Chapter 16

Software Tools Used in Math Refresher Courses at the University of Alcalá, Spain

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ABSTRACT

We describe our experience of using the following mathematical tools: an e-learning platform (Moodle), several components of the WIRIS software suite for mathematics education (the formula editor, WIRIS CAS, and WIRIS-Quizzes), the dynamical geometry package GeoGebra, the computational knowledge engine Wolfram Alpha, and the mathematics software system SAGE. Our aim in this chapter is two-fold: on the one hand, we report the use of these tools in Math refresher courses. On the other, we provide sufficient information about them for readers to decide on the usefulness of these tools in their own particular context (maybe different from that of a refresher course). More specifically, for each tool we give a general description, some comments on its use in Math refresher courses, and a list of (general) advantages and drawbacks.

INTRODUCTION

E-learning (see for example Albano G. and Ferrari P.L., 2008; Descamps S.X., Bass H., Bolanos Evia G., Seiler R. and Seppala, M., 2006; Nichols M., 2003; Tavangarian D., Leypold M., Nölting K. and Röser M., 2004) essentially comprises learning/teaching tools with computer support. Therefore, learning platforms, specialized software packages, scientific repositories, etc. can all be considered as e-learning tools.

These tools have obvious advantages: on the one hand, they can be used for (synchronous or asynchronous) online teaching, and they can improve classroom teaching; on the other hand, students usually find them interesting and attractive, which results in higher motivation to study. These advantages have encouraged many teachers to try them; however, when it comes to using a new tool (whether computer-supported or otherwise), teachers tend to be cautious: commonly, it is tested with a small number of students, so that everything can easily be kept under control; if the experience is successful, then the testing is extended to larger groups and to other contexts. Thus, it is useful to have some kind of test group, in order to evaluate the tool's capabilities and to identify its drawbacks.

The authors of this chapter, being no exception, have also started using e-learning tools with small groups of students. In the case of our university (University of Alcalá, Madrid, Spain), we found the perfect test group in the refresher courses, called, in our university, "zero courses". These are refresher courses in basic areas of science (essentially Mathematics, Physics and Chemistry), which were introduced at UAH (University of Alcalá) several years ago in order to provide a common foundation for all students about to start their degrees. In fact, this kind of course is offered in many other universities in Spain, and also in other countries (see for example http://pre.universia.es/que-estudiar/cursos-cero/index.htm,

the web page of Waterloo University, Canada, http://de.uwaterloo.ca/preuniversity.html, or the web page of Dakota University, US, http://www.dsu.edu/disted/math-refresher.aspx, to give just a few examples). Zero courses in Mathematics typically cover such basic topics as:

- Algebra: inequalities, equations, and systems, matrices, determinants, polynomials.
- Calculus: sequences, functions, limits, derivatives, integrals.
- Discrete mathematics: combinatorics.
- Basic statistics.
- Geometry: trigonometry, affine plane geometry, conics.

At UAH, these courses are offered on many different degree courses, such as Engineering, Architecture, Biology, Environmental Sciences or Chemistry, but are not compulsory since not all the students need to refresh those topics. There are usually around 30 students on each of these courses, which generally last between twenty and thirty hours and are completed before the degree course begins (at the moment, the academic year at most Spanish universities begins in the third week of September, although this is likely to change in the future). The courses take place in a traditional classroom setting, although some online support is commonly provided. Furthermore, it has been decided that evaluation on these courses at the UAH should be merely informative, so that it has no impact on students' degree marks. As a consequence, the contents are more flexible than on a compulsory course, and the teacher can adapt the contents to the initial level of the students, which is evaluated in the first session.

In addition, for those students attending refresher courses this is usually their first academic experience (at UAH). Hence, and also because of the short duration of the course, it is clearly important to:

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