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THEMATIC ISSUE ON "LEARNING AND TEACHING STATISTICS: NEW CHALLENGES AND FRONTIERS - EDITORIAL"

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In the era of data, Statistical literacy has become a fundamental skill required to provide anyone a competitive edge in any field. Nowadays, the last century prophecy by Herbert G. Wells seems to be fulfilled "*Statistical thinking will one day be as necessary for efficient citizenship as the ability to read and write*".

Even in non–STEM (Science, Engineering, Technology, and Mathematics) graduate and undergraduate programs, primary or intermediate statistical knowledge is required even more. Statistics is offered in non–STEM undergraduate and master programs in Cultural Heritage, Health Sciences, Medicine, Political Science, Psychology, Social Science, and several others. However, students enrolled in such programs often do not have a solid mathematical background, and teaching Statistics must be utterly different than STEM courses.

Many scientific articles highlighted that several reasons generally contribute to students' low performance in Statistics in courses belonging to the Human science field. These reasons can be roughly gathered in three main groups: (i) lack of background knowledge; (ii) psychological traits of anxiety towards Mathematics and Statistics; (iii) lack of motivation for the study of Statistics.

In this broad framework, this thematic issue collects contributions starting from experience of the partners of an Erasmus Plus KA2 project, funded by the

European Commission. The project, named ALEAS, aimed to design and implement an integrated system to profile students facing with Statistics inside non–STEM programs, taking into account young people's habits and preferences in the digital era. Students' profiling hinged upon their background in Mathematics and Statistics, and according to their psychological profile in term of anxiety towards the Mathematics. The project involved four different countries, German, Greece, Italy and Spain, with five partners:

- Jacob University Bremen, German
- Democritus University of Thrace, Greece
- University of Naples Federico II (Project Leader), Italy
- Universitat de Valencia, Spain
- Smarted srl, Italy.

The core of the ALEAS project was the development and implementation of an **A**daptive **LEA**rning **S**ystem (ALEAS), realized exploiting the most innovative and digital technologies embedded in an open access framework. The system was designed with the aim to support students' learning providing several resources (tests, videos, cartoons, texts). The different learning materials and resources were inserted in an online system and delivered through technological devices of any type, including mobile devices.

The design and implementation of ALEAS involved the partners in a careful study of the literature on teaching Statistics, and in the development of original researches in such field. Main deliverables of the project are available on the official webpage (`www.aleas-project.eu`) and consist of several main outputs, pertaining research on secondary school students' performance in Mathematics and Statistics, technical specifications related to the design and implementation of ALEAS, and evaluation of the impact of the system for facing with statistical anxiety.

This thematic issues collects five original papers originated during the ALEAS project, briefly summarised as follows:

- the first paper, by Aschenbruck R., Szepannek G., Lübke K., and Wilhelm A.F.X., clusters students' attitudes toward Statistics, starting from the results of a survey based on the SATS-36 questionnaire;
- the second paper, by Folgado-Alufre M., Serrano-Mendizábal M., Miragall M., Desdendato L., García-Ubiedo L., Baños R.M., analyzes the protective role of intrinsic motivation, self–efficacy, and self–regulation strategies

against procrastination and statistic anxiety, a common problem affecting final performance of the students;

- the third paper, by Fabbricatore R., Parola A., Pepicelli G., Palumbo F., exploits a partial least squares path modelling to investigate on factors affecting students' performance in Statistics offered inside non–STEM programmes;

- the fourth paper, by Markos A., Themelis E., Moschidis S., evaluates a set of distance measures for use in cognitive diagnostic models, i.e. models widely used in educational testing to provide diagnostic information by identifying the level of mastery of an examinee on a set of skills or attributes;

- finally, the paper of Rossi L., Camminatiello I., and Zanetti M., investigates the common pattern of learning styles of students with callous-unemotional traits. They consists of problems entailing learning difficulties, lower academic achievement, and school dropout. The paper aims to detect specific learning styles useful to improve performances by encouraging students' inclusion.

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The Guest Editors

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