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Research and development of a creative instrument to allure students towards Engineering

Paulo Silva, Bento Aires, Anabela S. Conde, Carlos Felgueiras and Alicia García-Holgado

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ORDEM DOS ENGENHEIROS REGIÃO NORTE

isep Instituto Superior de Engenharia do Porto

VNiVERSiDAD D SALAMANCA

cieti centro de inovação em engenharia e tecnologia industrial

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Research and development of a creative instrument to allure students towards Engineering

Introduction and theme overview

Pratical case study

Impact

Expected results and conclusion

Need to adress SDGs:

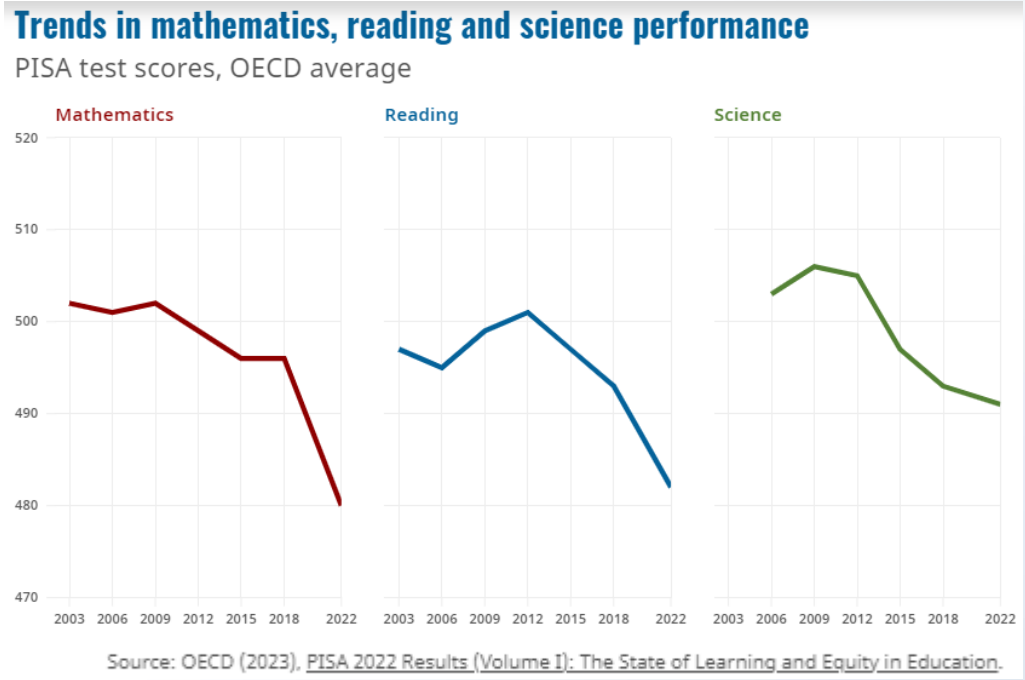
- Need for more people in STEM carreers
- Need for more Engineers
- Tradicional monodisciplinary courses – Need for multidisciplinar / transcidisplinary / interdisciplinary skills

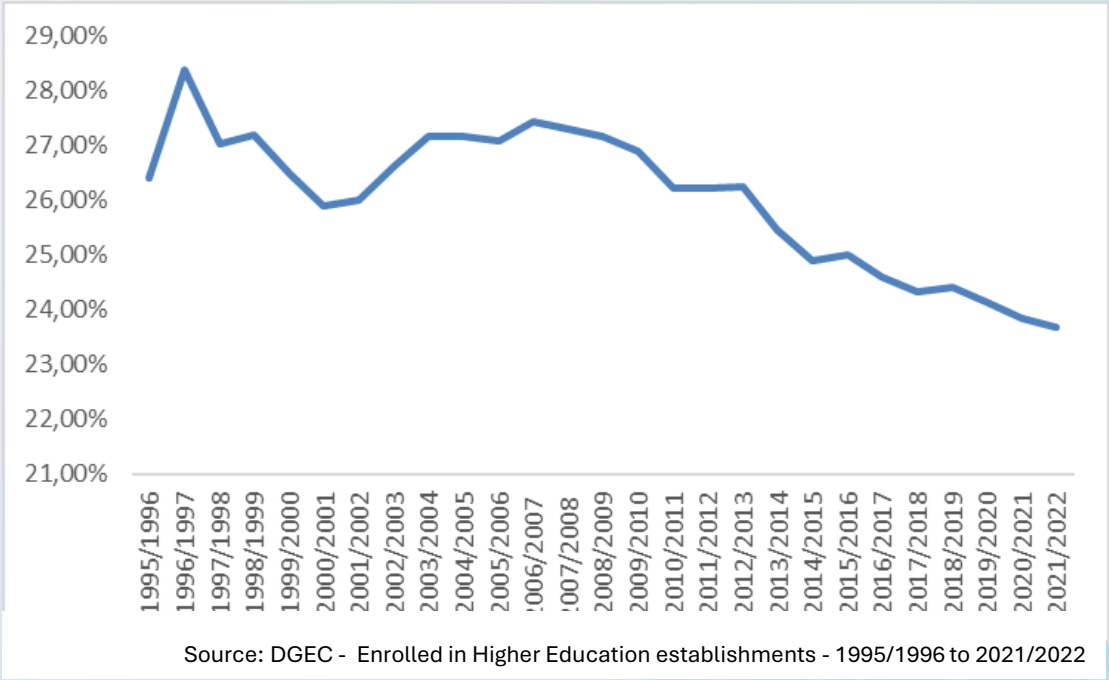
However, we have more and more:

- Poor STEM results in secondary schools;
- Less people enrolled in Engineering courses;

Question: How can we adress the SDGs?

- Try to desmistify Engineer carrers; *e.g. There is Engineering in me*


Trends in mathematics, reading and science performance
PISA test scores, OECD average
Mathematics
Reading
Science
520
510
500
490
480
470
2003 2006 2009 2012 2015 2018 2022
Source: OECD (2023), PISA 2022 Results (Volume I): The State of Learning and Equity in Education.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2021/2022
Source: DGEC - Enrolled in Higher Education establishments - 1995/1996 to 2021/2022

MORE COMPLEX, MORE EFFICIENT AND MORE SUSTAINABLE SOLUTIONS

+ ENGINEERS!!!

EDUCATION SYSTEM IN PORTUGAL

NUMBER OF ENGINEERS NEEDED TO MEET SOCIETY'S NEEDS

ERROR

BASIC EDUCATION

PROFESSIONAL PROGRAMS

HIGH SCHOOL

HIGHER EDUCATION

- *MEASUREMENT;*
- *REAL-TIME DATA OBSERVATORY;*

ENGINEERS OUTSIDE THE SPECIFIC LABOR MARKET

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ENGINEERS OUTSIDE THE SPECIFIC LABOR MARKET

Há Engenharia em Mim® (There is Engineering in me)

- Discover Engineering
- Gain interest and motivation in exact sciences
- Foster interest in mathematics and physics
- STEAM Teaching/Learning - combining science, technology, engineering, arts and mathematics
- Stimulate the practical sense of engineering, in a playful-pedagogical ‘hands on’ aspect
- Build prototypes, combining abstract-logical reasoning with know-how

Há Engenharia em Mim® (There is Engineering in me)

What we design:

- Study mathematics and physics while playing
- Multi-task
- Develop soft skills
- Explore creativity
- Awaken the critical spirit

Perceptions:

- Involvement of the entire educational community
- Enthusiasm during and after each session
- Request for new activity of greater complexity
- More enthusiasts for this profession

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REGIÃO NORTE

HÁ ENGENHARIA EM MIM®

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PARTNERSHIPS

Com o Alto Patrocínio
de Sua Excelência

Under the High Patronage of the
President of the Portuguese Republic

O Presidente da República

Under the patronage of the European Parliament

European Elections 6-9 June 2024
#UseYourVote

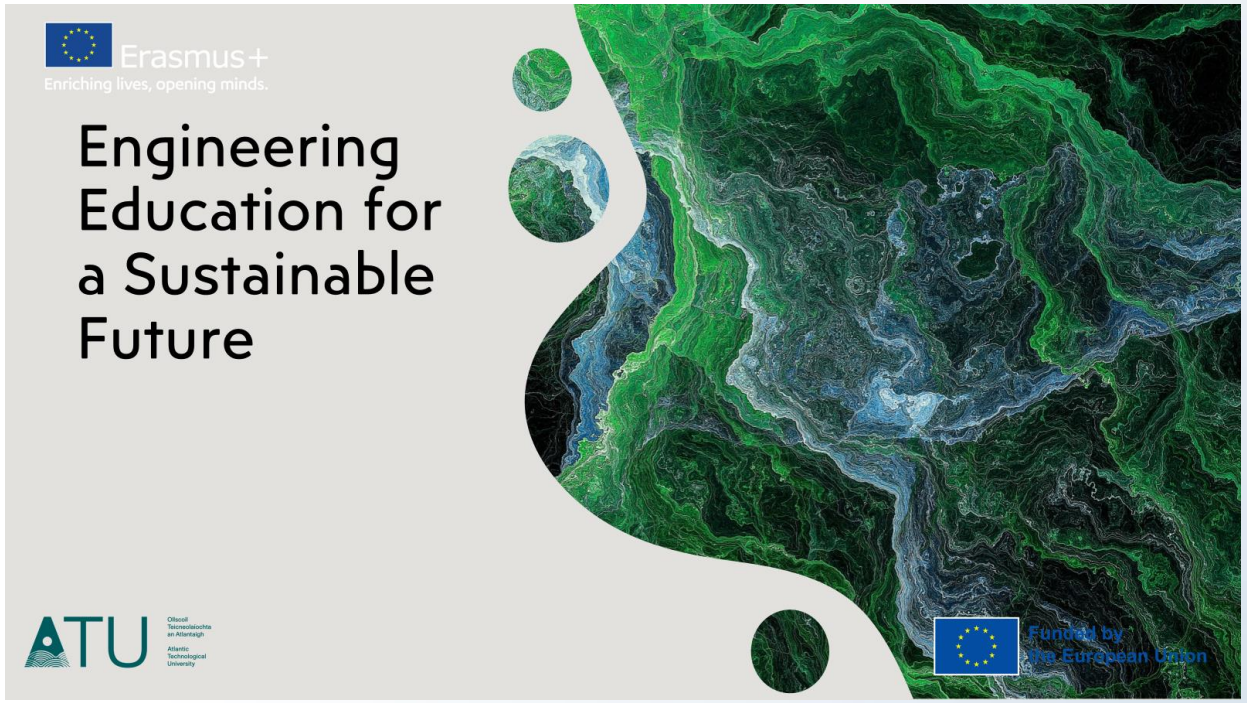
ACT NOW GLOBAL WEEK TO #ACT4SDGs

SUSTAINABLE DEVELOPMENT GOALS ACTION CAMPAIGN

PARTNERSHIPS
Erasmus+
Enriching lives, opening minds.

Ollscoil Teicneolaíochta an Atlantaigh
Atlantic Technological University

Institut Mines-Télécom Business School



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TECHNICA NATIONI IMPENDI

MOMENTUM MARKETING

PARTNERS FROM 5 COUNTRIES: PORTUGAL, FRANCE, IRELAND, SPAIN, DENMARK

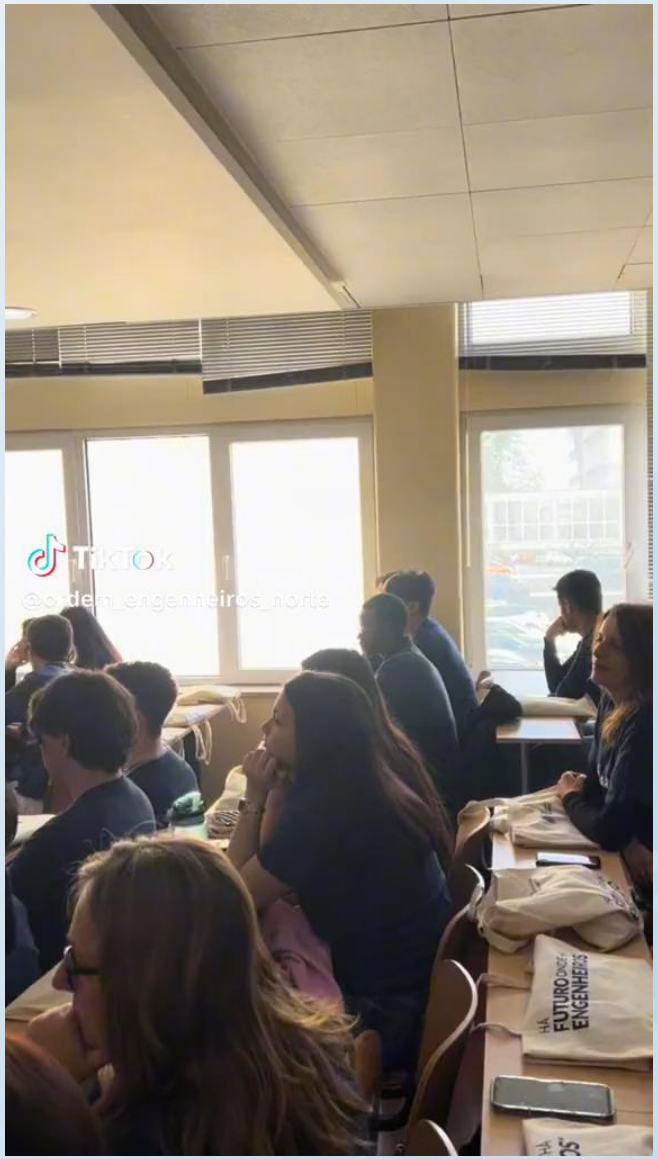
HÁ ENGENHARIA EM MIM | OERN NAS ESCOLAS

Com o Alto Patrocínio de Sua Excelência O Presidente da República

A Europa é Engenharia nas minhas mãos

Under the patronage of the European Parliament
European Elections 6-9 June 2024
#EUatYourVote

Europe is Engineering in my hands, with the HighPatronage of the **European Parliament**



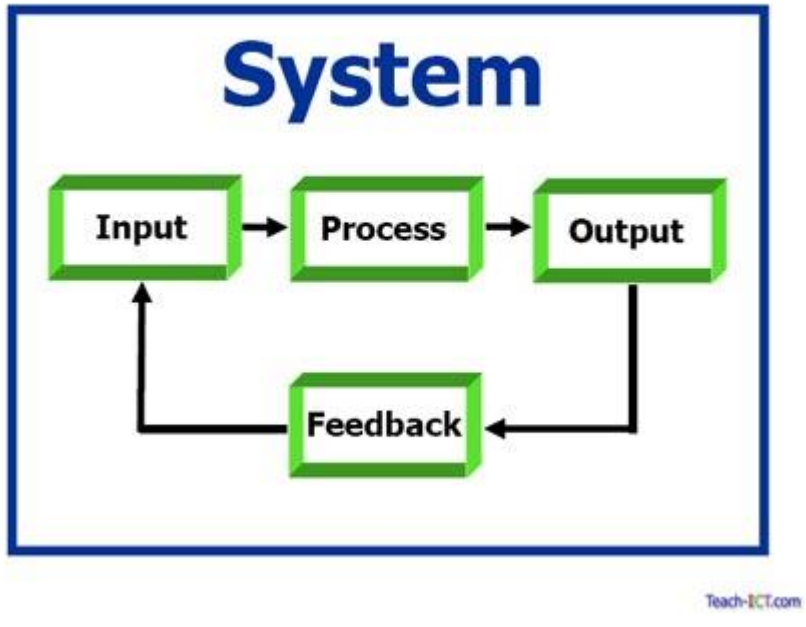
WHAT IS THE IMPACT OF THIS INITIATIVE?

ARE WE GOING TO HAVE MORE ENGINEERS?

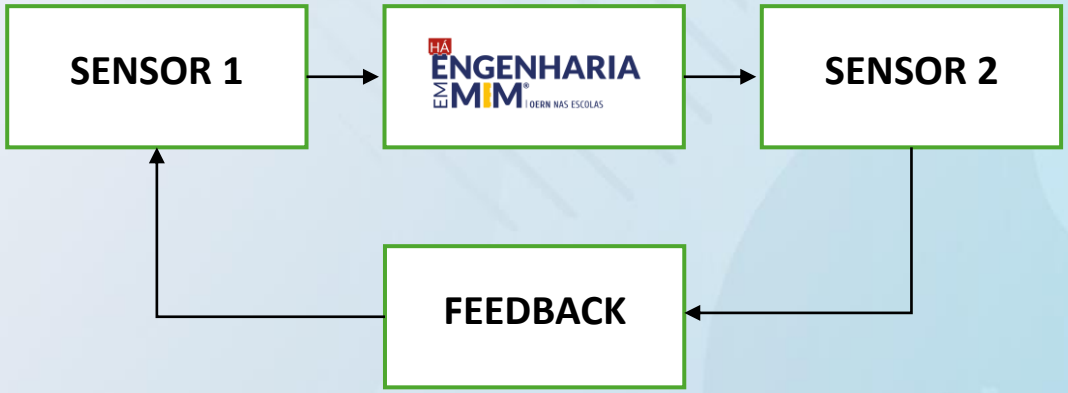
SINCE WE ARE ENGINEERS… WELL, LET'S MEASURE IT!

MESURING THE IMPACT ON STUDENTS

AUTOMATION



MEASURING THE IMPACT OF THE PROCESS



SURVEY– A SENSOR FOR PEOPLE

Res Sci Educ (2014) 44:461–481
DOI 10.1007/s11165-013-9389-3

The Development of the STEM Career Interest Survey (STEM-CIS)

Meredith W. Kier · Margaret R. Blanchard · Jason W. Osborne · Jennifer L. Albert

Published online: 20 November 2013

Abstract Internationally, efforts to increase student interest in science, technology, engineering, and mathematics (STEM) careers have been on the rise. It is often the goal of such efforts that increased interest in STEM careers should stimulate economic growth and enhance innovation. Scientific and educational organizations recommend that efforts to interest students in STEM majors and careers begin at the middle school level, a time when students are developing their own interests and recognizing their academic strengths. These factors have led scholars to call for instruments that effectively measure interest in STEM classes and careers, particularly for middle school students. In response, we leveraged the social cognitive career theory to develop a survey with subscales in science, technology, engineering, and mathematics. In this manuscript, we detail the six stages of development of the STEM Career Interest Survey. To investigate the instrument's *reliability and psychometric properties*, we administered this 44-item survey to over 1,000 middle school students (grades 6–8) who primarily were in rural, high-poverty districts in the southeastern USA. Confirmatory factor analyses indicate that the STEM-CIS is a strong, single factor instrument and also has four strong, discipline-specific subscales, which allow for the science, technology, engineering, and mathematics subscales to be administered separately or in

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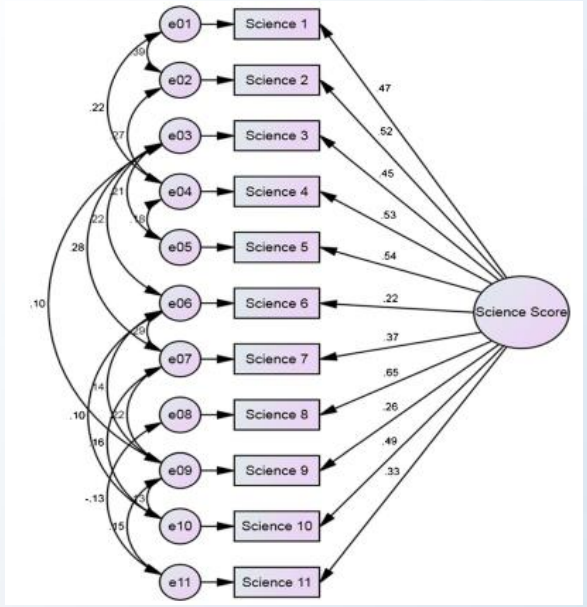
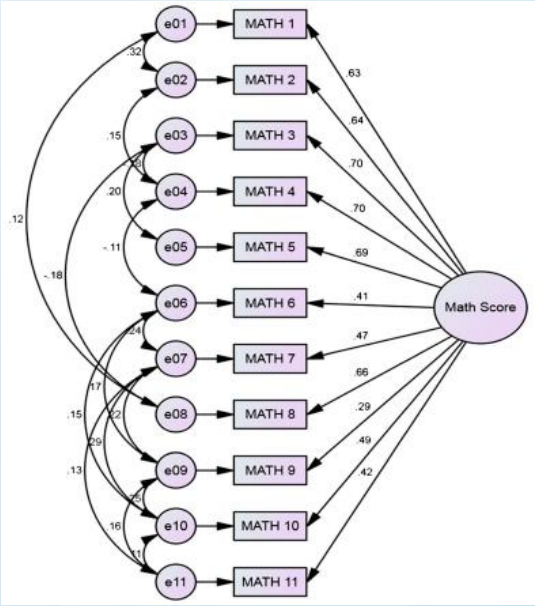
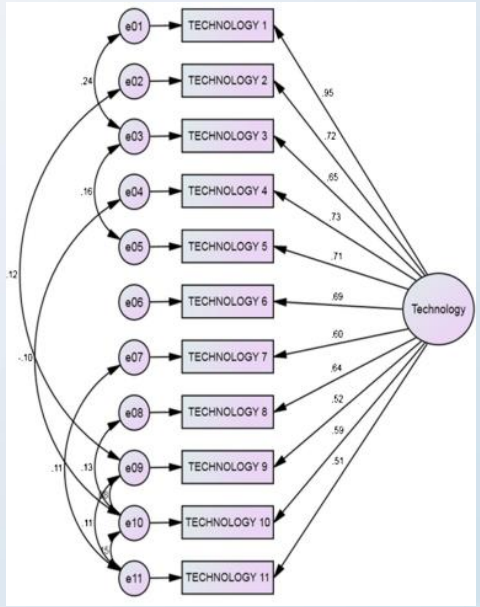
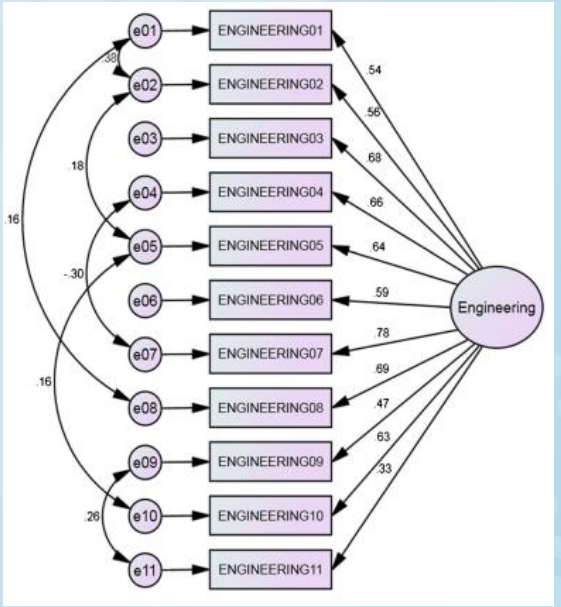
Springer





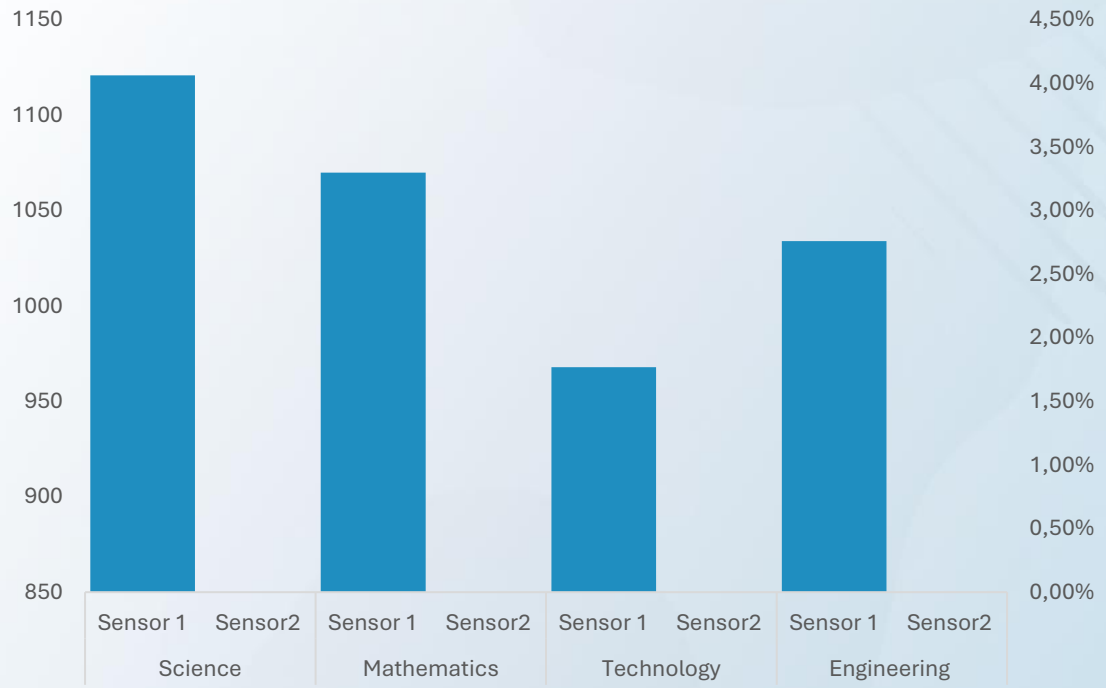




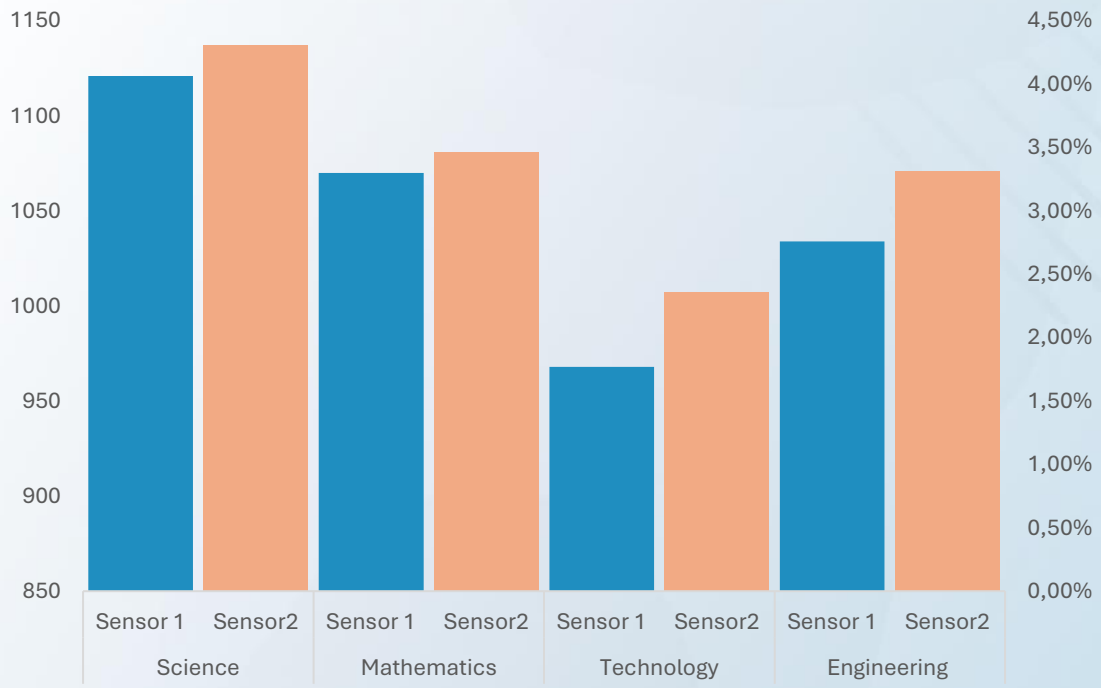
MESURING THE IMPACT ON STUDENTS

THE LIKERT SCALE IS A FUNDAMENTAL TOOL FOR MEASURING OBJECTIVES THAT AIM TO DETERMINE PEOPLE'S OPINIONS, PREFERENCES OR ATTITUDES ON CERTAIN SUBJECTS. THUS, IT AIMS TO QUANTIFY SUCH OPINIONS OR ATTITUDES IN RESEARCH.

MESURING THE IMPACT ON STUDENTS



MESURING THE IMPACT ON STUDENTS



+ 1,43% **+ 1,03%** **+ 4,03%** **+ 3,58%**

EXPECTED RESULTS

- Awaken within students the perception of continuous improvement in results
- Demonstrate the importance of ingenuity in solving tasks and the development of vocations in Engineering
- Our previous perception was that Math should represent the subject with lowest interest. Surprisingly, Technology is the subject that students mostly don't want to pursue careers in it

CONCLUSIONS

- Students are motivated, curious, and challenged to improve their prototype, achieving better and more efficient results;
- The development and implementation of creative programs and tools are highly efficient in enticing, captivating and promoting skills and qualities in adolescent students;
- The data obtained in the preliminary assessment are very encouraging and promising very positive results, demonstrating enormous potential in this creative tool that has aroused interest from several national and international entities.

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Thank you for your attention

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