Selecting Assessments for Problem Based Learning

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Abstract: - Learning environments accompanied by collaborative projects as a strategy are reverted to different types of activities and the use of different spaces that make students' experiences not focus on the classroom or the life itself of the university institution. It is essential that the world be exploited by searching its interaction with it in a variety of ways, and that through its experience it approaches learning. Higher Education is changing very fast in the last years and nowadays it seems obvious that active methodologies must be part of the educational system. The question is not if this type of strategies will work or not, but how to implement them. And the answer is that it depends of a several factors, from the size of the group of students in the class to the type of the subject related to some field.

This paper has two parts: in the first one, some these active methodologies are presented, with more emphasis in the Problem Based Learning (PBL). The second part is a presentation of different assessments, which can be developed inside PBL, or can be a point of comparison in order to choose the best one for each case.

Key-Words: - Problem Based Learning, assessment, active methodologies, education, teaching, learning.

1 Introduction

Since the end of the last century, there have been many authors who have been warning that the educational methodology needed a change from its base. It was noted that some students were trying to get into scientific knowledge by memorizing equations and definitions. It was also said that other students did analysis of scientific problems with reasoning strategies and superficial methodologies [1]. Other authors said that students applied knowledge by daily heuristic reasoning, but of little rigor for its application to scientific content [2], and sometimes applied metacognitive strategies to control the understanding of the problem, in an erroneous way, and therefore were not aware of their comprehension problems [3-5].

The pedagogy understood, and nowadays some people defend it, as unidirectional and abstract transmission of information from the teacher to the learner (in general in a passive way) or receiver has lost its old meaning. The present learner from very early in childhood participates in a world of face-to-face and fundamentally virtual exchanges of omnipresent information, unlimited, free, easily accessible, ubiquitous and updated, which makes the conventional teaching practices out of time [6].

A teaching based solely on the transmission of knowledge, without critical thinking or any other type of thinking, is clearly insufficient, so it is necessary to research among other teaching strategies so that a really significant learning takes place and the efficiency of learning is improved.

At the present, teacher must assess skills and competences, and obviously knowledge of the subject [7]. These three concepts are difficult to assess with traditional teaching approach that considers normally the student as passive recipient of information [8]. The memorization of the content, narrated by the teacher, is the main objective of this teaching process. Stored knowledge is only abstracted. Learning and teaching are considered individual processes with the teacher in front of an audience, composed of a set of individual students [9], [10].

2 Active strategies focused on students

Among the strategies based on constructivist learning, three techniques have usually been highlighted as more useful and advisable: Problem Based Learning (PBL) [11], Project Oriented Learning (POL) [12], and Case Based Learning

(CBL) [13]. Although in the last years the modality of Problem Solving Based Learning is taking force [14].

In the PBL, a small group of students is dedicated to analyzing and solving a problem selected by the teacher to achieve certain learning objectives. It is intended to achieve a concrete learning goal.

In the POL, students try to find solutions to complex problems applying the concepts and fundamental principles learned. It is intended to integrate different knowledge to solve complex problems.

In the CBL, students must find solutions to a problematic situation in real life. The aim is to train in the generation of solutions, but working in a specific frame (case) of some problem.

3 Mean strategies used in different universities: Problem Based Learning and Project Oriented Learning

Problem-Based Learning (PBL), Project Oriented Learning (POL), Team-Based Learning, Maker Spaces, Design Thinking, and many other active learning methodologies can intensify and renovate Higher Education, and also basic education, by creating innovative and interdisciplinary knowledge and stimulating connections among people from different academic, socioeconomic, and educational backgrounds [6].

In this section, we will only focus on the two main strategies at the moment: PBL and POL. In addition, for PBL we will follow the methodology used in Maastricht, and for POL the Aalborg model.

3.1 Problem Based Learning

It depends on the country, university, etc., but we can generalize saying that each semester is divided into thematic blocks of several weeks. In each block, a theme should be developed with a series of cases that students must work on. The cases try to integrate practice and theory and each student has the choice to select the case that he will work on.

Students meet in groups to analyze the cases with the teacher. The teacher facilitates the group's work and communication, but students plan and discuss the solutions through a seven-step method: defining concepts, defining problems, analyzing problems, looking for explanations, formulating learning objectives, searching additional information, and preparing a report. There is usually an individual examination of each student.

3.2 Project-Oriented Learning

This model of work has spread particularly in the field of Engineering worldwide. In Aalborg, project work takes up about 50% of the learning time, although in other universities this time is reduced by up to 20%. A greater occupation of time implies greater complexity of the project and a greater integration of remote scientific-technical issues. Therefore, it is possible to distinguish between the project by disciplines and the project by problems [15]:

- In the project by disciplines, the tutor selects the disciplines and professional methods that will be used in the project. Groups select the problem and its solution within the framework indicated by the tutor.

- In the project by problems, the tutor defines the problem and the groups can work with different disciplines and methods.

In our university, curricula requirements play also a high-level role. That is, we have some constraints that all subjects must fill and students have, nowadays, some rights that allow them to avoid, if they want, continuous evaluation and therefore active methodologies. So, this percentage of learning time dedicated to POL can be lower under some circumstances.

Project Oriented Learning, or as it is also called Project-Based Learning, is planned taking into account the professional objectives that must be covered in the career (degree or master). Because projects are normally treated in a deep way, it means that a broad vision of knowledge cannot be sometimes covered, so it is necessary to ensure that students are able to cover their possible content gaps. The phases of project learning planning are usually: objectives and professional profile, themes and types of projects, project proposals, project realization, and evaluation of learning achievements.

Objectives and professional profile. It is necessary to consider objectives in all the phases of the realization of the project in order to be able to take advantage of all its potential, both in the planning, and in its realization and its evaluation.

Themes and types of projects. The theme is the framework in which the project is developed and is defined by the objectives, disciplines and professional methods.

Project proposals. The projects must motivate students so proposals can be presented by the students themselves, although sometimes they prefer to be given by teacher (that is, students prefer

teacher to propose different projects). However, it is essential that the analysis process is not indicated, so in this way students can formulate alternatives and develop their own autonomy.

Project realization. Students have autonomy to plan, propose alternative solutions, and make decisions. It is necessary that they learn to compare the process of realization of the project with their planning, and to review the partial results to correct their errors and the quality of their work. The tutor must advise and motivate in the realization of the project.

Evaluation of learning achievements. Once the project is finished, the results and the carried out process (errors, successes, performance, etc.) are assessed together (students and tutor).

4 Problem Based Learning and assessments

It depends on the way that teacher has taken to conduct his or her classes, and also on the students that attend these classes, assessment can vary in different terms. Therefore, teacher should know which the wide variety of choices is in order to select the best one. We present some of the models of assessment that have been used by us or that we can find in the bibliography related to PBL, especially in the briefing of Macdonald and Savin-Baden [16]. The majority of them try to avoid typical examinations, where only memory or pure concepts are evaluated.

4.1 Self-assessment

PBL is an active methodology, therefore self-assessment is very appropriate method, but teacher must give students the proper tools to develop the evaluation. Self-assessment allows students to think more carefully about what they do and do not know, and what they additionally need to know to accomplish certain tasks. Notice that it is not the same thing self, peer and collaborative assessment.

4.2 Peer assessment

This method fits also in a good way with PBL. Teacher can give some rules to students in order to maintain a homogeneous assessing or can provide them with an assessment rubric. A rubric often helps guide the peer evaluation process even better. This kind of assessment also emphasizes the cooperative nature of the PBL environment.

4.3 Portfolio

These can be cumbersome if the method is not managed well and are usually difficult to mark. It is also complicated to develop if you have a high number of students. Therefore, teacher must design well the portfolio. Portfolios have been used normally in a number of programs that educate students for the professions. In the last years, the requirements for portfolios have diminished from a great quantity of materials towards a softer version that supplies a major reflection and critical thinking than in the last century. It is necessary to pay attention to establish criteria to guarantee that a requirement exists to create a global synthesis.

4.4 Triple jump

This is an assessment that was specifically developed in the last quarter of the XX century for PBL [17, 18].

It is normally used only with a small number of students. Other cons are that it is time consuming and costly and tends only to be used in well-funded programs. The 'Triple jump' exercise has three phases: hop, step and jump. In the hop phase the tutor questions the student, thus they are caught on the hop. The step phase allows the student time to research the findings and hypotheses that have emerged from the hop phase. In the jump phase, they are expected to provide the tutor with a written report of their findings.

4.5 Group presentation

This method can be taken as part of collaborative models. Teacher asks the students to submit their work orally or in written form (or both of them). It fits very well with PB.

But it is usually difficult to mark if teacher does not use other strategies. A rubric is often used in order to maintain the same criteria in the evaluation, because oral presentations can be done by different students in different days.

4.6 Individual presentation

In this method, students are asked to submit the component of work that they have researched for their contribution to the overall solution or management of the problem scenario. This has some of the problems of the above and, if the students just present the component they have researched, then there is little synthesis over all with the problem

scenario. This is also time consuming with large number of students.

4.7 Tripartite assessment

Savin-Baden defined three components for this model [19]: a) The group submits a report for which they receive a mark. b) The individual submits the piece of work they researched. c) The individual writes an account of the group process that is linked to the theory of group work.

According to the author, these three components are added together to form the overall individual mark. The advantage of this is that it does not privilege some students who do less work and an individual student will be responsible for gaining two-thirds of the marks. As a result, most students perceive this kind of grading as being fair.

4.8 Viva voce examinations

This type of examinations was typical in the past, and it depends on the field or the subject, it was very effective. Nowadays, it is part of the final degree examinations, or also part of examinations with tribunal. It was widely in use and have since been adopted by several curriculum designers for use with PBL. However, they are best done in practice situations and, although they are very effective, they can be costly, time consuming and extremely stressful for the student.

4.9 Reports

Written communication is an important skill for students to acquire. In the era of evaluation by competences, reports play an important role in the evaluation of students. Requiring written reports allows students to practice this form of communication, particularly if the word allowance is short and it is used in the final year, as it can promote succinct, critical pieces of work.

4.10 Reflective (online) journals

These have worked well in engineering and health areas. Students hand them in each week and receive a mark at the end of each term/semester. For a high number of students, it can be a very time consuming method, although students tend to be more open and honest about their learning than one would expect and these can be criterion referenced.

5 Conclusion

Although traditional methodology for teaching and assessing are used in the majority of countries and universities, it is also true that a huge effort is being done by teachers worldwide to adapt the educational system to the new digital time.

However, it is not strange that these new methodologies or strategies have not been taken into account as a very important part of the teaching-learning process. And we can add that assessment is in this context the poor brother. Although there has been a tendency towards continuous assessment, not many teachers include the evaluation system itself as a tool for learning and acquiring the subject's own competences or even for acquiring transverse skills of the degree.

Among the different active methodologies that exist, Problem Based Learning is one of the used. This didactic technique is increasingly considered as an alternative for the teaching-learning process.

Assessment of PBL is a keystone and there are various models that can be followed and taken by teachers, depending on different factors as type of subject, number of students in class, etc.

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