New Categorization of Practical Works Activities with Hybridization of Bloom's Taxonomy, Grimard's Pyramid, and Specific MOOC

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Abstract: Due to the outbreak of the coronavirus pandemic and the total confinement imposed on all countries to prevent the spread of the virus, Massive open online courses (MOOC) systems have been widely used in recent years, and have attracted more attention in educational institutions, especially. But MOOCs intended for learning practical work have not been adequately addressed. However, everyone knows that the chances of dropping out of MOOCs are very high compared to conventional offline courses. Researchers have implemented extensive and diverse methods to determine the reasons behind learner attrition or lack of interest to apply timely interventions. We decided to address the dropout problem due to the lack of motivation among learners, with special practical works MOOCs. We have hybridized two methodologies: cognitive levels of learners, namely, Bloom's taxonomy and Grimard's pyramid for motivation this hybridization allowed us to create a new categorization for practical works, and we propose a new MOOC for learning practical works activities for programming languages in computer science. The main objective of this MOOC platform is to automatically generate practical works of different levels of complexity to be solved according to the level of motivation related to the learner. It composed into three principal components: IMMS survey component, motivation component, and practical works generator component.

1 INTRODUCTION

In recent years, there has been extensive use and considerable interest in using MOOCs systems, especially in crisis times like the Coronavirus pandemic, these MOOCs seem to be as much about the collective empowerment of university leaders to bring higher education into the digital age (Alamri et al., 2019). In the depth of relevant literature, the authors observe that there is a lack of MOOCs explicitly addressing learning practical works activities on one hand and the other hand though these MOOCs systems have some drawbacks like the significant number of learners' dropouts which turned out to be a severe problem (Alamri et al., 2019). Moreover, the causes of dropout are known to every specialist in traditional learning, but their causes can be very different in distance learning. There may be problems of another kind that can increase the dropout rate among distance learning students and push them to leave online courses, including issues of isolation, disconnectedness, and lack of technical mastery (Willging and Johnson, 2019). The authors see that one of the main reasons that made the dropout rate so high with these kinds of MOOCs is learners' motivation level problem.

To address the above two challenges (dropout, lack of MOOCs addressed to learning practical works), we propose to design and develop a MOOC platform for learning practical work in computer science programming languages for learners. This MOOC automatically generates practical work to be solved according to the learner's degree of motivation. This important approach is yet to be introduced in the Learning with practical works MOOCs. Thus, the main contributions of this work are:

1. We hybridized two methodologies: cognitive levels of learners, namely, Bloom's taxonomy and Grimard's pyramid for motivation this hybridization allowed us to

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create a new categorization for practical works.
2. Propose architecture of practical works MOOC. The main objective of this practical works MOOC platform is to automatically generate practical works of different levels of complexity to be solved according to the level of motivation dear to the learner.

The rest of the research paper is organized as follows. In section 2, we talk briefly about the overview of Bloom's and Grimard's pyramids. In section 3, we present the new categorization of the practical works according to the methodologies (Bloom and Grimard). We present in section 4, the general architecture of the practical works and its main components. Finally, we conclude with a conclusion and future directions.

2 OVERVIEW OF BLOOM'S AND GRIMARD'S PYRAMIDS

Our proposal is based on cognitive levels of learners, namely, Bloom's taxonomy and Grimard's pyramid for motivation evolution synthesized in what follows (El-Seoud et al.,2016; Bloom,1965):

2.1 Bloom's Taxonomy

Bloom's taxonomy is a model of pedagogy proposing a classification of levels of knowledge acquisition. Taxonomy hierarchically organizes information, from the simple restitution of facts to the complex manipulation of concepts (Haddadi and Dahmani,2016). It can be summarized in six hierarchical levels. Each level corresponds to typical operations. The taxonomy is offered as an aid to teachers to formulate questions that allow situating the level of comprehension of the learners. For example, a question can be used to determine that a student is proficient in the knowledge of facts, understanding, application, analysis, synthesis, and evaluation. By structuring the questions, teachers can better understand the weaknesses and strengths of the students, which helps to promote the progression of learning to higher levels. According to Bloom (El-Seoud et al.,2016; Bloom.,1965): a learner goes through several stages in their learning. He begins by acquiring abstract knowledge, which is realized more and more until the learner can create knowledge in particular fields. These levels are (see Figure 1):

- Remember: Retrieving relevant knowledge from long term memory,
- Understand: Determining the meaning of instructional messages, including oral, written, and graphic communication,
- Apply: Carrying out or using a procedure in a given situation,
- Analyze: Breaking material into its constituent parts and detecting how the parts relate to one another and to an overall structure or purpose,
- Evaluate: Making judgments based on criteria and standards,
- Create: Putting elements together to form a novel, coherent whole or make an original product.

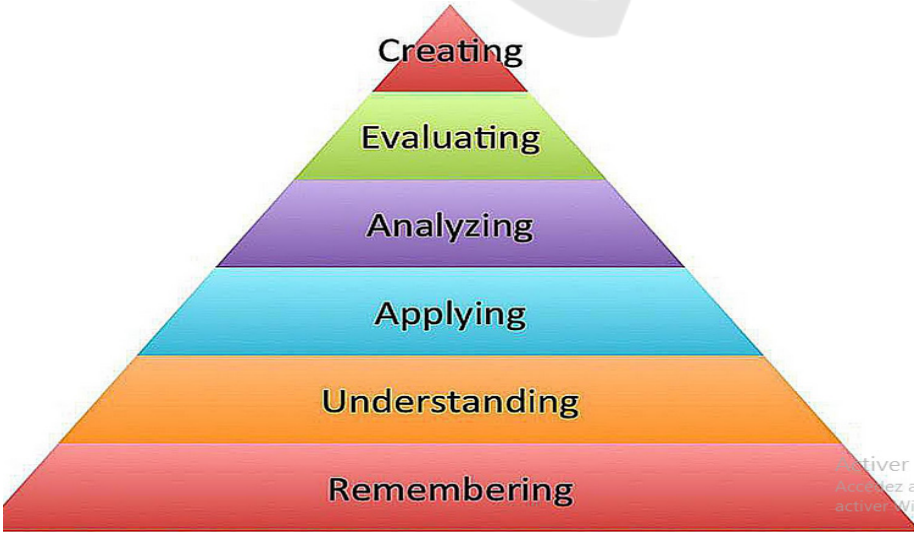

Figure 1: Bloom's taxonomy (El-Seoud et al. 2016; Bloom., 1965).

2.2 Grimard's Pyramid of Learner's Motivation

In the learning process especially in presenting lessons, the teacher motivates his students in many and varied ways to ensure successful receiving of lessons, but the motivation component in distance learning environments is considered a missing element under the absence of direct contact between the learner and the teacher (Hadadi and Dahmani,2016). Indeed, there is a close relationship between learner motivation and the success of the learning process. In our paper, we will focus on the motivation centered on learning and based on the four levels of motivation proposed by Dany Grimard and presented through the pyramid of "Figure 2".Dany Grimard proposes a taxonomy with the description of four levels of motivation (Haddadi and Dahmani, 2016; Jamil et al.; 2019).

- The passion: To understand this point, the author describes the three components by the acronym PIC (Passion, Intensity, and Confidence). The "P" means that we must have a sincere intention and do the activity or work by passion and not by obligation. The "I" indicate that we must commit unconditionally and "C" shows that we must have an excellent knowledge of ourselves.
- Autonomy: in the second level. It is related to the learner's ability to make choices indecently. That means learners should develop a capacity for reflection and recognize strategies that help them to succeed.
- Mastery: consist of training and developing the knowledge of learners, this gives them the desire to always be better in a given activity.
- Find meaning: that means knowing the direction and target. When a learner works on a project, he can recognize if the project goes in the same direction, as the mission he is given. Figure 2 presents the four motivation levels proposed by Dany Grimard.

3 A NEW CATEGORIZATION OF PRACTICAL WORKS ACTIVITIES

We used the same concept and the same hypothesis that was put forward by Haddadi and Dahmani (2016) in their proposal for the assessment activities pyramid and by combining the point of view of Bloom (the social cognitive view) with Grimard about learners' motivation levels(Haddadi and Dahmani,2016). We found that the two pyramids are compatible with each other and with ours, and we inspire and propose a new categorization of practical works activities as shown in Table 1. We were also inspired by capability levels of CMMI (Capability Maturity Model Integration), which consist of best practices that address development and maintenance activities applied to products and services (Team, 2006).

Figure 2: Motivation levels proposed by Dany Grimard (Haddadi and Dahmani,2016).

Table 1: Practical works categories according to Bloom's and Grimard's pyramids.

Practical work level	Practical Works codes written with	Motivation levels	Cognitive-learning levels
Level one	Closed questions	Have passion	Remember Understand
Level two	Half-open questions	Be autonomous	Understand
Level three	Open questions	Mastery	Apply Analyse
Level four	Problems solution	Find meaning	Analyze Evaluate Create

- Practical works level one: Consists of practical works codes written with closed questions, in the form of holed texts. This kind of practical works is intended for learners who have a passion degree of motivation, this type of practical works offer a choice of predefined answers with progressive difficulties to create a relationship of trust with the learner, to guide him gradually to decide to reach the next level.
- Practical works level two: Consists of practical works codes written with half-open questions, in the form of (compound questions and short answer questions) which is a little more complex than the previous ones. At this level, the learner should have a certain degree of autonomy, which is one of the critical success factors for intrinsic motivation. With this type of practical works, we aim to ensure that the acquired knowledge is maintained and the learner can combine his knowledge to write an answer, thanks to the autonomy created in him.
- Practical works level three: At this stage, and thanks to the learner's degree of motivation, mastery, practical works codes written in the form of open questions (exercises) are presented to the learner in a clear and precise manner and contain all the information to solve the problem. Then, the learner puts into practice a rule, a method, or mobilizes knowledge in an ordinary situation. At this level, the teacher should set specific criteria and quantitative quality objectives to ensure that the learner acquires the skills.
- Practical works level four: Consists of practical works codes written with problem-solving. This kind of practical works are intended for learners who have to find a meaningful degree of motivation. The practical works of this level present problematic situations (case study). This, allows the learner to analyze a real situation, to extract conclusions from it to enrich knowledge, develop the learner's reasoning, stimulate his sense of creativity and increase his confidence.

4 GENERAL ARCHITECTURE OF THE PROPOSED PRACTICAL WORKS MOOC

Our proposition consists to design and develop a practical works MOOC for distance learning of practical work in computer programming languages for learners. This platform automatically generates practical work (Boussaha et al., 2015; Boussaha et al., 2021) to be solved according to the measure of the degree of motivation related to the learner, that is to say, we will divide the learners into four groups according to the Dany Grimard pyramid. Learners who have passion, learners who have Autonomy, learners who have mastery, and Learners who have the find meaning. This is on the one hand, on the other hand, we will divide the practical works to be generated into four levels according to Bloom's taxonomy. Knowing that for each type of learner we will offer the practical work adapted to his level of motivation. Figure 3 shows the principal components of the practical works MOOC platform proposed. It is composed of four principal components: IMMS survey component, motivation component, practical works generator component, and certification component.

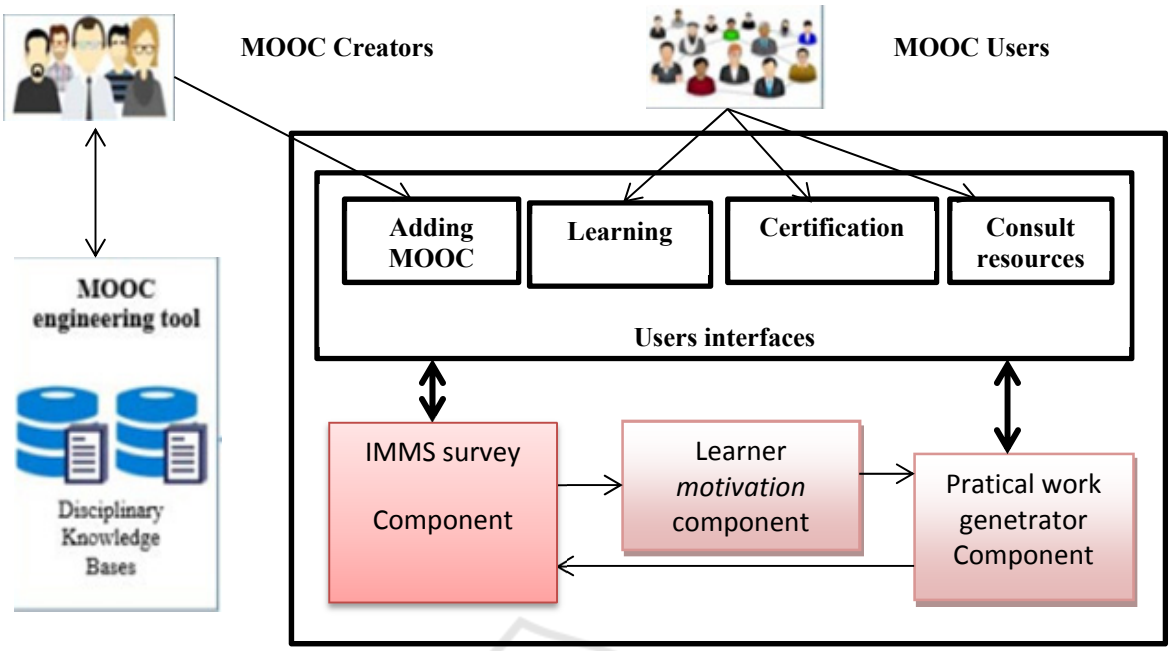

Figure 3: General architecture of the proposed MOOC.

4.1 Practical Work Generator Component

This component is responsible for the generation of the type of practical work (practical work level one, practical work level two, practical work level three, practical work level four) according to the learner's motivation level.

4.2 Learner Motivation Component

This component is responsible for determining the learner's motivation level (Passion, Mastery autonomy, Find meaning).

4.3 IMMS Survey Component

The IMMS survey was designed to measure responses to self-directed instructional materials. These are situation-specific self-report measures that can be used to estimate learners' motivational attitudes in the context of virtually any delivery system (Breslow et al., 2013; Li and Moore, 2018).

4.4 Certification

This component is responsible to verify if the learner achieves his learning process, and offering certification according to the questionnaire filled in by the learner at the end of the learning session.

5 CONCLUSION

MOOCs environments have proven to be very useful, especially in difficult times such as the Coronavirus pandemic. Unfortunately, the use of this type of environment is not without a price. Excessive numbers of dropouts, among other problems, remain a serious problem. Therefore, it is necessary to motivate many researchers to conduct more and more studies to understand the reasons behind this problem or to develop new techniques that will improve the cognitive level of learners and thus reduce these frightening numbers.

Knowing the reasons why a learner has dropped out is a very effective factor that can be taken into consideration when creating new algorithms and techniques to reduce dropouts. In addition, it is necessary to find indicators with a goal that may reflect the state of the learner, such as in a conflict or encountering problems. Behavioral and cognitive indicators are the most used against other indicators such as biographical or social indicators or even psychological indicators that seem very difficult to calculate and control their values.

In this work, we have presented a new approach based on the learner's motivation level capable of identifying and helping learners in critical situations, thus preventing them from dropping out. The proposed approach uses a hybridization of Bloom's and Grimard's pyramids which hybrid to detect the

learner's motivation level and created a new categorization of practical works which are proposed like learning process activities. The objective of our approach is how to attract learners to finish their learning until they receive the certifications by developing a Practical MOOC Platform intended for learning practical work. Our goal is to generate the type of practical work (simple, medium, complex) to give to the learner according to his level of motivation. Our research work is in the early stages. We still have a lot of work ahead of us on many points until it matures. We can mention some future directions. We will develop the algorithm used in the calculation of the learner's motivation level and we program to develop a prototype of the practical works MOOCs.

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