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EXPERIENCE REPORT

The importance of the introduction to the scientific initiation in the construction, characterization and sensing of surgical instruments and biomedical equipment

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Introduction

Scientific initiation refers to an activity that initiates the undergraduate student in the production of scientific knowledge. However, Brazilian higher education was set up focused on professional education, with no space for the humanistic and scientific training of the student, which is reflected this day in the country since there are few institutions that associate teaching and research [1]. From this perspective, it is essential to promote scientific initiation, especially when it is done in an interdisciplinary way, as this model is not widespread in universities. The development of projects involving the making, characterization, and sensing of surgical instruments and biomedical equipment, promotes a deeper immersion between the exact and health sciences, improving the teaching-learning process, the development of devices, and the success rate in their use.

As with video laryngoscopes, video laryngoscopy was especially preferred during the SARS-COV-2 pandemic, due to the increased probability of first-pass success in patients with difficult airways [2]. It was observed that the amount of force exerted during laryngoscopy is the main determinant for the mechanical stimulation of the supraglottic region and stretch receptors present in the respiratory tract [3]. Thus, the use of different types of laryngoscope blades can help to reduce these responses, since excessive forces can stimulate to lead to pathological responses of the cardiovascular systems; changes in hemodynamic parameters, and local effects, such as edema, tooth, and soft tissue injury [4]. This paper presents a case study of the experience of a medical student in the characterization and sense of biomedical equipment: an anatomical video laryngoscope sensorized on the blade and printed in ABS.

Therefore, this study reported the importance of scientific research within scientific initiation in the making, characterization, and sensing of surgical instruments and biomedical equipment, in particular, an anatomic video laryngoscope in ABS.

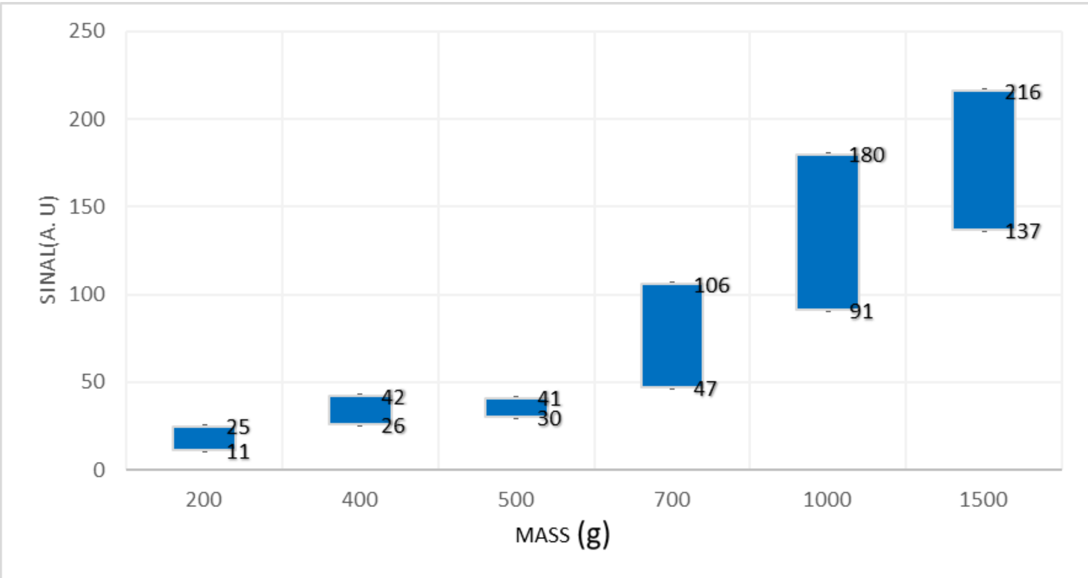
Experience report

The activities were carried out by a medical student, scientific initiation scholarship holder, related to acting as an active participant of the research project of confection, characterization, and sensing of realistic simulators, surgical instruments, and biomedical equipment from 2020 to 2021. The first step was a survey of the most relevant scientific productions on the subject, to understand the main difficulties encountered by health professionals during video laryngoscopy.

Therefore, the relevance of a cheaper and more ergonomic instrument for orotracheal intubation was perceived, reducing the risk of complications for patients. From this perspective, the force distribution of a low-cost anatomical video laryngoscope printed in ABS will be evaluated, made by the authors with patent registration, on airway manikins. The reading of the force intensity will be performed by a resistive sensor (model FSR 402) fixed along the concave distal surface of the video laryngoscope blade. To amplify the signal, the FSR 402 will be connected to an operational amplifier (LM324), associated with a low-pass filter, to amplify the output voltage and remove the 60Hz frequency from the power network grid. Then, the output voltage will be connected to an analog port of an Arduino.

At present, the force sensor is in the calibration step, to convert the voltage signal, generated by the compression of the sensor, into mass units. In the first calibration tests, the force sensor was fixed on a scale, which was previously tared, to eliminate the weight of the sensor and other materials present during its positioning. Then, masses were added gradually on the sensor surface, starting with a mass of 200 g and ending with a mass of 1.5 kg. Then, a graph of Force mass (g) x Signal (A.U) was plotted as depicted in Figure 1. According to the results of **Figure 1**, it is possible to note that the FSR 402 overlaps signal ranges for different mass values. In addition, although the manufacturer suggests the use of the FSR 402 sensor for a range for mass measurement from 0 to 10 kg, it has been found that its real operating region does not exceed 1.5 kg. Such characteristics make the use of the FSR 402 unfeasible for sensing the blade and the handle of video laryngoscopes.

Figure 1. Sensor calibration data (FSR 402) was obtained by the authors during the tests.



Reflection on experience

Based on the scientific initiation project, it was possible to improve the understanding of the construction and applications of medical instruments, which will enable clear and correct applicability of the product. Because there is little attention at the undergraduate level to understanding the functioning of the materials used in practice by students, which changes the perception of handling the instrument. In addition to the study, providing access to an ergonomic device, which reflects the opportunity for teaching collaboration, since video laryngoscopes are products that allow the expansion of the image for better student learning. Furthermore, as a consequence, health professionals will reduce the risk of complications for patients.

Conclusion

Therefore, it is notorious that the activities developed by undergraduate students are fundamental for the contribution and facilitation of medical education since the project evaluated the effectiveness of a biomedical circuit formed by an amplifier, a low-pass filter, and a sensor of force, FSR 402, as force signal pickups for a video laryngoscope. In addition to the possibility of reducing complications by clarifying the material's mechanism of action, thus becoming a reflective and critical professional with an emphasis on mastery and improvement of the technique so that in the future this professional can provide qualified care.

Keywords: Education. Research. Multidisciplinary.

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Conflict of interest
The authors declare no conflict of interest.

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