Digitally enhanced assessment in virtual learning environments

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ABSTRACT

One of the main challenges in teaching and learning activities is the assessment: it allows teachers and learners to improve the future activities on the basis of the previous ones. It allows a deep analysis and understanding of the whole learning process. This is particularly difficult in virtual learning environments where a general overview is not always available. In the latest years, Learning Analytics are becoming the most popular methods to analyze the data collected in the learning environments in order to support teachers and learners in the complex process of learning. If they are properly integrated in learning activities, indeed, they can supply useful information to adapt the activities on the basis of student's needs. In this context, the paper presents a solution for the digitally enhanced assessment. Two different Learning Dashboards have been designed in order to represent the most interesting Learning Analytics aiming at providing teachers and learners with easy understandable view of learning data in virtual learning environments.

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1. Introduction

In educational processes the formative evaluation plays a key role in effectiveness of learning since it allows the learning path to be adapted to actual student's abilities [1–3]. It differs from the summative assessment that aims at evaluating the educational outcomes of a specific learning path. In order to apply the formative evaluation, virtual environments supply different tools, such as quizzes, online exercises, and so on.

These are important both for students, that can self-assess the acquired knowledge, and for teachers, that could verify if her/his educational strategies are adequate to the classroom by measuring how much of the topics have been assimilated by the students. But, in e-learning contexts in order to make the formative evaluation significant it could not be limited to results of quizzes and tests. Enriching those results with data about the interactions between the users (students and teachers) and the system could be a solution. For example the level of participation to the different activities, the quality of interaction and communication among peers, could be interesting data to be used during the assessment. This perspective was also the focus of the Working Group at EDUsummIT 2011 [4,5]. The group stated that digitally-enhanced assessment requires: (1) an authentic learning experience involving digital media with (2) embedded continuous unobtrusive measures of performance, learning and knowledge, which (3) creates a highly detailed (high resolution) data records which can be computationally analyzed and displayed so that (4) learners and teachers can immediately utilize the information to improve learning.

In this context the paper presents a solution for enhancing the formative assessment in e-learning

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platforms. In particular, the Learning Analytics (LAs) will be studied in order to be integrated in an e-learning platform to manage the available data. Finally, two different dashboards were designed and built to facilitate the interpretation of data using a graphical representation.

2. Motivation and problem definition

The analysis of the state of the art about the assessment allows different approaches to be classified in quantitative and qualitative methods. The quantitative approaches usually are focused on analytic measures and quantification of the student's performances to make them understandable and comparable. Often the quantitative assessment is used for the summative evaluation to measure the knowledge and skills acquired at the end of a learning path. The qualitative approaches, instead, aim at improving the learning process, while it happens, giving continuous feedbacks to promote actions and interventions to reduce the gap between the performance actually achieved by the learner and the expected performance. These types of assessment are used for the formative evaluation. The two approaches have different goals, methods and consequences but they are not necessarily at odds. Recently, however, the need to prove the effectiveness of educational institutions at different levels with evidence of the success of the educational activities has pushed the quantitative approach more than the qualitative one.

Moreover, the assessment is a complex process: the traditional "face to face" education relies on the role of the evaluator, like a teacher or a team of teachers, who is required to carefully consider and weigh all the criteria involved in the final evaluation. In distance learning environments, the evaluator rarely has the overall picture of the learning process. Often, in fact, only quantitative evaluations, such as multiple-choice tests, are used. These are unreliable and not always significant [6,7]. But the assessment in virtual environments presents new opportunities and challenges that should be investigated.

Research on digitally enhanced assessment is still at early stage [8]: it is necessary to understand if and how technology can support both the quantitative and the qualitative assessment. Moreover, new models of students' evaluation and assessment are requested to take full advantage of technologies [9]. As pointed out by Pachler et al. [1], indeed, the technologies for assessment are not educational itself, but they can empower the educational effectiveness of assessment processes. Among the different emergent technologies the Learning Analytics have a high potential in it.

2.1. Learning Analytics

The Learning Analytics (LA) represent the "measurement, collection, analysis and reporting of data about learners and their contexts, for purposes of understanding and optimizing learning and environments in which it occurs" [10].

Research in this field is becoming very popular because the digitally enhanced assessment is very pressing in virtual learning and LA can supply the perfect tool to this end. The LA, in fact, gives methods to interpret data collected in LMSs to understand which activities involve learners and to customize the learning processes. Moreover, these data are useful also to the learners to become aware of their own knowledge and abilities in specific contexts. Thus, higher results can be achieved if students and institutions would be involved as stakeholders in the definition of learning analytics [11]. To this aim, some researches distinguish Learning Analytics (LA), Academic Analytics (AA) and the Educational Data Mining (EDM). Each of them involves different stakeholders, with distinct purposes at various levels of abstraction [12,13]. Their common goal is to process data to find out problems and plan solutions in order to enrich the learning paths and to ensure educational success.

In particular, the EDM are useful to get value from large sets of data using data mining and machine learning methods, AA are useful to evaluate and analyze university and educational institutions from an organizational point of view [14], while LA are addressed to analyze data in order to model social connection and learning preferences in educational settings. In this perspective, the LA are the most suited to support the digitally enhanced assessment.

As said before, the LA analyze mainly the user generated data, one of the main problems dealing with is the privacy. To this end, Slade and Prinsloo [11]. propose to distinguish two levels of LA data usage: the educational level and the no educational one. The first aims to facilitate the evaluation, reflection and personalization of curricula and it is mainly addressed to students and teachers; the second one is addressed to business analysis of the educational institutions.

Another risk in using LA is to exceed in the quantification of activities. The LA can be used "to track learner progress, to assist in developing and maintaining motivation, to help the definition of realistic goals and to develop plans to achieve them" [15]. But performance measurements may not be enough if they are not enriched by appropriate reflections on the learning itself.

3. Learning analytics process

Given the complexity of the assessment process and the inadequacy of fully automated evaluations to take into account many factors, a digitally enhanced assessment proposal has been defined. The work uses the LA to provide teachers and learners with a set of tools to simplify the assessment process and to make more significant the assessment results.

First of all, we need to identify and collect the interactions: as a matter of fact, during learning activities, students interact through the system with other people and resources. The type and intensity of the interactions vary depending on both the learning environment and the educational resources.

To this end it is important to classify the resources on the basis of their interactivity type: it is active if the