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[1] OJ L 79, 24.3.2005, p. 1.

Final Report

03/09/07 to 31/08/10


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b) Report Summary

1. Project Overview

The electronic Virtual Patient project (eViP) was a response to emerging issues and challenges to medical education in Europe. Opportunities for student-patient contact and chances for students to practice competence in patient management were declining for a variety of reasons at a time when improvements in patient-doctor interaction and treatment with a more modern approach to patient care were required. There was a growing belief that virtual patient, computer based simulations of patient encounters, could assist in the transition to more learner- and patient-centred, community-based, clinically focused teaching. However, that fact remained virtual patients were expensive to create, relatively few in number, and rarely shared by the institutions that created them.

The primary objective of the eViP project was achieved through the creation of a bank of more than 320 virtual patients adapted for multi-cultural and multi-lingual use from the existing partners' collections. A common standard was developed in conjunction with the central organisation in healthcare standards, MedBiquitous; to enable sharing of virtual patients between different authoring systems used by partners and non-partners. eViP changed the way that virtual patients were viewed and used internationally. eViP delivered its message powerfully to the global community of medical educators, with a five-fold increase in the number of VP patient presentations at international meeting and illustrated by the very successful inauguration of an annual high profile International Conference in Virtual Patients.

2. Project Outputs

The eViP project deliverable outputs are listed below in chronological order, with hyperlinks to the relevant eViP webpage where these deliverables are available. Please note that **all** publically available eViP deliverables are also available to download via the eViP Deliverables page: http://www.virtualpatients.eu/evip/deliverables/

- **D2.1**: eViP Application Profile and Evaluation Report on Third Party Tools and Services: http://www.virtualpatients.eu/evip/deliverables/ [*Published September 2007*]

- **D7.1**: eViP PPT presentation: http://www.virtualpatients.eu/about/about-evip/ [*December 2007*]

- **D 4.1**: Collaborative eViP website including blog and wiki for engaging the wider community www.virtualpatients.eu [*First published February 2008*]

- **D4.2**: Case studies for the use of virtual patients: http://www.virtualpatients.eu/resources/case-studies-the-use-of-virtual-patients/ [*Published February 2008*]

- **D3.1**: Inventory of existing VP cases with any IRP issues and report on which VP cases that will be repurposed, medical/healthcare specialty targeted and responsible partner: http://www.virtualpatients.eu/evip/deliverables/ [*Published February 2008*]

- **D3.2**: Populated repository of English VPs as selected in 3.1: http://www.virtualpatients.eu/evip/deliverables/ [*Published July 2008*]

- **D4.3**: Needs analysis for VPs from wider community: http://www.virtualpatients.eu/about/about-evip/survey-results/ [*Published August 2008*]

- **D7.5**: eViP Annual Report: http://www.virtualpatients.eu/about/evip-annual-reports/ [*Published August 2008*]

- **D2.2**: Report on eViP Application Profile implementation and conformance testing: http://www.virtualpatients.eu/about/about-evip/evip-technical-reference-group/ [*Published October 2008*]

- **D2.3**: Report on Common Consent and Licensing DRM framework, all documentation, best practice: http://www.virtualpatients.eu/about/about-evip/ [*Published December 2008*]

- **D3.3**: Report on set of new repurposed standards compliant VPs, with metadata and packaged for multilingual use: http://www.virtualpatients.eu/evip/deliverables/ [*Published January 2009*]

- **D4.4**: Good practice guidelines for developing and repurposing virtual patients: http://www.virtualpatients.eu/resources/good-practice-guidelines/ [*Published February 2009*]

- **D5.2**: Published evaluation instrument for VPs and for learning and teaching activities with VPs: http://www.virtualpatients.eu/resources/evaluation-tool-kit/ [*Published April 2009*]

- **D4.5**: Market research data on acceptance of eViP product and options appraisal for exit and sustainability business models: http://www.virtualpatients.eu/about/about-virtual-patients/who-uses-virtual-patients/ [*Published August 2009*]

- **D3.4**: Report on set of repurposed VPs in new disciplines and set of localized new VPs into new cultures and approved peer review processes: http://www.virtualpatients.eu/evip/deliverables/ [*Published December 2009*]

- **D5.3**: Publically available set of enriched and standards compliant VPs for different educational scenarios with published educational guidelines for enriching and implementing VPs for different educational scenarios and different cultures: http://www.virtualpatients.eu/evip/deliverables/ [*Published April 2010*]

- **D6.2**: Published cooperative business licensing model, copyright and IPR model as well as awareness and dissemination strategy: http://www.virtualpatients.eu/evip/deliverables/ [*Published April 2010*]

- **D3.6**: Complete referatory of repurposed, standardized and localized VPs for different disciplines, including metadata description: http://www.virtualpatients.eu/referatory/ [*Published June 2010*]

- **D4.6**: Programme outputs and documentation available via the eViP website: http://www.virtualpatients.eu/evip/deliverables/ [*Published August 2010*]

- **D6.3**: Published documentation and training material guidelines: http://www.virtualpatients.eu/resources/ [*Published August 2010*]

3. Impact and Benefits to the Community

The eViP partnership set out to change the way in which institutions viewed the pedagogic value of VPs. It showed how VPs could be combined with teaching and instructional activities for curricular integration. The lessons learned from repurposing and implementation provided the wider community with an idea of how VPs could be used for a new generation of scenario-based learning. Partners were heavily involved in disseminating VP approaches, values, and uses across the world, and through a range of new approaches using social networking. The VP standard is now used routinely to move VPs between players.

eViP was the first project to provide a comprehensive systematic description of VP design and curricular integration, promoting improved reporting and research on VPs. The documentation provided educators and administrators with information on how to successfully implement VPs in education.

The eViP programme was based on the principle that virtual patients were expensive to make, and therefore it was important to recycle virtual patients across Europe. An outcome of the project activity was a streamlining of the creation process; VPs became relatively cheap to create.

In the process, the team demonstrated very thoroughly that, in a variety of formats, repurposing types, and between a variety of different authoring/player systems, repurposing was more efficient than creating VPs 'from scratch'. It also showed which types of repurposing were particularly efficient, and left pointers to the areas of repurposing that future entrants into the field of virtual patients may find of most value, iinstilling early institutional confidence in repurposing VPs.

In this regard the unified system for IPR clearance was important, since it gave a clear instructions to users, current and future, how the VPs could be used for their purposes, making the VP content more accessible.

The eViP project partners formed the majority of members working on the standard in the MebBiquitous Working Group and was directly responsible for the ANSI virtual patient standard. The standard proved to be both useful and practical, perhaps unexpectedly. The VP content became interoperable between players, and as a result some partners used the import/export facility to move virtual patients between players, or to provide backup- systems

in alternate players for the delivery of VPs to students, as a precaution against the failure of any one delivery system.

Th evIP delivered through its website over 320 virtual patients openly available, adapted for multi-cultural, multi-lingual use, covering a wide range of uses, curriculum requirements. The web presence is is now the main port of call for all things virtual patient related, 1st, 2nd 3rd, on Google with a dedicated online following, more than 20,000 visitors a month by July 2010, but with 58% new visitors.

Perhaps the biggest impact on the medical education community was the outcome of the activities of the partnership in direct contact, publications, workshops and conferences. At the start of the project in 2007, the largest medical education conference had only four presentations at the major education conference, AMEE, and eViP was only given a poster presentation. A year later, there were 18 presentations, twelve of which involved eViP partners and the majority of which involved partners' VP player systems.

Over the next three years, this continued worldwide as partners presented virtual patients, delivered workshop and demonstrated an increasing use of VPs in the curriculum. These uses increased to cover: replacing paper-based PBL; creating interactive VP-based lectures and seminars; replacing paper-based assessment; supplementing clinical bed-side teaching. eViP informed the community on what types of VPs can be used in different educational scenarios, and triggered development and use of additional technology, such as interactive images, feedback tools, electronic polling and use of tablets.

From 2009 onwards the partners have been able to promote virtual patients at a much higher level, creating and delivering the 1st and 2nd widely acclaimed International Conferences on Virtual Patients, and a special issue on virtual patients in 'Medical Teacher' with the majority of articles involving the eViP partners. There has been considerable uptake of partners VP player systems across the world, with high demand for workshops, in VP creation and curriculum embedding. eViP nformed the community on what types of VPs can be used in different educational scenarios, and triggered development and use of additional technology, like: interactive images, feedback tool, electronic polling and use of tablets

The impact will go even further as the project enters its sustainability phase. Peer-reviewed VPs will be shared, not only through the eViP website but also through other sites such as MedEdPortal and Open Jorum www.jorum.ac.uk Increasing link have been built with other organisations for VP development.

Core partners from eViP are now part of a major new EC 'FET-Open' Flagship bid to creaate a step-wise change in virtual patients, a digital clone /avatar/e-human to mimic every individual in health and disease in the European Union.

4. Main Lessons Learnt

There is a much increased interest in VPs in comparison to the start of the project, and it is still growing. However, the value of eViP was probably as much a community shift in the

perspective of the role VPs could play in training competency, as it was in the resources it produced.

Three years was too short a time to see the full impact upon the education community, which only now can examine VP examples and seek out a partner or free player to use or repurpose their own VPs. They can follow the clear and powerful examples of the European leaders in the field, and if there is factor which appears to hold users back it is the lack of a freely available player.

In effect, eViP was not really just a 'content' project, but the emergence of a Network of Excellence, which is now part-way through a task of changing the medical education culture to maximise the value of computer-based, scenario-based, learning. So, although eViP could hardly have hoped to do better in terms of its current impact on that medical education community, much of its contact with that community was often direct, face-to-face. The reality, that its online resources would emerge near the end of the project, meant that its estimation of the numbers of website hits by year 3 was unrealistic. The numbers will continue to climb, and the embedding of VPs will accelerate, but clearly the culture change in the use of VPs will take place over a longer period than the initial eViP funding. The website will continue to be supported indefinitely by at least two of the partners.

c) Main Body of Report

1. Introduction

The electronic Virtual Patient project (eViP) was created in response to significant issues that were rising in medical education across Europe. Opportunities for student-patient contact and chances for students to practice competence in patient management were declining at a time when improvements in patient-doctor interaction and treatment with a more modern approach to patient care were required. Contributing factors include increasing budget constraints, reduced learner-patient contact through decreased patient time in hospital, and reduced training opportunities through increasing hospital specialisation.

These factors run counter to the increasing demand for effective, evidence-based and cost-effective teaching expressed by policymakers, teaching institutions, and by teachers and learners themselves.

Many of these groups recognise the need for a transition to more learner- and patient-centred, community-based, clinically focused teaching. With the ever-closer union of the EU, doctors – traditionally one of the most mobile elements of the workplace – will be practicing across borders and in jurisdictions other than that which they trained in. The importance of a commonality of competencies in medical school curricula and in postgraduate training is therefore increasing. The requirement for accountability is likely to lead to a demand for consistent common certification of learner competency.

Pedagogical training needs to mimic as closely as possible the role of the practitioner and provide learners with self-directed personalised learning opportunities. The movement to a more modern scenario-based, decision-making style of learning with direct training in clinical and communication skills and professional development is a step in the right direction, but far more needs to be done. Fortunately, technology has provided us with excellent solutions to a potential crisis in medical training.

Virtual Patients (VPs) are now recognised by the medical education community as highly effective tools for developing clinical reasoning (Ellaway 2009). However, VPs are time-consuming and expensive to produce. Even leading e-learning institutions are unable to produce a sufficient number to give full coverage of the medical or healthcare curricula.

In 2005, several of the major European e-learning centres in medicine and healthcare formed a working group for the development of a pan-European collection of VPs. These shared resources could be used to maximise VP uptake by educators in both partner and non-partner countries to underpin and extend current teaching and learning, to minimise inefficient practice, reduce costs, and improve the consistency and quality of clinical care and wellbeing of patients throughout the EU.

There was a recognition that mobility of labour would cause a rising degree of potential problems and legal challenges as the inconsistencies in competencies and procedures began to impact on health practice throughout the European Union. Together with MedBiquitous - the leading developer of healthcare standards - this group had also begun to define a standard for the interoperable use of VPs across Europe as a forerunner of the consistent use of VPs across the European Union for training purposes (Ellaway 2008).

Non-partner institutions would then be able to repurpose these VPs for their own local and educational needs. The shared bank of VP resources would cover the entire range of specialisms required to support clinical training.

Fit to Programme Objectives

These are issues that are particularly relevant to the eContent*plus* programme vision, which is to support projects that will make digital content in Europe more accessible, usable and exploitable by addressing specific market areas where development has been slow.

The programme also aims to facilitate access to digital content, encourage the use and exploitation of such resources, enhance the quality of content with well-defined metadata, and to reinforce cooperation between digital content stakeholders.

eViP also aimed to tackle multilingual and multicultural barriers where there is already much existing digital content created by many educational institutions, but the uptake of these resources by other institutions from the wider community has been slow. The eViP consortium therefore bid to the eContent*plus* programme in 2006.

2. What we did, the highlights and the impact

WP1 The Pilot Case study

What Did We Do?
This work package was coordinated by St George's University of London (SGUL).

WP1 was an important precursor to the main eViP repurposing activities that later followed. The working hypothesis of this pilot study in WP1 was that repurposing an existing VP was easier and more cost effective than creating a new VP from scratch. During this early phase, the project partners completed the following eight steps of this pilot:

1. **Agreed definition of repurposing in the context of the project**

For eViP, repurposing was defined as the following:

"*To convert a Virtual Patient (VP) created for one purpose into a VP fit for a new purpose. The change of purpose or context could be cultural, linguistic, education scenario, a different educational level, or for a different subject discipline or healthcare profession.*"

2. **Created definitions for the following different types of VP repurposing, appropriate to the needs of the project:**

- Repurposing to different cultures
- Repurposing for multilingual use
- Repurposing to different educational levels
- Repurposing to different educational scenarios

- Repurposing for different subject discipline or healthcare profession
- Content enrichment

3. Prepared pilot repurposing exercises to produce example VPs to fit the individual partner needs

An inventory of partners existing VPs was first created, allowing partners to explore each other's VP collection. This pilot was a very open exploration: partners were free to repurpose and enrich VPs in any way they chose, driven by their own needs.

4. Tested the feasibility of the definitions by ensuring there were examples for each repurposing type

The cooperative agreement to cover all repurposing was a bonus for the project; it was not in the original plan. A total of 19 VPs had been repurposed and enriched as part of this early pilot case study. All types of repurposing were covered, 8 single examples of repurposing that addressed single repurposing types, and 11 covering multiple repurposing types.

5. Analysed the efficiency of repurposing, i.e. the time taken to repurpose, compared to the time taken to create a VP from scratch

The time taken to repurpose and enrich a VP covered a wide range from 5 to 80 hours: KI estimated the process took 5- 20 hours; WAR, SGUL, LMU 20-40 hours; CLUJ 40-60; and HD, UM, UJ 60-80.

6. Obtained feedback from staff involved in the repurposing and enrichment process

Different types of repurposing and content enrichment were carried out throughout the course of this study. The evaluation criteria used by each of the project partners differed. All partners agreed to evaluate and obtain feedback from staff involved in the repurposing and content enrichment process as the main focus of the pilot study.

7. Obtaining staff and student feedback from the use of the repurposed and enriched VPs.

The majority of partners also conducted supplementary student evaluation and feedback exercises to better inform the pilot study. The students were involved primarily to evaluate, and where possible contrast, the different learning styles offered by the partners. The intention was to capture feedback on a wide range of approaches to repurposing and enriching VPs, and inform the process followed by any future activities of a similar nature.

The project partners used different tools for evaluation and feedback including web-based, email, and paper questionnaires, and face-to-face and online interviews. The duration of this evaluation phase varied from partner to partner due to differences in academic timetables. This was the main reason why several partner institutions were unable to conduct these supplementary student evaluations.

8. Collated feedback and finalise report

The final step was to collate all the information relating to the pilot study since the start of the project and compile it into one final deliverable report for the European Commission.

Highlights From WP1

1. Feasibility of repurposing and enrichment

In all cases of repurposing and enrichment, the pilot exercise had demonstrated feasibility i.e. all partners succeeded in the various tasks of repurposing and enrichment that they had set themselves. It was significant to note that in each case where a partner discussed the 'time taken' issue (i.e. LMU, HD, UM, KI, WAR and SGUL) the task of repurposing was regarded as significantly easier than 'starting from scratch'.

2. Positive responses from staff and students

It was encouraging that subject experts from the partners who had not previously used VPs (e.g. CLUJ and UJ) considered the repurposed and enriched VPs to be useful tools in learning. As with HD and UM, they found repurposing more time-consuming than expected, but expected the process to accelerate, and subsequent repurposing did indeed proceed much more quickly. A consistent evaluation by all staff revealed that this repurposing and enrichment exercise was worthwhile.

Students had also responded well in every case. This is not surprising; an additional tool is usually a positive experience for students. In several instances the pilot presented a new format to students, and in four cases the feedback indicated that the educational scenario would need adjustment to fit the educational level of the tested student group, which varied from 1st year students to 3rd year students on clinical attachment. This is valuable information, and demonstrates that tailoring the VPs to the educational level and needs of the curriculum is as critical a step in VP repurposing as it is for more conventional learning resources.

3. Repurposing and content enrichment workflows

Common features emerged from the different approaches that partners took in repurposing and content-enriching their VPs. As expected, the first step for all the different workflows proposed by the partners was to identify the cases and consider their suitability for the pilot study. All partners then made minor modifications to their multimedia resources (e.g. images, videos and animations) in order to embed them within their respective VP systems or players, and then tweaked the structure of their original VPs in order to repurpose to a different context. All partners employed a review and sign-off step by content and case experts in order to quality-assure the validity of the content.

Variations in workflow were typically based on the type of repurposing. Partners who localised cases ensured that a 'culture and language check' had taken place by a native speaker (for e.g. HD, UM, KI, CLUJ and UJ). It was also noticed that partners who used the same VP systems had similar approaches to the repurposing and enrichment workflows (for e.g. LMU-UJ and KI-CLUJ).

Each project partner had selected a different target audience and some had targeted different educational levels, differences that were reflected in the variations in the workflow steps from partner-to-partner. This diverse approach produced variation and richness in the eventual evaluation data, which was important to the wider community as exemplars of repurposing.

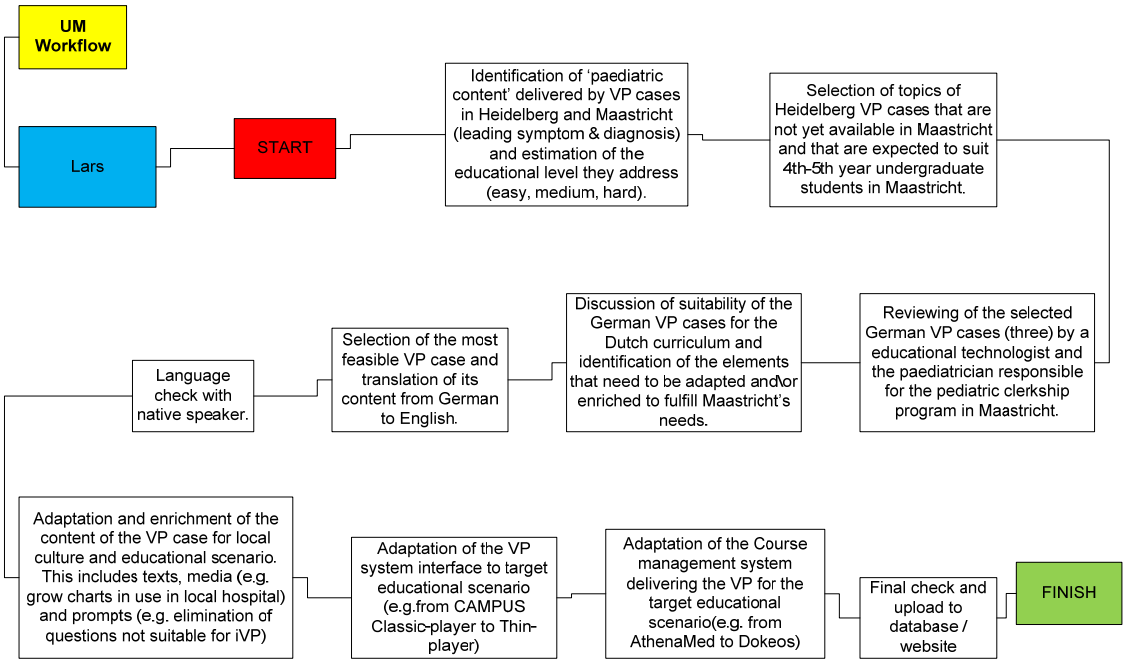

Figure 1: Example of repurposing and enrichment workflow from UM

Impact of the Pilot Study

In some instances repurposing and enriching was more time consuming than anticipated. This was particularly true at first, as the repurposing process represented a novel, un-rehearsed exercise. However, as expected, subsequent repurposing proceeded much more quickly and at a more ergonomic rate.

All types of repurposing demanded less effort than creating a case 'from scratch'. Content enrichment was a particularly efficient use of time, especially if the resources were already available.

Despite the short timescale, in most cases the partners had managed to obtain feedback from both staff and students. In general, no repurposing problems emerged which could not be solved. In all cases there was strong support from content experts, staff and students for the future use of the repurposed and enriched VPs.

WP2 Standards Specification and Implementation

This work package was coordinated by Karolinska Institutet (KI).

The overall objective of the eViP project was to create a shared bank of virtual patients (VPs) for the improved quality and efficiency of healthcare education across the European Union. The objective of WP2 was to contribute with a standardised technical approach that would enable interoperability and reusability of VPs across different VP systems.

What Did We Do?

1. Developed an eViP application profile

The eViP application profile is composed of the following:

(i) Schemas that define how to encode VPs using xml;
(ii) A specification of how to package the VP; and
(iii) Requirements for conformance with the eViP profile.

The profile is an adaptation of the MedBiquitous Virtual Patient Standard (ANSI/MEDBIQ VP.10.1-2010)

2. Developed an eViP metadata profile

The eViP metadata profile is a systematic description of the virtual patient. The metadata specification is based upon a subset of the IEEE 1484.12.1-2002 Standard for Learning Object Metadata and MedBiquitous Healthcare Learning Object Metadata Specification. The metadata specification also adds additional fields to describe the unique aspects of the eViP resources that existing specifications could not support, such as information regarding the repurposing history of a resource.

3. Developed eViP conformance testing suites

Tools to support the process of validating the VP resources against the eViP application profile were developed. Two concurrent solutions emerged representing different implementation approaches. The conformance testing suite developed by KI uses a Java implementation of the Document Object Model (DOM) interface, whereas HD developed a suite based on XSLT templates.

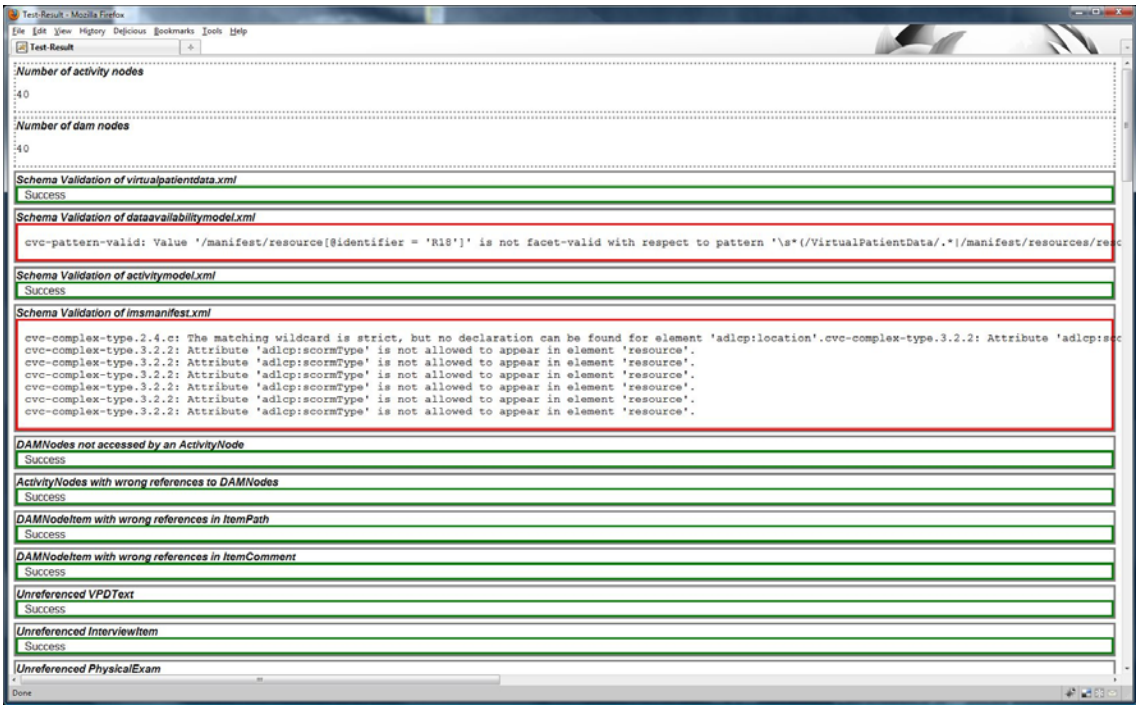

Figure 2: Screenshot from HD conformance testing suite

4. Implemented the eViP application profile

All the partner VP systems implemented the eViP application profile and tested that these implementations allowed for compliant import and export of VP content.

5. Developed a consent and licensing process workflow

The eViP project adopted a simple and robust licensing model for ensuring all new and repurposed digital content is appropriately used with copyright and IP acknowledgement to the source or repurposed source.

6. Created best practice guidelines

The first guideline addressed technical issues related to the exchange of VPs between different systems. The second guideline proposed to implementers a conformance testing process. The third guideline suggested recommendations for handling external specifications that are not covered by the VP standard. The last guideline offered a solution to the problem of internationalisation of media resources.

Highlights From WP2

Significant contribution towards the first ever international standard for VPs

During the course of the project eViP strongly contributed towards shaping the first standard that enables interoperability, accessibility and reusability of Web-based VP learning content. The collaboration between the eViP partners and MedBiquitous proved to be an exemplary model for cooperation on the development of technical specifications.

Successful implementation of the eViP application profile

All four VP systems successfully implemented the eViP profile, allowing the partners to export their repurposed VPs to the eViP repository. The variation in strategies to achieve the

deliverables in WP2 has provided us with an increased knowledge that was partly translated into best practices for the wider technical community.

Technological innovation
The eViP project was the first of its kind to define levels of conformance and managed to release the only conformance testing applications available to date. These applications are under consideration to be included as part of a wider conformance testing, validation and certification process for the MedBiquitous Virtual Patient Standard (ANSI/MEDBIQ VP.10.1-2010), and may prove to play an important role in enabling the increased sharing of conformant VP packages.

Simple and robust licensing model for academia
Intellectual property in the form of copyright is not something that can be ignored or considered lightly. It is an important issue that could potentially threaten academic collaboration. However, provided that the right steps are taken in preparation, such as the adoption of common consent forms and licensing models, the eViP programme showed that it is possible to facilitate the sharing of digital content whilst protecting the liability of the respective institutions, regardless of geographic location.

Impact of Technical Standards

First time a project is successful in making VP content interoperable
eViP has successfully tried and tested standards and processes for making content interoperable, an endeavour that many people have been attempting for years without success.

The programme objective was to address organisational barriers and promote the uptake of cutting-edge technical solutions to improve accessibility and usability of digital material in a multilingual environment. WP2 strongly contributed towards this objective.

The collective learning experience of all eViP partners involved in the implementation of the eViP Application Profile has the potential to be adopted in the future by future implementers of the profile. The approach of combining several specifications (MedBiquitous Virtual Patients XML, Healthcare LOM, and SCORM) was innovative and has inspired the international healthcare standardisation community.

The eViP project demonstrated that by analysing the potential obstacles and devising common pathways to overcome these barriers, it is possible to both manage and share digital content. Although there are many issues involved in sharing digital content between medical institutions, the eViP project showed that a unified approach can be adopted.

Furthermore, this model can potentially be applied to any internationally developed/repurposed content that will be shared beyond the scope of this project.

WP3 Repurposing and enrichment

This WP was coordinated by Karolinska Institutet.

What Did We Do?

WP3 was the backbone of the eViP project. The main goal of WP3 was the adaptation of the VPs to the common framework developed in WP2 and to ensure that the repurposed VPs provided media-rich support for basic and clinical sciences, communication and clinical skills, and personal and professional development issues.

1. Identified and established an inventory of existing VPs

All possible VP cases from project partners were identified and an inventory established by:

(i) Setting up a plan and gathering the details (including type of VP cases, type of systems, and IPR issues) for the inventory;
(ii) Creating an on-line inventory of cases; and
(iii) Performing an analysis of the inventory.

2. Identified the VPs to enrich and repurpose

The existing VPs to be repurposed were identified, based on medical and healthcare specialties, the expressed needs of the partners and thorough individual partner feasibility studies.

3. Repurposed VPs to different healthcare disciplines

Following discussions, it was agreed which healthcare discipline should be targeted. Each partner selected VPs from their own, or another partner's VP collection to be repurposed for a new discipline.

4. Adapted the VPs to the common technical framework

The VPs were adapted to be compliant with the eViP Application Profile, including adding standards-compliant structure, metadata (particularly language metadata), and content packaging; all to enable 'multi-lingual access'. Content was enriched with resources shared by the partners, and where required, existing media content (images, graphics and audiovisual materials) was modified to meet the specific needs of different cultures.

5. Repurposed VPs to different cultures

Possible cultural differences and needs within every partner's local (i.e. national and regional) settings were identified. VPs were then localised to the range of cultural aspects defined.

6. Developed a quality assurance peer-review process

A process was developed to validate cultural references, language metadata, and medical information in the VPs.

7. Developed a VP repository

All VP cases that were repurposed were identified, and it was verified that all VPs created were 'eViP compliant'. Finally, a publically accessible web-based repository was developed that contains a (metadata) description of the VPs, and which also provided functionality to download the VPs in a standards-compliant format.

Highlights From WP3

A collection of 320+ repurposed, standardised and localised VPs
The work towards creating over 320 repurposed, standardised and localised VPs started with a pilot case study (as described in WP1). Issues relating to the standardisation of the VPs were reported in D2.1 (*eViP Application Profile and evaluation report on third party tools and services*), D2.2 (*eViP Profile Implementation and Conformance Testing*) and D2.3b (*Best Practice Guidelines for the eViP Application Profile and Conformance Metrics*). The different steps of the repurposing efforts and the knowledge gained were reported in D2.3a (*IP Management*), inventory of existing VPs, D3.2 (*Populated Repository of English VPs as selected in D3.1*), D3.3 (*Report on Set of New Repurposed Standards Compliant VPs, with Metadata, and Packaged For Multi-Lingual Access*) and D3.4 (*Report on Set of Localised New VPs Into New Disciplines and New Cultures and Approved Peer Review Process*).

The cultural dimension
Culture comprises a patchwork of values, beliefs, practices and discourses that shape how we value and explain the world.

In eViP, the repurposing activities attempted to encompass different aspects of culture such as ethnicity, language, socio-economics, geography, profession and discipline. This effort uncovered a variation in the cultural aspects present in each of the partner countries and confirmed the importance of such aspects when repurposing VPs from other regions and countries of the EC.

A model to peer-review VPs
The eViP project contributed with a systematic internal and external peer-review process that can be applied to ensure consistency in quality among all stakeholders who repurpose and share VPs across Europe and the world.

Metadata optimized for the VP community
Metadata facilitates the searching and browsing of VP packages in referatories and repositories. We customised an existing standard (IEEE LOM and its extension MedBiquitous Healthcare LOM) in order to illustrate system properties and workflow stages commonly encountered when authoring VPs.

eViP repository
The repository is one of the main achievements of the eViP project. It is the result of the work carried out by the partners over the last three years. The project has produced more than the anticipated number of repurposed and enriched VPs initially forecast at the outset (i.e. 320+ VPs, n=327).

Impact of Repurposing and Enrichment

Practice guidelines for repurposing content from other countries and languages.
WP3 proved that repurposing was efficient compared to creating VPs from scratch, and it also provided insight on how and when the repurposing effort is most efficient.

The major VP repository worldwide
The eViP repository is currently the major publicly available VP repository worldwide, both in terms of number of virtual patients and the cultural richness of its content.

WP4 Awareness and Dissemination

This work was coordinated by The University of Warwick, UK

What Did We Do?

The main objectives of WP4 were to:

(i) Engage with institutions outside the project partnership to prepare the groundwork for eViP deliverables;
(ii) Publish good practice guidelines for developing and repurposing virtual patients and associated e- learning materials; and
(iii) Foster a community of collaboration between institutions through exchanging virtual patient e-learning materials via the eViP project web site.

This was accomplished by:

(i) Maintaining an eViP project web and social networking presence to document progress and sustain awareness of project activities.
(ii) Gathering preparatory data from the wider community involving stakeholder interviews, consultation, social networking and market research, in order to assess community acceptance of repurposed VPs and preliminary business models for eViP exit & sustainability.
(iii) Publishing outputs and documentation via the eViP project website.
(iv) Presenting project activity and deliverables at European medical education and e-learning conferences; and
(v) Publishing scholarly articles in relevant journals and newsletters.

In addition to these objectives, WP4 also took on a lead role in creating the platform to release repurposed VPs to the wider community. This in itself was a significant activity, and ultimately perhaps the main deliverable on which the project will be judged.

For the first year of eViP the web site www.virtualpatients.eu acted first and foremost as a project web site, with the internal collaborative wiki being the main focus. During year two of the project a major redesign and launch of the new public-facing web site resulted in significantly greater interest from non-partners. This coincided with the release of a number of guideline documents with useful information on how to create and repurpose virtual patients from a technical, content authoring and pedagogical standpoint. A successful social networking strategy saw interest generated from other channels, including YouTube, Twitter, LinkedIn and Facebook. The website and social networking strategy facilitated comprehensive coverage of major international meetings, including ICVP 2009, AMEE 2009 and ICVP 2010 & MedBiquitous Annual Meeting.

Figure 3: Evolution of the eViP Website

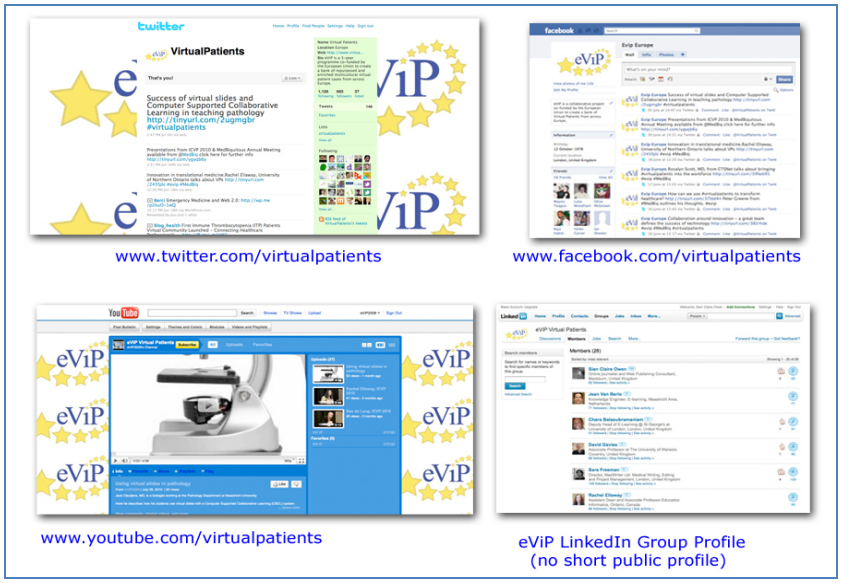

Figure 4: The eViP Social Network Presence

The third and final year of the eViP programme saw the release of many video and audio interviews with project partners and other stakeholders. These interviews remain amongst the most popular resources on the eViP web site, for understandable reasons. People like to hear other people speak, and to listen to stories about what they did and how they did it. Guideline documents are useful, but hearing directly from teachers about what works for them is a powerful message.

Although this was not anticipated at the start of the project, engaging with people in this way was a dominant and successful feature of the final months of eViP, and definitely a project highlight.

Figure 5: Interviews with Key Opinion Leaders are a popular eViP Resource

The eViP referatory www.virtualpatients.eu/referatory has been live since June 2010 and contains more than 320 virtual patient metadata records with links to individual virtual patients playing in partner systems. At the end of the project the referatory became a repository, with all 320 virtual patients being available for download (see WP3).

Figure 6: The eViP Referatory

Since the website re-launch in June 2009 the site traffic has increased by 42%, and since the site's inception in October 2007 there has been 17,904 visits from 123 countries around the world.

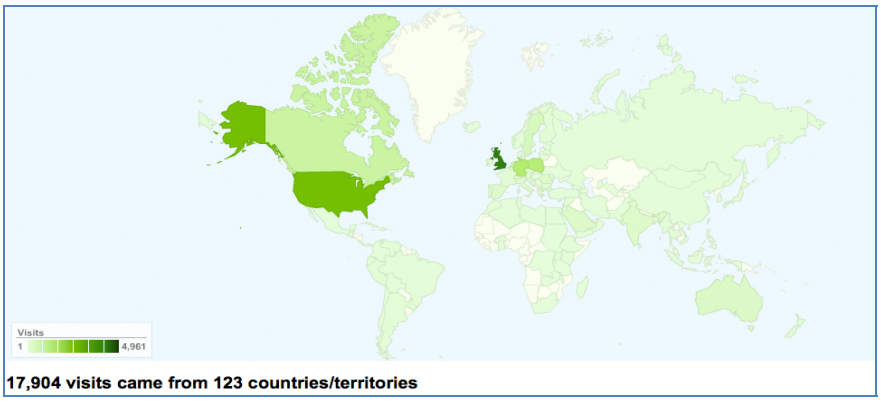

Figure 7: Data from Google Analytics [Accessed August 19th 2010]

The eViP website now ranks in the top search results in Google when searching for 'virtual patients'. This is no small feat, as eViP outranks Wikipedia for this search term.

Highlights From WP4

This work package has largely been about reaching people, and there can be no doubt that this has been achieved during the past three years. The many presentations given at meetings alone have reached an audience of thousands, but a highlight has been the use of social networking and the new and innovative ways of reaching people in the EU and indeed globally that the programme has adopted.

The International Conference of Virtual Patients (ICVP), now entering its third year, has been a significant highlight. The ICVP 2010 meeting was combined with the MedBiquitous Annual Meeting, reaching a European and North American audience. Interviews and podcasts with key opinion leaders in the field of virtual patients, and e-learning more generally, has been a highlight of our publishing strategy.

Perhaps the best way to sum up the highlights of eViP's dissemination is to hear from a collaborator from the USA. Dr James B McGee, Associate Professor of Medicine and Assistant Dean for Medical Education Technology at the University of Pittsburgh, told us in August 2010:

"*After 15 years of involvement with virtual patients I can say that the eViP project has already done more to promote VPs as a pedagogy than any other VP initiative to date.*"

Impact of eViP and WP4

eViP has made an impact far wider than just the EU, with significant interest coming from the USA. This is significant given the influence of the USA on e-learning generally, and eViP's contribution to the ANSI/MEDBIQ VP.10.1-2010, MedBiquitous Virtual Patient standard. Valerie Smothers, Deputy Director of MedBiquitous told us in August 2010:

"*The eViP project made it possible to develop a technical standard for the exchange and dissemination of virtual patients; without eViP it would have been difficult to find the institutional support for standards development necessary for progress. In addition, the eViP repository sets a precedent for international collaboration and dissemination of virtual patients, laying the groundwork for larger collaborations that cross the Atlantic. With these collaborations in place, and the use of virtual patients rising in parallel, we now have the opportunity to develop entire curricula based on virtual patients, and thereby revolutionize medical education.*"

In addition to eViP-associated events, meetings and symposia, WP4 Awareness & Dissemination has successfully brought the eViP programme to the forefront of the global virtual patient community. The website has provided a robust platform to promote eViP, and to discuss peripheral issues in virtual patient technology.

The policy of publishing articles and interviews about e-learning and VPs in general has resulted in the eViP website being the first port of call for information about virtual patients. Therefore, given the high Google rankings of the eViP website, it is arguable that in addition

to the primary function of hosting the eViP VP referatory the website is a valuable resource for providing information about VPs, and also archiving information about the development of the eViP programme.

Furthermore, it is felt by the eViP partners that in writing and recording interviews with eViP members – from institution leads, professional staff and learning technologists to students – eViP has 'put a face to the name', and made the programme more personal. Where possible, interviews were conducted in the native language of the institution members and English translations were provided. This was to more fully represent the multicultural nature of the project.

WP5 Assessment and Evaluation

The work package 'Assessment and Evaluation' was led by Maastricht University (UM).

What Did We Do?

The aim was to support a process of deliberate repurposing and enrichment of VPs during the eViP project. For this purpose the perceptions of the students ('end users') and teachers were evaluated throughout the project using different specially-developed instruments. A number of steps were taken to carry out this work:

1. Created an initial inventory

As a first step an inventory of existing VP types and VP implementation scenarios within the eViP consortium was created. This provided an overview of what was available and planned for the future. In addition, the inventory raised awareness within the consortium of the main aspects of the development and implementation of VPs. It also became clear that different partners used and interpreted various terms in different ways and that the project would benefit if partners could agree on a uniform terminology for VP elements and aspects. The VPs were categorised (VP types) and various implementation scenarios for the VPs (VP-implementation scenarios) were developed und summarised. As an indirect spin-off, a paper presenting a typology of VPs was published in Medical Teacher, an international journal for medical educators indexed in the Science Citation Index (Huwendiek, 2009).

2. Developed evaluation instruments for VP design and curricular integration

The effective use of VPs requires evidence to guide design and integration, but an evidence base is currently missing (*Cook* et al. 2009). Since no published evaluation instruments were available to gather such missing information, we developed the following four instruments (Deliverable 5.2):

(i) A checklist enabling reviewers such as teachers and authors to characterise the design of a VP in detail;
(ii) A questionnaire assessing students' experiences in using VPs to develop clinical reasoning skills;
(iii) A checklist enabling reviewers to characterise in detail the curricular integration of VPs, and
(iv) A questionnaire to assess students' experiences with the curricular integration of VPs.

The student questionnaires were made publicly available in six languages (English, German, Swedish, Polish, Rumanian and Dutch) via the eViP website (http://www.virtualpatients.eu/resources/evaluation-tool-kit/translated-versions/) and their existence and use were

communicated to the larger medical education community via several international conferences (e.g. ICVP 2009, IAMSE 2009, AMEE 2009, ICVP 2010) and publications (Huwendiek & deLeng 2010). In addition, all eViP partners had secured access to the 'Evaluation of Virtual Patients Database' (EVDB, http://85.12.18.83/evdb) in which they could register VPs and VP scenarios, enter reviews, generate student questionnaires and view and download evaluation results.

3. Evaluated a set of repurposed and enriched VPs

This was completed for five prioritised educational scenarios by large numbers of students and several teachers using the above-mentioned instruments and interviews (Deliverable 5.3).

A set of 15 publicly-available VPs together with relevant documentation (a description of VP and scenario) was intended to give a wider audience an idea of what VPs are and how they can be used for learning. Additional documentation (student and educator experiences with the VPs and scenarios and developer experiences with the repurposing process) showed educators and administrators interested in using these types of VPs and scenarios what is required in order to make VPs work in education.

The following five scenarios were described and evaluated in detail:

(i) Individual self-study using VPs
(ii) Small group discussion after working through the VP (*see Figures 8 and 9*)
(iii) Problem based learning in tutorial group with VPs (Poulton 2009)
(iv) Skills laboratory training following instruction by a VP (*see Figures 10 and 11*)
(v) Assessment with VPs

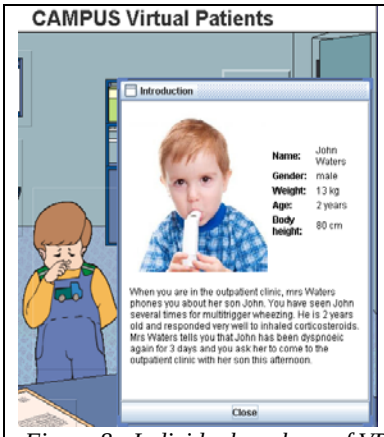

Figure 8: Individual work-up of VP

Figure 9: Group discussion on diagnostic reasoning

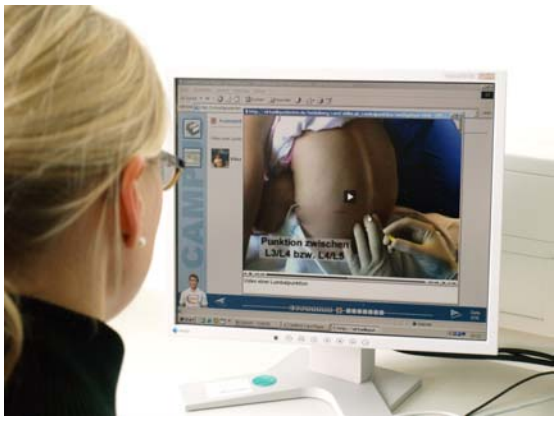

Figure 10: Student working through skills lab VP

Figure 11: Student performing corresponding skill in skills lab

4. Established an Assessment and Evaluation Group (AEG)

The purpose of the AEG was to coordinate the activities of the partners concerning the evaluation of VP designs and VP integration. In addition to regular meetings using a web-conferencing system (Wimba) face-to-face meetings were scheduled during a mini-conference in Maastricht and the ICVP conference in London (*see Figure 12*).

During these meetings the ongoing evaluations at the partner institutions were discussed and their results presented. Focus group studies were also conducted during these meetings with the aim of collecting the partners' experiences of the repurposing process.

This revealed an unexpected but welcome side effect of the repurposing process; repurposing VPs turned out to be a good start for creating new cases. In the first instance, teachers and content experts were willing to put some effort into the repurposing of existing material. Having done so, and having discovered what VPs encompass and which aspects of VPs were of most importance to them, they wanted to create their own new VPs.

The joint evaluation approach with shared instruments generated ideas for multi-centre studies, and many of the eViP partners continue to have an interest in this direction.

Figure 12: Presentation of results of VP research during Mini-conference in Maastricht

Impact and Highlights from Assessment and Evaluation

The work of WP5 has contributed and continues to contribute significantly to the international VP community for the following reasons:

(i) WP5 raised awareness of the importance of the pedagogical aspects of VPs. The viewpoint that a VP only deals with medical content has been abandoned, and more attention is now paid to the educational aspects of cases - i.e. the feedback and prompts in VPs. The widely held notion of VPs as isolated learning material was also discarded. Awareness that curricular integration of VPs is a critical factor for their success in education has created more attention for combining VPs with corresponding teaching events and coordination with other instructional activities. This increased interest in pedagogical aspects was evident during the closing session of the ICVP in London, in which the highlights of the conference were reviewed from both an organisational, technical and pedagogical perspective.

(ii) It is the first reported effort to provide a systematic description of VP design and curricular integration. This enables a consistent description of VPs and their curricular integration across repositories and promotes improved reporting and research on VPs.

(iii) The eViP-developed evaluation instruments allowed comparisons that yielded important and valuable data. This data is in line with Cook's (*Cook 2009*) call for experts in the field of VPs to transform their experience into published evidence using defensible methods, and to share this with the wider medical education community.

(iv) The lessons learned from repurposing and implementing VPs in the five prioritised educational scenarios make it possible to give a wider audience an idea of what VPs are and how they can be used to foster learning. The documentation produced by eViP provides educators and administrators interested in using VPs with information about how to successfully implement VPs in education.

(v) In an effort to optimise learning with VPs, additional technology has been applied and developed, such as: learning activity management systems, electronic polling and aggregation/feedback tools for logged user behaviour (*see Figure 13*), and interactive images and enriched media assets (e.g. synchronous video presentation of handling a stethoscope and the resulting sounds; (*see Figure 14*).

Figure 13: Feedback tool used as input for group discussion

Figure 14: Enriched media with findings of physical examinations with synchronised sounds on video

WP6 Exit and Sustainability

The exit and sustainability of eViP was coordinated by Ludwig Maximilians University and Witten/Herdecke University (LMU and UWH). All project partners contributed, especially SGUL with respect to IPR-model development.

What Did We Do?

The primary aim was to develop a model for the sustained access to products and services from the eViP project. The secondary aim was to provide technical and organisational solutions for this model. As the multiple outcomes of the eViP-project cover a broad variety of fields in the spirit of a 'programme of projects' rather than a single standalone project, best-practice models were derived from the experiences of all project partners.

Furthermore, a joint dissemination and awareness model needed to be developed in tight collaboration with WP 4 to ensure adequate public accessibility to all eViP products and services. Below are some of the key developments relating to the sustainability of eViP:

1. Agreed cooperative business and licensing model

It was agreed that public access to all 320 VPs would be provided via the eViP website (http://www.virtualpatients.eu/referatory/) free of charge for at least three years (*see Figure 15*).

Figure 15: eViP Virtual Patients referatory screen: Searchable access to over 320 repurposed and enriched VPs

Partners agreed that users would need to register with their name and e-mail address before they can access the VP content due to the need to protect IPR and requirements for due diligence. Furthermore, this registration process would potentially allow for continuous communication with users and provide support for community building for all VP providers.

It was also agreed that users would be able to follow the provided links via the eViP website to access VPs through the respective VP systems of the eViP project partners, or to download content packages from the website directly for import in a MedBiquitous standard compliant VP system of their choice.

This dual approach allows for maximum flexibility with respect to how users can best take advantage of the VPs, and takes into account the range of systems and use cases at different educational institutions. It helps to encourage a sustained European culture of various VP delivery systems and networks. A wide range of different VP systems are in use, with some being open-source, and others requiring licensing agreements with the institution or company that provide the system.

The sustained central management of the eViP web pages and repository will be coordinated by the entire consortium.

3. Agreed copyright and intellectual property right (IPR) model

The copyright and IPR model was continuously discussed and developed throughout the duration of the project on the basis of experiences from all project partners and national regulations (Campbell 2009). It was a key prerequisite to include VPs from all partners and to allow for copyright clearance of all different routes of repurposing.

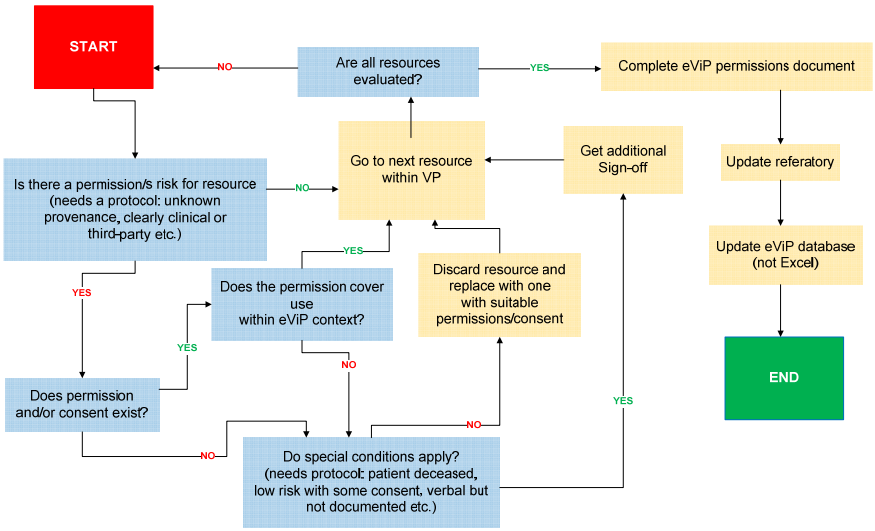

Figure 16: Workflow for VP copyright clearance

The eViP Consent Form Information Sheet and a Performer Consent and Release Form for Virtual Patient Digital Content were jointly developed and can be downloaded form the eViP website (http://www.virtualpatients.eu/resources/common-consent-form/). The legal framework for the use of VPs from eViP is indicated in the eViP website and complies with the Creative Commons approach (see http://creativecommons.org/).

3. Agreed awareness and dissemination model

Finally, the awareness and dissemination strategy for eViP project results is centred on the eViP website (www.virtualpatients.eu). Interest in the site continues to rise, not least due to an increase in cross-linking to the eViP website from many educational organizations and institutions across Europe.

National mirroring efforts of the eViP VP collection (via Jorum Open by the JISC in the UK, see http://www.jisc.ac.uk/) in the partner countries and cross-linking (e.g. MedEdPORTAL, see www.aamc.org/mededportal and SimShare: http://www.simshare.org.uk/project.php?id=55) has already begun, and should contribute to the visibility and use of the VPs from the eViP project. Cross-linking and mirroring will be continued after the end of the project as part of the sustainability concept.

Highlights from WP6

One of the highlights was the collection and exchange of copyright and IPR-models from the project partners with respect to the different national regulations. Based on these different experiences, a differentiated model for both IPR clearance of existing VP embedded educational materials and of newly created media was developed, discussed and agreed upon.

A second highlight was the open and critical discussion of the sustainability models of each of the project partners which took place during all project meetings, especially in the final year of the project. Ultimately it became clear that the eViP project partners represented different institutional and cultural perspectives, and that this wide range of viewpoints led to a

complementary and jointly agreed model for the long-term availability of products and services through the eViP-web page for a large European and global audience.

Impact of Exit and Sustainability
The internationally agreed copyright and IPR-model is now widely used in the community of medical educators working with VPs and serves as a reference model in the field. This approach will potentially help to foster multi-institutional and international VP development and repurposing.

The sustainability activities for eViP products and resources, which mostly centre on the eViP website, have the potential to prove successful in both the mid- and long-term. In particular, the 320 publicly available VP content packages can form the basis for a widely adopted European VP-curriculum for medicine and other health professions that will grow and be further differentiated according to the specific target learner audience.

The competence and network quality that was developed during the eViP project enables all project partners and the European and global medical community to improve the educational, technical, and economical quality and effectiveness of VPs.

A key lesson learnt from eViP is that neither the perfect technical solution, the perfect content, nor an optimally structured educational scenario would lead to successful and broad adoption of VPs in medical education. The eViP community believes that the combination of open access to high-quality VP content and technical and educational consultancy services represents the best path to the widespread adoption of VP content. It remains to be further determined which blend of these three components is needed for different educational contexts in the medical education community and how to ultimately measure and document success across learner groups and institutions with respect to VP use.

WP7 Project Management

This work was coordinated by St Georges University of London, UK

What Did We Do?
The project management of eViP was coordinated by St George's, University of London (SGUL).

The primary aim was to provide an agile framework for all the partners to conduct their research as per the agreed project plan. The secondary aim was to ensure the entire project adhered to the key milestones, and to make sure eViP deliverables were produced to the agreed time, cost, and quality.

In order to achieve a cohesive approach to the overall management of the project, all Work Package (WP) lead partners managed their respective work packages and deliverables. Therefore eViP was always considered to be more of a 'programme of projects' than a single standalone project.

From the project inception, one of the key challenges of this WP7 was to provide a structured framework (using PRINCE2 and MSP project methodologies) for all partners to work within whilst ensuring that there was scope within this framework for creative freedom - this is

essential in the ever-changing arena of embedding state-of-the-art Virtual Patients (VPs) in medical and healthcare curricula.

In order to maintain the fine balance between structure and creativity, the following steps were implemented:

1. Implement a robust Project Management Structure
In the first instance, a robust project management structure was established at the outset, under the leadership of a project director, and under the specific direction of a project steering group. This steering group comprised the principal investigators from each of the eViP partner institutions. A project manager who was responsible for the overall management of the project was also appointed. Once this high-level organisation was agreed, partners were then free to assert their own expertise when recruiting their institutional project teams.

The success of any project depends on the people involved. In our case, one of the project success factors was to empower institutional partners to recruit staff to their project team based on an area of expertise which the other partners did not have, whether it was academic, technical, research, administrative or management. Subsequently, each partner had their own strengths. It was therefore the stitching together of this myriad of skills which ultimately made for a successful project.

2. Create effective communication mechanisms
For the second step, effective communication mechanisms were created. Due to the pan-European dimension of eViP, the communication mechanisms had to serve both synchronously and asynchronously at all times. In addition to face-to-face meetings, the partners agreed on a number of methods and tools to facilitate communication over the course of the project. These included regular project team meetings using a web conference system such as Wimba (*see Figure 17*), monthly status reports, small group specialist meetings using web chat (Skype), project wiki (DokuWiki), 6-month progress reports and annual reports.

There was a general feeling that the first year of the project was perhaps the most crucial in eViP's lifecycle, and consequently a lot of effort from a project management perspective was dedicated to the first year. For example, there were regular fortnightly project team meetings in Wimba and regular weekly specialist meetings in Skype throughout the first year.

However, as the project progressed, the team successfully transitioned from a period of 'familiarisation' in the first year to a more 'hands-on and process driven' approach in the second year, which concluded with a 'wrap-up' period in the final year. By the final year, the communication mechanisms agreed at the outset were still operating, but the frequency in which this was done decreased accordingly as the project team morphed from being a group of individuals with expertise to a coherent family of expertise in unison at all times.

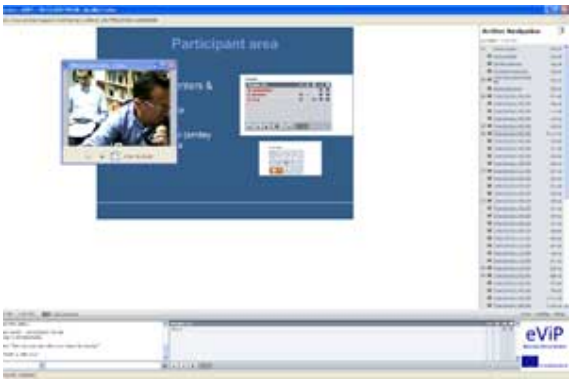

Figure 17: Example of eViP team meeting in Wimba

3. Monitor the project progression

Monitoring of the project was also considered to be an important success factor for eViP. Often projects can slip in terms of cost, quality and schedule. So, keeping a close eye on proceedings and budget from the outset, without being too regimented and dictatorial was imperative. Working with a large number of people from a wide range of backgrounds – from academics and technical staff, to tutors and students – all of whom have very different methods of working, may often introduce slippage in projects of this nature. The entire team addressed any potential issues by adopting a malleable approach to monitoring the project, with different 'rules of engagement' for different project members. Arguably, the monitoring phase of the project was the most interpersonal element. To their credit, all partners accepted our mixed approach to monitoring the project. Information from team meetings, WP specialist meetings, progress reports, and monthly status reports gave the team enough information to monitor the project from start to finish, and intervene with appropriate solutions where necessary.

Figure 18: Example of an eViP project plan

4. Consider perceptions of the wider community

Finally, with eViP working towards ultimately benefiting medical and healthcare education, it was imperative that the project management took stock of, contributed to and reacted to the perceptions of the project from the wider community. As such, the management was involved in the organisation of major conferences (e.g. the International Conference on Virtual Patients and the MedBiquitous Annual Conference), workshops (e.g. AMEE and Ottawa), publications (e.g. Medical Teacher/Education journals), Bio-Algorithms and Med-Systems Journal and Higher Education Academy Newsletters).

Figure 19: eViP Director presenting at the ICVP MedBiq conference in London, April 2010

Highlights from WP7

One of the project management highlights was the organisation of the International Conference on Virtual Patients (ICVP) and MedBiquitous (MedBiq) Annual Conference, London, April 2010. [LINK: http://www.medbiq.org/events/conferences/2010/index.html]

This eViP-led conference was the second in the successful ICVP series, with the first being held in 2009, organised by Jagiellonian University, Krakow, Poland. It also combined similar efforts in this field from North America by hosting the established MedBiquitous Annual Meeting.

The co-hosted ICVP & MedBiquitous event, held at County Hall, London, UK, attracted some of the most prominent names in Virtual Patients, E-learning, Web 2.0 & Social Networking. The eViP project management team, supported by the eViP partners and MedBiquitous colleagues organised the entire two-day event, and feedback from the attendees was overwhelmingly positive. The event's success was confirmed at the conference awards reception hosted by MedBiquitous, where the eViP project management won the MedBiquitous award for Managerial Excellence 2010, a highlight in itself.

Virtual Patients were at the forefront of medical education from 2007 to 2010 and the success of this event was testament to the eViP project for raising the profile of curriculum reform using state-of-the-art innovation.

Figure 20: MedBiquitous award for managerial excellence in London, April 2010

However, the biggest highlight from a project management perspective was working as part of a successful 'team', in the truest sense of the word. Great teams are hard to come by, and a

good team with a wide range of expertise requires cooperation from everyone involved. Of course, over the past three years there were disagreements in the project that presented challenges when trying to reach a majority consensus. However, the humble nature of the project partners and their ability to eloquently convey their views, take the lead where necessary and at other times make compromises for the sake of the project, made for a smooth and trouble-free process in terms of project management.

Figure 21: The eViP project team

The impact of project management

Previously, a number of academic research projects were managed by the academic staff themselves. This often caused problems when it came to general everyday project management tasks. Academics are trained to teach and conduct research, therefore asking them to take on the additional task of professionally managing projects could be considered unreasonable.

In our experience academic staff generally prefer to adopt a less regimented approach regarding their teaching and research, preferring a more open reflective approach that is not confounded by boundaries. On the other hand, members of staff involved in areas of technical development tend to be more accepting of a structured and focussed approach to their work. This is reflected in the fact that technical projects often follow recognised methodologies.

Therefore, a project like eViP required a unique managerial approach which best utilised the expertise from both academia and technical development. A new style was adopted which was fluid enough to meet the needs of our academic members, but also was rigid enough to meet with the needs of the technical developers.

Many of eViP's project management approaches and tools are already available from the project website, www.virtualpatients.eu. However, below are listed examples of scenarios that illustrate this new type of management:

- Depending on the nature of the work, different approaches were taken to plan the work and any sub tasks. For the more technical work, the eViP partners chose to adopt a dependency-based Microsoft project plan with sequential and interdependent tasks in a chronological order. Whereas, for the academic research tasks, partners chose to identify high-level tasks with set deadlines, but also agreed to be flexible when needed. However, the most popular model was a hybrid of the above two which better reflected the symbiotic nature of the eViP project.

- An 'open door management' policy was in operation at all times. A three-year project of this nature would undoubtedly encounter changes to scope based on external factors. This applied especially to the field of new media where technology and tools change frequently (e.g. the emergence of Twitter and Wimba). It was important to keep abreast of these external changes and incorporate them whenever it was advantageous, without losing the focus of the project. An open door policy allowed partners to intervene at any time and propose new ideas which, whilst above and beyond the original scope of the project, would be for the ultimate benefit of the project (for e.g. adopting an open Creative Commons License for the eViP VPs at a time where the Open Educational Resource community was particularly active across the world). This policy ensured that eViP was always applying current and relevant state-of-the-art technologies.

- A transparent approach was adopted to ensure that all partners were party to all project information at all times over the course of the project lifecycle. In the past, some projects may have taken the view that sensitive information, such as budgets and Intellectual Property Rights (IPR) were handled in private between relevant individual partners. This was not the case with the eViP consortium. It was agreed from the outset that everything would be transparent and open to all, including a comprehensive consortium agreement which was agreed and signed off by all partners.

- In advance of major conferences, the partners would gather and adopt a common unified stance on the 'eViP vision' so they could better inform the conference delegates and interested parties about eViP and its progress. One exercise was the 'elevator pitch', where depending on the type of audience (technical, academic or political), the partners took 30 seconds to describe the eViP programme to a 'stranger'. The aim was to entice the 'stranger' into finding more information about the project. After some deliberation, this approach was successfully adopted by the team before major conferences.

These are just some of the different ways in which eViP management strived to innovate using different approaches, whilst ensuring that the approaches were successful. Of course, over the three years not all the approaches were successful, but these were soon shelved if proven to be ineffective. After all, this was new to all of us and we were all working in unchartered territories.

d) Conclusions & Recommendations

In May 2010, the eViP project achieved its primary objective, the creation of a bank of virtual patients adapted for multi-cultural and multi-lingual use. By that time, the eViP project had then exceeded all the expectations of the partners.

During the course of the project the partners developed a number of processes to enhance the value and relevance of these VPs for reuse across the European Union. The first of these, and essential for the sharing of virtual patients between partners and non-partners with their own authoring systems, was the creation of a common standard for Virtual Patients. This standard would be developed in conjunction with the central organisation in Healthcare standards, MedBiquitous, and would prove to be a necessary device for moving VPs between major authoring systems used in Europe (Campus, Casus, OpenLabyrinth, WebSP and dSim).

Clearly both the authoring systems and the virtual patients needed to be adapted to meet a common standard which would allow virtual patients be exported from any of these major systems and imported into another.

The associated collaboration of eViP with MedBiquitous brought together these two groups so successfully that the 2nd International Conference was held in conjunction with the Medbiquitous Annual conference which was held in Europe for the first time, in London 2010.

Initially, it would have been easier to ignore the standard, which was time-consuming to create and implement, and to simply repurpose the cases manually. This would have failed to achieve a long-lasting consensus in the community, a consensus which made it possible to move VPs from one authoring system to another. It would also have prevented an additional objective from being achieved; that of allowing the embedding of VPs into new curricula, even where alternative VP authoring systems were being used. In other words, eViP was not prescriptive, enabling a diverse range of VP author/player systems to flourish so that each could take its place with its own particular advantages for specific pedagogic purposes.

Subsequently, using the import/export features of the authoring systems which were conformant to the standard, eViP was able to complete its central task of creating a bank of virtual patients adapted to a wide range of uses, languages and cultures through selection and repurposing from partners' existing collections. From May 2010 these VPs were shared, free of charge, with the wider community, via the eViP website which carried a rich collection of guidelines, learning content, news and information for the medical practitioner interested in VPs.

However, even before the bank had been created, eViP achieved unexpected outcomes of even greater significance in medical education; outcomes which had a profound effect upon the use of VPs across the world. Unexpected benefits arose, almost before the project had started, from the continual dissemination by partners of VPs, VP uses, and VP authoring systems.

Firstly, the eViP partnership had changed the way in which institutions around the world viewed the value of VPs. It became accepted that VPs represented a new generation of scenario-based learning. Partners found themselves heavily involved in disseminating VP approaches, values, and uses not only throughout the European states but across also the world. In all major international meetings related to the field, there was approximately a 5-10 fold increase in virtual patient presentations.

Secondly, the eViP programme was fundamentally based on the principle that virtual patients were expensive to make, and therefore it was important to recycle virtual patients across Europe through the creation of a repository of VPs. In retrospect, it was perhaps to be anticipated that an outcome of the project activity would be a streamlining of the creation process; VPs became relatively cheap to create, taking perhaps between 10 and 40 hours. As a consequence, the value of repurposed virtual patients to new users changed, and over the last year partners have been witnesses to that change. It is now much more common for teachers and institutions to look at virtual patients which are offered 'for free', and to then use these virtual patients as training exercises and examples in order to generate, first their own repurposed content and secondly, their own new content from scratch.

In many ways this is an ideal outcome, leading to the continued development and, hopefully, the widespread sharing of new and inexpensively-constructed content.

Recommendations:

A. Network of Excellence

During the time of the project, the eViP group set up what was in effect a network of excellence. The supporting elements for this network were:

(i) The regular meetings;
(ii) The close collaboration required to carry out steps within the project;
(iii) The attraction of specialist working groups for different interests and skills across the eViP partnership;
(iv) The funded support for a high quality website acting as a route for communication and dissemination across a wider VP community.

The ideal outcome would be a sustainable Network of Excellence, funded beyond the lifetime of the eViP project, to capitalise upon the developments in VPs and the large emerging community of users which have begun to have such an impact upon medical education. This would be analogous to the 'Virtual Physiological Human' network, with perhaps one important addition being that this potential network is already grounded in practice with its tools already embedded in medical education.

B. The extension of scenario–based learning to patient modelling, for education and clinical practice

There has been a growing awareness that pedagogical training needs to mimic as closely as possible the role of the practitioner and provide learners with self-directed personalised learning opportunities.

The movement towards a more modern scenario-based decision-making style of learning, with direct training in clinical and communication skills, and professional development is a step in the right direction, but far more needs to be done. Technology and VPs have provided us with excellent solutions to looming problems in medical training.

The next steps beyond the VP should be to develop increasingly immersive patient simulations in virtual clinical environments, to:

(i) Provide a realistic immersive working environment for confident and safe practice; and
(ii) Form the basis of a scenario-based learning common European curriculum.

Linked to this would be long-term, multicentre, multidisciplinary assessments of the impact of hi-fidelity clinical environments on learners, from pre-intake to established practice.

This approach could draw upon the huge but fragmented strengths across Europe in the underpinning technologies needed for patient modelling viz. anatomical and physiological e-simulations, interactive virtual patients and virtual clinics. Such a programme would revolutionise medical training by placing the patient – both real and virtual - at the centre of the educational process, and would provide safe practice to protect against reducing opportunities for learners to rehearse their future competencies.

It would provide an ideal multidisciplinary research environment (in arts, humanities and sciences) for evaluation of both medical training and treatment. In terms of competency training, it will also provide a consistent control mechanism for the cost of medical and healthcare education.

e) Implications for the future

After several nationally-funded projects to stimulate the broader educational use of VPs in medical education, eViP was the first European project of its kind. It collated the experience and ideas of major players in the field of media-supported education with patient examples, bringing the level of exchange with respect to content, cultural diversity, technical standards and educational approaches to a new level.

The basic yet innovative idea of sharing resources within Europe and the world and adapting them to local needs and circumstances was exemplified by the eViP programme. This model, which led to a substantial number of usable educational materials in the form of VPs accompanied by instructions and tools detailing how best to use them, could be transferred to other educational scenarios and to fields other than medicine. The differing experiences of the eViP partners with regards to their implementation and integration of VPs in medicine, and the unique viewpoint that exchanging this knowledge has provided, could be considered to serve as best practice in itself.

The impact and outcomes of the eViP project warrant further careful attention and evaluation, and results obtained from the eViP project could form the basis of further sound educational research projects.

It is crucial to better understand the factors that foster learning with VPs in the context of medical education with its multiple needs and competencies. Through eViP we have seen the development of a sound international network of experts who will be in the centre of such follow-up research activities. These activities should be multi-institutional and contribute further to the sustained use, upgrading, adapting and enlarging of VP collections within Europe and the world.

It is noteworthy that eViP exemplified the leading role of European academic institutions in the field of VP development and delivery to the individual learner and teacher. It remains a permanent challenge to find the right balance of public and private incentives and activities to further develop and seamlessly integrate VPs in the learning environments of the future. Those environments will cross boundaries between primary, secondary and higher education and will also cover postgraduate professional learning.

VPs and related resources from eViP should support the process and also stimulate new Inter-professional communities of learners – both face-to-face and virtually.

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