# Education 4.0: A Case Study Based on the Design and Launch of a High Altitude Balloon Using the STEAM Approach

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## Abstract

The emergence of new disruptive technologies, allied to the combination of different scientific and technological bases, brings significant productivity and quality gains in industrial processes. This is the fourth industrial revolution or Industry 4.0, which affects virtually all segments of human activity, with social and economic consequences. In this situation, education is faced with new challenges to train citizens who are ready for this new scenario. Education 4.0 is a model of education proposed to face these new challenges. In this model, the educator becomes the orchestrator of multiple information available in global networks along with the students, seeking to organize and synthesize the information and transforming it into knowledge. On the other hand, students become the protagonists in this teaching-learning process, where, through multidisciplinary projects, they face challenges and look for solutions that allow the construction of knowledge about different disciplines, making possible the development of their skills and abilities aligned with the new reality. Given this new model of education, new approaches are being developed so that the teaching-learning process is aligned with this new reality, such as the STEAM (Science, Technology, Engineering, Arts and Mathematics) approach, which integrates different areas of knowledge and is based on multidisciplinary projects. . This approach provokes students' interest in scientific research for problem solving, and knowledge is constructed in a collaborative and harmonious way among them The purpose of this work is to investigate the use of the STEAM approach by educators in Humberto de Campos and Fernanda Pires public high schools, located in the city of Sorocaba - SP — based on the proposal to develop a high altitude balloon (HAB) project, from its design to its launch — is aligned with the Education 4.0 model. In the first phase of the project, its objective was to collect from the atmosphere the following information: cosmic radiation, altitude, velocity and temperature for further study on the behavior of cosmic radiation with variations in temperature and pressure. During the development of the project, the students experienced the following stages of an engineering project: (a) the technical specification of the HAB; (b) the use of different technologies to build a mechatronic system based on a small and low-cost single-board computer, but with the functionalities of a large computer; (c) the process of integrating the computer with sensors, cameras and GPS; (d) the programming of the computer; (e) the test of computer integration with the other components; (f) the development of all project documentation and (g) the launch and actual operation of the equipment. An initial qualitative assessment showed that using the STEAM approach caused a significant improvement in students' behavioral attitudes regarding cooperative work, scientific research,

communication and facing new challenges. Thus, in a preliminary analysis, the STEAM approach proved to be adherent to the Education 4.0 model, although other studies involving quantitative methods are needed to evaluate the efficacy of this approach.

## Keywords
Industry 4.0, Education 4.0, STEAM approach, High Altitude Balloon.

## Acknowledgements

## Biographies

**Gabriel Henrique Fragoso Gonçalves** is a student of Monsenhor João Soares and Federal Institute of Education, Science and Technology of São Paulo - IFSP Sorocaba Campus

**Reinaldo Squillante Junior** is the Research and Professor of Electro-electronics and Mechatronics at Federal Institute of Education, Science and Technology of São Paulo - IFSP Sorocaba Campus.  He received B.S. in Electrical Engineering from University of São Judas - Brazil; Master in Science in the area of Automation and Control Engineering from University of São Paulo - Brazil, and Doctor in Science in the area of Automation and Control Engineering from University of São Paulo - Brazil. He is author of books Applied Computing and Factory and Industrial Installations Project. Dr. Squillante have been developing research in the area of Automation and Mechatronics Engineering with a focus on control systems directed by events with experience in modeling, analysis and validation of control algorithms for advanced manufacturing systems; diagnosis of critical failures on the Process Industries based on Bayesian networks; modeling of accidents on the Process Industries from incomplete databases, and design of safety instrumented systems (SIS). Furthermore, he has over 20 years of experience working in technology companies, and finally, he has interested in Industry 4.0 and new approaches of education 4.0.

**Sergio Shimura** is the Research and Innovation Coordinator and Professor of Electro-electronics and Mechatronics at Federal Institute of Education, Science and Technology of Sao Paulo - IFSP Sorocaba Campus - Sorocaba, Brazil. Dr. Shimura holds a Bachelor Degree in Electronic Engineering, Master Degree in Power Systems, Doctor Degree in Electronic Systems, and Post-Doctorate in Renewable Energies from University of Sao Paulo. He is author of Book Chapter of Photovoltaic Systems and Applications and earned a Certified Reliability Professional (CRP) in 2012. He has over 30 years of experience working in technology companies. His research interests include Aerospace engineering, Artificial Intelligence, Reliability engineering, Automation and Renewable Energies.

**Veronica Trevizoli** is professor at public and private schools in Sorocaba, Brazil. Miss Trevizoli holds a Licensed Degree in Mathematics and Pedagogy, Specialist in Methodology of teaching Mathematics and Physics, title of senior IT Management Specialist at FIAP, Sao Paulo. She has over 30 years of experience working in technology companies, with processes and technology. Her research interests include Education, STEM.

**Cesar Hipolito Pinto** is professor at public and private schools in Sorocaba, Brazil. MSc. Hipolito holds a bachelor's degree in Electric Engineering, Licensed Degree in Physics and master's degree in Astrophysics. He is author Radio telescope construction for analysis of 12 GHz solar microwaves in 2017. He has over 20 years of experience working in technology companies. His research interests include Aerospace engineering, STEAM Education and cosmic ray detection and analysis.