FACTORY IN THE CLASSROOM

ENCOURAGING STEM CAREERS IN THE PORTUGUESE VOCATIONAL EDUCATIONAL SYSTEM

JORGE SOTTOMAIOR BRAGA
AGENDA

EPRAMI
Industry
The challenge
The diagnosis
The solutions
The concept
The implementation
The resources
The results
EPRAMI

WHO ARE WE?
"UMA ESCOLA ÚTIL PARA A VIDA"

António Sérgio
Microsoft Showcase Schools

LEADING INNOVATION IN EDUCATION
WHAT TO DO AFTER A 12TH GRADE VOCATIONAL COURSE?

Higher Education

- Post.Secondary
  - CET (1.5 years)
    Curso de Especialização Tecnológica

- Tertiary Level
  - CTESP (2 years)
    Curso Técnico Superior Profissional
  - Bachelor (3 years)
    - Global quota (general purpose exams)
    - Specific quota (specific vocational exams)
  - Bachelor + Master (3 +2 years)

Job market

- Get a job!
- Create a job!
AGE | YEARS in E&T
---|---
16 | 10
17 | 11
18 | 12

SECONDARY LEVEL

- **EOF 2**
  - Basic education – 3rd cycle, 3 years
  - ISCED 244

- **EOF 3**
  - General programmes, 3 years
  - ISCED 344

- **EOF 4**
  - Art education programmes, 3 years, WBL varies
  - ISCED 344, 354
  - Professional programmes, 3 years, WBL 19-24%
  - ISCED 354
  - Apprenticeship programme, 3 years, WBL >40%
  - ISCED 354
  - CEF 1-3 years, WBL 15-19%
  - ISCED 354

**Progression routes**
- Giving access to tertiary education
- Possible progression routes
- Prior VET studies may be recognised affecting programme duration
- Entry through validation of prior learning (formal/informal/non-formal)
- Work-based learning, either at the workplace or a VET institution
- End of compulsory education

**Notes**
- ISCED-P 2011
- Source: Cedefop and ReferNet Portugal, 2019
**TERTIARY LEVEL**

- **Equation 8 (EQF 8)**
  - PhD programmes, 3-4 years
  - ISCED 864

- **Equation 7 (EQF 7)**
  - Integrated programmes leading to a master degree, 5-6 years
  - University master programmes, 1.5-2 years
  - Polytechnic master programmes, 1.5-2 years
  - ISCED 767

- **Equation 6 (EQF 6)**
  - University bachelor programmes, 3-4 years
  - Polytechnic bachelor programmes, 3-4 years
  - ISCED 665

**ADULT LEARNING/CONTINUING TRAINING**

- **EQF 2-4**
  - Validation (RVCC) pathway, including 3 years professional experience for 18-23 year-olds
  - ISCED 244, 344

- **EQF 2-4**
  - Certified modular training (also for <18 year-olds in certain cases)
  - ISCED 254, 354

- **EQF 2-4**
  - Adult education and training courses (EFA) (also for <18 year-olds in labour market)
  - ISCED 254, 354

**POST-SECONDARY LEVEL**

- **Equation 5 (EQF 5)**
  - C10SP
  - 2 years; WBL ≥25%
  - ISCED 554

- **Equation 5 (EQF 5)**
  - CE1
  - 1-1.5 years; WBL 30-46%
  - ISCED 454
PROVA DE APTIDÃO PROFISSIONAL

- Final Project
- 3rd year
- Presented to an external jury
- Proof of aptitude to be a certified professional
- Usually a group project
INDUSTRY

PORTUGUESE AND (PROBABLY) EUROPEAN STATUS
INDUSTRY 4.0
DATA IS CHEAP
INDUSTRY 1.0
Mechanization, steam power, weaving loom

INDUSTRY 2.0
Mass production, assembly line, electrical energy

INDUSTRY 3.0
Automation, computers and electronics

INDUSTRY 4.0
Cyber Physical Systems, internet of things, networks

1784  1870  1969  TODAY
THE CHALLENGE

Ever changing industry needs
Highly adaptable
Leadership skills
Resilience
High technical skill and knowledge
Clear career focus
THE DIAGNOSIS

Improve work based social skills
Improve collaboration
Improve informal learning
Improve student motivation
Improve career goals
Maintain high technical knowledge
THE SOLUTION

Project Based Learning
Modern Workplace support
Matrix Management Learning System
Framework Support
THE CONCEPT

Matrix Management
Group vs Team
Project Based Learning
Modern distributed workplace
MATRIX MANAGEMENT – CLASSICAL IMPLEMENTATION
<table>
<thead>
<tr>
<th>THE CONCEPT</th>
<th>Disadvantages</th>
<th>Advantages</th>
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<tbody>
<tr>
<td>MATRIX</td>
<td>Multiple Reporting</td>
<td>Collaboration</td>
</tr>
<tr>
<td>MANAGEMENT</td>
<td>Managerial Roles definition</td>
<td>Sense of community</td>
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<tr>
<td></td>
<td>Decision making process can be slow – multiple inputs</td>
<td>High level of interaction</td>
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<td>“Employee” performance assessment</td>
<td>Co-responsibility</td>
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<td></td>
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<td>Motivation</td>
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<td>New skills set</td>
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</table>
THE CONCEPT – MATRIX MANAGEMENT

Flexibility and adaptability
Initiative and self-direction
Productivity and accountability
Leadership and responsibility
THE IMPLEMENTATION

Multiple class integration
Constant Access to Data
Data storage support
Data permissions
Create a new class – Collaboration and Information Technologies
PROJECTS

Célula de Produção de Porta-Memos (2011-2012)
- Manipulação Robótica e AGVs

- Tecnologia Partilhada

CLARA (2015-2016)
- Célula Local para Aprendizagem de Robótica e Automação

CLIP (2016-2017)
- Célula Local de Instrumentação e Pneumática

MARIA 4.0 (2017-2018)
- Mecatrónica Aplicada à Robótica Industrial e Automação

EVA (2018-2019)
- Empresa de Vasilhames Aromáticos
PROJECTS

FILIPA (2019-2020)
• Fabricação Industrial em Linha com Instrumentação Pneumática e Automação

ELISA (2019-2020)

CATIA (2020-2021)

LARA (2021-2022)

#FAST (2021-2022)

ZENDAL (2022-2023)
• Not yet started

Vanguard Marine (2022-2023)
• Not yet started
THE RESOURCES – TECHNOLOGIES AND COMPONENTS

Robotic components
Pneumatics components
Automation components
3D Printing
PLC
Industrial Profile
Sensors
Specific plastics
THE RESOURCES – SPECIFIC SOFTWARE

ABB Robot Studio
OMRON CX/SYMAC/TIA Portal
Autodesk Inventor
Autodesk Fusion
Autodesk AutoCAD
Autodesk AutoCAD Electrical
EPLAN*
Unity (VR)
THE RESOURCES – SOFTWARE

In the beginning
SharePoint
Skype for Business
Yammer

Currently
SharePoint
Microsoft Teams
Office 365 (desktop apps)
Power Platform
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<td>a minha câmara aparece de lado</td>
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<td>Nilton Barbosa A16-0119</td>
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**List of Sections:**
- Secção E - Armazém Desenhos
- Secção D - Recriação de Caixa
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<th>VER</th>
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<td>18</td>
<td>19/11/2018</td>
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WANT WENT WELL?

Improvement of non-formal learning and peer learning
Increase of course completion
**Improvement in STEM career follow up**
More complex implementations
Higher grades from external jury
Higher school evaluation by external stakeholders
Significant improvement in Tertiary and Post-secondary enrolment*
0 safety issues (to date)

We had a lot of fun!
WHAT WENT WRONG?

Open specification problem
Off-topic specs.
Risk of over-specific work
Group management vs Team management
Project planning
Teachers involved / paradigm shift
Time consuming
WHAT WE CAN DO BETTER?

Improve clear task definition
Increase resources (€€€)
    Preview tech in the near future and buy it!
Involve more industry partners from start
Have industry as a client
    Vanguard Marine (June 2023)
    ZENDAL (March 2023)
DEMO

SAMPLE “FACTORY” – SHARE THE FUN!
CHRISTMAS CARD FACTORY

Objective
Design, create, develop, and implement a factory/service that sends personalized cards to the elderly all around the nursing homes.

Age Group
6-9 years old

Name of the factory?
ELF – Emotional Letter Factory
STEP 1 – CUT PAPER TO SIZE

- We need a guide on how to use the in a safety manner this tool.
- We need a design for the paper (dimensions, fillets, punch holes)
- Batches of 50 sheets of paper ?
- Different colour paper.
- Additional cuts with “crazy” scissors.
**STEP 1 – CUT PAPER TO SIZE**

- We need a guide on how to use the in a safety manner this tool.
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STEP 2 – FOLD PAPER

- There are commercial folding machines that we can study.
- Maybe we can implement in LEGO.
STEP 3 – DECORATE

- Let’s create a product with 4 different types of STAMP
- We build stamps from potatoes!
- Dry decoration (STAMPS)
- We need to design the stamps.
- We need to train the kids in applying the stamps.
- Stamps get used (specially potato ones) and need to be replaced.
STEP 4 – WRITE A PERSONAL RANDOM DEDICATION

- Everybody in the factory contributes with great quotes.
- Kids that need probably to work on their calligraphy are the Official Writer Technicians (Scribe).
- (We need T-shirts with job categories ... by now! - maybe name tags for the entire class!)

Merry Christmas
STEP 5 – PLACE ADDRESS ON ENVELOPE

- We need kids that need to practice reading.
- Kids needing to improve reading and writing ability.
- Maybe we need a work task list.
STEP 6 – QUALITY CHECK (BEFORE INSERTING)

- Humans make mistakes. Kids are humans. Hence mistakes.
- We need quality control.
- Is the address in envelope correct for that person?
- Kids needing to improve reading and writing ability.
- Kids needing to improve on relational skills with others.
STEP 7 – INSERT IN ENVELOPE

- Machine opens envelope for easy insertion.
- Maybe a balloon-controlled air blower with a frame done in LEGO.
- Maybe some sort of reverse pliers.
STEP 8 – CLOSE THE ENVELOPE

- We need someone to lick the envelope!
- We can, of course, outsource the work. If big companies do it... so can we.!
- It is always a good excuse to get a dog in the classroom.
- Just be sure that the glue in the envelope is Dog safe!
STEP 9 – MAIL

- Go into the mail station.
- Explain the objective.
- Send the Christmas Cards.
- Check the task as done.
- Pay and keep a record of payments.
MATRIX MANAGEMENT

Groups / Sections
- Paper Manufacturing
- Decorating and Personalization
- Shipping

Teams
- Paper Technology
- Design
- Quality and Safety
- Logistics
TECHNOLOGY/ACTIONS

- Guillotine
- Scissors
- Copyrighting (everyone should be involved in this one!)
- Writing (Calligraphy!)
- Potato Stamp Design
- Potato Stamp Manufacturing
- Peel potato
- (No plastic Glitter – bad for the Oceans)
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FEEDBACK
