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Teamwork assessment in the educational web of data: A learning analytics approach towards ISO 10018

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ABSTRACT

The Web of Data is an emerging research field that contributes to make better decisions because it gathers, combines and analyses different data sources available worldwide. Educational data is an interesting domain because it deals with the quality of the education itself and educational institutions which are common goals for every country. This paper is devoted to present how this idea has been used to improve a learning analytics tool. By means of this tool, teachers can perform teamwork competence assessment of a group of students taking into account how the individuals acquire the essential components of such competence. In this sense, authors use the Comprehensive Training Model of the Teamwork Competence in Engineering Domain (CTMTC) method to gather competence evidences and improve the system with a learning analytics tool to support the process. This tool is able to transform competence evidences and stores them in a competence ontology built upon ISO 10018 concepts. The final result is the production of educational results for the web of data.

1. Introduction

With the growing importance of Information and communication technologies (ICT) in the educational field, learning management systems (LMS) have been maturely developed and widely adopted (García-Peñalvo and Seoane-Pardo, 2015) to store a wide range of data, including students' characteristics, learning histories, achievements, testing scores and grades (Huang et al., 2016). Although LMS present their drawbacks (Stantchev et al., 2014), these systems can offer a great variety of instruments to facilitate information sharing and communication among learning stakeholders (Romero et al., 2008). Given that LMS generate a vast amount of data, the problem of categorizing, analysing and using these data is not trivial. Researchers have encountered different ways to use these data in acquiring understanding of students' effort and competence development (Iglesias-Pradas et al., 2015) and giving this fact, the need to understand and use data available in LMS is unquestionable. However, given the amount of data available in a LMS, in many cases, data are either overlooked or underused (Daniel, 2015). As a result of this, learning analytics is a fertile research field devoted to understand how learning took place online (Ferguson, 2012). Learning analytics is becoming an essential tool to inform and support learners, teachers and their institutions in better understanding and predicting personal learning needs and performance (Greller and Drachsler,

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2012). According to (Long and Siemens, 2011), Learning analytics is the "measurement, collection, analysis and reporting of data about learners and their contexts, for purposes of understanding and optimizing learning and the environments in which it occurs". The final goal of learning analytics is improved learning via the interpretation and contextualization of educational data (Siemens, 2013). Using learning analytics, universities are able to improve decision making and resource allocation, identify at-risk learners and areas of concern, they can get a better insight into their strengths and weaknesses, they can drill down on causes of complex challenges, and they can create and try different academic models (Marksv et al., 2016). Examples on the use of Learning Analytics include aspects like analytics of communities of inquiry (Kovanović et al., 2015), mobile learning (Miguel et al., 2016), learners engagement (GopalaKrishnan and Sengottuvelan, 2016), social relationships (Gómez-Aguilar et al., 2014, 2015) and procrastination factors (del Puerto Paule-Ruiz et al., 2015) citing just some of the most important and recent ones.

In parallel, human factors are key for business environments. The knowledge about individuals' competences and skills are essential both for the educational institutions and for the companies. In fact, competence management has been a fertile field of study. Since the nineties, organizations and educational institutions are adopting a competence-centric approach in human capital management (De Leenheer et al., 2010). The study of competences and their management using semantic technologies is not new. Literature has reported several efforts in aspects like social media tagging (Braun et al., 2012), performance based simulation (Colomo-Palacios et al., 2014), consensual knowledge derived ontology-based system (Kimble et al., 2016) or competence profile management (Tarasov, 2012). Apart from purely academic approaches, competence management has also been approached in a more industry-oriented approach (García-Peñalvo et al., 2014). Maybe the most important one is the Unified Enterprise Modelling Language (UEML), a language that provides constructs to cover process, resource, competence and enterprise entities (Pépiot et al., 2007). Other previous initiative worth to mention is the HR-XML by the HR Open Standards consortium.

These specifications are, as mentioned above, especially useful in such industrial environments, where the need of employee education is, again, crucial to improve overall quality in both services and products (Boys and Wilcock, 2014). The standard, ISO 10018, Quality Management – Guidelines on People Involvement and Competence, was published in September 2012 (ISO, 2012). The idea behind the standard is to help organizations in the involvement of people. The following human factors are addressed in the ISO 10018 standard: attitude and motivation, education and learning, empowerment, leadership, networking, communication, recruitment, awareness, engagement, teamwork and collaboration, responsibility and authority, creativity and innovation, and finally, recognition and rewards.

In the context of the initiative, teamwork results from the ability of people to work together in a creative and productive relationship within a process, leading to enhance and assure quality in products and services (ISO, 2012). Teamwork is a recognized competence present in both curricular activities and professional educational endeavours (Colomo-Palacios et al., 2013). Not in vain, the importance of teamwork is determined by the fact that an effective team increases the probability of achieving set results for any project, process, product or service, including learning.

However, and in spite of the importance of teamwork in education in general and in eLearning settings in particular, just 20% of the students have never been evaluated in teamwork (Fidalgo-Blanco et al., 2015b). In the LMS scenario, literature has also reported initiatives to assess teamwork competence (TWC) e.g.(Conde et al., 2016; Fidalgo-Blanco et al., 2015b; Koh et al., 2016; Sun and Shen, 2014; Tarmazdi et al., 2015).

The aim of this work goes beyond the recognition and assessment of competences or the representation of competence acquisition following a language or methodology. The idea is the definition of a tool that allows assessing teamwork competence acquisition that includes functionalities to populate a competence ontology as a result of the final process, including competence evidence as an extension of what is meant to be a competence ontology, like for instance the one proposed by (Dodero et al., 2007). This extension of the ontology was designed to be complaint with the ISO 10018. The final aim is making the whole system open for the production of Linked Data, following the path drawn by previous initiatives like (Alor-Hernández et al., 2014) including statistical aspects (Alvarez-Rodríguez et al., 2013) and focusing in the educational field in works like (Piedra et al., 2014) or more recently (Zablith et al., 2015).

The reminder of the paper is as follows. Section 2 presents state of the art. Section 3 describes the methodology employed for teamwork competence assessment and the tool developed. Section 4 presents a case study carried out to test them. Section 5 presents the results that in Section 6 are discussed. Finally, some conclusions are posed.

2. State of the art

In order to clarify what is the research gap covered by this work it is necessary to explore two issues: 1) if there are learning analytics tools that facilitate teamwork competence assessment from and individual and group perspective; and 2) If those tools allow tagging these learning evidences and populating them into a competence ontology.

Regarding the first issue, there are several learning analytics tools that provide information about what students have done in web-based learning environments. The works by (Hernández-García and Conde, 2014) describe different categories of them. Maybe, the most employed tools nowadays are the dashboards that can be included in the LMSs. Examples are: Leony et al. (2012) experiment with LearnGlass, Amo (2014) use of Google analytics to assess the time employed to complete activities or the Moodle dashboard plugin (Conde et al., 2015).

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