New Moodle Blocks for Knowledge Management

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Abstract. The work shows the development of a module for Moodle, used to manage the knowledge Involved in the process of teaching and learning, where interact Smartphones, Tablets, Wearables and LMS Moodle, as idea of Internet of Things. The module includes was Lessons Learned, Yellow Pages and FAQs, also the developed the Monitor Agent of student activities. The Agent Monitor performs three basic tasks: User Assistance and Management of activities. To evaluate the module developed, we used three validations, a usability test based on Nielsen's protocol for heuristic evaluation, and functionality test, where 6 users worked in the process, and they executed 41 test cases, and the results of this evaluation were satisfactory, and the satisfaction survey, applied to 450 Moodle users.

Keywords: Knowledge Management, Moodle, LMS, Internet of Things.

1   Context

The LMS (Learning Management Systems), also known as CMS (Course Management Systems) are web-based platforms whose general functions are to manage, monitor and report the student interaction with the content, with the teacher and other students [1], used in e-learning, b-learning and m-learning.

After this pioneer, the Programmed Logic for Automated Teaching Operation (Plato) [2], hundreds of similar systems were introduced. Major milestone happened in 1997 when WebCT 1.0 released and Blackboard was founded because these two LMSs attracted millions of users. But after WebCT and Blackboard second milestone was LMS Moodle. This was introduced in 1998 and finally released in 2001 [3].

Moodle (Modular Object Oriented Dynamic Learning Environment) soon imposed itself as best solution and is becoming one of the most common used LMS, a large community of developers around the world and in all languages [4]. Data obtained in September 2015, from official Moodle statics sites confirms the mentioned fact, is being used by more of 77 million registered users, in more than 60k registered sites of 221 countries, available in more the 100 languages [5].

Moodle and the LMS in general, have many advantages in the field of distance education, creating a student-teacher connection, which translates into an educational

success [6]. The LMS promote communication and interaction among students and between them and the teachers because through this route the barrier is overcome shyness, interaction and bonding among students is increases and there is more contact between the own students, thus realizing an effective collaborative work.

The Moodle functions are realized in modules: site management, user management, course management, task modules, chat room module, selecting module, forum module, logging module, test module, resource module, etc., which can be integrated and applied in course design [7]. Also, Moodle has an ability of tracking the learner's progress, which can be monitored by both teachers and learners [3].

However, we can see that today's Moodle and LMS in general, only offer isolated modules and resources for use by teachers in the different courses taught. The various tools are applied at the discretion of each teacher, without being aware of what resources they use will lead to better results, not taking into account the experience provided by other teachers.

Also, the students do need to be self-disciplined, meeting deadlines and working steadily over the course. Thus, immature students who are not used to taking responsibility for their own learning can struggle even with well-designed courses [8] and we believe that the LMS must leverage technology to manage knowledge involved in the teaching and learning environment, and use artificial intelligence technologies to monitor and keep students involved dynamically in the courses and the environment.

The work shows the development of a module for Moodle, used to manage the knowledge involved in the process of teaching and learning, where they interact Smartphones, Tablets, Wearables and Moodle, based on the basic principles of the Internet of things.

The Knowledge Management module includes: Lessons Learned of the other students or teachers in the use of Moodle, Yellow Pages of teachers, FAQs related to the use of the Moodle activities and a Monitor Agent of student activities.

1.1   The Knowledge Management

Since Peter Drucker used the concept "knowledge worker" in his book "Landmarks of Tomorrow" in 1959, many important authors have written about Knowledge Management (KM), as Thomas Steward, Ikujiro Nonaka, Hirotaka Takeuchi, Davenport, Prusak and many others [9]. Simply, are the processes for making available the knowledge they need, to those in need, where they need them, as needed and when needed.

There are many tools and techniques of KM, and this work includes three that can generate, share and use the knowledge that occurs in the LMS Moodle, specifically Yellow Pages, Lessons Learned and FAQs, conceptualized in previous work [10].

The Yellow Pages.

The Yellow Pages (also known as white pages or personal directories) are data repositories in which personal information is collected, as well as areas of knowledge and interest of each person [11]. This way when someone needs information about a topic, search the list of the organization that knows him better than him and asks for help directly. These yellow pages are based on a technology that allows you to find related information with users of the KM system, and in turn, serves to encourage dialogue with people within an institution. Through the yellow pages, the dynamism of the institution is driven.

In an educational environment, specifically Moodle users how can "know who knows", and find and contact other staff members with specialized knowledge and skills.

The Lessons Learned.

The Lessons Learned are tools, which places at the disposal knowledge gained through experience, which are applicable to a task, decision or process so that when this knowledge is reused, impacts positively on the results of the organization [12]. Lessons Learned helps favor convert tacit knowledge (that which is in the mind and comes from the experience of people) in explicit knowledge (that contained in documents, electronic files or objects), facilitating their transmission.

The Frequently Asked Questions.

The purpose of the Frequently Asked Questions (FAQs) is to provide a tool for that a query can to help find related FAQs documents, stored in a database to help teachers solve problems and questions that appear frequently [13]. As input to the system, the user asks a question, the relevant terms are extracted query-based of the domain vocabularies and based on these terms, then it query in the FAQ database.

To effectively and efficiently implement a course in LMS, teachers must have a comprehensive and detailed knowledge about important aspects of the activities and platform for develop course.

Tacit knowledge describes the practical experience gained by students and teachers using Moodle, and this knowledge that could help others if it can represent explicitly. One possible way to represent and transmit this knowledge is lists of FAQs, expressing a question and answer given by a specialist. According to [13], FAQs included the most common questions on a particular topic, providing knowledge and strategies to assist in finding a solution to the problem they are having.

1.2   Intelligent Agents

The FIPA (Foundation for Intelligent and Physical Agents) defines an agent as "A computational process that implements a communication function autonomously in an application" [14].

One type of software agent are the Intelligent Agents, defined for Jennings and Wooldridge [15] as a "computer system located in an environment, able to act autonomously, to achieve their design goals."

In [16], presents a review of the state of the art of agents in virtual teaching and learning environments, especially some previous projects, which were implemented Agents Monitors, which do tracing the activities of students, and their responses to certain exercises, then adaptations of questions and activities.

1.3   The Internet of Things

The Internet of Things (IoT) was first coined by Kevin Ashton, who used it to describe how internet-connected devices would change our lives. IoT, sometimes referred to as the Internet of Objects, will change everything, including ourselves. This may seem like a bold statement, but consider the impact the Internet already has had on education, communication, business, science, government, and humanity. Clearly, the Internet is one of the most important and powerful creations in all of human history [17].

2   The Problem

In [18] it establishes that in terms of usability, Moodle is not easy to use for both students and teachers. "The feeling that gives us the platform to enter first is bewilderment. Many tools and features make that basic premises are lost, for example ease of use, comfort, and usability".

On the other hand, "is not enough to make available to the student the necessary resources to build their knowledge, it is important that the virtual classroom is truly usable, intuitive, ergonomic and space, to transform the user experience a more comfortable, enjoyable and significant" [19]. Also, students' academic life is composed of several goals as they go through different courses, topics, assignments and several other activities.

Based on this analysis, we can see that today's LMS only offer isolated modules and resources for use by teachers in the different courses taught. The various tools are applied at the discretion of each teacher, without being aware of what resources they use will lead to better results, not taking into account the experience provided by other teachers.

This experience is required to use it to best practices, thereby creating a teaching-teaching nexus that has not been taken into account so far. Establishing KM tools, within the LMS platform, the usability and accessibility will be improved and also allow you to manage knowledge, which is obtained thanks to the experience reported by other teachers. This knowledge is wasted currently not being taken into account in any tools within the platform.

Then, is need to structure and develop these tools within Moodle, thus allowing better use of knowledge and management to harness the benefits of KM process, where the main purpose is to translate knowledge into action and this in results.

Given the underlying problem and the possible solutions, we do the following question: How to develop KM tools in Moodle, which allow teachers and students access to knowledge and support on the use of the platform?

3   The Development

In the development and implementation of KM tools, we used the agile methodology of Scott W. Ambler [20], used some software tools for to integrate the new blocks in Moodle, we analyzed of the logs Moodle for creating intelligent agent rules, were defined functional requirements and we develop the Moodle blocks:

3.1   The Methodology

It was used the agile methodology of Scott W. Ambler [20], called Agile Development with Models Base (Agile Model Driven Development, AMDD). AMDD is an iterative and incremental methodology, which are developed agile and simple models that are used to develop the system.

The first phase, called Iteration 0, presented by the green box (Fig. 1), integrated two activities: initial needs and the original architecture. These results are presented in the following sections.
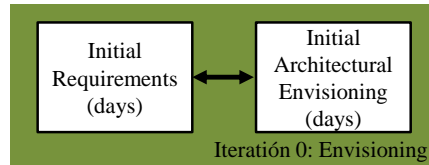

Fig. 1. AMDD Iteration 0 [20].

The remaining activities (Fig. 2): iteration modeling, model storming and test driven development, were developed in all iterations, where progress was validated with experts.
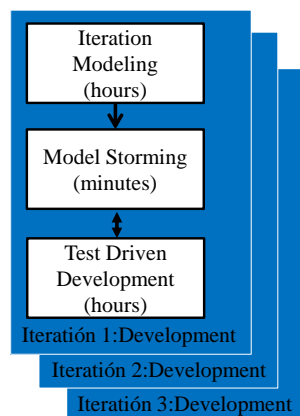

Fig. 2. AMDD development iterations [20].

3.2 Functional Requirements

The functional requirements were defined for user role:

- Teachers can:
  - TFR1: Search Yellow Pages, FAQs and Learned Lessons.
  - TFR2: Add Yellow Pages and Learned Lessons.
  - TFR3: Update the attributes of the Yellow Page associated with his user.
  - TFR4: Update Lessons Learned added for him.
  - TFR5: Update the options for Intelligent Agent.
- Administrators can:
  - AFR1: Search Yellow Pages, FAQs and Learned Lessons.
  - AFR2: Add Yellow Pages, FAQs and Learned Lessons.
  - AFR3: Update attributes of the Yellow Pages.
  - AFR4: Update Learned Lessons.
  - AFR5: Update the options for Intelligent Agent.
- Students can:
  - SFR1: Search Yellow Pages, FAQs and Learned Lessons.
  - SFR2: Add Learned Lessons.
  - SFR3: Update Learned Lessons.

3.3 Software Tools

In the development and implementation of KM tools, we used some software tools for to integrate the new blocks in Moodle:

- PHP: Moodle is developed in PHP and develop KM tools to integrate in Moodle blocks; you should use the same programming language. PHP runs on the server, you can connect to the database and generates dynamic HTML.
- HTML: This language allows structuring the website, her tables, headings, footnotes and links (hyperlinks) were built.
- JQuery: This tool allows field validation running, as well as interaction with the user server without refreshing the page.
- Cascade Style Sheets (CSS) to facilitate the design of the HTML page, separating structure from presentation (colors, backgrounds, and letters).
- Database Management System MySQL: The Moodle database must be modified using MySQL, as mentioned above. In modifying some tables were added.

3.4 Architecture

The programming was performed using the MVC architecture, in order to separate the data, the user interface and control logic into three distinct components [21]. Then, are shown the developed modules in the MVC architecture and the Software tools used (Fig. 3).
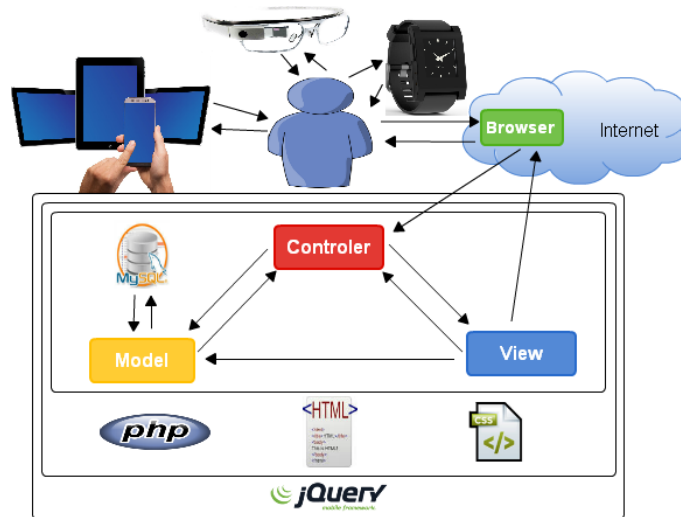
Fig 3. MVC architecture and the software tools used.

3.5 The Intelligent Agent

The intelligent agent was designed as a simple reactive agent, where inputs from environments are compared with rules to determine which actions to carry out. The reactive agents simply react to events in their environment according to predetermined rules [22]. The Figure 4 show the intelligent agent architect, developed in this project.
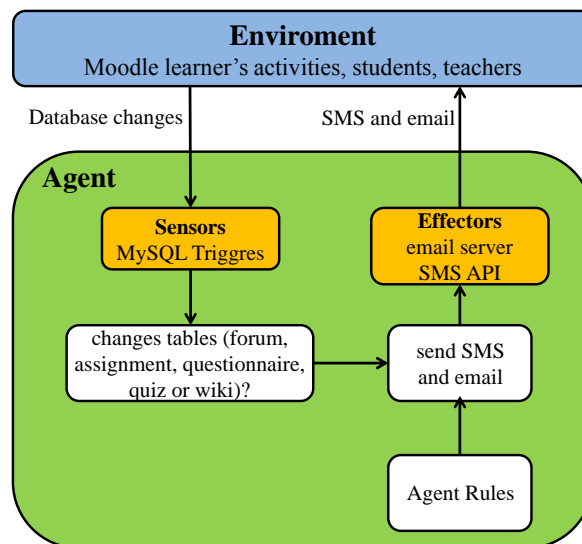

Fig 4. The Intelligent Agent.

The environment is defined by the Moodle learner´s activities, the students and teachers. These activities are recorded in the Moodle Database, then any change in it, is detected by the agent sensors. When the sensors perceive the changes, the agent determines where the change occurred and what type. Subsequently, the agent uses its rules to determine what action, and effectors send SMS and email to students and teachers. The Moodle learner´s activities, and the agent rules are show below.

Moodle LOGs.
Moodle has an ability of tracking the learner's activities, as mentioned above. The activities are recorded in the Moodle Database, and the teacher or administrator could investigate for functionality of auditing, using the Reports Module in the Administration Block (Fig. 5).

Fig. 5. Reports Module in the Moodle Administration Block.

The Reports Module displays the parameters of time, group, activity, even and actions can be used for filtering. It is possible to access the data entitled "Time," "IP address," "User full name," "Action" and "Information", then the course teacher or administrator can apply filtering in the activities as shown in Table 1. The Table includes the KM Tools developed: Lessons Learned, Yellow Pages and FAQs.

Table 1. Activities and options.

Activities	View Options	Update Options
Forum	view discussion, search, view forum	add discussion, delete discussion, move discussion, add post, delete post, update post
Chat	view, report	Talk
Assignment	view, submission, view feedback	upload, submit
Questionnaire	view, view all	upload, submit
Quiz	view, view all, report, review	attempt, attempt, preview, edit questions, delete attempts
Wiki	views	Post
Yellow Pages	view page, view attribute	add page, delete page, update page, update attribute
Learned Lessons	view lessons, view category	add lessons, delete lessons, add category, delete category, update lessons, update category
FAQs	view FAQ, view word	add FAQ, delete FAQ, add word, delete word, update FAQ, update word

Intelligent Agent Rules.
The Agent Rules was defined in each Moodle activity:

- Forum
  - RF1: When adding or modifying a forum, will send a SMS and email to all students.
  - RF2: 24 hours after created a forum, will send a SMS and email to students who have not seen the forum.
  - RF3: 48 hours after created a forum, will send a SMS and email to students who have not participated in the forum.
  - RF4: Every 24 hours send a SMS and email to students who have not participated in the forum.
- Assignment
  - RA1: To schedule any activity, send a SMS and email to all students.
  - RA2: 24 hours before any scheduled activity, send a SMS and email to all students.
  - RA3: 1 hour prior to any scheduled activity, a SMS and email is sent to all students.
- Questionnaire
  - RQ1: By adding a questionnaire is sent a SMS and email to all students.
  - RQ2: 24 hours after it created a questionnaire is sent a SMS and email to students who have not responded to the questionnaire.
  - RQ3: 48 hours after it created a questionnaire is sent a SMS and email to students who have not responded to the questionnaire.

‒ RQ4: When performing submits a questionnaire, send a SMS and email to the teacher student data.
- Quiz
  ‒ RQZ1: To add a quiz, you send a SMS and email to all students.
  ‒ RQZ2: 24 hours after created a quiz, a SMS and email to students who have not responded is sent quiz.
  ‒ RQZ3: 48 hours after created a quiz, a SMS and email to students who have not responded is sent quiz.
  ‒ RQZ4: when it closed a quiz, SMS and email is sent to the teacher with student data.
- Wiki
  ‒ RW1: To add a Wiki, send a SMS and email to all students and the teacher.
  ‒ RW2: 24 hours after created a wiki, a SMS and email to students who have not participated in the wiki is sent.
  ‒ RW3: 48 hours after created a wiki, a SMS and email to students who have not participated in the wiki is sent.
  ‒ RW4: When making a wiki post, SMS and email is sent to the teacher with student data.

3.6 The Moodle Blocks Developed

The Fig..6 shows the Moodle blocks developed, related to KM tools.

Fig. 6. KM tools blocks.

The KM Tools are available in English and Spanish. The next figures show the tools options in Spanish. The Yellow Page block has two options: Search (Fig. 7) and Edit my Yellow Page (Fig. 8).
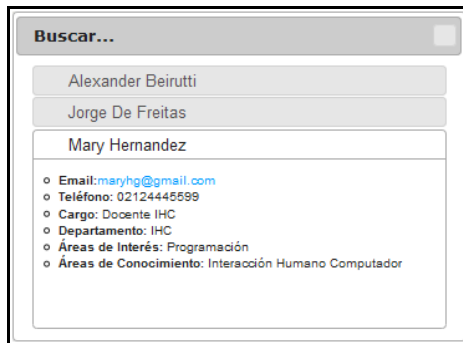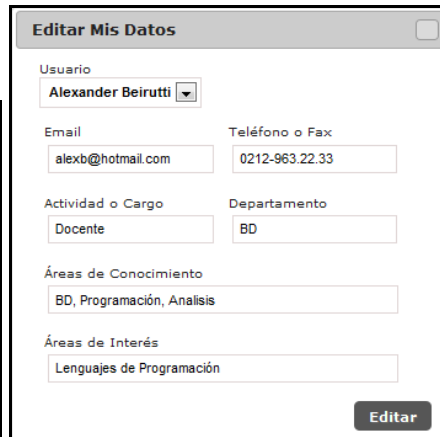
Fig. 7. Yellow Page Search.

Fig. 8. Edit my Yellow Page.

The Lessons Learned block has the Search and the Category Organizer (Fig. 9). The FAQs block has the Search, the Highlights section (the most requested FAQs) and the new FAQs section (Fig. 10).

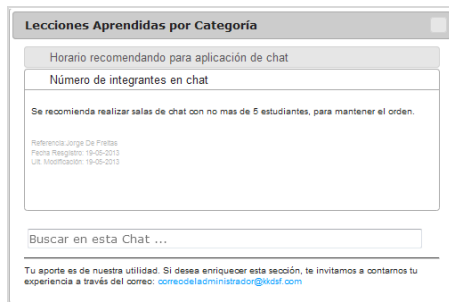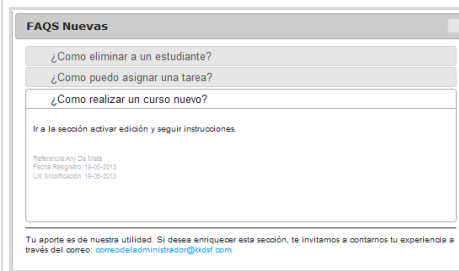**Fig. 9**. The Lessons Learned block.

Fig. 10. FAQs block.

The Intelligent Agent block has: the new track, tracking list and the messages configuration (Fig. 11).

Fig. 11. The Intelligent Agent block.

Fig. 12. New track section.

The new track section is shown in Fig.12, where you can include all possible options for a new track, according to the rules of intelligent agent indicated previously.

4   Validation

For the validation of the blocks incorporated in Moodle, the rules implemented in the activities with de intelligent agent, we did three validation processes.

The first process was the usability validation, the second was the functional validation and the third a satisfaction survey.

4.1   Usability Validation

In the usability validation, we did the tests that consisted of analyzing the conformity of the interface with recognized usability principles (heuristics) and correspond to Jakob Nielsen's 10 general principles for interaction design [23]:

1) Natural and simple dialogue
2) Speak the user's language
3) Minimize the cognitive load
4) Consistency
5) Feedback
6) Provide clear outputs
7) Provide shortcuts (hotkeys)
8) Descriptive error messages
9) Prevention of errors
10) User support

The scale used for assessment of the problems was: 0 (there is a usability problem), 1 (cosmetic problem), 2 (minor problem), 3 (major usability problem) and 4 (catastrophic usability imperative fix solution) and it was applied to 6 users (3 teachers and 3 students).

Table 2 shows the most outstanding problems encountered with the heuristic evaluation.

Table 2. Problems encountered with the heuristic evaluation.

Problem	Heuristic	Assessment	Solution
The categories of the Lessons Learned have not sorted	H1	4	Organize content
Some Yellow Pages data are not mandatory	H4	5	All fields are required
Not shows the shortcuts in the Intelligent Agent options	H7	4	Include shortcuts in each attribute and each option

Positive opinions about usability issues are evident. It is necessary to note that the questionnaire sought opinions related to investigate usability issues reported by Nielsen [23], therefore, to obtain a greater number of favorable responses, we can say that the application is usable.

4.2   Functional Validation

The second validation consisted of forty-one (41) cases of evaluation, covering fully all functional levels of the new blocks for the KM tools and the Intelligent Agent.

In this test, participated 6 users (3 teachers and 3 students), who entered the system using the password of teacher, administrator password and finally as students, to run the test, related each functional requirement, to previously defined in section 3.2, and the Agent Rules defined in each Moodle activity, showed in section 3.5.

We used the Likert scales [24] with the typical format of five levels of responses (5. strongly agree, 4. Agree, 3. neither agree nor disagree, 2. disagree and 1. strongly disagree).

Then we show the questions and the percentages of responses given to each question, by the group from 6 users.

- Questions of functional requirements:

  1) TFR1: Search Yellow Pages is successfully?: 100% strongly agree.
  2) TFR1: Search FAQs is successfully?: 100% strongly agree.
  3) TFR1: Search Learned Lessons is successfully?: 83.33% strongly agree and 16.66% agree.
  4) TFR2: Adding Yellow Pages is successfully?: 100% strongly agree.
  5) TFR2: Adding Learned Lessons is successfully?: 100% strongly agree.
  6) TFR3: Update attributes of the Yellow Page associated with his user is successfully?: 100% strongly agree.
  7) TFR4: Update Lessons Learned added for him is successfully?: 100% strongly agree.
  8) TFR5: Update the options for Intelligent Agent is successfully?: 100% strongly agree.
  9) AFR1: Search Yellow Pages is successfully?: 83.33% strongly agree and 16.66% agree.
  10) AFR1: Search FAQs is successfully?: 100% strongly agree.
  11) AFR1: Search Learned Lessons is successfully?: 100% strongly agree.
  12) AFR2: Adding Yellow Pages is successfully?: 83.33% strongly agree and 16.66% agree.
  13) AFR2: Adding FAQs is successfully?: 100% strongly agree.
  14) AFR2: Adding Learned Lessons is successfully?: 83.33% strongly agree and 16.66% agree.
  15) AFR3: Update attributes of the Yellow Pages is successfully?: 100% strongly agree.
  16) AFR4: Update Learned Lessons is successfully?: 83.33% strongly agree and 16.66% agree.

17) AFR5: Update the options for Intelligent Agent is successfully?: 100% strongly agree.
18) SFR1: Search Yellow Pages is successfully?: 100% strongly agree.
19) SFR1: Search FAQs is successfully?: 83.33% strongly agree and 16.66% agree.
20) SFR1: Search Learned Lessons is successfully?: 100% strongly agree.
21) SFR2: Adding Learned Lessons is successfully?: 100% strongly agree.
22) SFR3: Update Learned Lessons is successfully?: 83.33% strongly agree and 16.66% agree.

- Questions of Agent Rules:

23) RF1: When adding or modifying a forum, the system sends a SMS and email to all students, is successfully?: 100% strongly agree.
24) RF2: 24 hours after created a forum, the system sends a SMS and email to all students who have not seen the forum, is successfully?: 100% strongly agree.
25) RF3: 48 hours after created a forum, the system sends a SMS and email to students who have not participated in the forum, is successfully?: 83.33% strongly agree and 16.66% agree.
26) RF4: Every 24 hours, the system sends a SMS and email to students who have not participated in the forum, is successfully?: 83.33% strongly agree and 16.66% agree.
27) RA1: When schedule any activity, the system sends a SMS and email to all students, is successfully?: 83.33% strongly agree and 16.66% agree.
28) RA2: 24 hours before any scheduled activity, the system sends a SMS and email to all students, is successfully?: 83.33% strongly agree and 16.66% agree.
29) RA3: 1 hour prior to any scheduled activity, the system sends a SMS and email to all students, is successfully?: 66.66% strongly agree and 33.33% agree.
30) RQ1: By adding a questionnaire, the system sends a SMS and email to all students, is successfully?: 83.33% strongly agree and 16.66% agree.
31) RQ2: 24 hours after it created a questionnaire, the system sends a SMS and email to students who have not responded to the questionnaire, is successfully?: 100% strongly agree.
32) RQ3: 48 hours after it created a questionnaire, the system sends a SMS and email to students who have not responded to the questionnaire, is successfully?: 100% strongly agree.
33) RQ4: When performing submits a questionnaire, the system sends a SMS and email to the teacher student data, is successfully?: 83.33% strongly agree and 16.66% agree.
34) RQZ1: To add a quiz, the system sends a SMS and email to all students, is successfully?: 100% strongly agree.

35) RQZ2: 24 hours after created a quiz, the system sends a SMS and email to students who have not responded the quiz, is successfully?: 83.33% strongly agree and 16.66% agree.
36) RQZ3: 48 hours after created a quiz, the system sends a SMS and email to students who have not responded the quiz, is successfully?: 100% strongly agree.
37) RQZ4: When it closed a quiz, the system sends a SMS and email to the teacher with student data, is successfully?: 100% strongly agree.
38) RW1: To add a Wiki, the system sends a SMS and email to all students and the teacher, is successfully?: 83.33% strongly agree and 16.66% agree.
39) RW2: 24 hours after created a wiki, the system sends a SMS and email to students who have not participated, is successfully?: 100% strongly agree.
40) RW3: 48 hours after created a wiki, the system sends a SMS and email to students who have not participated in the wiki, is successfully?: 66.66% strongly agree and 33.33% agree.
41) RW4: When making a wiki post, the system sends a SMS and mail to the teacher with student data, is successfully?: 100% strongly agree.

The 48.78% of the cases had responses "100% strongly agree", the 29.26% of the cases has responses "83.33% strongly agree and 16.66% agree" and finally the 21.95% had responses "66.66% strongly agree and 33.33% agree". The options neither agree nor disagree, disagree and strongly disagree, were not answered in at all (Fig. 13). This allows functionally validate the system, because 100% of the answers were strongly agree or agree.
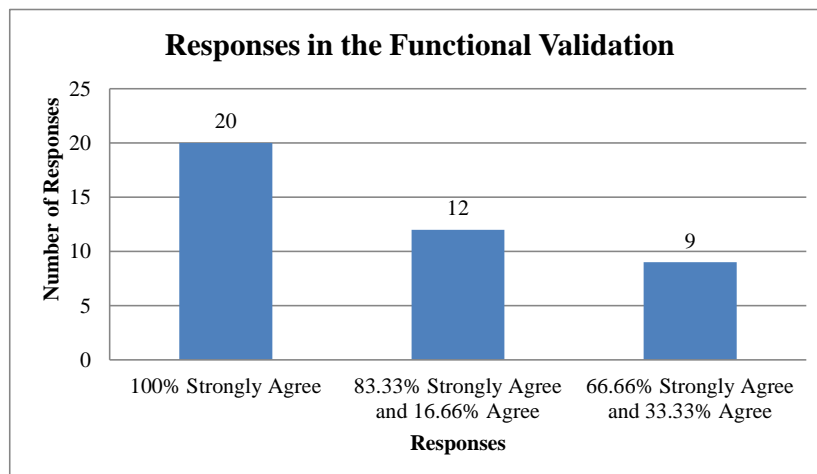

Fig. 13. Responses of the functional validation.

4.3 Satisfaction Survey

The satisfaction survey was completed as third validation. It had 5 questions and was applied to 40 professors and 400 students, in the Universidad Central de Venezuela. The 450 evaluators are Moodle user in the university.

Then we show the satisfaction survey questions, and the responses associated also were Likert scale (Fig. 14).

1) Does using new Moodle blocks, is performed intuitively?
2) The new Moodle block meets the expectations of knowledge management?
3) Is it appropriate to use the Internet of Things with Moodle and course management?
4) Are the interfaces are usable?
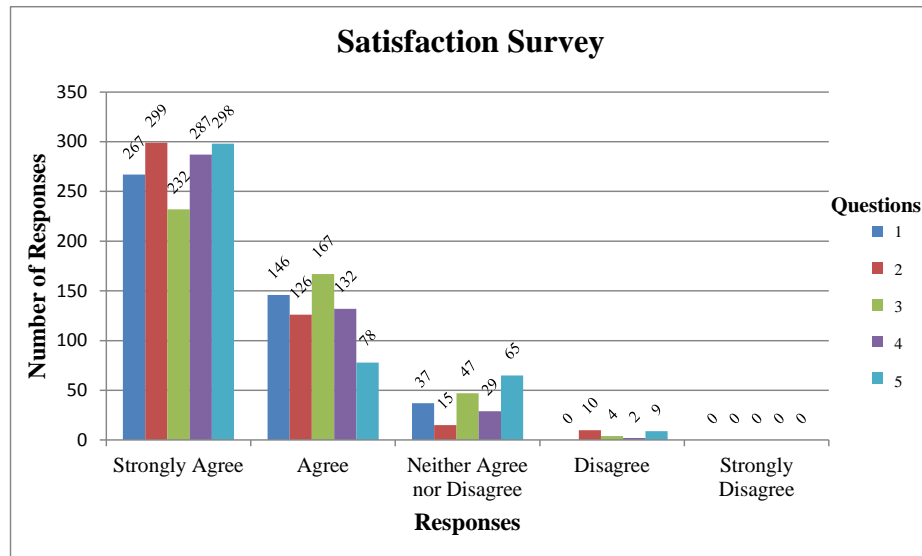5) Would you recommend the system developed to colleagues and other students?

Fig. 14. Satisfaction survey responses.

The question 1: "Does using new Moodle blocks, is performed intuitively?", the 59.33% is strongly agree that is performed intuitively, the 32.44% is agree and the 8.22% is neither agree nor disagree, therefore, the 92% think strongly agree and agree think being performed intuitively. Also in the question 2: "The new Moodle blocks meets the expectations of knowledge management?", the 66.44% is strongly agree that the use it meets the expectations, the 28% is agree and the 2.22% is neither agree nor disagree, then the 94.44% think positively, and the other 5.55% is neither agree nor disagree and disagree.

In the question 3: "Is it appropriate to use the Internet of Things with Moodle and course management?", the 51.55% is strongly agree that is appropriate to use it, the

37.11% is agree and the 0.88% is neither agree nor disagree. The 88.66% think positively and the 11.33% is neither agree nor disagree and disagree.

The question 4: "Are the interfaces are usable?", was answered similarly, the 63.78% is strongly agree, 29.33% is agree and 6.44% is neither agree nor disagree and only 0,44% think disagree about it.

The question 5: "Would you recommend the system developed to colleagues and other students?", the 66.22% is strongly agree to recommend it, the 17.33% is agree, the 14.44% is neither agree nor disagree, and finally 2% think disagree about this.

All questions had similar responses, where the option strongly agree had the highest responses, the second option was agree and the third the option neither agree nor disagree, the option disagree the less answered, and the option strongly disagree no response.

5   Conclusions

The use of LMS has grown in education institutions to offer new alternatives in the teaching and learning process, allowing us to offer courses e-learning, b-Learning and m-learning, or support in a system of classroom education, but always is looking for new resources or services that may be offered, it is for this reason that three tools of knowledge management were developed: Yellow Pages, Lessons Learned and FAQs, and an Intelligent Agent, which they were integrated into learning management system Moodle. Upon completion of this work it was possible to successfully develop a set of tools to easily, provide tangible support for teachers and students that make this platform a vital tool in the teaching and learning process.

The developed tools have the following advantages: they are free, not limited to any specific educational area, enable knowledge management, ensures that data and experiences of other teachers and students are not wasted and offers continuing improvements in materials and courses.

For the validation of the developed tools, we did three processes, the usability validation, the functional validation and the satisfaction survey, all being satisfactory, and allowing validity usability, functionality and satisfaction.

As future works, we propose testing in courses implemented, considering control groups and experimentation in order to evaluate the management of knowledge and its impact on real cases. Likewise, it is recommended as a possible extension of this work, implement a module that allows teachers subscribe to specific topics of interest, and which in turn are notified by sending email when there are new entries.

Similarly, in the future is important that the learning and teaching environment can to be intelligent environment based in semantic web that not necessarily used intelligent agents in LMS, and can to find and recommend significant contents for the students learning.

Finally, it is important that these tools will be released within the development community Moodle for subsequent incorporation of new versions, and thus any institution or organization to install new versions may have developed blocks in this work.

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