Analysis of Tools for Learning Assessment and Tracking in Distance Education

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Abstract

Learning Management Systems (LMS) used in Distance Education present two classes of assessment tools: objective and written test tools and communication tools, such as forums and message boards. Assessment metrics in these tools are usually based on averages and totals, and are presented in measuring units that are not compatible, therefore making difficult the comparisons and the accurate analysis of the student Knowledge Acquisition Level. This article objective is to present the analysis of some assessment tools included in two learning management systems: Moodle and TIDIA-AE, which is an adapted version of Sakai developed in Brazil. The analysis presents the metrics that can be obtained from each tool in the two systems and also the amount of feedback that each one gives to the student. The work is concluded presenting the main gaps that exist in the analyzed assessment tools and pointing out the need for new research to deal with them.

Keywords: Assessment, Distance Education, Sakai, Moodle, LMS.

Introduction

In many learning settings it is important to know what each student has as previous knowledge of the topic to be lectured. With this previous knowledge information, it is possible to find out what the student does not know about the prerequisites for the topic to be learned and to use this information to better plan the learning activities. In the educational system, the mechanism used to execute these measurements is the diagnostic assessment of learning (Perrenoud, 1999). It seems that the continuous assessment to follow the student in the teaching-learning process is even more important in Distance Education.

In Distance Education, given that the level of feedback is lower than in face-to-face interactions, tracking learning is only possible through records collected by different interaction mechanisms. For Distance Education supported by the Internet, these records tend to be rich and plentiful, and can be obtained by tools such as forum, chat, messages boards, on-line and off-line activities, by tracking followed links, by WebConference, etc (Valenti, Cucchiarelli and Panti, 2002).

The wide record of student interaction with a virtual learning environment

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opens a path to design tracking strategies using the collected information. This matches what Tori (2010) calls Education Without Distance by arguing that the lack of proximity does not bring any advantage from the pedagogical perspective: "... what really matters in the teaching-learning process is not the physical distance between the student and the teacher (if they are kilometers or meters apart) but the real feeling of proximity between them. Then, the challenge is to reduce the feeling of distance in teaching-learning processes..." (Tori, 2002, p. 10).

In the last 20 years, researchers in education have given considerable attention to the investigation of the impacts of practices of assessment on student learning and motivation (Brandsford et al, 2003). The identified significant effects suggest that it is important to consider how the assessment can be used to support and to improve student learning and motivation. This formative use has been described as assessment for learning while the most common use of summarization assessments is usually described as learning assessment (Broadfoot et al., 1999).

Various studies have been developed to support the formative assessment in Distance Education environments. Otsuka and Rocha (2005) propose the use of formative assessment in Distance Education environments. The proposed model seeks to support the formative assessment with emphasis on the collaborative learning. The model explores computational technologies to provide a more effective support for formative assessment not only to plan and record learning activities but also to reduce the amount of information to be analyzed by the instructor (teacher). Other references are : Langley and Ronen, (2010), Gouli , Gogoulou, and Grigoriadou (2003) Slack et all.(2003), Weirich et al (2007), Rodrigues (2002), Prata (2003), Piva Jr (2005), Franciscato et al (2008), Romani (2000), Zaina (2002), Kenski et al (2006), and Fuks et al (2006).

The use of Learning Management Systems (LMS) in the formative assessment offers rich information recorded in the system, and it is the instructor duty to transform this set of information in subsidies for an assessment (Kenski, 2006). However, it is important to have a proper on-line support for the formative assessment process given that this model of assessment can create an instructor overload. (Otsuka, 2006; Pimentel, 2006). This overload is usually due to the need to analyze the information on student performance and participation, which is scattered in the LMS.

Assessment in Learning Management Systems

Learning management systems integrate various mechanisms for assessment in the on-site presence mode. According to Ardigo (2004), of all assessment mechanisms the most successful ones with the use of computers are the objective tests, mainly due to the possibility of making an on-line application which simplifies the distribution logistics and to the automatic correction. Mcdonald (2002) performed a study aiming to verify the equivalence between the assessment on computer and the conventional assessment on paper, and came to a conclusion that there are empirical and statistical differences between them.

Bennett (1998) presented a scenario, about 14 years ago, of how the educational assessment should be reconsidered in relation to large scale tests. The study divided the scenario in three generations:

- The first generation would establish the basic infrastructure for electronic tests to measure traditional abilities and would have similar format to paper-based tests;
- In the second generation, large scale tests would have qualitative changes including, for example, multimedia resources and automatic generation of items; however, its objectives and distribution mechanisms would be essentially the same;
- In the third generation, tests would be integrated into virtual learning environments and could be applied constantly; these tests would be conceived according to cognitive principles which would allow a more natural interaction with computers.

After many years, it is easy to perceive that many characteristics listed by Bennet (1998) are still not a reality and are not present in the massively used LMS.

Table 1, adapted from Hack (2000), presents in the first column the various assessment mechanisms and a comparative frame including two learning management systems: Tidia-AE (2011) developed in Brazil in the Sakai Project (Sakai, 2011; Berg and Korcuska, 2009) and Moodle (2011).

Table 1 - Comparison of LMS assessment characteristics

Assessment Mechanisms	Tidia-AE (Sakai)	Moodle
On-line Tests	X	X
Tracking System	X	X
Text Analysis System		X
Customizable web tests (*)		X
Home works via web	X	X
Personalized Tests		
Record of information exchange in Chats	X	X
Record of information exchange in Forums	X	X
(*) Customization refers to the possibility of the assessment to be made different for each student using, for example, previous answers (rights and wrongs)		

Table 1 analysis indicates that neither system has all assessment mechanisms, which is evident looking at each column. Moodle system is the one which seems to have more mechanisms.

Analysis of Some Assessment Tools

Next, the main assessment tools that are included in the Moodle and Tidia-AE/Sakai systems are presented. Moodle is one of the most used LMS worldwide, either by public or private institutions. Tidia-AE is a configuration of Sakai (Berg and Korcuska, 2009) with some extensions. Sakai is a worldwide project which has been used by more than 350 organizations around the world and among them are some universities such as: Australian National University, Boston University, Oxford University, Stanford University and Yale University. Sakai was selected for this work because it is a worldwide project and also because it has a good users base. Moodle and Sakai were also chosen because they are open source and free use systems.

For the analysis, the tools were grouped according to the assessment objectives presented in table 2 and detailed next. For each objective, a discussion is presented highlighting the gaps in each analyzed tool.

Objective 1 - Verify the Participation Level and Degree of Interaction among Participants

The tools that usually allow interaction among the participants are: Forum, Chat, Wiki and Workshop. Figure1 presents a cut of results from a forum in Tidia-AE/Sakai system. For each participant, whose names are not real ones, the tool presents the number of messages authorships, the number of read and unread messages, and, in the last column, the percentage of read messages, which allows a general view of the interaction intensity among the participants.

Fóruns

Nome	Autor	Lido	Não lido	Percentual Lido
Ana da Silva	2	7	107	6%
Belcrano da Silva	0	0	114	0%
Benito Gama da Silva	0	0	114	0%
Camilo Pitanga da Siva	4	5	109	4%
Francisca da Silva	0	21	93	18%
Fulano de Tal	1	2	112	2%

Figure 1 –Interactions total among students in the Forum tool (Tidia-AE/Sakai).

The tool counts only the total interaction for each student and does not allow the identification of the classmates each student interacted with. No tool with these characteristics was found either in Tidia-AE or in Moodle.

Table 2 - Assessment Objectives x Instruments x Metrics

	Assessment Objectives	Assessment Instruments in Distance Education	Metrics
1	Verify the participation level and degree of interaction among participants	Discussion Forum / Chat	Total number of interactions computed from the messages posted in forums; Number of people interacted with
2	Verify the capability of "asynchronous" elaboration of the participant	Discussion Forum; Off-Line Activities (Essays and Written Questions)	Similarity Index between the Issued Answer and the Expected Standard Answer quantified, for example, by keywords in the solution
3	Verify the capability of "synchronous" elaboration of the participant	Chat; On-Line Activities (tools for collaborative edition)	Similarity Index between the Issued Answer and the Expected Standard Answer quantified, for example, by keywords in the solution
4	Verify student knowledge level about a given topic with instant feedback	Objective Questions	Similarity Index between the Issued Answer and the Expected Standard Answer
5	Verify student knowledge level about one or various topics	Written Questions	Similarity Index between the Issued Answer and the Expected Standard Answer quantified, for example, by keywords in the solution
6	Identify learner confidence level about the learner own knowledge before studying a topic	Self-Assessment (Diagnostic)	Confidence Level stated in an increasing scale where the larger values indicate greater degree of confidence to be later compared with performance
7	Verify student participation level	Access Statistics	Access index of the student in tools by executed actions
8	Indicate the Knowledge Acquisition Level of the Student	Grades Board	Metrics that summarizes the student performance indicating student cognitive and metacognitive profiles

Objective 2 - Verify the Capability of Asynchronous Elaboration of the Participants

The tools that usually allow asynchronous interaction among the participants are: Forum, Workshop, Search and Quiz. In the analyzed tools, only the Quiz of Moodle system allowed the similarity index to be obtained between the issue answer and the expected standard answer.

Figure 2 presents an example where the similarity index recorded by the tool was 100 for the case between the expected answer “Time, Cost and Scope” and the issued answer “Time”. However, the recorded grade was only 50% of the total value of the given question, because even if the issued answer is 100% similar to one of the standard registered answers it is not 100% correct.

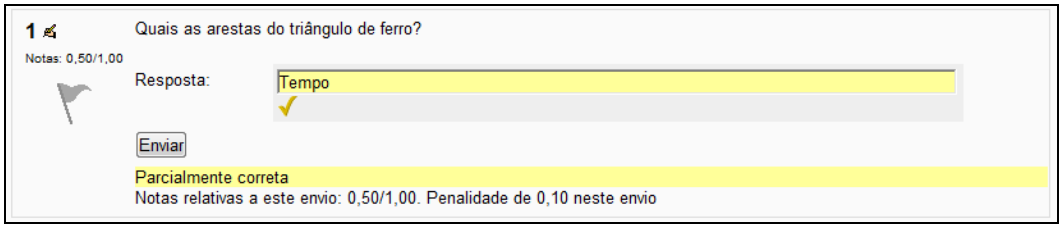

Figure 2 – Question tool of Moodle which compares the similarity between the issued answer and the expected standard answer. The example is of a partially correct answer and 100% similar.

Moodle allows many standard answers to be registered, each one of them with different correct percentages, which justifies the fact that the similarity index does not imply the same correct percentage. In addition, it identifies only extreme similarities, such as 100% and 0% for each issued answer, but does not identify similarities such as 5% and 90%.

Objective 3 - Verify the Capability of Synchronous Elaboration of the Participants

The tools that usually allow synchronous interaction among the participants are: Chat and Forum. In the analyzed tools, none of them allowed the similarity index to be obtained between the issued answer and the expected standard answer. It is possible to obtain the similarity index in a non-automatic way, where the instructor must extract the interactions history of the Forum and Chat, establish a similarity criterion, execute the non-automatic correction of the student issued answer, and grade the score manually.

Objective 4 - Verify Student Knowledge Level about a Given Topic with Instant Feedback

The analyzed tool that allows the verification of the student knowledge level about a given topic with an instant feedback is the Quiz tool. Both Moodle and Tidia-AE/Sakai have this tool and the student can have an instant feedback in both systems after answering an objective question.

Figure 4 presents a question in Tidia-AE/Sakai. In highlight are the feedbacks for answers C and D, which are not correct.

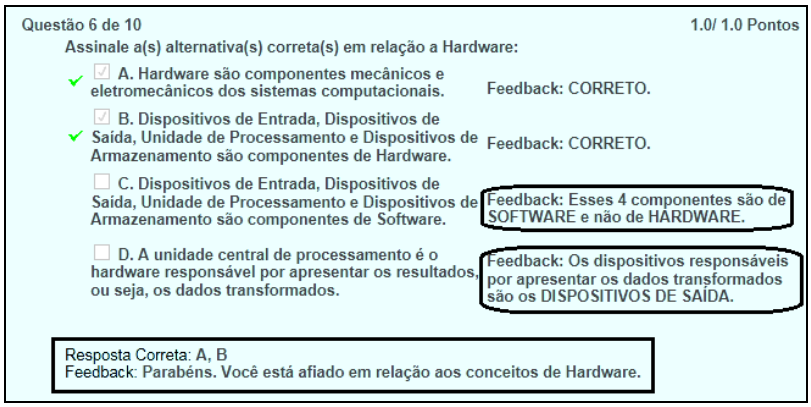

Figure 4 – Quiz tool in Tidia-AE: Displaying the feedback after student answer.

Figure 5 presents a written question in Moodle. In highlight is the feedback for a partially correct answer.

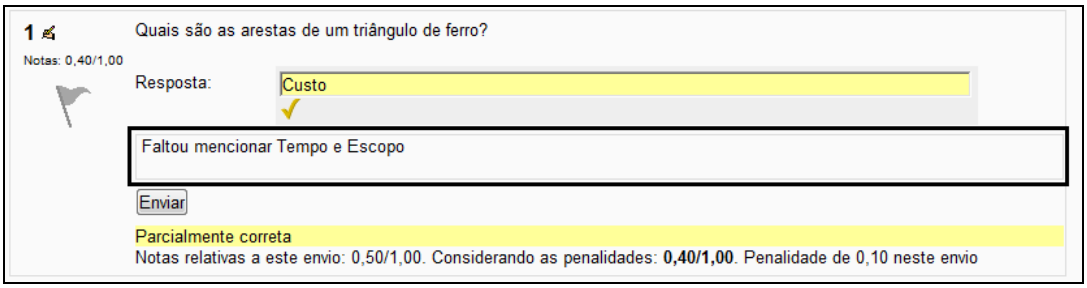

Figure 5 – Quiz tool in Moodle:
Displaying the feedback after student answer about a written question.

Objective 5 - Verify Student Knowledge Level about One or Various Topics

The analyzed tools that allow the verification of the student knowledge level about one or various topics are Quiz and Forum. These tools in Moodle and Tidi-AE do not allow a report to be created automatically to verify the student knowledge level about some topics.

For the forum tool, this report can be obtained in a non-automatic way by extracting the interactions history of the students and classifying the knowledge level by topic manually. Figure 6 shows the screen that allows access to the interaction history for each student whose names are fictional, Tidia-AE forums.

Figure 6 –Forum Tool in Tidia-AE: Access to the Forum history for some students.

In the Quiz tool a report can be obtained by extracting the required information from the questions results and later classifying them by topic manually.

Objective 6 - Identify Learner Confidence Level about the Learner Own Knowledge before Studying a Topic

Usually the quiz tool can be easily used to identify the confidence level about the own knowledge before studying a topic. However, the comparison between the student confidence about the own knowledge and the student real performance can only be obtained manually, that is, the tools do not generate the metrics automatically.

Objective 7 - Verify Student Participation Degree

Finally, the systems usually have tracking mechanisms that allow queries about the student actions in the system. Figure 7 present the Site Stats tool of Tidia-AE, with details about the actions of each student in the Repository tool. The shown names are fictional. One or more tools can be selected here to visualize student actions. The shown columns display the name of each participant, the event that took place, the most recent date of the event and the number of events. This allows, for example, a quantitative view of the participant presence in the system. However, the tool does not indicate the quality of the student access to the system. Accessing the tools does not mean that these accesses contributed for learning.

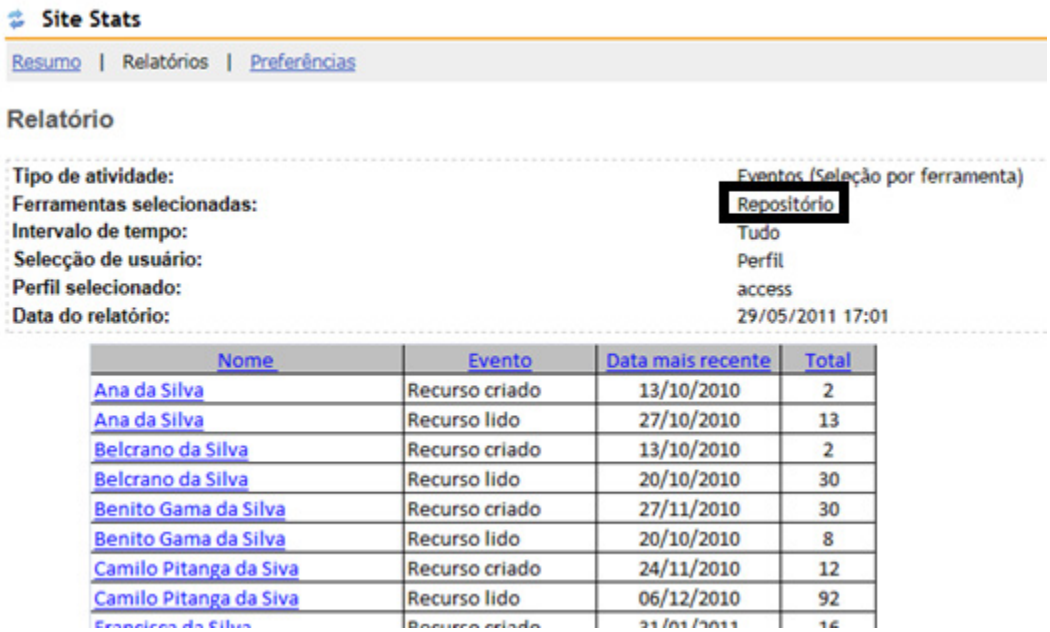

Figure 7 – Screen Cut of the Site Stats Tool in TIDIA-AE.

Objective 8 - Indicate the Knowledge Acquisition Level of the Student

It is from the results analysis that the future of educational programs or their components are determined: one of them is the students learning. The analysis task implies at first in the organization of all results, which include:

- Organize them by category;
- Relate them with each other;
- Identify patterns and trends;
- Search for relations and inferences at a higher abstraction level.

The analysis is present in the various steps of the assessment and it becomes more systematic and formal after the data collection is finished. Quantitative results can be analyzed from simple statistics: frequency analysis, averages, medians, standard deviation, etc. Qualitative results require other analysis ways before they can be transformed into quantitative ones. This is the case, for example, of the participant interaction in a forum.

Figure 8 presents a cut of the Grades tool in Moodle. This tool also groups the various assessment tools used in the course and shows the obtained result consolidated in a single screen. In this screen, the instructor can have a view of the performance of each student and also of the group.

Nome / Sobrenome	Nota da prova	Trabalhos	Nota Bimestral	SWOT-PESTEL	Nota da apresentação em ...	AVALIAÇÃO DO 2º BIMESTRE	Exame Final
Intervalo	0,00–100,00	0,00–100,00	0,00–100,00	0,00–5,00	0,00–20,00	0,00–75,00	0,00–10,00
Ana da Silva	5,90	2,50	8,40	5,00	20,00	59,40	-
Belcrano da Silv	0,00	1,50	1,50	5,00	10,00	0,00	5,86
Benito Gama da S	5,80	2,50	8,30	5,00	20,00	58,33	-
Camilo Pitanga	3,30	2,50	5,80	5,00	20,00	33,08	4,39
Francisca da Silv	3,80	0,00	3,80	0,00	0,00	38,19	2,84
Fulano de Tal	4,70	0,00	4,70	0,00	0,00	46,74	5,67
Guida de Souza	6,60	0,00	6,60	0,00	0,00	66,31	6,82
Sicrano da Silva	5,90	0,00	5,90	0,00	0,00	59,17	5,27

Figure 8 – Cut of the Grades Tool (Moodle).

The grade tools in Tidia-AE and in Moodle help the instructor and the student by making possible a general view of the performance for tracking or even for final decisions. However, these tools present two difficulties that must be treated: (a) Both work with consolidated results for each assessment and, therefore, do not allow the indication of the points where there are learning deficiencies, and (b) Each assessment instrument can work with a different metric and, therefore, there is a need for data normalization for comparison purposes.

Conclusions

This work assumes that a formative and continuous assessment is the ideal one for tracking learning in Distance Education besides being a mechanism capable of creating conditions for the process self-regulation. Basically, the assessment is required to supply the instructor with a set of qualified information and not raw ones, about the cognitive and meta-cognitive level of the learners, enabling the instructor to use differentiated pedagogies. In the same way, it aims to offer the learner with detailed information about his/her Knowledge Acquisition Level, to be able to continuously track his/her learning and also to execute a self tracking of the meta-cognitive processes, therefore, allowing the learner to take control of his/her learning.

Valenti, Cucchiarelli and Panti (2002) present a generic analysis of assessments in Distance Education environments. This work executed a critical analysis of the assessment tools that are present in two LMS: Moodle and Tidia-AE/Sakai. The analysis was directed to eight objectives of assessment according to table 2. For each objective, it was listed the related required metrics for achieving the objective and the assessment tools in Distance Education that can help in obtaining these metrics.

The analysis demonstrated that the evaluated systems have tools to help metrics to be obtained in order to achieve the eight assessment objectives. However, the obtained metrics are not enough for a formative assessment since they do not provide detailed information which allows the gaps in the learning of the students to be detected. Therefore, these tools require improvements to: (a) automate the process to obtain results, and to (b) detail the results to clearly identify the gaps in the learning of each student. Table 3 presents a summary of these gaps.

Table 3- Summary of Gaps in Assessment Tools

Evaluation Tool	Main Gaps
Discussion Forum and Chat	• Do not allow the interaction qualification by indicating, for example, who each student interacted with
Discussion Forum; On-Line and Off-Line Activities (Essays and Written Questions)	• Do not identify the Similarity Index between the issued answer and the expected answer
Objective and Written Questions	• Do not allow the identification of which topics the student has learning deficiencies
Self-Assessment (Diagnostic)	• Do not execute comparison between the confidence level (prediction) and the student real performance
Student Participation Level	• Show only some quantitative interaction results without indicating the quality of the student accesses to the system
Grade Board	• Consolidated results do not indicate which are the student learning deficiencies (by topic) • Different metrics make it difficult to get automatically a value that summarizes the current level of the student

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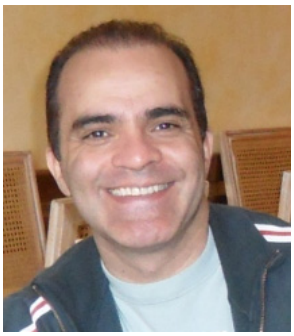
Biographies



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