Creative Mathematically Modelling Videos Developed by Engineering Students

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Abstract : Ordinary differential equations (ODE) are a fundamental part of the curriculum for most engineering degrees, and students typically have difficulties in the subsequent abstract mathematical calculations. To enhance their motivation and profit that they are digital natives, we propose a teamwork project that includes the creation of a video. It should explain how to model mathematically a real-world problem transforming it into an ODE, which should then be solved using the tools learned in the lectures. This idea was indeed implemented with first-year students of a BSc in Engineering and Management during the period of online learning caused by the outbreak of COVID-19 in Spain. Each group of 4 students was assigned a different topic: model a hot water heater, search for the shortest path, design the quickest route for delivery, cooling a computer chip, the shape of the hanging cables of the Golden Gate, detecting land mines, rocket trajectories, etc. These topics should be worked out through two complementary channels: a written report describing the problem and a 10-15 min video on the subject. The report includes the following items: description of the problem to be modeled, detailed obtention of the ODE that models the problem, its complete solution, and interpretation in the context of the original problem. We report the outcomes of this teaching in context and active learning experience, including the feedback received by the students. They highlighted the encouragement of creativity and originality, which are skills that they do not typically relate to mathematics. Additionally, the video format (unlike a common presentation) has the advantage of allowing them to critically review and self-assess the recording, repeating some parts until the result is satisfactory. As a side effect, they felt more confident about their oral abilities. In short, students agreed that they had fun preparing the video. They recognized that it was tricky to combine deep mathematical contents with entertainment since, without the latter, it is impossible to engage people to view the video till the end. Despite this difficulty, after the activity, they claimed to understand better the material, and they enjoyed showing the videos to family and friends during and after the project.

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