IB AFRICA, EUROPE & MIDDLE EAST REGIONAL CONFERENCE 2014
ROME • 16–19 OCTOBER
Using the Design Cycle to teach robotics through cooperative learning

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My name is Pedro Pozo Morillas
(you know, we Spaniards have two surnames…)
I work at Colegio de San Francisco de Paula in Sevilla, Spain
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My current position is Head of Dpt of Visual Arts & Design Technology, and PYP Coordinator
I am also MYP School Visitor
University background: Architecture
PROJECT CONTEXT

1) ROBOTICS is a compulsory topic for our year 10 students, according to Spanish educational regulations (RD enseñanzas mínimas de Secundaria), so it was embedded on our curriculum.

2) EDUCATIONAL LEVELS: Year 10 and year 11 students, both in English and Spanish, taught between my colleague James Reilly and me.

3) TIMING: Two-terms project...you´ll see it is quite long and, like all the Design&Visual Arts teachers of the world, I am always begging for more hours.

4) MAIN METHODOLOGY: DESIGN CYCLE

5) T&L STRATEGIES:
   - Learning to Learn
   - Cooperative Learning
   - Team-building

6) PARTICIPATION ALSO IN A EXTERNAL COMPETITION
MAIN OBJECTIVES

Using the Design Cycle to teach robotics through cooperative learning
ESSENTIAL AGREEMENTS

• First of all, thank you for choosing this session…but if it doesn´t meet your expectations, please feel free to leave the room and try another one…please, feel also free to raise your hand and interrupt me during the talk. And, in advance sorry for my English.

• This session is just about me sharing this experience with you, in case you find it useful. But it lasts just one hour, so if you need more information, just write me at: pedro.pozo@sfpaula.com

• I am going to ask you now to access my wiki, where you can find all the information given here:
http://tecnosanfran.wikispaces.com/
SESSION OBJECTIVES

• Gaining deep knowledge of the stages of the Design Cycle.

• Know more about strategies of cooperative learning (students-teaching-students)

• Analysis of the influence of external competitions in the motivation of our students

• Learn how to program a robot using Lego NXT software (*laptops needed for this*)

• Working together in groups to experience the idea of "learning through fun" that engage our students
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Using the Design Cycle to teach robotics through cooperative learning
DESIGN CYCLE

The Design Cycle

- Identify the problem
- Develop the design brief
- Formulate a design specification
- Design a product or solution
- Plan a product or solution
- Use appropriate techniques and equipment
- Follow the plan
- Create the product or solution
- Evaluate the product or solution
- Evaluate the use of the design cycle

Investigate

Plan

Create
DESIGN CYCLE

WHAT´S THE DESIGN CYCLE?

- MYP methodology for Design (a.k.a. Technology).
- On-going process that gives feedback to the next stage.
- It is not new on the “MYP: next chapter”, but it presents several changes: one Criteria has vanished...not its tasks, though.
- My School were part of the Pilot Process, with this Unit of Work.
CRITERION A - Description

A- Inquiring and analysing

• Identify the problem to be solved: show awareness and evaluate the importance for life, society and the environment.

• Develop the design brief; formulate and discuss some appropriate questions that guide the investigation; Identify and acknowledge a range of appropriate sources of information; collect, analyze, select, organize and evaluate information; evaluate the sources of information was useful

• Formulate a design specification: list the specific requirements that must be met by the product/solution
CRITERION A - Task

• First theoretical approach.

• Individual tasks: 1500 words essay

• Method that has been trained from year 7, so students are familiar with it. In year 7, we prepare a set of closed questions. But in year 10, is it just an open question: Which is is the impact of Robotics on Invididuals and Society?”

• Each year, it´s thematised to meet the specifications of the “First Lego League” robotics competition. In this case-study, “Senior Solutions”.

• Thought-provoking introduction: new robots
  https://www.youtube.com/watch?v=S5AnWzjHtWA

Examples:
CRITERION A – Rubric Assessment

"Keeping Food Safe" Releases September 2, 2011 12 pm ET

Can FIRST® LEGO® League teams improve the quality of food by finding ways to prevent food contamination? In the 2011 Food Factor Challenge, over 200,000 9-15" year olds from over 55 countries will explore the topic of food safety and examine the possible points of contamination our food encounters – from exposure to insects and creatures, to unsterile processing and transportation, to unsanitary preparation and storage – then find ways to prevent or combat these contaminants. In the Food Factor Challenge, teams will build, test, and program an autonomous robot using LEGO® MINDSTORMS® NXT to solve a set of Food Safety missions as well as research, develop, and share their innovative food safety solutions. Throughout their experience, teams will operate under FLL’s signature set of Core Values. 

http://firstlegoleague.org/challenge/2011foodfactor

Investigation Task:
With particular reference to food production, processing and safety, investigate and explain the applications and impact of robotics on individuals, society and the environment.

You should produce a document of 1000 words (5% tolerance) that includes:
- an introductory paragraph that explains the context
- an argument in your own words that explores the advantages and disadvantages associated with the application of robotic technology in this field
- specific examples or case studies that support your argument using quotation marks and references where appropriate
- appropriate images and/ or diagrams
- a personal conclusion and your thoughts about the future
- a bibliography using appropriate citing format

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<thead>
<tr>
<th>Criteria: Investigate Assessment Rubric</th>
<th>1-2</th>
<th>3-4</th>
<th>5-6</th>
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<tbody>
<tr>
<td>You state the problem. You investigate the problem, collecting information from sources.</td>
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<tr>
<td>You describe the problem, mentioning its relevance. You investigate the problem, selecting and analysing information from some acknowledged sources.</td>
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<tr>
<td>You explain the problem, discussing its relevance. You critically investigate the problem, evaluating information from a broad range of appropriate, acknowledges sources.</td>
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CRITERION B - Description

B- Developing ideas

- Design the product/solution: generate several feasible designs that meet the design specification; evaluate the design against the specification: select one design and justify its choice

- Plan the product solution; construct a plan to create the product/solution that has a sequence of logical steps and makes appropriate use of time and resources; evaluate the plan and justify any modifications to the design.

We finally got to the funny stage!!
CRITERION B - Task

- **GOAL:**
  TO PROGRAM A LEGO ROBOT THAT COMPLETES FLL MISSIONS

- **Group tasks:** 3-5 members

- **Two parts related:** DESIGN AND PLANNING

1st STAGE:
To program, we start using the freeware: MSW Logo, where students have to type simple orders to move the cursor on the screen

You can download it at:
http://mswlogo.en.uptodown.com/
CRITERION B - Task

• 2nd STAGE:
• To break down the missions in simple movements (cross-curricular area with Science)
• To represent their outcomes in a Flow Diagram
CRITERION B - Task

3rd STAGE:

• To learn how to program using Lego NXT Mindstorms

• Really basic program, is based on blocks

• Just some parameters (link with Maths) to control

• But it can get really complex when using sensors…
CRITERION C - Description

• **Creating the solution:**

• Use appropriate techniques and equipment; use a range of appropriate techniques and equipment competently; ensure a safe working environment for themselves and others

• Follow the plan; Follow the plan to produce the product/solution: evaluate the plan and justify any changes of the plan where necessary.

• Create the product/solution; create a product/solution of suitable quality
CRITERION C - Task

• GOAL:
  TO DESIGN AND BUILD A LEGO ROBOT THAT COMPLETES FLL MISSIONS

• Group tasks: 3-5 members

• Two parts related: DESIGN AND BUILDING

1st STAGE:
To design it, they have to use the freeware “Lego Digital Designer”

You can download it at: http://ldd.lego.com/en-gb
2nd STAGE:

• To build the robot, using Lego pieces

• We start with the little basic Wall-E that we have here, following an instruction manual…

• But as soon as they feel confident enough, they start to design and create their own designs
CRITERION D - Description

D Evaluating

• Evaluate the product/solution; carry out tests to evaluate the product/solution against the design specification; evaluate the success of the product/solution in an objective manner based on testing, their own views and the views of the intended user; evaluate the impact of the product/solution on the individuals and on society and the environment.

• Evaluate the use of the design cycle; evaluate their performance at each stage of the design cycle; suggest ways in which their performance could be improved.
CRITERION  D - Task

• Self-assessment

• Individual task at the very end of the project

• It includes questions like:
  • When learning to use a new software program, explain why is it important to explore and experiment with it for yourself (Learning to learn)
  • Flow diagrams can be used to plan a sequences of human activities, at school and in industry. Explain how feedback can be used to ensure the quality of outcome when products are being designed and manufactured.
  • Explain how well you tested and developed your final solutions (using an interactive fault-finding process). Include specific examples of how and why you changed the systems building blocks you used as your work developed.
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T&L USED STRATEGIES

1 – LEARNING TO LEARN

• After a brief explanation by the teachers, they have to learn how to program by themselves, using video-tutorials, asking their class partners..

• To make their researches, they have to improve their Investigation skills: case of Dr. Enrique Pérez de la Sota
T&L USED STRATEGIES

1 – STUDENTS AS TEACHERS

• Improvement of students’ motivation through collaborative learning strategies (for younger students) and fixation of contents (for older ones)

• Establishment of vertical collaborations between students of different educational levels.

• And they DO pay attention to their colleagues…if you know who to choose…life is much easier!!!
T&L USED STRATEGIES

3 – TEAM-BUILDING

• Democratic decision of distribution of tasks
• To learn from each other
• To recognize own strong and weak points
• Group decisions
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FIRST LEGO LEAGUE

• External worldwide educational robotics competition.

• More info at: http://www.firstlegoleague.org/

• It is divided into four parts:
  • Scientific project
  • Technical project or Robot Design
  • Robot competition
    (2:30 minutes against other Schools)
  • FLL Values

The good thing is that those stages fit perfectly with MYP Design Criteria!!!!
So it is a classroom project that can be easily taken out!
FIRST LEGO LEAGUE

And, I know it’s hard to believe but...THEY EVEN HAVE RUBRICS OUTSIDE OUR SCHOOL WALLS!!!
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VIDEO

OK!

Now, let’s watch it!

You can find it at:

http://youtu.be/VinoKwTlKgM
http://www.youtube.com/watch?v=VinoKwTlKgM&feature=youtu.be
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USING LEGO NEXT MINDSTORMS

Let´s program something really easy...

1) HE is going to go for 60 cms and then come back to use

2) Now, HE is going to kick a ball and score a goal…I hope!

Who wants to try????
gracias