Automatic identification of student’s learning styles to develop flexible massive open online courses.

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Abstract—Massive open online courses (MOOC) are a relatively new form of e-learning, they are to the organization of contents, usually video, and other generic learning activities aimed at developing skills and competencies to large numbers of Internet users. Some successful experiences and the huge investments made in the MOOC recognized universities in the world, have been awarded the label of disruptive technology, which although not without problems and disadvantages which include high dropout rates, low flexibility and pedagogical inefficiency. To try to solve these problems, the present proposal for doctoral study proposes the alternative of automatic identification of learning profiles according to Kolb's model for designing activities in a MOOC thus expected more flexible development, reduce dropout rates and improving the quality thereof.

Keywords—Kolb, instructional design, machine learning, learning styles, MOOC.

I. INTRODUCTION

MOOCs appeared in 2008 as an evolution of Open Educational Resources, as a proposal for universal education and provide free and quality education to people living in remote or disadvantaged areas, they inspired at Connectivism [1], an innovative educational theory proposed by George Siemens in 2005. But it is the end of 2011 when MOOCs reach worldwide fame with the course "Introduction to Artificial Intelligence" designed and directed by Sebastian Thrun (Professor, Stanford University) and Peter Norvig (Researcher, Google) to which about 160,000 students enroll, approvingly over 34,000. This course led to a first classification of MOOCs, differentiating cMOOC (MOOCs connectivist), learning communities rather than courses, and xMOOCs (truly massive courses) [2]. After this experience, Thrun left Stanford and think Udacity a spin off to development and offering MOOCs designed by prestigious universities in the world; subsequently they emerged similar companies (Coursera, edX, Udemy, Miriadax) associated with universities and promoting higher education worldwide.

However achieved worldwide fame by MOOCs to the point of being considered the person of 2012 by TIME magazine [3], MOOCs are not without problems and difficulties among which are: high attrition rates [4], poor quality of education received [5], sustainability [6], lack of adequate education and customization [7] [8], extreme rigidity [9] and evaluation [10] among others. This generates questions such as:

• What is meant by quality in MOOCs?
• Are the design methodologies MOOCs cover aspects to achieve flexibility??
• What can be to flexibility in the developing a MOOCs?
• What impact does contemplate the learning style in the creation and development of MOOCs?

II. KNOWLEDGE STATE

Recent studies have begun to address issues related to learning styles applied to the MOOCs. In [11] it is said that there is a 90% chance that the learning style of the student influences their intentions regarding a MOOCs, which provides insight into the motivations of people to join MOOCs, but it’s not sufficient to resolve the essence of the problems associated with their rigidity.

Most of methodologies for developing MOOCs agree the following phases: defining learning objectives, raising activities (including evaluation) to achieve those objectives, organizing activities into thematic units, or selection of content creation, to define the platform technological, and design the dynamisation plan [12]. Few cases of methodologies that include the use of learning styles for the creation and development of flexible MOOCs known and most discussed Felder-Silverman model, without addressing other more recent models such as Kolb [13]; then the most outstanding research are presented:

Sonwalkar proposes the term aMOOC (adaptive MOOC) where one based on cloud services architecture handles large numbers of users makes content adaptation to five learning strategies, it use an inference engine to manage diagnostic tests for learning outcomes and feedback in a course of molecular biology [14]. It is unclear how the identification of the student profile is made and used its own pedagogical model instead of models of learning styles popular in the academic community.

Fasihuddin et al propose an adaptation to customize open learning environments model based on the theory of learning styles Felder and Silverman’s model, they used an agent identification for determining the profile according to interaction patterns with learning materials, and employ one recommender agent responsible for supporting adaptive navigation [15]. In the absence of an implementation to verify the model, the non-adaptation of learning activities is highlighted.

Grünewald et al presented reflections and guidelines for MOOCs design to address for learning style Kolb using gamification and virtual laboratories techniques in developing a course of internetworking with TCP/IP [16], they do not automatically identify the learning style and the
recommendations are linked to the discipline of the course.

III. DOCTORAL PROPOSAL

Given the above, the following research question arises: do not contemplate the learning or preferences style of students causes that MOOCs offering is rigid and thus their quality is low, which in turn generates the following working hypothesis: automatic identify the learning style of students will define and develop flexible learning paths in MOOCs thereby improving their quality.

The overall objective of the PhD is to propose a mechanism for selecting flexible learning paths MOOCs from the automatic identification of learning style on the Kolb’s model; with the following specific objectives:

• To define a procedure for automatically identifying learning styles of students by Kolb model.
• To formulate a rule-based system for selecting instructional routes in MOOCs by learning styles of Kolb.
• To verify the impact on results MOOCs contemplating learning styles for selection of activities.

The contributions of the proposal are summarized in:

• Construction of a dataset for training and evaluation of a machine learning algorithm.
• Identifying patterns of behavior, according to learning styles (Kolb) of students in MOOCs.
• Generating a taxonomy of activities for the MOOCs design that takes into account the learning profile as Kolb.
• Integration services to offer a platform for flexible MOOCs.
• Generating a methodological approach for automatic identification of different learning styles to the definition of learning activities that develop more flexible MOOCs.

IV. METHODOLOGY AND EVALUATION

It is expected to use data from the Galileo University (Guatemala) of your telescope MOOCs platform [17], where courses have been offered since 2012. At MOOCs that are offered from July 2015, it will be applied a test online to identify the learning style Kolb. Following the SEMMA methodology [18] it will be design a dataset for training and evaluation of machine learning algorithm to relate the learning style behavior patterns in telescope design platform. Among the algorithms to be used are: artificial neural networks, Bayesian classifiers, support vector machines, K-NN and decision trees.

In parallel, it will be generated a learning activities taxonomy appropriate to learning style according Kolb that allow the definition of flexible learning paths correlated with the student’s profile. It should also redesign existing courses or build new courses that take into account the student profile according Kolb. For this it can follow the methodological guidelines set forth in [19] for instructional design supported learning styles. Subsequently, it will be offered MOOCs whose students will be automatically identify their learning style and also automatically and through a rules-based system, technological platform define a profile suitable route of learning.

Measuring the impact on the inclusion of learning styles by Kolb on the creation and development of a MOOC will be taking indicators that can be compared with the indicators obtained by the Galileo University previously in at least two variables: attrition and retention [20].

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