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The Potential of a Pedagogical Approach in Mathematics based on Autonomous and Collaborative Exploration of Web 2.0 Tools – a case study in Higher Education

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Abstract

The Bologna process imposed new challenges for higher education, including for Mathematics, a structuring area for most courses that continues to compromise students' learning. A proper use of Web 2.0 tools may establish an innovative way to overcome the situation.

To address this issue, a case-study was developed with the aim to analyze if a pedagogical approach based on the collaborative and autonomous exploration, extra-class, of webquests and questions based on forum interactions, could contribute to the development of transversal and specific abilities by students, in Mathematics curricular units, in engineering courses.

The statistical and content analysis of inquiry gathered data, direct observation and documental collection allowed to conclude that this pedagogical approach promoted interest for Mathematics, as well as expand students' motivation and learning commitment, contributing to build and apply knowledge about inverse trigonometric functions and differential and integral calculus.

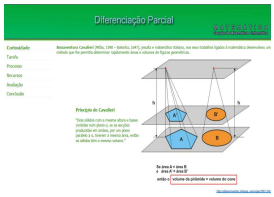


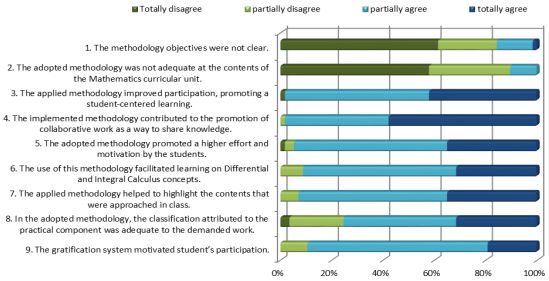
Fig 1 / Example of a webquest applied in this study.

Framework: The Bologna Declaration, the access globalization and the free circulation of information brought major reforms to Higher Education. The possibility of sharing and recreating knowledge changed the educational process, defending a lecturing methodology that focus on personalized and collaborative learning (Loureiro & Pombo, 2012). The Mathematics takes a fundamental role as the engine of innovation, growth and economic recovery, as well as the means for personal achievement. However, it is one of the curricular areas that remains doomed to failure (Araújo & Cabrita, 2014).

This study was proposed to analyze and understand to what extent the implementation of a pedagogical approach, based on the exploration of autonomous and collaborative work and resorting to webquests that comprise diverse tasks, can enhance: i) a student-based lecturing; ii) the students' motivation and commitment in learning; iii) the development of transversal competences, namely collaborative attitudes; and iv) the development of specific competences as inverse trigonometric functions and differential and integral calculus.

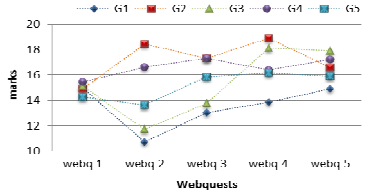
Method: Taking into account the problem's nature and the research aims, it was chosen a case-study, essentially qualitative, with a descriptive-interpretative character (Stake, 2009). The investigation focused on the students enrolled in the Mathematics curricular unit of engineering courses, deepening the study into 5 groups. To gather data, it was privileged the inquiry technics, observation and documental collection.

Results: In the surveys' analysis, it is evident how the pedagogical approach was well-accepted among students, making them feel responsible for building their own knowledge, in a motivating and interesting way of learning (Graph 1), which corroborate with the findings from direct observation.



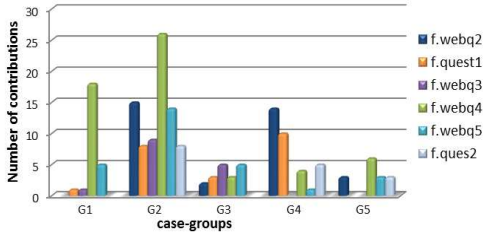
Graph 1 / Analysis of the degree of agreement with statements regarding the methodology implemented.

We may observe that the webquests' marks (including presentation and discussion) were higher as we progress along the semester. It is particularly highlighted that the case-group after the 4th and 5th webquests got marks equal or superior to 16 values (out of 20 values), except for case-group 1 who got 15 values (Graph 2).



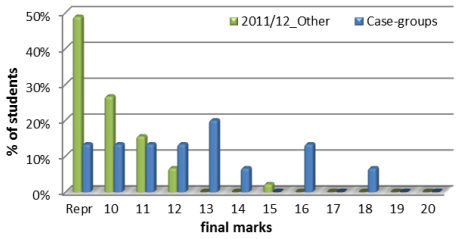
Graph 2 / Comparison of webquests' marks for each case-group.

The study shows that the web forums improved the level of collaboration between students. All case-groups published on the forum. However, group 2 was responsible for the majority of contributions (46,5%), followed by group 4 (20%), although its participation was more irregular (Graph 3).



Graph 3 / Comparison of number of forum contributions for each case-group.

Finally, it was also clear an evolution on students' final marks and it was registered a significant difference between the marks of students that integrated the case-groups and the ones that did not (Graph 4).



Graph 4 / Comparison of final marks from case-groups versus the other students, in the academic year 2011/2012.

Conclusion: The collaborative work in class and, specially, extra-class, mediated by using several resources and technologies, has promoted the students' participation and involvement and their autonomy in constructing knowledge, which fostered motivation and success in the curricular unit. Such results are concordant to the opinion of several authors (Coutinho & Lisboa, 2014; Pombo, Loureiro & Moreira, 2010). This study allows theoretical generalizations in the multimedia field for education about the importance, possibility, efficiency and effectiveness of pedagogical approaches mediated by Web 2.0 tools, with implications in higher education of engineering.

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