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AprendIS: a tool for (in)formal learning in Health Informatics

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Abstract

Introduction The popularity of wikis has increased in the last few years, particularly in education. By allowing collaboration and information sharing, wikis can be used as a tool for lifelong learning. Health Informatics, as a field in permanent transformation, offers particular challenges that can be better tackled if access to centralized information and support to collaboration is possible. By adding semantics' strengths to wikis' features, such thing is possible.

Aim This paper aims to present the development of a Semantic MediaWiki on Health Informatics - *aprendIS*: a place for information and knowledge sharing, and virtual collaboration of the Portuguese speaking community.

Methods A survey has been conducted on students and teachers in health informatics in Portugal and Brazil to evaluate the need for a wiki in health informatics and to assess the most important subjects to address in such a platform, and a first structure of the Semantic MediaWiki was developed, based on the opinion of the respondents.

Results Results show that more than half of 11% of respondents are interested in contributing with content and in using the wiki, and that there is a consensus in what the respondents expect to find in the wiki: the most voted subject was Health Information Systems.

Conclusion According to the survey conducted, students and teachers of Health Informatics are definitely interested in a Semantic MediaWiki such as *aprendIS*. Our proposal builds such a tool according to the needs and wants of those students and teachers.

Keywords: Wiki; MediaWiki; Semantic MediaWiki; Semantic Web; Formal Learning; Informal Learning; Collaboration; Collective Intelligence

1. Introduction

Users add value [1]. This belief that people matter and that their participation in content is the central focus of the Web is the main characteristic of Web 2.0 (even though this is only one perspective on Web 2.0) and, more particularly, the main idea of its collaboration tools. And wikis are the main example of collaborative approaches today.

A wiki (from the Hawaiian wiki, to hurry, swift) is a collaborative Web site whose content can be edited by anyone who has access to it. Perhaps, the best example of a wiki in action is 'Wikipedia – The Free Encyclopedia' [2, 3]. In fact, wikis can be used as a source of information and knowledge, as a method of virtual collaboration, as a way of sharing dialogue and information and even as a way of learning [2]. They allow different users from around the world to work together, enabling the constant development and enrichment of information online. In fact, by using these kinds of tools, people assist with their

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development and are part of the "collaborative intelligence" which is harnessed to make the services better and more responsive [4].

The popularity of wikis has increased in the last few years, and we are right now experiencing an exciting time in wiki history with wiki software being freely available by the dozen and a new wiki community being created every day. [5] This is particularly true in education. Indeed, wikis architecture of participation offers students ways of learning in an environment that is much more in line with their normal ways of learning now [6], and much more personalized. Nevertheless, wikis are not just interesting tools to integrate in academic environments (the so called 'formal learning' environments), but also in non-formal learning practices, i.e., learning practices developed in two-way interactive process in-between individuals, and in-between individuals and the surrounding context [7]. This means that learning is not limited to an academic context, rather it can happen at any place, at any time. Wikis, as the real collaborative tools of today, enable such learning processes and promote real lifelong learning. By being a part of a virtual community and participating in its activity, people learn, and this can happen in an academic context or any other environment, at any given point in time.

The field of Health Informatics is one in permanent development and change. Challenges are faced by health informatics' professionals every day, and for that it is extremely important that information and knowledge are accessible whenever needed. Furthermore, being such a broad field of knowledge, different competencies and skills are necessary to overcome these daily challenges and to provide good services and products, making it that much more important to promote and facilitate collaboration. However, information is scattered all over universities, businesses and citizens. A wiki could be a great platform to centralize this information and to support collaboration and sharing among institutions, businesses, clients, students, teachers and other professionals in the Health Informatics field. And by adding semantics, this platform can be further improved. The fact is, wikis are not without limitations – wikis do not support structured access, for they provide no means for navigating related information, as well as automatic information reuse, since information is only represented in natural language. But adding semantics to wikis, through metadata annotations, addresses these issues. Structured information retrieval by querying, automatic reuse and database-like views of the information become possible. [8]

Gathering all the information in Portuguese about Health Informatics is, then, the aim of *aprendIS*, a Semantic MediaWiki presented here. Its intention is to harness collective intelligence from students, teachers, professionals, institutions and clients who are interested and/or actively involved in the field of Health Informatics in the Portuguese speaking community.

2. Objectives

This paper aims to present the development of a Semantic MediaWiki on Health Informatics – *aprendIS*, based on the results of a survey made to students and teachers of Health Informatics in Portugal and Brazil.

2.1. Study A

The main goal of **Study A** is the assessment of potential participants' opinion on *aprendIS*, that is, if they are indeed interested in a Semantic MediaWiki on Health Informatics.
Other objectives of this study are:
- Assessing which contents are considered most important to include in the platform
- Determining if the respondents are willing to actively participate in the creation of content
- Determining if the respondents are willing to use/consume the contents in *aprendIS*
- Trace a profile of the prospect users of the wiki

2.2. Study B

The main goal of **Study B** is creating a first version of a wiki page, with focus on the definition of semantics.
Other objectives of this study are:
- Defining the structure/display of wiki pages
- Defining semantic categories
- Defining semantic properties
- Defining semantic forms

3. Study A

3.1. Methods

The subjects of the survey were:

N (Respondents; Response Rate)		
	Students	**Teachers**
Masters in Medical Informatics UP	158* (39; 24,7%)	18 (5; 27,7%)

Masters in Management of Medical Information Systems IPL	25 (10, 40%)	-
Biomedical Informatics USP	Between 262 and 375 (- ; -)	
Biomedical Informatics UFP		
Total	Between 463 and 576 (64; 11,1% to 13,8%)	

*Estimated number

The survey contained 10 questions, where the first two asked which were the most important functionalities and topics of information to include in the wiki; the third and fourth questions asked if the respondent had ever performed a professional activity in Health Informatics and which one; question 5 asked how much time were the respondents willing to dedicate in adding and using the wiki.

Questions 6, 7 and 8 of the survey contained demographic information regarding the respondents' age, gender, educational level and area of training. The last two questions aimed to differentiate between students and teachers.

To ensure the suitability of the survey instrument, it was administered to a pilot group of 6 students of the Masters in Medical Informatics from UP with different training backgrounds. Participants provided written and oral feedback on the clarity and structure of the survey. Apart from minor suggestions on the structural organization of the survey, no recommendations were made to the improvement of clarity or suitability.

The survey was sent electronically, at a first moment to institutional emails of students and teachers of UP and IPL in November 2013.

Given a low number of responses, the survey was sent once again, in December 2013, through the same means as before. Because the survey was anonymous and the respondents could not be identified, a message was added informing the ones who had already answered not to answer again, in order to avoid repeated responses.

In February 2014, the survey was sent to the Brazilian students and teachers via institutional Facebook groups, at a first moment, and then sent via institutional email, again with a warning to those who had already answered.

Descriptive statistics were used to analyze the responses. All items were closed-ended, apart from questions 4 and 6.

3.2. Results

Question 1: From the list below, chose the functionalities you consider most important to incorporate in aprendIS.	
Definition of concepts	56 (88%)
Biographic pages of collaborators	19 (30%)
Useful links (entities/other platforms, etc.)	50 (78%)
Available training in Portugal	47 (73%)
Bibliography of interest (scientific journals, books, etc.)	57 (89%)
Articles/Papers of interest	53 (82%)
News/Events	49 (77%)
Discussion forum	40 (63%)
List of popular pages in the wiki	9 (14%)
User's guide	13 (20%)
Table of contents	22 (34%)
Wiki's framework	20 (31%)
Topics	16 (25%)
Question 2: From the list below, chose the topics you consider most important to incorporate in aprendIS.	
Basic concepts	48 (75%)
Health Information Systems	51 (80%)
mHealth (mobile)	42 (66%)
Technology evaluation	34 (53%)
Information Management in health institutions	45 (70%)
Health Informatics	51 (80%)
Terminologies and standards	44 (69%)
Applications	38 (59%)
Legislation and ethics	40 (63%)
Medical image	37 (58%)
Signal processing	34 (53%)
Data mining and Databases	42 (66%)
Monitoring	25 (39%)
Question 3: Were/are you involved in any professional activity in Health Informatics?	
Yes	32 (50%)
No	31 (48%)

Question 5: How long are you willing to spend: 5.1. Adding/editing content in aprendIS / 5.2. Using aprendIS?	
None	5 (7.8%) / 1 (2%)
Up to 1 hour a week	35 (55%) / 16 (25%)
Up to 2 hours a week	10 (16%) / 23 (36%)
More than 2 hours a week	11 (17%) / 18 (28%)
Question 6: Age	
Under 20	1 (2%)
Between 20 and 29	30 (47%)
Between 30 and 39	15 (23%)
Between 40 and 49	12 (19%)
Between 50 and 59	2 (3%)
Question 7: Gender	
Female / Male	27 (42%) / 37 (58%)
Question 9: I was/am a student of the Masters in:	
I was/am not a Masters' student	10 (16%)
Medical Informatics (UP)	39 (61%)
Management of Medical Information Systems (IPL)	10 (16%)
Question 10: I was/am a teacher of:	
I was/am not a teacher in higher education	45 (71%)
Masters in Medical Informatics (UP)	5 (8%)
Management of Medical Information Systems (IPL)	1 (2%)
Other: Health Technologies	1 (2%)

In **question 1**, people were given the option of suggesting functionalities. Only two respondents suggested others that, in reality, were recommendations of modifications: rather than having a forum of discussion, on respondent recommended a space for recommendations and suggestions, in order to avoid disagreements; and one other respondent suggested that the list of available training should be global and openly edited.

In **question 2** respondents were given the same option, but only one respondent suggested one other topic: *Access to information in health*.

Question 4 was only answered by the respondents who said *Yes* to question 3. Out of the 31 positive answers, 3 respondents (10%) were/are teachers, and 3 (10%) were/are teachers and investigators; 5 respondents (16%) were/are developers of information systems, clinical software, mobile applications, among others; 2 respondents (7%) were/are investigators/researchers, and 1 (3%) was/is a researcher and developer; 2 respondents (7%) were/are database managers; and other 2 respondents (7%) were/are part of IT departments in health institutions, but have not specified an activity. With only 1 answer each (2%), are professional activities such as systems administrator, consultant, functional analyst and programming analyst, apps analyst, technical and functional supporter, telemedicine specialist, doctor, radiologist, IT engineer, and RAI.

Question 8 refers to training backgrounds (degrees). Regarding technological degrees, 26 respondents (41%) have some sort of training in informatics, being the most significant, degrees in Biomedical Informatics, with 8 respondents (13%), Health Informatics, with 7 respondents (11%), and Computer Engineering, with 5 respondents (8%); 5 respondents (8%) have a degree in Computer Science; 2 respondents (3%) have a degree in Electrotechnical and Computer Engineering; 2 respondents (3%) have a degree in Information Technology and/or Information Systems; 1 respondent (2%) has a degree in Health Equipment's Technology; 1 respondent (2%) has a degree in Biomedical Engineering; and 1 respondent (2%) has a degree in Information Science.

Regarding health related degrees, 5 respondents (8%) have a degree in Radiology; 3 respondents (5%) have a degree in Nursing; 2 respondents (3%) have a degree in Cardiopneumology; 2 respondents (3%) have a degree in Medicine; 1 respondent (2%) has a degree in Biochemistry; and 1 respondent (2%) has a degree in Dentistry.

Others: 3 respondents (5%) have a degree in Economy; and 1 respondent (2%) has a Law degree.

A total of 37 responses were missing or were considered invalid. In **question 5**, 3 respondents (5%) did not answer this question about adding/editing content and 6 respondents (9%) did not answer if they were willing to use the wiki. 1(2%) respondent didn´t answer **question 3** and 2 others (3%) did not respond to **question 4**. A total of 4 respondents (6%) did not answer **question 6**. In **question 8**, 8 respondents (13%) did not answer or failed to answer appropriately. In **question 9**, 5 respondents (7.8%) did not answer or failed to answer appropriately. Finally, a total of 12 respondents (19%) did not answer **question 10** or failed to answer appropriately.

4. Study B

4.1. Architecture

The technological characteristics of *aprendIS* are: MediaWiki 1.22.1 (Apache + PHP + MySQL). Once the installation of the MediaWiki was complete, the *Semantic MediaWiki* 1.9.1 extension was downloaded and installed. This extension, which is freely available at [url: http://semantic-mediawiki.org/], is an open-source extension to MediaWiki that has the power of turning a simple wiki into a flexible knowledge management system.

4.2. Results

Before assembling a first page in *aprendIS*, a mind-map was developed in order to define a guiding structure, as can be seen in Fig. 1.
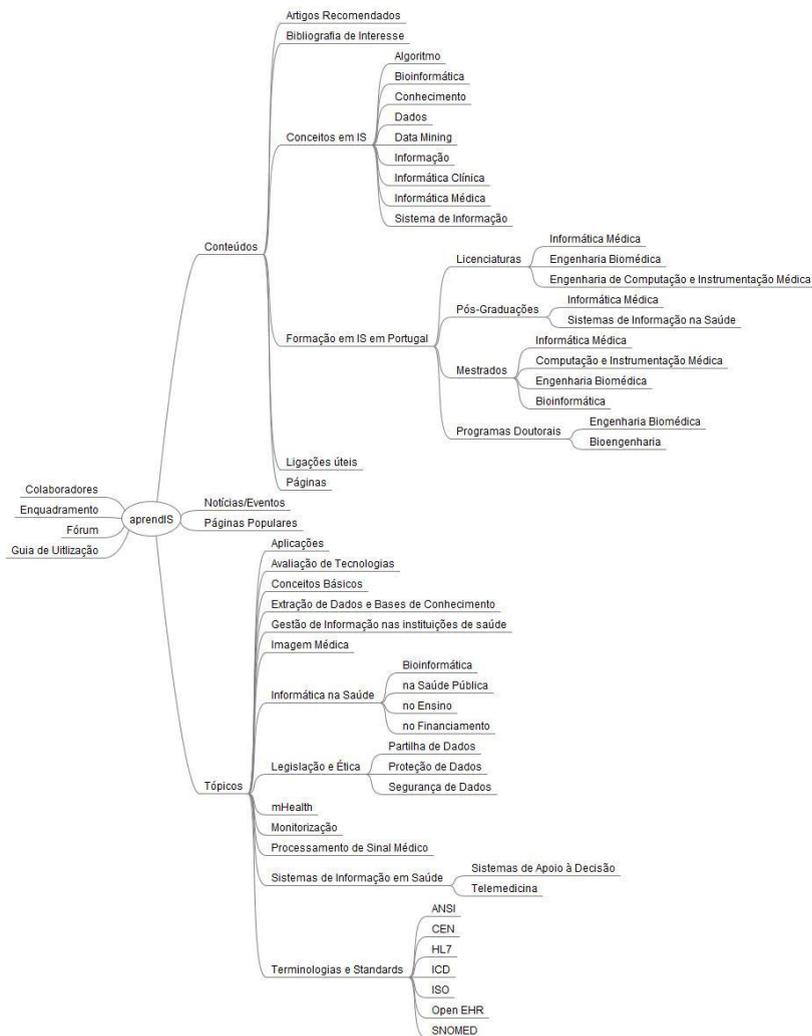

Fig. 1 – Mind-map of *aprendIS*

The mind-map to the left represents a possible structure to *aprendIS*. The main topics of the wiki (the ones evaluated in the survey) are represented, as well as some of the possible sub-topics.

This structure is dynamic and has the potential to grow according to the wants and needs of *aprendIS*' users.

Fig. 2 is an example of an *aprendIS* page concerning a health information system. This page has a description of the system *Glintt for prescription v5.0*, a system for electronic prescription, but the most important piece of information is the semantic properties on the right.

These properties represent the very first attempt on semantics' definition in *aprendIS* and they are: 'Designation', 'Creator Institution', 'Managing Institution', 'Year of Release', 'Current Version', and 'Operative System'.

Fig. 2 – *AprendIS* example page

5. Discussion

According to Study A, respondents are interested in participating in and using a collaborative tool such as *aprendIS*. In fact, more than half the respondents said they are willing to spend up to an hour every week adding content to the wiki, and more than 15% are willing to spend more than 2 hours a week collaborating. Furthermore, over 35% of the respondents said they're interested in using the wiki up to 2 hours a week, and almost 30% more than 2 hours a week. In order to encourage participation, these students should be required, by their teachers, to use the wiki for/in their classes. This would not only allow them to get familiarized with the tool, but would also introduce editing habits. Furthermore, it must be clear for those who visit *aprendIS* the distinction between unrevised student content, and revised/ready to use content. Teachers will be asked to add their classes' material to the wiki and to act as reviewers.

These results are a good indication that there is room for *aprendIS* in the Health Informatics' community, and that it can grow from the collective intelligence of this community and evolve to fulfill its needs. Moreover, there is a consensus in opinion regarding its contents. Between 50% and 80% of the respondents (more than half) want to see subjects such as Health Information Systems, Health Informatics (public health, bioinformatics, financing, etc.), Information Management in health institutions, Terminology and Standards, mHealth, Data mining and Databases, Legislation and Ethics, Applications, Medical Imaging, Technology Evaluation, Signal Processing, and even Basic Concepts addressed in *aprendIS*. *AprendIS* can also benefit from the variety of backgrounds in the health informatics community. Out of the 64 respondents, almost 60% have a background in informatics or other information technologies, including health technologies; almost 22% have a background in health (nursing, medicine, radiology, etc.); and 4 respondents have a background in economy or law.

Based on these opinions, a first page of *aprendIS* has been developed, as shown in the results section of Study B. The definition of the semantic properties and categories of this first page allows for structured access to information and allows users to combine this information with other information in the wiki in the future. Both properties and categories are based on the key characteristics of the described health information system.

Clearly, there is a need for a tool such as *aprendIS*. And what makes it so special is that it is unlike any other platform of its kind. Not only is it the first MediaWiki in Portugal dedicated to Health Informatics in this format (with contents in Portuguese), but it is also the first to incorporate **semantics**.

6. Limitations of the Study

The survey conducted in Study A introduces some limitations to the investigation that should be accounted for.

The first limitation results from sending the survey electronically. Even though sending the survey this way allows reaching a large number of people at the same time, there is a tendency for people to overlook these messages. This results in a low response rate, meaning that the results may not be representative of the targeted population. Another problem introduced by electronic surveys is the possibility that respondents do not understand the questions made, resulting in missing or invalid responses, like shown in the results.

Furthermore, there is a very specific limitation in this study, regarding the number of respondents from University of Porto and Brazil. As referred to in the methods section of Study A, the survey was initially sent to Brazilian students and teachers via Facebook groups which contained members from one another. Many students and teachers were a part of more than one group

and others were only present in one (the number of repetitions is unknown), making it impossible to determine the exact response rate. Moreover, this could mean more than one response to the survey by the same person. The exact number of students of the Masters in Medical Informatics from University of Porto is also not known, for there is not a record of all former students.

4. Conclusion

According to this study, it is clear that students and teachers of Health Informatics (at least the ones who answered the survey) are interested in a Semantic MediaWiki such as *aprendIS*. Our proposal builds such a tool according to the needs and wants of those students and teachers.

Acknowledgments

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