

## Open Labyrinth – a Web Application for Medical Education Using Virtual Patients

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### Abstract

The aim of this paper is to present an application, implemented and used at “Iuliu Hatieganu” University of Medicine and Pharmacy Cluj Napoca for medical education, The application, called Open Labyrinth is an open source, web based application, developed using ASP technology, very useful for medical education using virtual patients technology. All the virtual patients developed using this application are MedBiquitos compliant. This application was implemented at University of Medicine and Pharmacy “Iuliu Hațieganu” Cluj-Napoca, part of eVip Project. There were developed four virtual patients, three of them were included in eVip database. The user friendly interface, the compliance with the standards, the level of IT knowledge request for the case developers make this application a useful tool for medical education at the clinical level.

**Keywords:** Virtual patients; Medical education; Labyrinths; eVip.

### Introduction

One of the goals in medical education on undergraduate level is to enable the students to identify and solve clinical problems. For this, the students must interact with the patients, and this experience is blended with traditional lectures and small group tutorials. But the issues of safety, the legislation, the patients punctual reactions, limit this interaction, and because of this, the medical education for the students is not the best that could be offer.

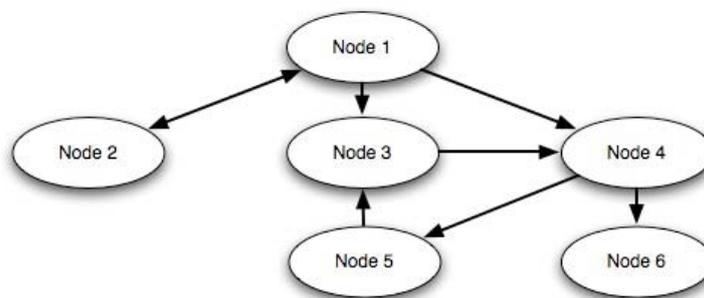
A solution for this is to use simulations instead of real patients. One of the most suitable technologies for this is the use of virtual patients. Virtual Patients are interactive computer applications that simulate real-life clinical scenarios, providing an effective way for the healthcare professionals or medical students to not only learn of clinical topics but also to practice in a virtual and therefore safe environment [1].

### The Application

OpenLabyrinth is an open source online activity modeling system that allows users to build interactive ‘game-informed’ educational activities such as virtual patients, simulations, games, mazes and algorithms. The original Labyrinth application was originally developed by the Learning Technology Section of the College of Medicine and Veterinary Medicine at the University of Edinburgh and latest version includes work from the Northern Ontario School of Medicine and the University of Edinburgh as well as input from St Georges University of London, England and the University of New South Wales, Australia [2].

The principal object in Open Labyrinth is the map or the labyrinth. A map has a series of global properties such as the map type (game, maze, algorithm, etc.), authors, real timers, visual appearance, scores, counters, etc. Within each map there are a series of linked pages, named nodes, defining the

options available to the user. The node is the unit of presentation to the user, most of the time being a webpage. Although a map may have just one node, typically it will consist of many interconnected nodes. Figure 1 shows a diagrammatic representation of a simple labyrinth consisting of six nodes [3].



**Figure 1.** A diagram of a simple Open Labyrinth map with six nodes

Considering the navigational model, a virtual patient designed in Open Labyrinth could be represented by a graph consisting of nodes interconnected by edges representing the potential decisions of the learner. Completing a case requires choices to be made at key scenario points with the consequences of these choices affecting the final path through the case [3].

The virtual patients developed using Open Labyrinth are conform with the MedBiquitous Virtual Patients Specifications [4].

The implementation of Open Labyrinth was part of eVip: Electronic Virtual Patient Project, founded under eContentplus Programme [5,6], project in which University of Medicine and Pharmacy “Iuliu Hațieganu” was partner. This application was the second virtual patient application implemented at the University, after the successful implementation of Web-Sp application [7], part of the same project.

Being a web based application written using Active Server Pages technology for installing Open Labyrinth it was necessary a proper Microsoft based server, having Microsoft Windows 2003 Server as operating system and Microsoft SQL Server 2005 as database server. The application was running in Internet Information Services and it was necessary to use a ODBC connector to join to the database.

Before using the application, each user has to log in using a username and a password, and depending of the user’s role in application (student or map creator), the user can perform different actions. Figure 2 shows the interface for a user who has the labyrinth creator role.

There are four different ways to create a labyrinth, as it is shown in figure 3: starting from zero, importing a MedBiquitous compatible virtual patient, importing a VUE map or duplicating an existing labyrinth.

At its core, the Visual Understanding Environment (VUE) is a concept and content mapping application, developed to support teaching, learning and research and for anyone who needs to organize, contextualize, and access digital information. Using a simple set of tools and a basic visual grammar consisting of nodes and links, the users can map relationships between concepts, ideas and digital content [8].

The application’s interface is very user friendly and intuitive, the user didn’t has to have advanced IT knowledge, only to have basic skills about internet navigation. Each object of the map can be accessed using a direct link, visually represented, directly from the labyrinth’s main page – Figure 4.

Each node could be very easy identified, using lists or visual representation of the labyrinth – Figure 5 and the application has a HTML editor on which the user can edit the content of the node.

The implementation of Open Labyrinth at University of Medicine and Pharmacy Iuliu Hațieganu is available on <http://curriculum.medicina.umfcluj.ro/ol>.



Figure 2. Open Labyrinth interface



Figure 3. Creating a labyrinth

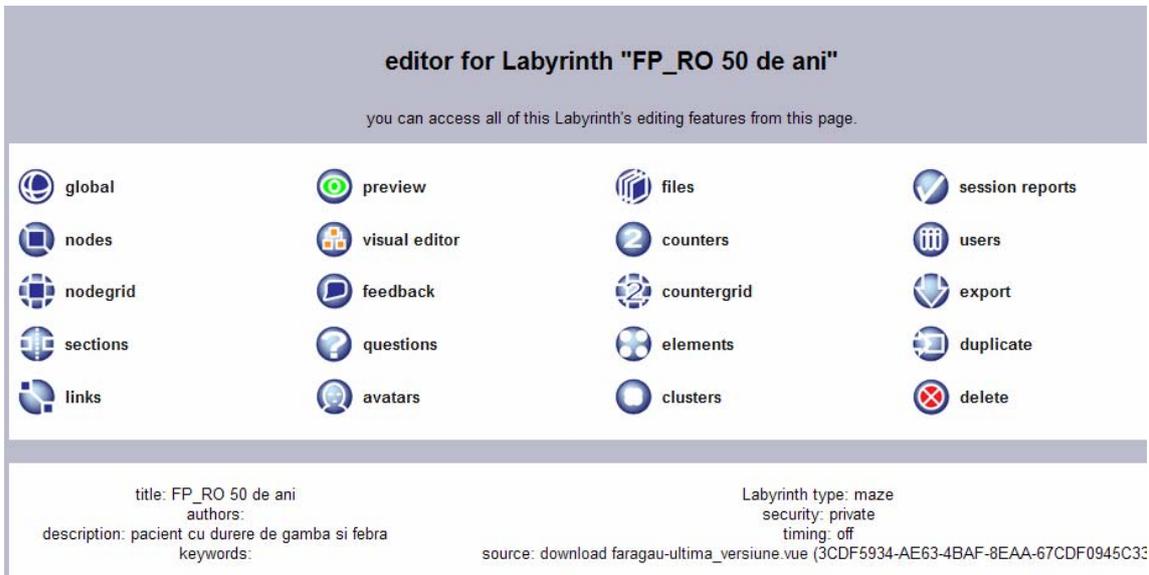


Figure 4. Elements of a labyrinth

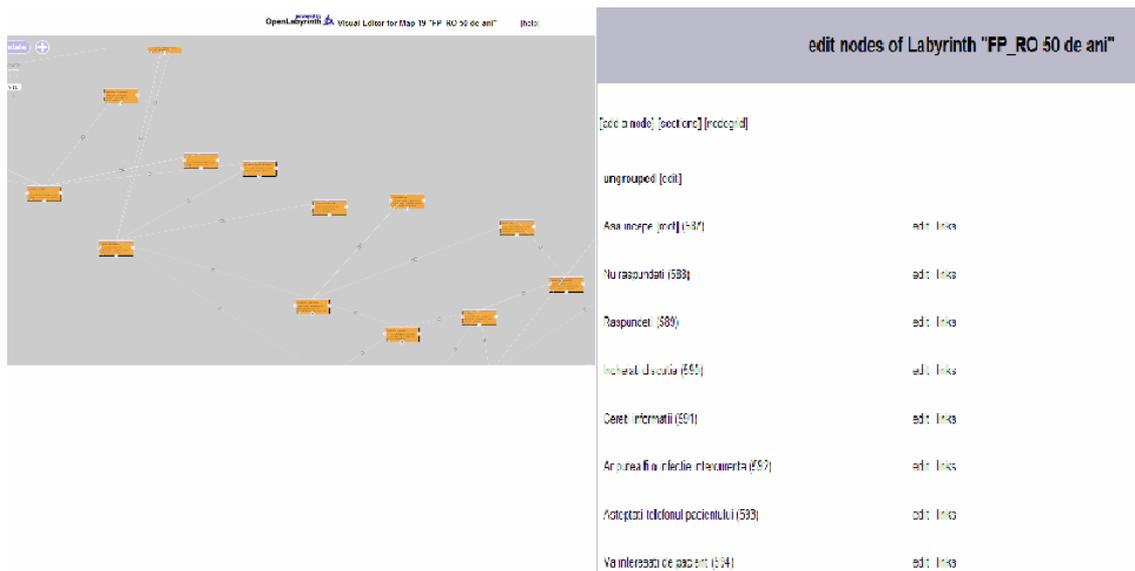


Figure 5. Two ways of identifying nodes into a labyrinth

### The Use of the Application

Since the ending of the implementation, there were developed four virtual patients, and three of them were included in the eVip project database. More than 100 users were enrolled and the four virtual patients were used for the course of Medical Education, for the students in 4<sup>th</sup> year, Faculty of Medicine. More information about the patients are presented in the table 1

Table 1. Virtual patients details

VP No	VP Description	No nodes	Language	Accessed by (no. of sessions)	Included on eVip Referatory
1	Male patient 50, years old, Lower limb infection, infectious endocarditis and sepsis in a male with diabetes	60	Romanian	99	Yes
2	Female patient, 61 years old, patient complaining of back and knee ache	44	English	24	Yes
3	Female patient, 61 years old, with hypercalcemia and parathyroid tumor	44	Romanian	49	Yes
4	Female patient, unknown age, serious tumor	13	English	9	No

The author of the cases has the possibility to monitor the access to the virtual patients that he is authoring, as well at global or individual level. Open Labyrinth permits graphical presentation of the number of decision per session, time taken per session and terminal nodes chosen per session – Figure 6 – at the global level and the way that specific user pass into the labyrinth at the individual level – Figure 7.

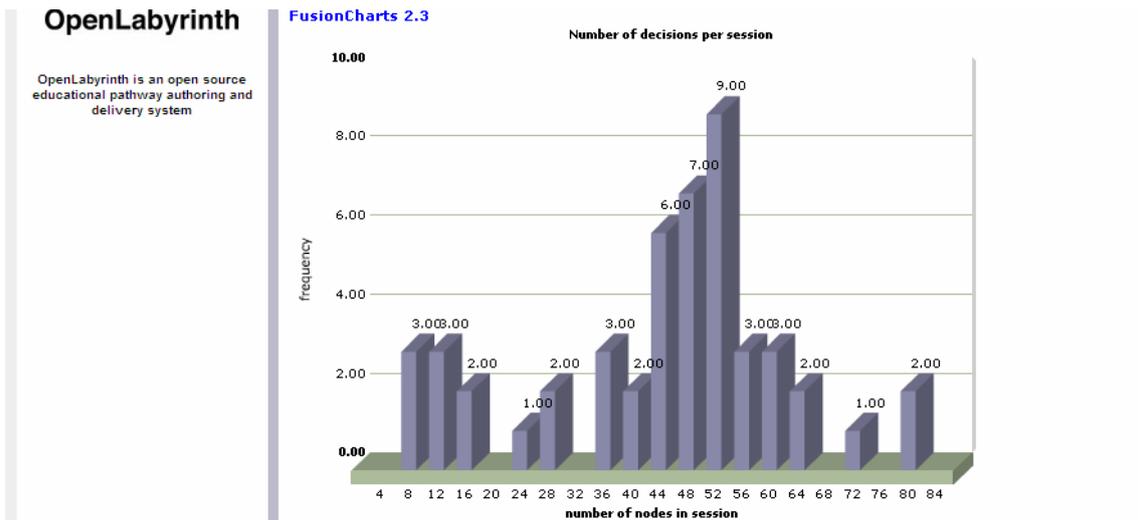


Figure 6. Graphical representation of the number of decision per session

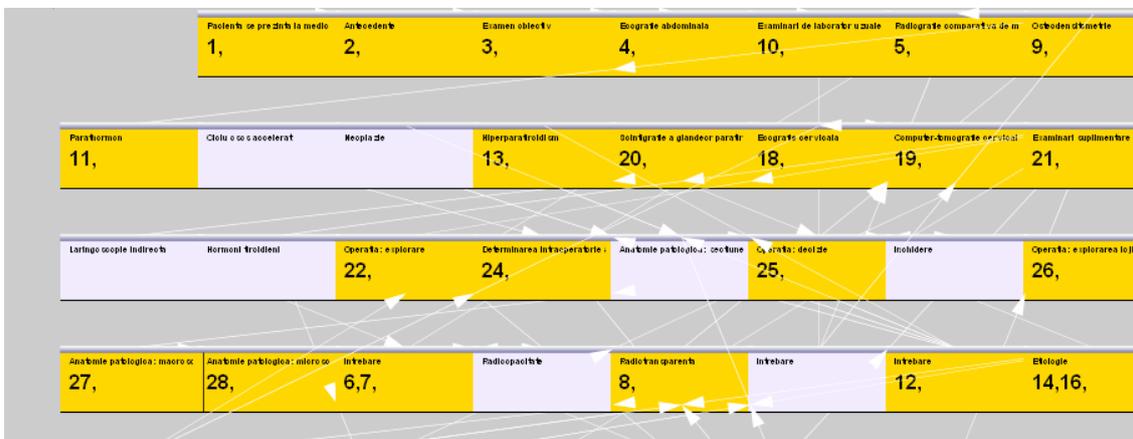


Figure 7. Graphical representation of a session

## Conclusions

In conclusion, the use of Open Labyrinth is a very good application for medical education using the virtual patients technology, and the implementation of this application was a success. More than 100 students used this application. The students seem to enjoy most the caser written in Romanian languages, the two patients in Romanian language being accessed four more times that the two virtual patients in English language.

As well, the very user friendly interface made possible the use of the application by the persons who have basic IT skills (in fact, only internet browsing skills are mandatory).

Because of the generality of the labyrinths, this application could be use to describe multiple pathologies, being easy to be integrated in University curricula for different courses, at the medical level.

## Conflict of Interest

The authors declare that they have no conflict of interest.

## References

1. Zary N, Virtual Patients for Education, Assessment and Research. A Web-based Approach; Karolinska Instituted 2007 pag. 4.
2. \*\*\*, Open Labyrinth User Guide v2.4 [online] [Accessed November 2010]. Available from: URL: <http://142.51.75.17/documents/userguide.pdf>
3. \*\*\*, Labyrinth Documentation and User Guide v1, [online] [Accessed November 2010]. Available from: URL: [http://labyrinth.mvm.ed.ac.uk/documents/labyrinth\\_userguide.pdf](http://labyrinth.mvm.ed.ac.uk/documents/labyrinth_userguide.pdf)
4. Zary N, Hege I, Heid J, Woodham L, Donkers J, Kononowicz A, Enabling Interoperability, Accessibility and Reusability of Virtual Patients across Europe - Design and Implementation, Medical Informatics in a United and Healthy Europe, K.-P. Adlassnig et al. (Eds.), IOS Press, 2009. pp. 826-830.
5. Azan B, Smothers V, ANSI /MEDBIQ VP.10.1-2010 MedBiquitous Virtual Patient Player Specifications and Description Document. [online] 2010 [Accessed November 2010]. Available from: URL: [http://www.medbiq.org/working\\_groups/virtual\\_patient/VirtualPatientPlayerSpecification.pdf](http://www.medbiq.org/working_groups/virtual_patient/VirtualPatientPlayerSpecification.pdf)
6. eVip Project. [online] [Accessed November 2010]. Available from: URL: <http://www.virtualpatients.eu/>
7. Europe's Information Society – Thematical Portal: eVip. [online] [Accessed November 2010]. Available from: URL: [http://ec.europa.eu/information\\_society/apps/projects/factsheet/index.cfm?project\\_ref=ECP-2006-EDU-410030](http://ec.europa.eu/information_society/apps/projects/factsheet/index.cfm?project_ref=ECP-2006-EDU-410030)
8. Călinici T, Muntean V., Achimaș A. WebSp- Informatics Application for Training in the Medical Domain. Applied Medical Informatics 2007;21(3,4):69-72.
9. 7 things you should know about... Data Visualization, EsuCase 2009. [online] [Accessed November 2010]. Available from: URL: <http://net.educause.edu/ir/library/pdf/ELI7052.pdf>