Usability Study of TEL Recommender System and e-Assessment Tools United

Beatriz Florian[1,2] and Ramón Fabregat[1]

[1] Institute of Informatics and Applications (IIiA), University of Girona, Spain
bflorian@eia.udg.edu, ramon.fabregat@udg.edu
[2] Escuela de Ingeniería de Sistemas y Computación (EISC), Universidad del Valle, Colombia
beatriz.florian@correounivalle.edu.co

Abstract. The following article presents a usability study applied over a process in formal learning that involves a set of e-assessment tools for: self-assessment, peer-assessment and summative assessment and then a simulated Recommender System (RS) in Technology Enhanced Learning (TEL). The system is constructed using Web 2.0 technologies and the Learning Management System Moodle. First, the assessment tools collect outcomes which are saved and classified according to European Qualification Framework. Second, in several times of a course, the outcomes are analyzed to find out the competence gaps of learners, the smart indicators of this analysis are showed to the learners. Finally, the simulated recommender system produces suggestions about reinforced resources to each learner according to their competence gaps. The essence of the planned presentation has three main goals: 1. To show the results of usability study on prototypes of assessment tools and the simulated RS in formal learning 2. To provide an idea of user–centered possible responses of RS for Adaptive Educational Hypermedia Systems, 3. To offer an environment for testing new recommendation approaches and methods for researchers.

Keywords: Usability study, formal learning, learning outcomes, competencies, e-assessment, adaptive educational hypermedia system, TEL recommender system, Moodle.

1 Introduction

Nowadays, formal learning focus on the institutional needs and offer support for learning processes of educational institutes like Universities. The most of universities and colleges use some Learning Management Systems (LMS) to support their courses. Some problems in the use of these systems are the few indicators of current performance of learners, the difficulty to define a competency-based learning design and the lack of recommender systems.

Toward a solution for these problems, and focus in the LMS Moodle which is the virtual learning platform for Universidad del Valle and Universitat de Girona, in our previous research we have defined a adaptive learning process [1] based on e-assessment, then we define a competency-based data model [2] which then was

C. Stephanidis (Ed.): Posters, Part I, HCII 2011, CCIS 173, pp. 138–142, 2011.

actualized according to the European Qualification Framework (EQF) [3]. We also build a set of e-assessment tool for: self-assessment and peer-assessment [4].Nowadays our work is focusing on build the adaptive algorithms of our system. This part covers some tools such as: smart indicators and a TEL recommender system in formal learning.

This work is related with TEL recommender systems [5] particularly in formal education. One advanced work in this particular area is [6]. The most of researches in TEL recommender systems has been made in the area of informal learning networks, leading by Drachsler [7] and Manouselis [8]. In [5] they collect about one hundred references to TEL recommender systems. From the educational data mining research, novelty proposals that, similar to us, use: assessment, content-based recommendations and analysis of log data from LMS are subscribed by Tang, Godoy and Sheard in [9]. The previous research in smart indicators in learning of [10] [11] are the point of start to build our layered architecture (1. Sensor layer 2. Semantic layer 3. Control layer and 4. Indicator layer). The EQF [3] defines our semantic to classified assessment items and the levels of competencies of assessment outcomes. Nowadays, several European projects, for example GRAPPLE and ICOPER, address the integration of adaptive hypermedia systems with LMS and also the building competency-driven assessment systems and recommender systems within virtual learning environments.

The novelty of the proposed approach is bring light into the gaps of the mentioned problems providing indicators to learners from the analysis of e-assessment outcomes, integrating e-assessment tools with an outcome-based competence model in a LMS and doing adaptation based on the diagnostic of learners' needs which are represented with the diagnostic of competence gaps. The assessment tools help to capture the outcome data and give them a semantic. The recommender system processes the data to produce the indicators of performance (diagnostic) and recommendations to the learners. This approach joins e-assessment, outcome-based learning, smart indicator and recommender systems in formal education.

2 Assessment Tools and Recommender System Tool United

At the first stage of the course the teacher define the competencies and the assessment plan to asses these competencies (What is the e-assessment tool to use? What is the moment to use an assessment tool? What competencies (knowledge, skills and wider competence) will be examined at each moment? What is the level expected for each competence at each moment?), for summative assessment the meta-data of each item in the test must be complemented by the teacher with the information of competence evaluated and level of evidence.

Following the architecture proposed by [14] which has four layers we are building the adaptive process. The assessment tools allow building the *Sensor Layer* and *Semantic Layer*. The *Sensor Layer* captures the outcomes from the assessment tools and transforms them into a standard outcome framework (the EQF). The recommender system acts in the *Control Layer* and *Indicator Layer*. In the *Control Layer* the data collected are analyzed and the diagnostic of competence gaps is

produced. In the *Indicator Layer*, smart indicators (statistic results of learners and their peers) and recommendations of resources are produced.

During the course if a self-assessment test is in the plan, the learners judge their own level achieved in the competencies displayed. Following the EFQ, each competence can be developed at eight levels; the competencies and levels are displayed as rubric scores. If a peer-assessment tool test is in the plan users qualify the work of their peers; this tool uses the same kind of interface displaying rubric scores. For summative assessment the learners use the Quiz tool of Moodle.

With these learning outcomes the system first display smart indicator of tests and then can calculate the gaps of competencies of a learner. A competence gap is evidenced when the difference between the level expected and the level reached is positive. The gaps of competencies are also displayed as indicators to the learners. With these diagnostics of gaps of competencies the RS suggest additional resources to each student according to the levels of competencies that he doesn't have achieved.

3 Satisfaction Analysis of the System

To evaluate the satisfaction of the users with the system prototype we started an evaluation phase with users allowed to sing up in a Moodle course about Design Patterns in OO programming. In total 20 people from 3 different countries subscribed to the evaluation and ratings to the prototype. The evaluation phase ran for one month and was concluded with an online recall questionnaire. The assessment tools are all ready building but the recommender system was simulated with a prototype.

In this section we present the most relevant answers from the online recall questionnaire regarding the satisfaction with the system.

The questions regarding the use of e-assessment tools and recommender systems in Table 1 are informative for us as they give an idea which tools are used how frequently. This information is rather important to us for the further development of the system. The most frequently used services are those which show to the users comparisons with other people.

In Table 2 we asked questions regarding the general satisfaction with the systems and the offered recommendations. It is important for us to measure the satisfaction of each kind of responses that the system gives to the users. The satisfaction with the recommendations was 55%, in an open question about this rating the users suggests that they prefer recommendations of activities rather recommendations of resources.

In Table 3 we asked the participants for the ultimate choice between the smart indicator algorithms and the recommender system algorithm. Which information technology did satisfy them more? People were more satisfied with the smart-indicators. Reasons for that could be, the participants could have plenty information of their performance and this information are useful for auto-reflexion about the next step in learning. On the other hand, we need to change our recommendation strategy to suggest activities rather learning resources and suggest peer learners that already achieved the competence that a particular learner doesn't have achieved.

Table 1. General statements about the usage of e-assessment tools and recommender systems

Strongly agree	Agree	Neutral	Disagree	Strongly disagree
I had used some LMS such as: Moodle, dotLRN, Blackboard, etc.				
45% (9)	10% (2)	25% (5)	10% (2)	10% (2)
I had used e-assessment tools				
10% (2)	25% (5)	25% (5)	15% (3)	25% (5)
I track my work results online				
45% (9)	25% (5)	20% (4)	5% (1)	5% (1)
I compare my work results with my peers				
30% (6)	50% (10)	10% (2)	5% (1)	5% (1)
I think is useful rating my own work and the work of my peers				
15% (3)	60% (12)	10% (2)	10% (2)	5% (1)
I follow recommendations of systems such as: Amazon RS, iTunesPing, MovieLens etc.				
25% (5)	45% (9)	10% (2)	10% (2)	10% (2)

Table 2. Questions regarding the satisfaction of the participants regarding the prototype system

Very Satisfied	Satisfied	Unsatisfied	Very unsatisfied
How satisfied are you overall with the system prototype?			
20% (4)	45% (9)	20% (4)	15% (3)
How satisfied have you been with the indicators about the competence levels evaluated in the summative test?			
30% (6)	35% (7)	20% (4)	15% (3)
How satisfied have you been with the rubric score-based algorithm to qualify competencies in peer assessment tool and self assessment tool?			
25% (5)	35% (7)	30% (6)	10% (2)
How satisfied have you been with the indicators about your assessment outcomes displayed as the comparison between the levels of competencies expected and levels achieved?			
30% (6)	40% (8)	15% (3)	15% (3)
How satisfied have you been with the algorithm of adaptive recommendations?			
5% (1)	50% (10)	30% (6)	15% (3)

Table 3. Question regarding the satisfaction of the participants regarding the prototype system

Smart Indicators	Knowledge-based recommendations
Which information technology did satisfy you more at the end of the evaluation?	
55% (11)	45% (9)

4 Conclusions and Future Research

This article presented a prototype system that implies a simulated recommender system to suggest resources from the emerging information of a Learning Management System. During a course a set of assessment tools in the LMS provide outcomes that are used to detect competence gaps of the learners. It further presented the results of a first satisfaction analysis by a small group of users.

The most obvious future research will be the evaluation of new recommendation algorithms regarding their impact on learners in formal education. Therefore, we first want to review suitable algorithms and adjust them to our goals.

In general we can conclude that the learners are well satisfied with the smart indicators about their assessment outcomes. On the other hand, in order to attract

participants for future evaluation we have to extend the functionality of the current simulated Recommender System towards a fully scaled LMS and include recommendations of activities and peer learners (maybe instated of resources) to help learners to overcome their competence gaps.

Based on the satisfaction analysis we want to develop our TEL recommender system in two different ways. One way is the integration of the TEL recommender systems to Moodle to have an attractive environment for participants for future experiments. The other way is the development of a web service to show the results of recommendations and smart-indicators to learners out of the Moodle environment.

Acknowledgements. Authors would like to thank the LASPAU Program for the scholarship No. 20080847. Also, thanks to the Universidad del Valle, Colombia for co-funding the research of Beatriz Florian. The work presented is framed in the context of A2U@ project (TIN2008-06862-C04-01/TSI) funded by the Spanish Government.

References

1. Florian, B.E., Baldiris, S., Fabregat, R.: Adaptive Evaluation Based on Competencies. In: Proceedings of the Third Workshop Towards User Modeling and Adaptive Systems for All (TUMAS-A 2009), AIED, Brighton, United Kingdom (2009)
2. Florian, B.E., Baldiris, S., Fabregat, R.: A new competency-based e-assessment data model: Implementing the AEEA proposal. In: EDUCON 2010, Madrid (2010)
3. Commission of the EC. Towards a European qualifications framework for lifelong learning, http://www.ec.europa.eu/education/policies/2010/doc/consultation_eqf_en.pdf
4. Florian, B.E., Baldiris, S., Fabregat, R., De La Hoz, A.: A set of software tools to build an author assessment package on Moodle. In: Proceedings ICALT 2010, Sousse, Tunisia, pp. 67–69 (2010)
5. Manouselis, N., Drachsler, H., Vuorikari, R., Hummel, H.G.K., Koper, R.: Recommender Systems in Technology Enhanced Learning. In: Kantor, P.B., Ricci, F., Rokach, L., Shapira, B. (eds.) Recommender Systems Handbook, pp. 387–415. Springer, Berlin (2011)
6. Santos, O., Boticario, J.: Modeling recommendations for the educational domain. In: Proc. of 1st. Workshop on Recommender Systems for Technology Enhance Learning. Elsevier, Amsterdam (2010)
7. Drachsler, H.: Navigation Support for Learners in Informal Learning Networks. Doctoral thesis, Heerlen, Open University of the Netherlands/CELSTEC (October 16, 2009)
8. Manouselis, N., Kosmopoulos, T., Kastrantas, K.: Developing a Recommendation Web Service for a Federation of Learning Repositories. In: Proceedings of the INCOS 2009, pp. 208–211. IEEE Computer Society, Washington, DC, USA (2009)
9. Romero, C., Ventura, S., Pechenizkiy, M., Chapman, B.R. (eds.): Handbook of Educational Data Mining, pp. 257–273, 311–322, 353–364. CRC Press, Boca Raton (2011)
10. Glahn, C.: Contextual support of social engagement and reflection on the Web. Doctoral thesis, Heerlen, Open University of the Netherlands, CELSTEC (September 18, 2009)
11. Verpoorten, D., Glahn, C., Kravcik, M., Ternier, S., Specht, M.: Personalisation of Learning in Virtual Learning Environments. In: Cress, U., Dimitrova, V., Specht, M. (eds.) EC-TEL 2009. LNCS, vol. 5794, pp. 52–66. Springer, Heidelberg (2009)