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Seeding Courses on Moodle: the AgriMoodle Case

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Abstract

The agricultural education covers all levels of formal education but focuses mostly on the higher ones as well as the vocational education and training. Online courses play an important role in the educational context and compared to traditional courses they eliminate the location and time restrictions and allow a self-paced attendance of a curriculum. At the same time, the existence of online courses raised the need for the design and implementation of the appropriate platforms which may be used for the organization and deployment of online courses. This paper presents the case of agriMoodle, a course management platform based on the widely used Moodle platform, which provides a number of enhancements in the form of modules or widgets specialized for the agricultural domain. These modules aim to enhance the user experience and the functionalities of a standard Moodle installation.

Key words

Vocational educational training, Moodle, agricultural education, online courses, agriMoodle.

Introduction

1. The status of the agricultural educational resources and courses

Agricultural education is of major importance for the agricultural community; covering all levels of formal education, ranging from primary (or even pre-school) to tertiary, vocational education and training (VET) (Hopkins, 2013) as well as adult education, it aims to meet the requirements of a diverse learning audience and to provide the knowledge required in each case. Additional knowledge may be acquired through various forms of informal learning and non-formal education (Latchem, 2014). Due to its nature and trans-disciplinary approach, the agricultural education covers a wide variety of topics, including plant and animal breeding, plant protection, crop management, as well as related topics such as environmental issues, ecology, biodiversity, management, marketing, economics/statistics etc. Despite the fact that there can be agricultural educational resources even for preschool context, focusing mostly on basic concepts and environmental topics, the majority of the formal education systems all over the world usually provide an agriculture-specific educational context at the college level or equivalent (Phipps et al., 2008).

Courses consist a significant component of the educational framework, allowing tutors to interact with the learners. Courses usually consist of a presentation which may be further supported by additional material in the form of documents (e.g. related publications), multimedia files (e.g. videos and images) and any other type of educational material. Online courses provide a number of advantages over the traditional ones, such as eliminating location/distance issues and the need to attend real-time (asynchronous courses) etc., while at the same time exhibiting unique characteristics (Richardson and Swan, 2003). In this direction, online courses provide a valuable tool for tutors that can organize and deploy their courses online, while at the same time distance learners can attend courses remotely and asynchronously, eliminating barriers that might prevent them from doing so in a traditional way such as in a classroom for several reasons. Offerings of online courses continue to increase in higher education settings, as institutions attempt to meet students‘ (and faculty members‘) increasing demands for online access (Inoue-Smith, 2014).

The growth of the online courses led to the need for the development of online course management platforms which allow the organization, hosting and delivery of online courses.

This paper aims to describe the developments and adaptations made in Moodle, the most commonly used online course management platform, leading to the development of the agriMoodle platform. These adaptations were based on the requirements collected from the agricultural learning community and aimed to provide a number of enhancements over α traditional Moodle installation.

2. The Moodle platform and the need for a domain-specific version

Moodle, originally an acronym for "Modular Object-Oriented Dynamic Learning Environment", is a learning platform designed to provide educators, administrators and learners with a single robust, secure and integrated system to create personalized learning environments (Dougiamas, Taylor, 2003). It is a user-friendly tool which allows tutors to create, host and deliver courses, which can be enhanced with various functionalities and additional supporting material. A number of available functionalities also facilitate its usage by the learners who decide to participate in one of the courses hosted in a Moodle instance. During its about 10 years of existence, Moodle has more than 85,000 registered and verified sites all over the world, serving more than 7 million courses tomore than 70 million learners (Moodle, 2014).

Moodle is free and licensed as open source software, which makes it really flexible as it can be customized and adapted so that it can meet specific requirements. In addition, thanks to its modular structure, it can be further adapted through the development and use of custom plugins and add-ons, a high number of which is already available for free.Addressing the needs of the educational community for over a decade, Moodle has nowadays become the native working environment for many educators at different countries, domains and educational levels. Another advantage of the Moodle platform is that it allows data mining, which allows the enhancement of the services provided through the educational analytics analysis (Romero et al., 2008).

The standard Moodle installation includes a wide variety of options and customization features. Courses are supported through various means of communication within the platform between the tutor and the learners, including a forum, private messages and blogs. Tags and notes can also be used for providing information about a course and its contents. A user of the Moodle platform can create his/her own profile and customize it further if needed.

A tutor has access to a variety of tools which facilitate the deployment of a course and the monitoring of the learners' progress. For example, there are options for monitoring the completion of a course and assignments on individual basis, a grading tool, the option to assign badges when a learner achieves a specific goal within a course (e.g. completion of an assignment), and has access to various types of logs and reports related to his course. Customization options include the setting of the location and the language of the user interface, the revision of the appearance of the Moodle page, addition of plugins and add-ons etc. In addition, the use of Moodle was shown to enhance the spirit of collaboration during distance learning through online discussions, combined with the use of social media web sites, like Facebook (Deng and Tavares, 2013). This collaborative learning behavior was studied by Lu and Law (2013), who focused their study on specific aspects of the Moodle platform. Another important feature of the Moodle platform for delivering online courses is that it can be used alongside data mining methods in order to extract useful information about the courses and the learners, such as the prediction of marks that a student may receive in the final exam of an online course (Romero et al., 2013).

While Moodle is considered as one of the main LMS platforms, especially now with the increased popularity of the Massive Open Online Courses (MOOCs) (Wulf et al., 2014), there are times that the general installation cannot cover the specific needs of some communities. What makes Moodle a success story of an LMS is the capability to be customized and the ability for developers to provide back to the community and create specialized components or even Moodle versions. Following this concept, the agriMoodle was born, as an extension of the Moodle platform to cover the needs of the agricultural community. In the next sections, the customized components of such customized platform are presented as well as an example use case where the specialized platform has been used.

Materials and methods

1. AgriMoodle: adapting the Moodle platform

The agriMoodle is an extended bundle of the Moodle software, developed by Agro-Know (**www.agroknow.gr**) and provides a feature-rich, fresh Moodle installation, integrating a set of green/agro-templates and themes, linking to interesting green/agri-information sources, and extended with specific modules and widget to serve the needs of the agricultural community.

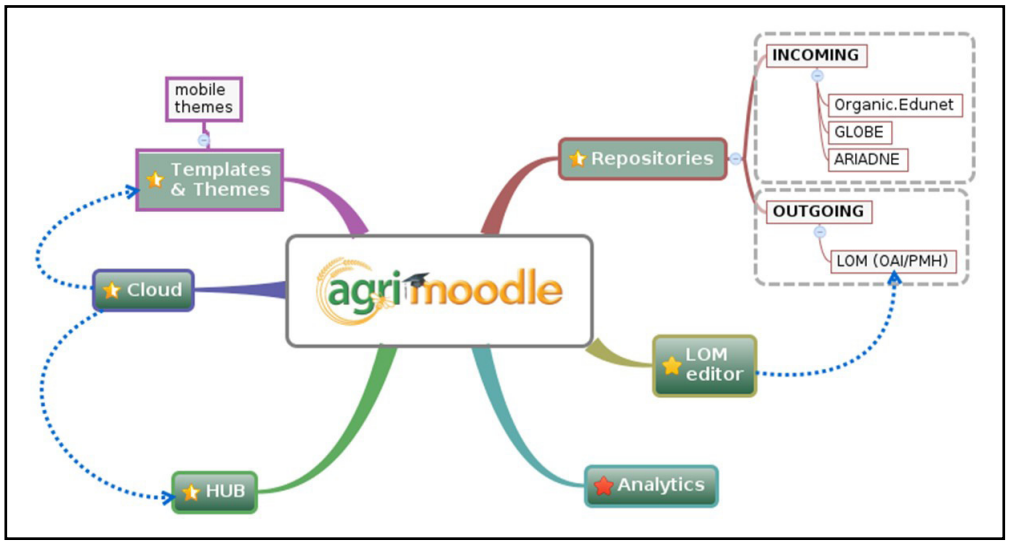
The objective of the agriMoodle is to integrate different services for discovery of agricultural content that is suitable for educators and learners into Moodle, thus making it directly available through Moodle's native environment, without requiring educators or learners to adopt to another environment or learn to use new tools, such as the ARIADNE Finder (**http://ariadne.cs.kuleuven.be/finder/ariadne**).

With the functionality that is integrated in the agriMoodle platform, trainers can use readily available widgets to import resources from relevant repositories and use an easy LOM editor to describe as well as export metadata for their resources. Learners can also benefit from (automatic) references to useful material, through various widgets.

In short, agriMoodle is a Moodle installation with a custom configuration and special modules that make it suitable for agri- related courses. agriMoodle's development follows closely the life-cycle of Moodle, so that any new releases, security upgrades, bug fixes, etc. of Moodle are readily integrated into the agriMoodle installation package. Moreover, special consideration has been taken into account, so that all agriMoodle features use the standard extension mechanism of Moodle and/or use the recommended methods for adopting and configuring Moodle. This allows for any existing Moodle installation to easily become an agriMoodle one, just by installing the needed extensions and modules and choosing to adopt any customisation of user interface and themes.

The main features of agriMoodle include the following:

- Out-of-the-box installation of agri-themes and course layouts, through well- documented process, designed for not requiring highly skilled IT capacities.
- Modules that implement easily configured widgets, which can be integrated in courses and display links to relevant learning resources from open-access agri-related repositories and collections, like that of GLOBE (**http://globe-info.org**), ARIADNE (**http://ariadne.cs.kuleuven.be/finder/ariadne**), Organic. Edunet (**www.organic-edunet.eu**), OER Commons Green (**http://www.oercommons.org/green**) and other related sources.
- Modules geared towards course creators, which allow identification of learning resources relevant to the course under



Source: own processing

Figure 1: The general architecture of the agriMoodle platform.

development and easy integration into specific course's location.

- An integrated metadata authoring widget that enables easy definition of metadata both for courses and learning resources, through an intuitive user interface, efficiently pre-loading metadata elements with information from the associated Moodle context, allowing description and classification of courses and resources against standard agri- related vocabularies and taxonomies, such as AGROVOC (**http://aims.fao.org/standards/agrovoc/about**). One of the most suitable and appropriate metadata format for describing data in the agrarian sector and rural areas is VOA3R Metadata AP - Virtual Open Access Agriculture and Aquaculture Repository Metadata Application Profile (Simek et al., 2013).
- A transparent mechanism for exporting collected metadata, through standard protocols, such as OAI-PMH in IEEE LOM and DC-based forms.
- Configurable publishing of selected information of agriMoodle instances to generic search-engines such as Google, including search-engine-optimization, push notifications to social portals and services, such as Facebook and Twitter, as well as through standard mechanisms, such as RSS.
- Out-of-the-box translation of all user-interface elements to many languages and a well-documented process, in conformance to Moodle's guidelines, for implementing new translations.
- Cloud-ready installation and specially designed operation of all agriMoodle extensions to allow for best benefit from a Cloud-based operational environment.

The platform includes three different tools - widgets to allow better connection to repositories and improve sharing data in an openly way, widgets that are pre-installed and can be configured with every new deployment of an agriMoodle instance. More specifically, the three widgets are the following:

- OER-Finder Widget, which provides an Open Educational Resources (OER) finder to search agricultural related content and can be used both by the content authors in order to locate useful resources and integrate them in their course, as well as by the learners who are given the opportunity to browse through a rich set of resources related to their current course.
- Metadata Editor Widget, which provides an intuitive, context-sensitive user interface to facilitate editing of the metadata of every learning resource by the manager of each course, in accordance to the Organic.Edunet IEEE LOM Application Profile.
- OAI-PMH Target Module, which allows the agriMoodle installation to provide an OAI-PMH (Open Archives Initiative - Protocol for Metadata Harvesting) target, thus serving as a source of metadata records, which can be harvested by any OAI-PMH compliant harvester across the globe.

2. The OER-Finder widget

The first widget is a Moodle "block" plugin which implements a component that filters and recommends educators and students with educational resources related to their courses and lessons that are available in any of the compliant repositories such as the ones provided by the Organic.Edunet portal (**www.organic-edunet.eu**).

The related items are displayed as a simple list of items on the side of the page with stars that indicate the relevance of the item to the user. The relevance is identified based on a dynamic user profile built for each user. Analytics algorithms are applied to build this dynamic user profile.

A search box at the top of the list allows the educator or student to change the search terms based on their interests. The default search term will be the title of the current course. Moreover, the educator is able to adjust the widget's parameters, like the keyword for default search, number of items to be displayed, etc.

In addition, a very interesting feature that is available for the educators is the ability for direct inclusion of the relevant items into the Moodle course content. When the learner clicks on an item, a modal popup dialog is displayed with details about the selected item. It's important to note that educators and learners are able to navigate and get recommendations from all educational resources available through the widget.

The figure below presents the OER Finder Moodle widget when used to search educational content using the term "organic farming".

Source: own processing

Figure 2: The OER Finder widget.

3. The OAI-PMH Target Module

The OAI-PMH Target Module adds support for any agriMoodle instance to provide an OAI¬-PMH target. OAI¬-PMH stands for the Open Archives Initiative Protocol for Metadata Harvesting protocol (Open Archives Initiative, 2002) and, indeed, this plugin is directly related with metadata and harvesting; it allows exposure of metadata that are intrinsic in Moodle's description of courses and resources, through a standards compliant OAI¬-PMH mechanism.

The objectives for the implementation of the Moodle OAI-¬PMH plugin are twofold. From one hand it is geared to facilitate exchange of resources and courses, among different Moodle installations (and, in fact, across different standards compliant LMSs), promoting the awareness of metadata across educators, since it is expected to reward coherent, well-¬defined descriptions of resources with greatly improved visibility, exploitability and credibility for the resources' creators. On the other hand, it will facilitate the exploitation of backend and front-end services, such as the Finder, to provide an integrated overview of existing resources and courses.

The OAI-PMH plugin is the interface of the agriMoodle platform for harvesting. A harvester is a client application that issues OAI-PMH requests and is operated by a service provider as a means of collecting metadata from repositories. In that sense, the Moodle installation becomes a „repository" from which any associated harvester can request information related to the metadata of the courses and the resources available through your installation.

The main important concepts, as they are used by OAI-PMH, are the following:

- Resource: a resource is the object that the metadata describe.
- Item: an item is a constituent of a repository from which metadata about a resource can be disseminated. The metadata may be disseminated on-the-fly from the associated resource, cross-walked from some canonical form, actually stored in the repository, etc.
- Record: a record is metadata in a specific metadata format. A record is returned as an XML-encoded byte stream in response to a protocol request to disseminate a specific metadata format from a constituent item.
- (Unique) Identifier: Each item has an identifier that is unique within the scope of the repository of which it is a constituent. Note that Items may contain metadata in multiple formats. The unique identifier maps to the item, and all possible records available from a single item share the same unique identifier.

This software component is implemented as a standard Moodle plugin, in compliance to the Moodle coding specifications and guidelines. All relevant code lives on a GIT version controlled repository, openly available in GitHub (**https://github.com/agroknow/agrimoodle/wiki**). The integration of the plugin in an existing installation is straightforward and described in the plugin's documentation.

The plugin offers the following six functionalities, though the corresponding OAI-PMH verbs:

1. GetRecord: this verb is used to retrieve an individual metadata record from a repository.
2. ListRecords: this verb is used to harvest records from a repository.
3. Identify: this verb is used to retrieve information about a repository.
4. ListIndentifiers: this verb is an abbreviated form of ListRecords, retrieving only headers rather than records.
5. ListMetadataFormats: this verb is used to retrieve the metadata formats available from a repository.
6. ListSets: This verb is used to retrieve the set structure of a repository.

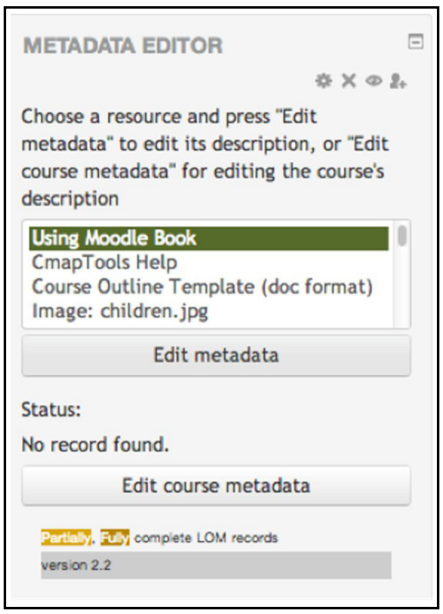
For harvesting purposes, the Service Provider will usually invoke the ListRecords verb (with a metadata prefix and usually a timespan) on the Metadata Provider. Moreover, the current implementation effort is targeted towards integrating this plugin

with the extended metadata that are captured through another plugin, the metadata editor.

4. The Metadata Editor Widget

The Learning Object Metadata (LOM) Editor Widget provides an intuitive mechanism for capturing metadata for the learning resources that are used within each course of an agriMoodle installation. Metadata are like hash-tags or keywords and is a way to describe a specific resource so that discovery services will be able to find the resource. One of the main problems that we face today is that while there are a lot of online resources, many of them do not have good metadata descriptions making them very difficult to be discovered. Widely-used resources have good metadata descriptions but still some excellent resources are not accessible due to the bad descriptions.

The agriMoodle platform brings metadata capture and editing directly into the Moodle LMS. The Metadata Editor plugin facilitates the tedious task of metadata provision for learning resources and courses that are available in the agriMoodle instance, and undertakes management and storage of all the metadata using the Organic.Edunet IEEE LOM AP format (Palavitsinis et al., 2009) which is compliant with the IEEE LOM standard, one of the most widely used formats for educational content.Thus, the Metadata Editor Widget, implements an integrated LOM metadata authoring tool that enables easy definition of metadata both for courses and learning resources, through an intuitive user interface.



Source: own processing

Figure 3: The Metadata Editor Widget.

When a user – the widget is addressed to course providers, teachers, etc. – opens the editor, it will efficiently pre¬loads metadata elements with information from the associated Moodle context. Even more, it links to existing vocabularies & ontologies allowing description and classification of courses and resources against standard agri-related vocabularies and taxonomies, such as AGROVOC. Finally, through the editor, users can view mandatory and recommended fields in order to make the description compliant to the Organic.Edunet IEEE LOM Application Profile (AP).

Results and discussion

1. Using agriMoodle in practice: The case of the Herbal.Mednet project

A case of using the agriMoodle platform for the vocational education needs of a specific agricultural domain is the case of the Herbal. Mednet project. With the support of the project the agriMoodle LMS was used and adapted to cover the needs of the organic agricultural domain in order for educational institutions or organizations (such as the Spanish Society of Organic Agriculture – SEAE, **www.agroecologia.net**) and companies (such as the cosmetic company APIVITA **www.apivita.com**) to take advantage of the platform to provide online education courses to people involved in organic agriculture and organic medicinal and aromatic plants (MAPs). The usage of the platform to cover the needs of SEAE is explained in the following sections following the personas approach (Pruitt, 2003).

2. Personnas identification

SEAE is the Spanish Association for Organic Agriculture, which organizes and offers trainings regarding the thematic area of organic agriculture and organic medicinal and aromatic plants. While SEAE offers a lot of trainings, they are targeted only to specific regions of Spain where they take place, limiting the number of people who can afford to attend them. SEAE will be most interested in expanding the targeted users and be able to offer online trainings to farmers and agronomists in the field of organic MAPs.

Juan is a PhD student in a Spanish Agriculture University having his thesis in the cultivation of specific MAPs that can be found in the region of Valencia, Spain. Juan is informed about the trainings of SEAE in the same area. Unfortunately, Juan has financial problems

and in order to sustain the expenses of his studying, he has to work during the mornings. Faced with the problem that he will not be able to participate to the trainings, which could have provided him with a lot of content for his PhD. and get in touch with a lot of people who are interested in the same area.

Victor is an agronomist expert in the field of organic cultivation of MAPs working for SEAE. In order to improve the SEAE's dissemination and to attract new students, Victor wants to start an online course. The course will also be available to current participants in trainings, especially for who cannot attend the events.

Marta is Victor's colleague and the technical administrator and responsible for the setup and support of new tools in SEAE's network. Marta is responsible for providing technical support to all the SEAE users and is the administrator in all the online platforms SEAE is using.

3. Current situation

Juan, while he is very excited about his PhD., due to his work he does not have a lot of time available to search over the internet for resources. Even more, since there is no integrated system, he has to use public search engines combined with public keywords, which usually produce much unrelated search results. Juan knows about some of the available educational portal, such as the Organic.Edunet portal, but unfortunately the resources he can find on thematic area of MAPs are very limited. Through one of his searches, Juan stumbles upon a press release about upcoming trainings in the area of MAPs from SEAE which could be of high importance for his PhD. Juan is now faced with a new problem, due to his work and luck of money he can not attend the SEAE trainings.

After a long search in the internet and conversations by phone, Juan manages to find that Victor is responsible for the trainings that SEAE provides. Juan contacts Victor regarding his problem and asks Victor for his help. Victor gets in touch with Marta and together try to see what educational content they can provide to Juan. They try to find a technical solution for recording or streaming the trainings so that Juan may be able to participate later but due economical factors (bandwidth, cameras, infrastructure, etc.) they cannot provide such help. In addition, the content that Victor has gathered is long presentations, which due to their size cannot be sent through e-mails. Victor, again with the help of Marta, needs to create an account in a sharing service, to upload the content there (which will take a couple of hours) and then send the link to Juan to download the files. Whenever another person contacts Victor and wants some additional or less information, he has to do the same procedure which is most time consuming and non productive.

4. The agriMoodle solution

For SEAE, being a partner in the Herbal.Mednet project, an instance of the agriMoodle platform has been made available. Marta will provide training to all trainers and help them to upload their educational content in the platform. When Juan contacts Victor, he redirects him to the platform and asks him to register in the platform for an account. Victor selects the courses for Juan to view based on his needs.

Juan is very excited with the SEAE platform. Not only he can access the SEAE trainings but he can also search metadata and learning resources from a number of collections through an integrated system. In addition, as Juan uses the finder widget he discovers additional trainings and educational content from other regions and countries, such as content provided by APIVITA, resources that he would never be able to find before. He can use all this content to make comparison studies for example of practices in Spain and Greece regarding the cultivation of organic MAPs.

Apart from the above, the SEAE agriMoodle instance also helps Marta in her work. She can connect the LMS platform with other tools they have been using in the association, by exposing the API in order to search and discover additional educational content.

Conclusion

The constantly growing number of learning communities and online courses has led to the development of a number of platforms which aim to support the uploading and organization of all course-related material as well as the actual deployment of these online courses. Several different solutions exist, meeting different needs of different learning communities, such as the MOLE (Multimedia Open Learning Environment) (Mylonakis et al., 2011), which has already been used in the agricultural context (Toader et al., 2012). However, the most widely used online course management platform remains

Moodle, with millions of registered users and courses available worldwide. Moodle exhibits a number of advantages over its competitors, such as the creation and delivery of adaptive courses, thanks to its module-based concept (Despotovic-Zrakic et al., 2012).

Despite the fact that Moodle is highly customizable and there are already thousands of modules and other types of plug-ins which aim to enhance the user experience and facilitate the deployment of online courses, a number of functionalities that were missing from the existing Moodle instances were identified in the context of the Organic.Lingua project, and they were successfully designed and implemented. These functionalities significantly increased the user experience, through the following modules:

- The OER Finder module, which allows users to retrieve open educational resources from quality data sources;
- The LOM editor, which enhances the discoverability of the agriMoodle courses through the use of educational metadata;
- The automatic translation functionalities of the LOM editor, which support the multilinguality aspects of the platform;
- The LOM OAI-PMH target module, which allows the exposure of educational metadata using the widely used OAI-PMH standard, enhancing the interoperability of the Moodle platform.

Through the use of educational metadata for the courses and individual resources of each course, which are exposed through the OAI-PMH target, the development of an agriMoodle hub is envisaged and is expected to be implemented in the next months. This will allow the interconnection of several agriMoodle instances through their OAI-PMH targets and the direct exchange of information about the courses available in these instances. Additional technical implementations regarding agriMoodle are expected to take place in the next months, based on the requirements identified by the current agriMoodle users and other stakeholders of the agricultural learning community.

The online learning communities are further served by aggregators of information related to online courses, such as Coursera (**https://www.coursera.org/**), Class Central (**https://www.class-central.com/**) and edX (**https://www.edx.org/**). These sites aggregate information about online courses, including the topics, the tutors and their cost, thus allowing learners to easily retrieve the courses that are related to their learning needs. The success of these aggregators only highlights the fact that the online courses are constantly increasing their popularity and usefulness among the learning communities.

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References

[1] Deng, L., Tavares, N. J. From Moodle to Facebook: Exploring students‘ motivation and experiences in online communities. Computers and Education, 2013, Vol. 68, p. 167-176. ISSN: 0360-1315.

[2] Despotovic-Zrakic, M., Markovic, A., Bogdanovic, Z., Barac, D., Krco, S. Providing Adaptivity in Moodle LMS Courses. Educational Technology and Society, 2012, Vol. 15, Issue 1, p. 326-338. ISSN: 1436-4522.

[3] Dougiamas, M., Taylor, P. Moodle: Using Learning Communities to Create an Open Source Course Management System. In D. Lassner & C. McNaught (Eds.), Proceedings of World Conference on Educational Multimedia, Hypermedia and Telecommunications 2003 (pp. 171-178). Chesapeake, VA: AACE. [Online.] Available: http://www.editlib.org/p/13739 [Accessed: April 11, 2014].

[4] Hopkins, C. Education for Sustainable Development in Formal Education in Canada in McKeown R. and Nolet V. (Eds.) Canada in Schooling for Sustainable Development in Canada and the United States, Schooling for Sustainable Development, 2013, Volume 4, p. 23-36.

[5] Interaction Design, Inc. User experience consulting: UI design, customer research, information architecture and usability strategy: Using personas in UI design. [Online.] Available: http://www.user.com/personas.htm [Accessed: March 15, 2012].

[6] Inoue-Smith, Y. Pre-service teachers‘ perceptions of the Internet and online courses: the case of an American Pacific Island University. Asia-Pasific Journal of Teacher Education. 2014, Vol. 42, Issue 2, p. 119-131. DOI: 10.1080/1359866X.2014.892057. ISSN: 1359-866X.

[7] Latchem, C. Informal Learning and Non-Formal Education for Development. Journal of Learning for Development, 2014, Vol. 1, No. 1, ISSN: 2311-1550.

[8] Lu, J., Law, N. Understanding collaborative learning behavior from Moodle log data. Interactive Learning Environments, 2012, Vol. 20, Issue 5, p. 451-466. ISSN: 1049-4820.

[9] Moodle (2014) Statistics on the use of Moodle. [Online.] Available: https://moodle.org/stats/ [Accessed: March 24, 2011].

[10] Mylonakis, M., Arapi, P., Pappas, N., Moumoutzis, N., Christodoulakis, S. Metadata Management and Sharing.In Metadata and Semantic Research Communications in Computer and Information Science, 2011, Vol. 240, p. 275-286. ISBN: 978-3-642-24731-6.

[11] Open Archives Initiative (2002) The Open Archives Initiative Protocol for Metadata Harvesting. [Online.] Available: http://www.openarchives.org/OAI/openarchivesprotocol.html [Accessed: September 6, 2002].

[12] Palavitsinis, N., Manouselis, N., Sanchez-Alonso, S. Evaluation of a Metadata Application Profile for Learning Resources on Organic Agriculture. In Metadata and Semantic Research Communications in Computer and Information Science, 2009, Vol. 46, p. 270-281. ISBN 978-3-642-04589-9.

[13] Phipps, L., Osborne, E., Dyer, J. and Ball, A. Handbook on Agricultural Education in Public Schools Sixth Edition. NY: Delmar Learning. 2007.

[14] Pruitt, J., Grudin, J. Personas: practice and theory, Proceedings of the 2003 conference on Designing for user experiences, , San Francisco, California. June 06-07, 2003 [doi>10.1145/997078.997089].

[15] Richardson, J., Swan, K. Examing Social Presence in Online Courses in Relation to Students‘ Perceived Learning and Satisfaction. Journal of Asynchronous Learning Networks, 2003, Vol. 7, Issue 1. p. 68 - 88. ISSN: 1092-8235

[16] Romero, C., Espejo, P. G., Zafra, A. Web usage mining for predicting final marks of students that use Moodle courses. Computer Applications in Engineering Education. 2013, Vol. 21, Iss. 1, p. 135-146. ISSN: 1061-3773.

[17] Romero C., Ventura, S., Garcia, E. (2008) Data mining in course management systems: Moodle case study and tutorial. Computers & Education, 2008, Vol. 51, Iss. 1, p. 368–384. ISSN: 0360-1315.

[18] Simek, P., Vanek, J., Jarolimek, J., Stoces, M., Vogeltanzova, T. Using metadata formats and AGROVOC thesaurus for data description in the agrarian sector. Published in Plant, Soil and Environment. Czech Academy of Agricultural Sciences, Prague, 2013, p. 378 – 384.

[Online.] Available: http://www.agriculturejournals.cz/publicFiles/97726.pdf. [Accessed: November 10, 2013]. ISSN 1805-9368.

[19] Toader M., Roman, Gh.V., Protonotarios, V. The Use of Metadata in the Description of e-Learning Content for Organic Agriculture. In Metadata and Semantics Research Communications in Computer and Information Science, 2012, Vol. 343, p. 313-324. ISBN: 978-3-642-35233-1.

[20] Wulf, J., Blohm, I., Brenner, W. Massive Open Online Courses. Business & Information Systems Engineering. 2014, Vol. 6, Issue 2, p. 111-114. ISSN: 1867-0202.