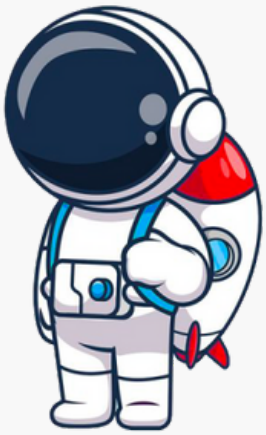
HELMeTO 2023
UNIVERSITY OF FOGGIA

5th International Conference on
Higher Education Learning Methodologies and
Technologies Online

Foggia, September 13th - 15th, 2023



BOOK OF ABSTRACTS

Università di Foggia

sirem

LSh

Autori vari
HELMeTO 2023 - Book of Abstracts

Editore STUDIUM s.r.l. a socio unico
Prima edizione Settembre 2023

ISBN 978-88-99978-64-8

Design of an online introductory math course for engineering students

Caterina Bassi[1][0000-0002-2262-520X], Giulia Bernardi[1][0000-0001-7622-9790] and Domenico Brunetto[1][0000-0002-3969-7103]

[1] Politecnico di Milano, Piazza Leonardo da Vinci 32, 20133 Milano , Italy
domenico.brunetto@polimi.it

In order to smooth the transition between secondary and tertiary education, universities usually offer preparatory courses to first-year students. At the Politecnico di Milano, preparatory math courses are delivered every year before the beginning of the first semester and are addressed to all first-year engineering students. Until September 2020, classes were delivered on-site, then, due to the pandemic, there was a compulsory shift to online classes. In 2022 the university decided to offer both the on-site and the fully online course. Both courses are structured in two parts: a MOOC that students are invited to attend during the summer and eight classes delivered in the two weeks before the beginning of the academic year. The pre-calculus MOOC is delivered on the POK platform (www.pok.polimi.it), where students can study videos about theory explanations and resolutions of exercises, test their basic knowledge in mathematics through quizzes and interact with other students and tutors through a forum. The MOOC course is structured in six weeks, i.e. units: arithmetics, algebra, geometry, logics, functions, and probability. The eight classes, four hours each, follow the syllabus of the MOOC course.

The scope of this work is to describe the design of the fully online format and to focus on the choice made by the tutors while planning the classes in order to guide students' work and increase the efficacy of the course The course was carried out in September 2022 and involved approximately 70 students. The eight classes were delivered in an online format in which the tutor and the students were interacting using an online platform (Webex). The course was blended in the sense that it involved both synchronous and asynchronous activities. This choice was made because different resources in mathematics education, see [1], suggest that one of the critical points in the transition between high school and university is that learning resources are perceived in a different way and that, at university, students are supposed to study and work with more independence. In our context, synchronous activities provide guidance to students, while asynchronous activities foster their independence, smoothing the transition between secondary and tertiary education.
Moreover, as Gamer and Gamer [2] pointed out, student-directed learning promotes conceptual learning more effectively if compared to teacher-directed approach. In the blended learning format, students have an active role since they have to watch videos, they have the possibility of solving exercises with self-evaluation and can use online forums and other sources to clarify their doubts. All this engages students in different mathematical activities that generate a personal production of meanings and mathematical knowledge.

In the following, we describe the course schedule. The first lesson started with an extensive explanation of the course structure provided synchronously by the tutor. Then, students were given a self-assessment quiz that lasted 30 minutes and covered the topics of the first week; a second self-assessment quiz was delivered between the fourth and the fifth lessons to cover the topics of the second week. The aim of the self-assessment quizzes was to guide students in identifying their strengths and weaknesses and, thus, to foster students' autonomy in choosing the lessons and contents more relevant to them. Each class started with asynchronous activities which lasted one hour. Through a shared Padlet students were told which part of the pre-calculus MOOC had to be studied (videos and quizzes) and they were asked to solve the task of a "warm-up" activity. With the warm-up activity, students were asked to think and reason about open problems and tasks. Afterwards, students posted their resolutions and possible questions on the MOOC forum. The second part of the class was synchronous, it lasted two hours and it was delivered through the online streaming platform Webex and a shared board (Jamboard). During the synchronous part, the tutor discussed the solution of the warm-up activity, addressed students' questions and deepened the topic. At the end of the class, students were given one hour to answer a formative-assessment test, which focused on the topics covered during the lesson.
At the end of the course, all the students were given a survey with the purpose of evaluating the effectiveness and usefulness of the two formats. As discussed in [3], the responses show that there was no significant difference between the online and on-site formats. In the survey to the final question "do you recommend this course to future first year students?", none of the students answered no, showing that the online format was as successful as the on-site one.

References

1. Kock, Zeger, J., Brunetto, D., Pepin, B.: Students' choice and perceived importance of resources in first-year university calculus and linear algebra. In: Barzel, B., Bebernik, R., Göbel, L., Pohl, M., Schacht, F., Thurm, D.E. (eds.) Proceedings of the 14th International conference on technology in mathematics teaching – ICTMT14. vol. 48, pp. 91–98. DuEPublico (2020). doi: 10.17185/duepublico/48820
2. Gamer, B.E., Gamer, L.E.: Retention of concepts and skills in traditional and reformed applied calculus. Mathematics Education Research Journal 13(3), 165–184 (2001).
3. Brunetto, D., Bernardi, G., Bassi, C.: Students' experience of blended teaching formats in pre-calculus courses. In: Proceedings of 9th International Conference on Higher Education Advances (HEAd'23), 1–8 (2023). Valencia, Spain. (in press)

Università di Foggia

sirem

LSh

HELMeTO 2023
UNIVERSITY OF FOGGIA

5th International Conference on
Higher Education Learning Methodologies and Technologies Online

Foggia, September 13th - 15th, 2023

ISBN 978-88-99978-64-8