

Analysis of the implementation of wiki-based platforms in university education

Juan Ortega-Valiente¹, Antonio J. Reinoso² and Rocío Muñoz-Mansilla³

¹ Department of ICT Engineering, Universidad Alfonso X el Sabio,
Avda. de la Universidad nº1, 28691, Villanueva de la Cañada, Madrid, Spain
jvalient@myuax.com

² Department of ICT Engineering, Universidad Alfonso X el Sabio,
Avda. de la Universidad nº1, 28691, Villanueva de la Cañada, Madrid, Spain
areinpei@myuax.com

³ Department of Computer Science and Automation, UNED,
Calle Juan del Rosal 16, 28040, Madrid, Spain
rmunoz@dia.uned.es

Abstract: Wikis have become increasingly popular both in corporate and educational environments due to the possibilities they offer to support collaborative approaches which can be applied to teaching and knowledge generation. For this reason, they are becoming a valuable tool for the improvement and enrichment of the learning experiences of students and employees. Leading universities all over the world have started to implement their own “wiki” platforms and to successfully apply them in different areas. This success has also encouraged other universities to adopt these platforms, and, as a result, most universities nowadays include wikis as a part of the academic resources available to their students. Nevertheless, not all of the benefits that wikis offer to multidisciplinary university environments are always obtained, and many students and teachers do not use them to their full potential yet. Therefore, the goal of our work is twofold. On the one hand, we aim to obtain a detailed picture of the introduction of wiki platforms in academic communities. This is done through the analysis of the use made of them in different universities located in Spain and in United Kingdom. On the other hand, we pursue to contribute to determine the methodological procedures needed to achieve the full educational potential of wikis. This last goal has led us to a practical case study consisting in the incorporation of a wiki portal as a proactive tool in the teaching of a specific subject from the M.Sc. degree in Computer Science. We hope that the obtained results will help to prepare the most convenient scenarios for the use of wikis in high education programs, as well as to properly analyze the possibilities of these platforms in educational environments. In addition, we hope to contribute to the improvement of wikis as supporting teaching tools towards fully functional multidisciplinary platforms.

Keywords: Wikis, wiki platforms, wiki engines, e-learning, EHEA, wikis in teaching.

I. Introduction

Surely, all of us have come across, at least once, with the term *wiki*, but what is it exactly? What are the possibilities and benefits that it offers and, even more important, how does it affect our lives and the educational methodologies? The term *wiki* comes from a Hawaiian word that means quick, and was

conceived with the premise of ‘simplicity’ and ‘collaborative work’ in mind. Therefore, wiki platforms were designed to allow users to visit and to add contents to their interlinked encyclopedic entries usually referred as *articles* or *pages*. Their ease of use is achieved mainly with the fact that only a web browser is needed to access and contribute to the contents of a wiki portal. Thus, articles are rendered to common web pages whereas contributions can be made through an embedded basic online editor which admits an easy-to-use markup language.

Wiki platforms have revolutionized the way in which universities, educational centers and companies design and implement collaborative learning courses [1] and subjects, enabling new ways of solving problems and achieving goals in a fully cooperative manner by encouraging the students’ interaction [2]. In addition, students can easily share their personal experience and knowledge inside and outside the university; and even with the rest of the world [3] through online wiki portals accessible from the Internet.

This new paradigm has shifted towards a model where the production of the information is no longer based on a centralized approach, but on a distributed one. In this way, all the effort invested by the community reflects and reverts on itself, so that the more contributions the users make, the greater the benefits they receive [4]. This new model also presents a new method of transmitting knowledge, which takes place in a three-part process: first of all the contents are created, then these contents are reviewed by the community and finally, the contents are distributed through various channels.

The methodology based in such a model of creation had been already applied in software production environments, basically through the so-called FLOSS (*Free/Libre Open Source Software*) projects. The management philosophy, directives, licensing and development methodology of these projects emanated from supporting organizations like the “*Free Software Foundation*” or the “*Open Source Initiative*”.

Soon after the same principles spreading out towards other areas, and the term “*Open Source Intelligence*” [5] appeared, referring to systems designed to produce independent and neutral contents, completely decentralized and with inner quality control systems. The more generalized term “*Open Intelligence*” was created by several authors in relation to the application of the collaborative philosophy in other areas away from software production. This open philosophy is also applied during the creation of content, its improvement, re-creation and redistribution to the public.

Perhaps the term that can describe the wiki platforms best is “*Web 2.0*” [6]. This term has been subject to controversy, as the 2.0 denomination can be mistaken for an upgrade of the web’s protocols while in fact, it refers to the new participative approach taken by the web’s applications and services.

According to this new approach [7], users do not only access and visit the published contents, but also express their own opinion and comments through the corresponding interface mechanisms. Even more, they are even allowed to contribute and submit their own contents and resources to share them with the whole community [8].

Another interesting feature characterizing these new portals is that their social aspects enable users to tag, rank, vote and share the contents they find most remarkable [9]. This revolutionary new role for the users makes up the core of *Web 2.0* [10], where every user is simultaneously an end user, an editor and a reviewer of information and knowledge. However, this requires a deep change on the Web’s architecture that has to provide the proper interface and storage supporting elements, to allow users to properly interact in blogs, chats and, obviously, wiki portals.

The new approach for gathering and accessing the information has achieved a great repercussion in today’s society and work environments [11]. It is especially notable in environments related to the management of knowledge and information, such as e-learning courses [12], schools, universities, learning centers [13] and companies [14], leading to a change in education models [15] [16] [17].

It is considerably noteworthy the fact that the newest ICT (Information and Communication Technologies) platforms have been promoted in academic environments as a result of the adoption of the Bologna process [18], promoted by the countries constituting the so-called “*European Higher Education Area*” (EHEA).

This process consists in a total reorganization of university degrees to provide homogeneous and transferrable education across the whole European territory. According to Bologna directives, students’ formation is structured around the concept of “*skills*” that entail not only traditional academic disciplines, but also new abilities such as communicative and team-work skills. In summary, Bologna process pushes for the introduction of collaborative tasks in university courses and degrees [19] and aims to involve students in their own learning stages, therefore enriching considerably their university learning experience.

The wiki platforms offer solutions to these new EHEA educational requirements [20] [21]. They have a simple but robust collaborative approach, which allows users to cooperate with each other to complete tasks and assignments

in an appropriate context, maintaining a complete history of the contributions submitted, as well as a proper supervision of both personal and community evolution. These functionalities also allow teachers to easily follow the individual and cooperative progress of each student.

In addition, wikis can be combined with other tools, such as blogs and chats, and can also include support of rich multimedia formats to obtain a full interactive learning experience for students. This does not require expensive systems, simply a server to be installed to. However, even this is not completely necessary, as there are free and paid online servers that offer wiki hosting (such as the case of *wikia* or *wikispaces*) with almost unlimited personalization options. This means that they can be configured to meet the specific needs and requirements of any university.

The rest of the article is structured as follows. The next section presents a revision of the previous research in the area related to the application of wikis in university teaching. After this, the methodology conducted to realize this work is conveniently described. In respect to our results, a classification of the studies carried out by several Spanish universities is presented, as well as a preliminary study about the wikis implemented in Spanish and UK universities. Afterwards, the different results from our experimental development are addressed. Finally, the most relevant conclusions from our case study and several ideas for further work are introduced.

II. Background

There have been several initiatives devoted to study the impact and benefits of wiki platforms in learning environments. It is particularly interesting the special issue on wikis and their use in universities from the journal “*Revista de Docencia Universitaria*” (*University Teaching Magazine*) [22] [23] on November 2009.

Several other studies about the incorporation of wikis in universities and learning centers have been also carried out [24], [25] and [26]. Furthermore, in the corporate and professional environments we can also find varied studies ([27], [28], [29] and [30]) about experiences involving the use of wikis. All these works have, thus, been considered in our examination, and it is important to remark that all of them agree on the fact that the use of the wiki platform as the main tool, or as a support tool in case studies that require collaborative work, is beneficial for the learning process of the students.

In general, all these studies show that the use of wikis caused an increase of the involvement of students, and show a positive cause-effect relationship between the contributions made and the grades obtained; even after taking into account a few exceptions related to the lack of continuity and involvement of a few low grade students. However, these exceptions proved to have a negative effect on the rate of success of the platform implementation, and revealed the need of establishing continuous supervision during the whole process to ensure that all the students develop the appropriate work habits and abilities [31].

<i>University</i>	<i>Degree</i>	<i>Subject</i>	<i>Use</i>	<i>Acceptance</i>	<i>Author</i>
University Alfonso X el Sabio	<i>Computer Science</i>	New Information Technologies	Work in groups. Teacher support Weekly supervision.	Higher student involvement. Better results - 60% less fails - 15% increase in grades	[32]
Polytechnic University of Valencia	<i>Computer Science</i>	Advanced Software Development Tools	Work in groups. Teacher support Weekly supervision. Individual contributions.	Higher student involvement. Lack of original contributions.	[33]
University of A Coruña	<i>Biology</i>	Conservation and Management of Animal Resources	Individual work.	Lack of student continuity.	[26]
University of Jaén	<i>English Philology and Tourism</i>	English Grammar	Work in groups and individual assignments.	Lack of student continuity. Students correct each other.	[34]
Open University of Catalonia	<i>Tourism</i>	Ecotourism	Work in groups. Individual roles.	Higher student involvement.	[35]
	<i>Arts and Humanities</i>	Digital Art and Aesthetics	Individual assignments. Students correct each other.	Better grades. Lack of student continuity.	[36]
Autonomous University of Barcelona	<i>Psychology</i>	Social Psychology Practices	Work in groups. Continuous supervision.	Higher student involvement. Higher quality work.	[37]
Rovira i Virgili University	<i>Law</i>	Environmental Legal Clinic	Work in groups. Continuous supervision. Role assignment.	Higher student involvement. Wiki server failures affected subject outcome.	[38]
University of Alcalá	<i>Law</i>	Legal English	Work in groups. Weekly supervision.	Higher student involvement. Students correct each other.	[39]
University of Granada	<i>Architecture</i>	Dialogs and Negotiations in the City	Work in groups and individual work. Continuous supervision.	Higher student involvement.	[40]

Table 1. Results of 9 selected wiki studies in Spanish Universities.

This aspect constitutes an absolute challenge since there are many subjects that are based on large assignments, or on exams, and require to be thoroughly redesigned in order to maintain a minimum level of continuous supervision.

More importantly, the continuous supervision must be meticulously implemented to ensure that it does not saturate the students nor hinders their whole learning process by adding too much pressure into a single subject.

The 12 subjects chosen from 9 different universities, represented in Table 1, are taken as an initial sample group. They stand for different approaches to the use of wikis in the classroom from different departments and degrees.

Unfortunately, due to the limited number of considered research works, only 12, it is difficult to completely determine or fully appreciate the true impact that the use of the wiki platform can have, as it also depends on many other factors; such as, for example, on the department or degree where it was implemented.

Besides the benefits from the introduction of wiki platforms, the reviewed research also focused on the resolution of different kinds of problems and limitations found

during the use of wikis. This means that future studies will certainly bring further improvements in those areas which will significantly increase the positive impact of wikis.

All of this shows that there is great potential in the use of wiki platforms. As a result, it is a concept that deserves further study and development, both in university and non-university environments [41].

III. Methodology

In this section, we will introduce the two methodological developments followed to perform the work presented in this paper. As we aim to two separated objectives, different strategies have been also applied.

The first stage of our study is based on the search of those university wikis that are accessible for the public and available directly on their official website or immediately linked from it. Only wikis used in subjects, by departments, research groups or as part of the university itself are included. In addition, only wikis corresponding to educational facilities from Spain and United Kingdom have been included in this study.

It is important to recall that some universities have more than one wiki, and even use different wiki platforms for each one. However, there is commonly a main wiki platform deployed to serve as a teaching support. The low usage of the rest of the platforms in these universities makes them barely relevant.

In respect to the study of the benefits and advantages derived from the use of wikis in the classroom, and to determine the main problems that arise during the process, a previous experience developed by one of the co-authors and thoroughly described on [32] [42] and [43] has been included. This study was carried out in the subject “*Nuevas Tecnologías de la Información*” (“New Technologies in Information Systems”) that corresponds to the last year of the M.Sc. degree in Computer Science at Universidad Alfonso X el Sabio.

The purpose of the wiki portal arranged for the study was to serve as a supporting tool, to be used during three case studies that students had to solve to pass the subject. The collected information about the use of the portal, both qualitative and quantitative, allowed evaluating the impact of introducing a wiki portal in university teaching. In addition, the examination was carried from the students’ and the teachers’ points of view. This kind of data may serve to help to improve the wiki for future applications. This is due to the fact that gathered information enables the possibility of establishing various usage patterns to determine new designs, which can be used for the different tasks required by the subjects to be implemented through wiki platforms.

In order to further encourage the collaboration between students and to guarantee a better use of the wiki portal, the case studies had to be solved in groups of 3 to 4 students and only contributions made during term time were allowed, discarding any other contributions.

The students were given the choice of whether to be part of the study or to continue using the traditional method. A total of 35 students, the whole class, chose to take part in the study and to give anonymous feedback at the end of the subject.

The wiki engine used was MediaWiki, as the benefits and characteristics that it offers fitted better the needs of the study. As most of the students were not used to work with wiki portals, or with the markup language, there was an initial period of training to ensure that all students were prepared to use the wiki portal to its full potential in the case studies that were going to be proposed.

After deploying the platform, several parameters were defined to analyze the access to it, and therefore being able to obtain statistics of usage, acceptance and interest of the students in the wiki portal. A few of these simple parameters were:

- Number of articles in the platform
- Number of contributions that led to new articles
- Number of mayor revisions
- Number of minor revisions
- Number of accesses to the platform
- Number of read-only accesses

These parameters can be either absolute or based on a specific period of time (*such as the length of the subject*). Additionally, from these base parameters, more complex parameters can be defined, depending on the needs of each subject, such as:

- Frequency of revisions overall
- Frequency of revisions per student
- Continuity of revisions overall
- Continuity of revisions per student
- Revisions quickly corrected (*soon after the mistake has been spotted or after suffering from vandalistic attacks*)
- Length of the article
- Amount of multimedia content
- Average visits per day
- Average usage depending on the degree
- Average visits depending on student’s degree
- Comparison between quality of contributions and student’s grades.

This process is iterative, since for each new parameter defined, new parameters can be formed, having a tendency of being more and more complex each time. However, sometimes the simplest parameters provide the most useful information.

IV. Results

This section presents our most relevant results concerning the main goals aimed by this work. In this way, several indicators related to the utilization of wikis in university environments are provided. In addition, the most significant findings after our analysis of the use of a concrete wiki platform as a part of the teaching resources of a technical degree will be shown.

To begin with, we are presenting in the following the observed fact about the different wiki platforms set up by the universities under study.

A. Spanish Universities

A total of 80 official Spanish Universities were evaluated in the first stage of this study, and 70 of them (87.5%) were found to have at least one working wiki for their students.

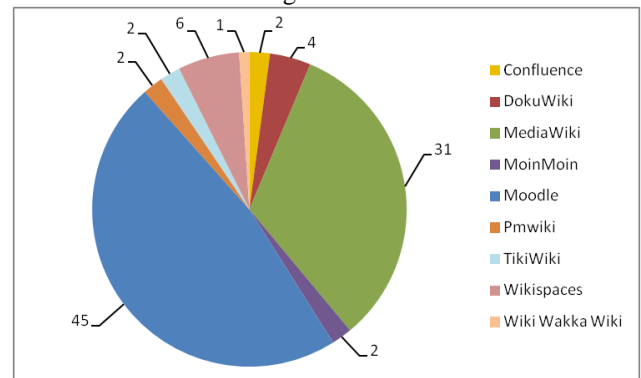


Figure 1. Use percentage of each wiki platform found in Spanish universities.

Regarding the wiki implementation technology, only a few wiki platforms are used, and among them two clearly stand out (Figure 1): *Moodle*¹, which is used in 45 universities, and *MediaWiki*², used in 31 universities.

However, the Moodle platform is more than just a simple wiki platform; since it includes a complete suite of tools designed to serve as a virtual environment for any learning center, offering mainly blogs, wikis, e-mail client, file sharing capabilities and multimedia functionalities, among others.

¹ <http://moodle.org>

² <http://www.mediawiki.org/wiki>

This means that not all universities that have Moodle make use of its wiki capabilities, however while anonymous access to the platform is not allowed, it is possible to find tutorials, on the official websites of the universities, regarding how to use the wiki capabilities of the Moodle platforms currently operative in their centers.

For this reason, the MediaWiki platform is the most appropriate to use for new wikis, as it focuses only on the wiki collaborative concept, alongside full multimedia compatibility and customization possibilities, among many other advantages as described in detail in [41].

B. United Kingdom Universities

The second country chosen for the first part of the study was United Kingdom. A total of 120 universities officially listed were analyzed.

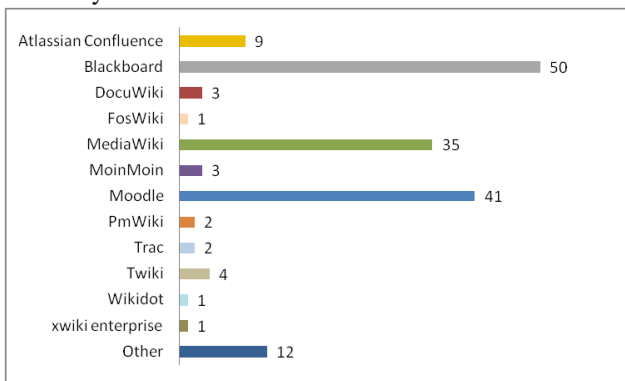


Figure 2. Use percentage of each wiki platform found in UK universities.

The results show that 100 of the universities evaluated (83.4%) have at least one working wiki on their website.

The amount of different wiki platforms used is larger than in the previous case (Figure 2), and among all of them, there are three that clearly stand out: *Blackboard*³, *MediaWiki* and *Moodle*. But as with the case of Spain, the rest of platforms are only used in very few cases or as small wikis.

Therefore MediaWiki is the only full wiki platform that peaks, since both Moodle and Blackboard include several functionalities and their use does not necessarily entail the wiki possibilities.

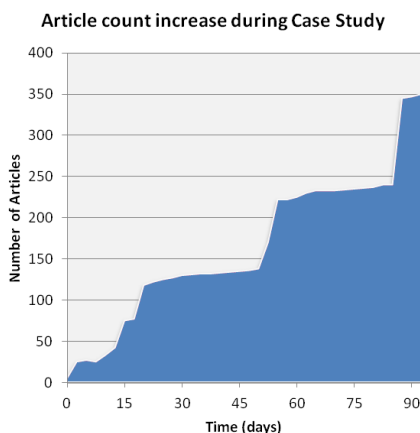


Figure 3. Article number Evolution.

From here onwards we will discuss the results from the observed parameters after the experimental study involving the use of a wiki as a teaching tool. The process followed has been explained in the methodology chapter.

Focusing on the quantitative data about the use of the wiki platform, Figure 3 presents the evolution of the new articles created on the platform, and it clearly shows that most articles were created at the beginning of each of the 3 case studies that the students had to complete.

This result was expected, as for each new assignment, students had to create corresponding new pages, which were continuously edited during the following weeks.

In Figure 4 we can see the profile of a standard student, where the number of accesses greatly outnumbers the contributions made. The same tendency is widely seen on other public wikis such as Wikipedia or on wikis contained in wiki-farms (*dedicated servers with tools designed to host independent wikis*) such as wikia.com. This is to be expected because a given user can visit a page many times.

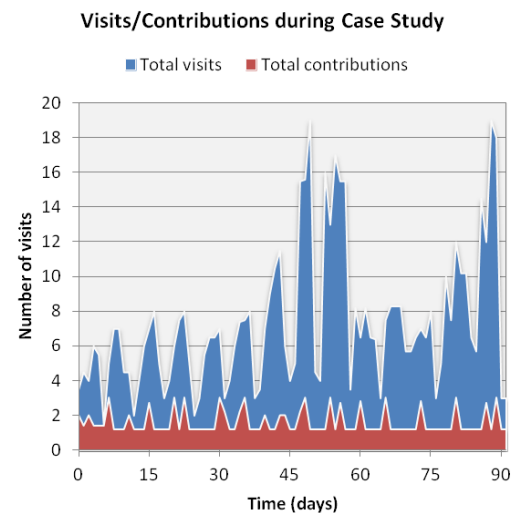


Figure 4. Visits/Contributions of a productive student.

However in this case study this information is relevant because it was a private wiki, and only the students that took part in the study could access it. This avoided false statistics that would have been obtained from non-related students, teachers or even web spiders/crawlers accessing the pages.

Both Figure 3 and Figure 4 also show that most new articles and most visits were made between the days 50 to 60 and 90 to 100, coinciding with both the second and third assignment's deadline. Unfortunately this means that continuity was not achieved, which is one of the main benefits to accomplish when working with wikis. Some possible solutions to this problem could be to distribute assignment contents into smaller sections or to have more continuous evaluation by reviewing contents every few days or weeks.

Information from surveys taken by the students also helped to evaluate and improve technical and non-technical aspects of the wiki portal. These surveys unfortunately, always tend to be subjective and depend on, for example, the grade obtained by the student. As a low grade student is normally more likely to criticize the wiki portal, there is a small percentage of error to be considered, as it happens with all surveys.

After carefully evaluating the answers to the several questions presented in the different performed surveys, we found that approximately 70% of students considered that the

³ <http://www.blackboard.com>

wiki portal was both a useful tool for case studies and as a system to exchange information and knowledge. However this percentage was reduced down to 25% when asked about implementing it for other subjects and degrees, as the students considered that there was a need for more stepped adaptation to the new system. This is due to the need of familiarization with this new system, which requires an initial extra workload for the students and teachers.

It was decided, after this evaluation, that extending the wiki platform to the whole M.Sc. degree in Computer Science was the next logical step. But before making it available to the whole degree, several upgrades had to be made to increase the wikis usability and capacity, based on the feedback given by the students. Some of the most relevant improvements made were:

- **Access Control:** While this wiki will be publicly available, registration will be required to be able to make contributions (*students are automatically registered*). This is necessary to ensure that student contributions are properly recorded and can be later used to evaluate them, and to maintain a level of control regarding the contributions, minimizing the risk of vandalism.
- **WYSIWYG editor:** Working with wiki markup language can be daunting for students in the first year of the degree, so a simple *What You See Is What You Get* editor has been included to simplify this task.
- **Categories:** A set of categories has been added to group articles according to the degree and subject that they belong to, thus simplifying searches and speeding up the access to related contents.
- **Article monitoring:** Students are now able to select articles and get instant notifications when changes are made to them.

As this wiki portal has been extended recently to make it accessible to the whole university, the results presented are preliminary and do not show the whole tendency and real impact of the wiki, as this will only be possible once the results of a whole year are collected and thoroughly evaluated.

WikiUax Statistics	
Content pages	58
All Pages	433
Uploaded files	183
Registered users	67
Total page editions	1.967
<i>Average edits per page</i>	4,54
Total visits	21.381
<i>Total visits per edition</i>	10,18
Most visited articles	
Página Principal	3.154
Blogger	1.046
Aplicaciones Web	890
CMS Made Simple	589
Drupal	535
Most edited articles	
Página Principal	162
Blogger	82
Mitos del software	58
Google sites	52
Lenguajes de programación	45

Table 2. WikiUax basic statistics.

This also explains why most of the contributions were carried out by students from the two last years of the degree.

Additionally, this also means that many students are not yet aware of this wiki's existence; leaving alone the possibilities offered by it. For this reason several events have been planned to take place during the next academic year to inform students and teachers about the wiki, its benefits and advantages, and how to use it as a tool for the course. Various learning seminars will be celebrated to allow students to learn the basic usage of the platform.

In Table 2 we can see a short summary of the preliminary results obtained from the wiki at the moment it was made available to the whole university. Therefore, the results represent only a small percentage corresponding to its usage in the previous study which included only one subject from a single degree.

For this reason four from the top-five most edited articles corresponds to the Computer Engineering Degree area, as articles related to other areas and departments are still under development requiring further contributions.

Despite this data being preliminary, the Figure 5 shows a tendency where most contributions are made during term time, reducing drastically during holidays, which make sense since contributions made outside of term time are not considered during the evaluation process.

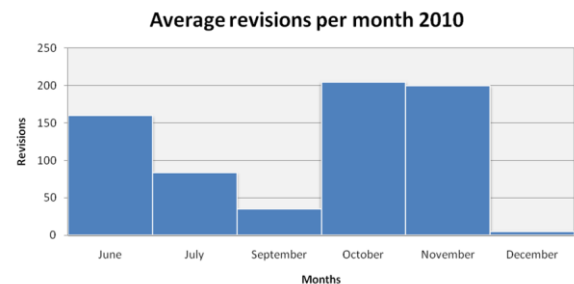


Figure 5. Preliminary wiki results graph.

The contributions made during June and July correspond to the wiki being created and populated with the initial contents and basic structure pages, while the contributions made during October and November were made by the students to complete their case studies.

Moreover, this fact also shows that the initial training was successful as students were aware of the requirements of the subject, and followed the instructions correctly, avoiding contributions outside of term time as they would not be evaluated.

V. Conclusions

The results presented, while being only preliminary, are very promising and inspiring. There is still much room for improvement, as students have shown the great potential that these platforms offer, and have also suggested changes and improvements that need to be made in order to make it more efficient and user-friendly, and ultimately increase its acceptance.

This kind of platforms offer lots of different collaborative ways of working to achieve a common goal, which is one of its more desirable characteristics according to the requirements made by the EHEA. This would explain the general diffusion

of these platforms: from personal wikis to university wikis, and even large company wikis.

One of the most relevant trends found is that in almost 75% of the universities that have a wiki, its usage is restricted to a single subject or department. However, their access is public, which means that only students and teachers from those subjects or departments can contribute, though it can be accessed by any student or person worldwide.

This leads to the possible conclusion that some of the platforms are being used as test cases in hopes of implementing it for more departments or the whole university in the future, as it is described in [37], [42] and [44], due to the need of progressive adaptation to its use by the teaching staff as well as by the students.

However, in other cases, the wikis may just be independent initiatives from teachers or research groups, as they show signs of currently being in development or in a testing phase, many having been online for only a short period of time.

This can lead to the erroneous belief that some subjects cannot benefit from the wiki platform at all, as they do not have a collaborative component. This has been refuted in [35], where they successfully used a wiki as the main tool in a subject where their students had to complete individual assignments using the platform, at the same time as the communication between students was promoted.

Therefore it is clear that wikis have found their way into most Spanish and UK universities, as it can be seen in the previous sub-chapters. Many are still young or small wikis, but show signs of being in evaluation processes or with a framework to enable future implementation in other areas.

This leads to the need of further investigation to improve the wiki platforms and to find new ways of implementing them. Moreover, additional efforts have to be devoted to deeply analyze the use of the platforms as part of subjects or to serve as supporting tools or as communication links between the students.

On the other hand, the universities that are using wikis as part of their virtual learning environments (*Blackboard* and *Moodle*) are unlikely to further develop them as they are designed to be part of the support tools offered by these virtual learning environments. However some of these universities have several wikis using different platforms, which could mean that the first studies were successful and therefore they are being expanded into other areas. This can only be confirmed with direct information from the universities themselves.

The portal presented, “*WikiUax*”, is an initiative that has been available for less than a year, and which is the result of previous studies carried out in a few subjects of a single degree. It has received several upgrades since then to improve its functionality and to fix the flaws found during the initial case study.

The use of the wiki is also a challenge for teachers, as they need to become used to these new technologies, and to the way in which they may serve to plan the courses and practices by applying this new collaborative approach. This can be especially challenging for teachers of degrees that have little relation with computers and new technologies, as they need to adapt to these technologies as well.

This also has another advantage, because becoming familiar with new technologies give teachers access to many more tools and systems that can further enrich their teaching experience, and therefore, the learning experience of their students.

In conclusion, the advantages that wikis provide are far worth the effort, as once the teachers and students become used to it, the simpler and easier its use becomes and greater is the interest generated.

Additionally, due to this great potential it will definitely continue to be further studied and developed to become even more useful for educators and professionals worldwide.

This can be appreciated on the results obtained from the preliminary study of Spanish and UK universities, where the tendency to further expand wikis into more degrees and areas is clear, with universities having, in some cases, three, four or even more independent wikis for different subjects, research groups or departments.

In conclusion there are many reasons to continue researching in this area and testing further improvements and implementation possibilities in hopes of increasing, even more, the usability of wikis in learning centers and universities and helping them become a common tool used by teachers and students to improve the teaching experience, the quality of education and the learning process of the students.

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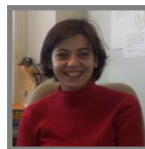
Author Biographies



Juan Ortega-Valiente was born in Murcia, Spain in 1986. He is currently a Ph.D. student at University Alfonso X el Sabio, Spain. He received his M.Sc. degree in Computer Science (2009) and his Master in Information and Communication Security Engineering (2010) from University Alfonso X el Sabio, Spain. His main research interests include e-learning, collaborative learning, open knowledge management, wiki platforms and open source software. He also carries out research activities funded by Fundación Universidad Alfonso X el Sabio and Banco Santander related to these research topics.



Antonio J. Reinoso (M.Sc. and Ph.D. in Computer Science) works as an Assistant Professor at the Universidad Alfonso X. He develops his research activities in the Libresoft Research Group at the Universidad Rey Juan Carlos. His main research interests include the study of free and open knowledge management systems, particularly Wikipedia, and the application of new technologies in information and communications (ICT) in learning and teaching. He also participates in research activities at Fundación Universidad Alfonso X mainly related to e/b/m/u-learning technologies.



Rocío Muñoz-Mansilla (M.Sc. in Physics and Ph.D. in Computer Science) works as an assistant professor in the area of Knowledge Management and Systems Engineering at the Universidad Nacional de Educación a Distancia (UNED). She has participated in several projects funded by the Spanish Inter-ministerial Commission for Science and Technology (CYCIT) and she has co-authored several articles related to QFT control and automated information systems which constitutes her main research interests.