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## APPlied Student (APPS) teaching/learning methodologies

Development of mobile pedagogical tools and contents for engineering courses, from students to students

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### Abstract

Technology has become the centre piece of modern society, being embedded in a natural way into individuals behaviour. Also, its rapid growth into the human life, has generated new ways of thinking and interaction.

Nevertheless, teaching methodologies seem to have been following the same approach during centuries, with the teacher as the centre of knowledge, responsible to deliver the information in small bits to a number of passive recipients (students), in the same way, disregarding the individual differences between students.

Starting from a case study prototype within a Solid Mechanics course integrated in the Master in Mechanical Engineering of the University of Aveiro, the APPlied Student (APPS) concept intended and managed to completely change this paradigm. This was done by empowering the students with a number of technical and societal skills and, from a pedagogical standpoint, making them responsible for creating and disseminating their own technical contents in an innovative way, for them and for successive generations of students.

### Introduction

Technology has been embraced in several areas of society. It is common to see people using some form of technological device, either as a communication tool, mean of entertainment or as a work tool. Despite playing a key role in many aspects of human life, technology is yet to be fully accepted in areas like Education. Computers already take part in some aspects of a teacher's work, mainly as a tool to produce and present the course materials at class. But every other aspect of transmitting that information to students is conducted traditionally, with the teacher being assumed as the main content/knowledge provider.

What if technology could be used to empower students to produce their own content and share their knowledge in class?

### The APPS concept

The concept of APPlied Student (APPS) teaching/learning stems directly from the classroom dynamics and aims to be an effective mean of developing new attitudes by teachers and students, new technical skills and new pedagogical materials. The key distinguishing feature of APPS is to put each student in a central (decision making) role on their technical education.

Broadly speaking, with the APPS methodology, the students are entitled to participate in building their own knowledge bases, embracing extracurricular challenges and investing on their hard and soft skills. Most importantly, they actively work on new technological and pedagogical solutions, to be used by them, by teachers and by subsequent students in the future.

### From concept to reality

The authors explored a case study centred on the development of pedagogical mobile apps by mechanical engineering students with no previous background on either programming or the technical subjects. The process was ignited by class related challenges, bravely undertaken by the most entrepreneurial students.

As for example, two students accomplished to create a mobile app to aid in the study of a Solid Mechanics subject. With no programming experience on the Android system, they started the development using the MIT App Inventor platform, where apps are developed by linking pieces of code in a puzzle-like fashion.

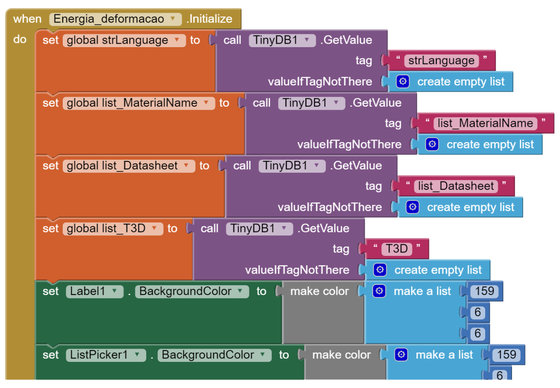
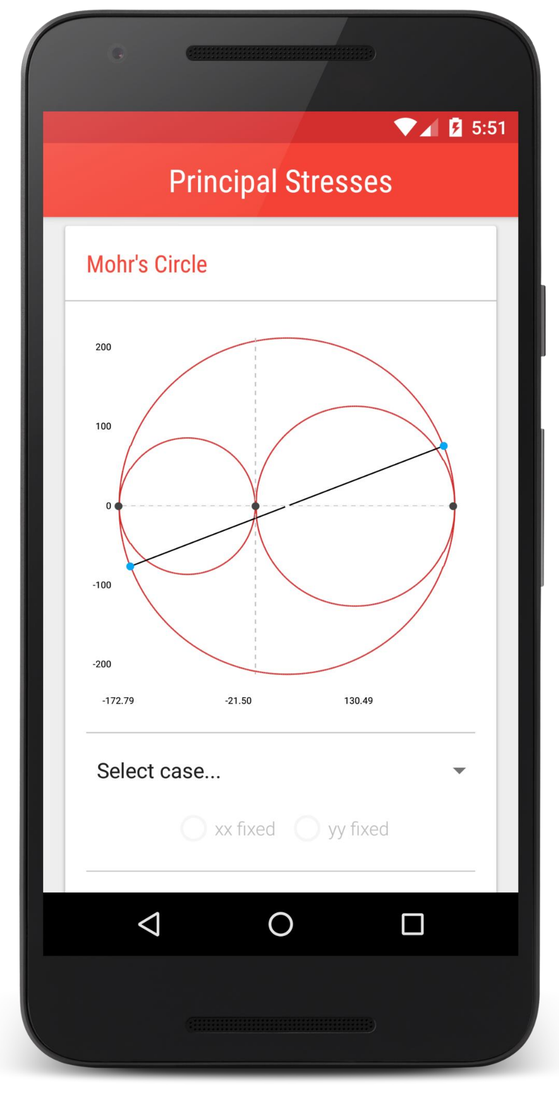



**Fig.1** Code snippet from an early version of the app, running on MIT App Inventor Code.

The visual character of the programming language gave the students a mean to understand how a mobile application works, gaining the necessary experience on designing the interfaces and assimilating the programming logic/syntax. By the end of the course subject, the app was able to perform the majority of the calculations learnt during classes. After a short period, the students successfully ported the app to the native Android programming language using Android Studio, which held a positive impact in performance and design responsiveness, while unlocking several new possibilities.

The app eventually reached the Google Play Store with their continuous support, periodically receiving updates with new features, content or bug fixes.




**Vid. 1** Latest app version running on native Android code. The app is available at the Google Play Store.

They also created an online site to show off their projects.

As part of the process the two students learned about Java, XML, HTML, JavaScript and image processing and editing (through visual content creation). Additionally, it allowed them to gain a greater insight into the course subject.

### Influence and academic impact

The approach had a direct impact not only on the course itself but also on several other levels. Besides the specific technological results of the challenge, the developed tools have become useful teaching tools for other students, being used as pedagogical media in subsequent editions of the course.

**Fig. 2** The students during a workshop, aiding other students in programming their first script. Photo taken during the CodeWeek EU event "MEC@DEM-UA", organized by them.

The APPS methodology was able to empower students with teamwork capabilities, far beyond those learnt on regular classes. Specifically, the involved students assumed the role of young researchers and educators, themselves, being responsible for a number of workshops on the development of pedagogical mobile applications and programming skills. These workshops were intended to be given to target groups composed of not only other undergraduates, but also post-graduate students and even engineering teachers. The workshops continue to exist with an ever increasing number of interested students and improved quality in each iteration.

### Conclusions

The impact of the APPS methodology was seen to be high, last standing and wide reaching, with outstanding results in terms of new and engaging teaching strategies for the future.

The next steps being taken by this project are to extend the methodology to other engineering courses within the UA Campus and, on the long term, to empower new entrepreneur students for the creation of cutting-edge teaching/learning materials based on mobile devices.