙΑΣ ΑΝΑΤΟΜΗΣ	ΙΑ0254	4	2	6	78	6	7
22	ΜΙΚΡΟΒΙΟΛΟΓΙΑ 1	ΙΑ0297	3	2	5	65	5	5,5
23	ΨΥΧΗ	ΙΑ0338	2	2	4	52	4	3
24	ΙΑΤΡΙΚΗ ΝΟΜΟΛΟΓΙΑ ΚΑΙ ΔΕΟΝΤΟΛΟΓΙΑ	ΙΑ0275	2	0	2	26	2	2
25	ΕΙΣΑΓΩΓΗ ΣΤΗΝ ΕΜΒΙΟΛΟΓΙΑ ΚΑΙ ΦΥΣΙΟΛΟΓΙΑ	ΙΑ0366	2	0	2	26	2	3
Σύνολο							19	20,5
6ο Εξάμηνο (Υποχρεωτικά)								
26	ΕΙΣΑΓΩΓΗ ΕΜΒΙΟΛΟΓΙΑΣ ΑΝΑΤΟΜΗΣ	ΙΑ0384	4	3	7	91	7	7,5
27	ΚΟΙΝΩΝΙΚΗ ΙΑΤΡΙΚΗ	ΙΑ0294	2	2	4	52	4	4
28	ΕΠΙΧΕΙΡΗΣΙΑ 1	ΙΑ0345	4	4	8	104	8	9
29	ΜΙΚΡΟΒΙΟΛΟΓΙΑ 2	ΙΑ0298	2	2	4	52	4	4
30	ΦΑΡΜΑΚΟΛΟΓΙΑ 1	ΙΑ0339	1	2	3	39	3	3,5
31	ΠΑΘΟΛΟΓΙΑ 1 (ΒΑΘΗΡΗ ΔΙΑΓΝΩΣΤΙΚΗ)	ΙΑ0320	4	4	8	104	8	9
Σύνολο							36	37
Σύνολο 3ου έτους								57,5

Figure 3: new UMC at AUTH. A detailed design of contact hours and credits are required for each thematic unit and for each combined topic area.

Considering the case for a hypothetical AUTH course for inclusion in undergraduate education (or even post-graduate education for that purpose) the following are required:

- scope and target audience
- type and mode of learning provision
- aims and objectives of the course
- educational/learning outcomes
- other general skills
- weekly and hourly content/themes/topics
- content/theme keywords
- types of educational material provided
- modes of assessment
- the kind and use of IT resources

-the detailed organisation of activities and their types and linkages to learning outcomes and types of assessments as well as hours of contact

-bibliography, references, online material and links

-course updating strategy

-other administrative information

As an example of the above when referring to final course credits, a total of 150 contact hours (including both lectures and independent workload) would correspond to some 6 Credits. The latter are fully recognised in all EU member states in a share alike manner.

Similar information bits are likewise required for an introduction of an MHeL course into the Life Long Learning programme (the latter can be also on a paid by fees basis). However, in the latter case, the University would require all CVs and professional standing of all involved personnel as well as details of:

-the scope and domain requirement definition (why the course is needed)

-the course marketing strategy

-business plan (including potential minimum and maximum trainee numbers)

-resources required and put forward

-assets planned and obtained

-certification strategy

-detailed time planning for course delivery and accompanying publicity

The following Figure provides an small snapshot of the existing digital systems of the Quality Assurance Unit at AUTH where all these details are entered:

The screenshot shows a web browser window with the URL `qa.auth.gr/el/class/1/600010910/M1/edit`. The page displays a form for entering course details. The form is divided into several sections:

- Μαθησιακά Αποτελέσματα**: A section for learning outcomes. It contains a text area with instructions in Greek: "Περιγράψτε τα επδιδυόμενα μαθησιακά αποτελέσματα του μαθήματος. Η διατύπωση των μαθησιακών αποτελεσμάτων συνήθως γίνεται σύμφωνα με τον τύπο: Με την επιτυχή ολοκλήρωση του μαθήματος, οι φοιτητές θα: **KANOVN TI** (πως). Τα μαθησιακά αποτελέσματα κατά κανόνα δεν είναι περισσότερα από 5 με 6 ανά μάθημα. Αναλυτικότερες πληροφορίες υπάρχουν στη σελίδα περιγραφής των μαθησιακών αποτελεσμάτων." Below this are two text areas for entering the outcomes in Greek and English.
- Γενικές Ικανότητες**: A section for general competencies. It contains a list of checkboxes for various competencies, with the first one checked: "Αναζήτηση, ανάλυση και σύνθεση δεδομένων και πληροφοριών, με τη χρήση και των απαραίτητων τεχνολογιών". Other options include "Εφαρμογή της γνώσης στην πράξη", "Προσαρμογή σε νέες καταστάσεις", "Λήψη αποφάσεων", "Αυτόνομη εργασία", and "Ομαδική εργασία".

Figure 4: a snapshot of the Quality Assurance system at AUTH where course details are entered and checked.

From the above and given the activities in the MHeL project, it becomes obvious that a great potential for the wide exploitation of the project achievements in the long run is hidden behind the very notion of "repurposing".

The majority of activities in the field of e-learning (and especially the related standardization work) to date have focused on reuse of complete educational content items with a fixed combination of structure and content. While the value of this approach is not disputed, critical issues of deep, conceptual understanding, a sense of ownership and wider issues of cultural assimilation remain unresolved. These issues alone can determine the success or failure of educational innovations, regardless of technical robustness, accessibility and quality of content. Thus, it has been argued in the literature that fully supported opportunities for teachers to 'repurpose' object structures through a participative design process is the path most likely to lead to the elusive goal of reuse of digital learning objects by a critical mass of teachers [15].

'Repurposing educational content' means transforming a learning resource initially created for a specific educational purpose in a specific educational context in order to fit a different new purpose in the same or different educational context.

Therefore, the term repurposing needs to be distinguished from the term reuse which refers to the reuse of an educational resource "as is" [16]. The mEducator repurposing definition views the transformed learning resource as consisting of the original object and its dynamic, cumulative meta-data. This may include educational goals, expected outcomes, proposed educational context, means of assessment etc. There is a variety of situations where repurposing of educational content is desired. These situations, referred to as "re-purposing contexts", can be of a pedagogical nature, a technical nature or both [17].

Actions and practice in MHeL has followed this notion. That is, MHeL learning objects follow the mEducator metadata scheme which is vital for specific key areas and is especially relevant to the process of sharing and repurposing, as well as suggestion of best practice guidelines and recommendations based on the gathered evidence. The term metadata according to [18] is used to describe other data which provides information about a certain item's content, i.e., data about data. A metadata schema is composed of a set of terms, a set of structural definitions of metadata instances, and a binding scheme for implementation [16]. These terms are used in mEducator to describe medical educational resources of various types in a standardized, machine processable format. An ultimate goal of the mEducator metadata description scheme was to provide the aforementioned standardized format in order to enable the medical educational resources to be shared, exchanged, searched and retrieved across academic institutions. This is actually the envisaged hope for MHeL's sustainability too: the provision of metadata schemas and standards for describing modules in an innovative environment would allow repurposing actions and would essentially improve for the continuation and inclusion of the MHeL course in different programmes as well as different contexts (both thematically and technically speaking). The latter can also be applied in train-the-trainer course as well.

To this extent, the long term aim is to reach a modernization of medical curricula through also training the Universities staff in innovative teaching methods and specific pedagogical approaches; these will enforce the creation of institutional cultures of teaching against (e.g.) medical error by exploiting media-rich environments such as the ones developed in MHeL. With such a strategy, Medical Schools can play pivotal roles in improving the quality of healthcare; in the long run, the MHeL project will benefit not only the involved target groups, but also the wider society at local, national and global levels. The project's website and online community tools as well as the partners capacity may be used to maintain a live community of

best practice. The usage of media-rich structures will enable the mass communication of teaching by means of simulated environments as an important educational instrument thereby impacting both health and academic environments. It will have impact on clinical environments (clinical training spaces of students): enhance the sense and focus on patient safety by clinical teachers, students and their colleagues/non teaching staff. They will form a critical mass of suitably equipped with skills and being in a position to influence the change of practice.

So it is believed that the undertaken project activities will contribute to the establishment of a network of institutions contributing to the enhancement of MD education. Its close links with scenario based approaches and problem based learning (PBL, VPs) enhance its capacity to modernise curricula as it creates :

(i) a unique learning experience for students (particularly development of their skills in clinical reasoning already during undergraduate education);

(ii) a meaningful adaptation exercise providing new training capacities for medical teachers; the latter adapt new teaching methods (case adapting, case writing, case and Educational material delivery).

(iii) an eventual healthcare quality improvement as setting the standards for teaching using MHeL alike environments as a means to creating an international network not only strengthens inter-University relationships but supports the improvement of overall (global) healthcare quality and safety.

(iv) New curriculum themes and educational approaches may rise as explained above; these enhance students` clinical training spaces (bases) in each University.

Learning is happening everywhere and the appropriate evaluation metrics must be recognized, extracted and analyzed using both traditional and non-traditional methods. There are APIs, such as the Tin Can API used on the MeHL project [19], that can capture data in a consistent format about a person or group's activities from many technologies. Then any subsequent to MHeL program outcomes evaluation will be based on data of three main categories: knowledge test and examination score, user engagement and group collaboration. Efficacy and impact may be evaluated based on standard instruments such as focus groups, loosely structured interviews, as well as analytics derived from the digital content's use. All gathered data may be analyzed and used to identify the effectiveness of the education and its associated activities, the total engagement and collaboration. Calculated scores may be used for unofficial users' contests and as dissemination of the results through social media channels, such as Twitter and Facebook. A final note before concluding should be our call for emphasis on evaluation. Medical educators need to understand what works when, and be able to compare virtual and simulation based approaches to medical education with traditional methods. Else it may be better to continue as usual. But here is the difficulty. Such media-rich platforms are not simply a tool to be applied in certain situations; they are now fundamental to how we relate to, and with, society, especially when coupled with social media and network capacities. We simply cannot explore education innovations without recognising the impact of such media-rich environments on university systems. Moreover, as social creatures, working in the socially situated science of medicine, we must resist simply codifying and classifying media-rich environments according to current ideas about how we practice medicine or medical education. It is likely that we are experiencing or are about to experience a significant 'disruption' to medical practice and medical education. Time is not on our side, and the nature of our discourse is already in the process of changing.

Clinical educators have always had the task of preparing today's students for tomorrow's practice, but never before have they had to balance such a range of approaches to learning

and training with an even wider range of technological innovations and encounters. Confining or restricting the influence of media-rich environments on medical education so we can study its impact would be a hopeless task. So perhaps, rather than using a rigorous traditional framework of appraisal and scholarship, clinician educators should facilitate the transition of media-rich environments in healthcare into a valid, recognised element of professional practice, working with learners to ensure that we realise the potential to facilitate learning. And in doing so, the tricky task of today's clinical educators may be helped by coproduction and colearning with their generation of students: a real change from traditional pedagogy [20]. To this extent, evaluating anything before final formal application into wide practice is paramount. To this extent the basis put together on the work conducted during the MHeL project is considered an essential step forward.

The following small scale studies have been conducted at AUTH recently in an attempt to provide some registered means of evidence as to the potential adaptation of the MHeL activities in the future.

Undergraduate testing and evidence produced.

Where: Thessaloniki, AUTH Medical School lecture theater; then individually at home; final feedback by email and e-form.

Context: Within the running of the UMC - undergraduate module "Medical Education"

How: Students attending the module (35 in total) were demonstrated the MHeL environment and were given instructions on how to access it. Then, at an individual basis, students attempted to login and go through the content as well as the assessments/quizzes. They were also asked to provide feedback in narrative form as to how they would like to have complete courses like that in their UMC (15 of them responded).

Results: Most of the students provided encouraging feedback in the sense that they are not against the whole idea. They were technology literate enough so as to be able to run the course. They did not find any difficulties with the hardware and software requirements and they navigated in a reasonable way. The mentality of the course content fits their preferred mode of content (media-rich). They expressed the idea that perhaps if such environments were merged with those of case-based learning like the OpenLabyrinth for Virtual Patients cases benefits would be maximised.

Post-graduate testing and evidence

Where: Thessaloniki, AUTH Medical School lecture theater; Medical Physics lab

Context: Within the running of the PMT module/seminar series "Digital Educational Technology".

How: A mix of post-graduate students and PhD candidates attended this session (15 in total). They were initially demonstrated the MHeL environment and were given instructions on how to access it. Immediately after the demo they, at an individual basis, attempted to login and go through the content as well as the assessments/quizzes. Once they were all done a focus group discussion was held.

Results: Postgraduates explained that the general notion is right. This is probably the way things should be shaped up in future medical teaching. However, they expressed some reservations, mainly associated with the fact that the content was not really case-based and interaction was not very natural in some cases. However, they all see the potential of the MHeL

environment especially if it is progressively introduced into the curriculum. Another idea around its wider exploitation that was dropped in was the suggestion about demonstrating it in conference of medical societies and associations, especially with repurposing the content and making it fit the topics/interests of each professional society every time.

A study with Medical Educators and other stakeholders

Where: Thessaloniki, AUTH Conference Centre; Office of Medical Education

Context: run within the CAMEI summer school.

How: A mix of experts including under and post-graduate students and PhD candidates attended this session (40 in total). The special session took place at the 2nd day of the school, Thursday, 18 June, 2015 from 11:45 to 12:15. Around 40 participants attended the special session "Millennium Hospital for Educating Surgeons" and 13 of them completed the evaluation form at the end of the day. A short presentation (3-4 minutes) introduced the Millennium Hospital project. The 3D platform demonstrated in the CAMEI summer school, by using a scenario followed by the users. The aim/objective of the special session was to practice with the Millennium Hospital 3D Platform. The learning outcome was the familiarization of the users with the Millennium Hospital 3D Platform. An expert rapportier (Barry Eaglestone, University of Sheffield, UK) was observing and registering his notes online at the school blog. [21]

Furthermore, a group of 4 academics (medical teachers) met at the Medical Education Office (in early October 2015) to discuss the case of the MHeL potential. Prof. Bamidis co-ordinated the meeting and lead the focus group discussion which started with a demo of the MHeL platforms, idea and content navigation.

Results:

We limit the results here to the observation of the rapportier who wrote up in his blog for the CAMEI summer school session:

"This talk presented the Millennium Hospital project (MHeL) which concerns developing an e-learning environment, platform and a demonstrator tool relating to minimally invasive surgery. The learning environment was then demonstrated, by first logging in, The user then has access to the environment, which is a 3D hospital around which the user can navigate. Users can interact with selected objects in this environment to explore their descriptions, roles, functions, etc, thus accessing and interacting with the learning material. For example, the user can interact with a "professor" object to explore information relating to the treatment of various condition about which the professor is expert. The environment also facilitates assessment of the learner. Thus, the general approach is to facilitate learning through use of a serious game. Again, it was not clear if any extensive validation and evaluation of the prototype and underlying ideas has taken place.

One questioner observed on the relative rudimentary and limited implementation at present. This was acknowledge, with promises of future improvements."

Medical Education Office Focus group.

The discussion was held around three axes: (i) feasibility to launch pilot courses like that in the UMC; (ii) potential content development; (iii) platform maintainance and linking with existing systems. It was admitted that this forms a contemporary way to provide educational content. However, the interaction capabilities were emphasised. These should become realistic, linked with medical cases/scenarios like the virtual patients for example, so that the pedagogic effects

are maximised. Regarding the content development, which is a crucial parameter for any proper launching in the UMC, it was agreed that perhaps the Train-the-trainers seminar series held at the Medical School of AUTH could provide the vehicle for further development of this idea. It was planned to design such a lecture in the following academic year already. Finally, it was emphasised that such system should be linked and combined with other running systems. The coin was dropped back to MHeL AUTH project team to guarantee this and make sure that maintainance of all platforms was actually something doable. The dicsussion was closed with the agreement of the potential of the platform and the promise to (i) launch pilot tests of this in the next year's academic courses; (ii) initiate the train-the-trainers sessions so as to engage more people for content provision for the proper enrichment of the MHeL platform.

References

1. Hatzipanagos S., John B., Chiu T., "The significance of Kinship for Medical Education: Reflections on the Use of a Bespoke Social Network to Support Learners' Professional Identities. *JMIR Medical Education*, In Press, 2015.
2. Hatzipanagos, S. Warburton, S., Reedy, G. (2010). *Technology-Enhanced Learning Benchmarking*. King's College London, UK, Internal Report.
3. Hatzipanagos, S. (2012). *Disrupting traditional teaching practices with social media: the case for medicine in: Bamidis P, Anastassov V., Despotova-Toleva, L. (Eds), E-education & E-science*. Plovdiv, Bulgaria: Medical Publishing VAP; 2011 ISBN 978-960-243-682-0.
4. Leinster S. (2002) *Medical education and the changing face of healthcare delivery Medical Teacher*, Vol. 24, No. 1, 2002.
5. Buckingham Shum, S., & Ferguson, R. (2012). *Social Learning Analytics*. *Educational Technology & Society*, 15 (3), 3–26
6. Brown J.S., Collins A., Duguid P. (1989). *Situated cognition and the culture of learning*. *Educational Researcher*, 18(1): 32-42. doi: 10.3102/0013189X018001032
7. Dafli, E., Antoniou, P. Ioannidis, L., Dombros, N., Topps, D., Bamidis, P. D. (2015). *Virtual Patients on the Semantic Web: A Proof-of-Application Study*. *J Med Internet Res*; 17(1): e16 doi:10.2196/jmir.3933
8. Dent JA, Harden RM (Eds), *A Practical Guide for Medical Teachers*, 4th Edition, Churchill Livingstone Elsevier, London, 2013
9. Kononowicz et al, 2015. Virtual patients - what are we talking about? A framework to classify the meanings of the term in healthcare education *BMC Medical Education* Sample. doi:10.1186/s12909-015-0296-3
10. Konstantinidis S, Bamidis PD, " *Why Decision Support Systems are Important for Medical Education?*", *Healthcare Technology Letters*, Under review, 2015.
11. MedBiquitous 2003, MedBiquitous: Collaborative Technologies for Medical Education, <http://www.medbiq.org/>
12. *Institute of Medicine (US) Committee on the Health Professions Education Summit, Health Professions Education: A Bridge to Quality*, Editors: Ann C. Greiner and Elisa Knebel. Washington (DC): National Academies Press (US); 2003. ISBN-10: 0-309-08723-6/ISBN-10: 0-309-51678-1
13. Komenda, M. et al. *Towards a System of Enhanced Transparency of Medical Curriculum*. *European Journal for Biomedical Informatics*, 2013. ISSN 1801-5603.
14. Kazakis et al, 2013. *Evaluating the research performance of the Greek medical schools using bibliometrics Scientometrics (2014) 98:1367–1384. DOI 10.1007/s11192-013-1049-x*
15. C. Gunn, S. Woodgate, W. O'Grady, "Repurposing Learning Objects: A Sustainable Alternative?", *ALT-J Research in Learning Technology*, vol. 13(3), pp. 189-200, 2005.
16. M. Meyer, T. Hildebrandt, C. Rensing, R. Steinmetz, "Requirements and an Architecture for a Multimedia Content Repurposing Framework", in W. Nejdl and K. Tochtermann (Eds.): *EC-TEL 2006, LNCS 4227*, pp. 500–505, 2006.
17. P.D. Bamidis, E. Kaldoudi, C. Pattichis, "mEducator: A Best Practice Network for Repurposing and Sharing Medical Educational Content". In *Proceedings of the*

PROVE 2009: 10th IFIP Working Conference on Virtual Enterprises, Thessaloniki, Greece, 7-9 October, 2009

18. E. Kaldoudi, A. Antoniadou, C. Schizas, C. Pattichis, P. Bamidis, "Functional Report on Content Sharing Functional Requirements", Deliverable 1.2 in the project "mEducator: Multi-type Content Repurposing and Sharing in Medical Education", supported by the eContentplus 2008 program, Information Society and Media Directorate-General, European Commission, Grant No.: ECP 2008 EDU 418006), October 2009
19. Tincanapi.com,. 'Overview - Tin Can API'. N.p., 2015. Web. 4 Oct. 2015
20. Hillman T, Sherbino J, Social media and health professions education; Social media in medical education: a new pedagogical paradigm?. *Postgrad Med J* 2015;91:544-545 doi:10.1136/postgradmedj-2015-133686
21. *Eaglestone B, An online report on the CAMEI summer school activities, <http://mei2015.camei-project.eu/rapporteur-blog>*