Using R for Active Learning and Self-assesment in an e-Learning Environment

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Over the past years, the way to teach mathematics and statistics has changed drastically. Nowadays it is unthinkable to teach statistics without the help of a statistical package. Moreover, the rapid pace of technological change has increased the importance of mathematics and statistics in science. Because of this, a project based on innovative learning and teaching techniques has been developed. The project aims to ensure that basic skills are mastered while developing conceptual thinking and modeling skills; to improve student's mathematical and statistical knowledge using an appropriate software; and to develop assessment methods that focus on higher level abilities and not just routine application of standard methods.

R-QUEST is an innovative system for e-learning based on self-assessment methods that guide the student throughout the learning process. It is an e-learning tool that helps students learn mathematics and statistics in an autonomous manner. The cornerstone of R-QUEST is R, R is used not only as a way to learn statistics but as a tool to better understand scientific concepts. At our university, the use of R has been introduced as a transversal competency in first year Biology and Biochemistry courses. Since we are dealing with first year students, it is out of the question to provide them with a manual and expect them to learn R without assistance. Moreover, programming languages can only be learnt through practice. The grading of weekly assignments can be quite a burden for the professors. But assessment plays a key role in determining student approaches to learning, since student's performance is driven by assessment. Therefore, it is essential to assess those aspects we want students to master.

Due to the above mentioned facts, R-QUEST a tool implemented on the Moodle Educational Platform has been developed. R-QUEST provides weekly lessons that consider one or two problems that must be solved using R. To help students learn R on their own (outside of the classroom), handouts on required commands are available on-line together with quizzes that allow students to practice and consolidate concepts. The number of questions in each quiz varies from 2 to 9, a typical quiz has 5 questions. In this first stage, each question has between 10 and 15 variants that are randomly assigned each time the quiz is opened by the student. The quizzes are adaptive in the sense that questions can be answered until the correct answer is found. At this moment, R-QUEST has a pool of 120 questions, each with 10-15 variants, our goal is to reach 300 questions.

Direct manual question introduction into the Moodle Educational Platform is a cumbersome and arduous task, specially when mathematical formulas are required. To ease this task, a Python package that transforms a quiz written in LaTeX into GIFT has been designed. The quizzes must be written following a specific format that provides a question template and specifies the parameters that handle the question variants. Once the set of quizzes is in GIFT format they are imported to the Moodle Educational Platform, where they are made available to the students.

The R-QUEST methodology makes learning R an easy chore. Furthermore, R-QUEST can be used by the student in an autonomous manner. R-QUEST helps the students to better understand topics of Mathematics and Statistics courses. The professor does not have to play an active role in the learning process since it is an e-learning tool implemented on the Moodle Educational Platform.

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