

## 'INTERDISCIPLINARY ACTIVITIES IN CONTEXT'

Maite Gorriz & Santiago Vilches

INS Arquitecte Manuel Raspall. Dept. Ensenyament. Generalitat de Catalunya.

*The paper reports on the meaning of 'interdisciplinary activities in context' and discusses interdisciplinary approaches to not only in the context of Science, Technology, Engineering and Mathematics, but also in relation to other disciplines. Further we present some examples in secondary education where we contrast them with theoretical definitions and its characteristics. Finally, we conclude by fulfilling the need for mathematical skills in a knowledge society.*

### INTRODUCTION

In today's society where there are an enormous sociocultural interactions and the changes are hectic, Mathematics, now more than ever, is present in all areas of knowledge and society. Mathematics has become an essential tool in all creative processes and development. Educational system cannot ignore this new development of knowledge and should be able to create a global awareness of mathematics. To make it possible teachers should be able to propose and develop with the students interdisciplinary activities in context.

We never fall into the trap of thinking that mathematics is a tool for other disciplines, on the contrary, mathematics are the engine and it is able to lead many of the interdisciplinary activities in context.

### TERMINOLOGY

We can define **disciplinary** as a work within a single discipline (subject or area of knowledge). However, when we want to define interdisciplinary firstly we found several terms: cross-disciplinary, multi-disciplinary, inter-disciplinary and even trans-disciplinary.

Interdisciplinary have more subtle and nuanced approaches (Davies and Devlin, 2007), researchers combine knowledge and methodologies, form new perspectives and jointly seek solutions to problems (McGill 2009). One reference is in higher education to Melbourne University, the second one is in CARDI a Center of Research, anyway we can use it in secondary education.

We don't define interdisciplinary activity for secondary education, it's enough to know that "innovations includes interdisciplinarity" (Istance, 2013). Our target is to report activities which we have called interdisciplinary activities in context.

### Interdisciplinary activities in context

An interdisciplinary activity in context has six characteristics:

1. It must be close to students. It should formulate issues or matters that are familiar and useful. Often, in an effort to achieve responsible future members of society, teachers propose activities related to situations in adults' environment, situations very far from the students who cannot show interest to a problem which they do not understand. It is always better to look for problems or models that help students to deal with future society but always from a perspective of the world from their ages, situations which should be motivating and exciting.

2. Interdisciplinarity should be intrinsic to any activity. In today's society, where calculus routine processes are automated by spreadsheet and computers, mathematics should be able to be develop in a creative context of decision-making and analysis of reality. Therefore, we need a real context in which several interrelated disciplines will intervene.
3. Teachers should suggest real challenges that involve a project with an end product to the students. An interdisciplinary activity in context cannot be a list of problems to solve.
4. Classroom methodology should follow human development models. This requires:
  - Teams of people working together with a common goal.
  - Working with respect and dignity.
  - Each individual must bring the best of himself, distinct from other individuals. Because humans are different and the key to success is being able to add differences to achieve better results.
5. Coordination of teachers is a prerequisite. Like the students, teachers are different and each has to contribute his knowledge to add differences but always from a global perspective. Current teachers cannot teach mathematics as they were taught when they were young, they should be able to go beyond and above all coordinated with teachers of other subjects in order to grow the students in an interconnected global knowledge.
6. Evaluation should be one more element of the teaching – learning process. In one hand, it should be integrated into the activity and it should aim to guide and improve students in both procedures and results. On the other hand, it should also help teachers to improve their teaching. It should not only become a tool of self-control but a self-regulating tool for both, students and teachers.

## EXAMPLES

### Packaging design

The study of the concept “volume” in most textbooks is based on the calculation of volumes of flat representations of shapes which do not correspond to any real object. The effort of abstraction that students have to do to understand the figure and imagine it as a 3-dimensional object makes “volume” concept difficult to learn. So, students learn volumes by memorizing formulas.

Our interdisciplinary activity in context consists in analyzing a real 3-dimensional object close to students (a can of juice) and proposing to change its shape. Each student should make a creative proposal with only one restriction: the can must be  $330\text{cm}^3$ . In a second step, we propose to create a company which has to bring to market 4 different products under one corporate trademark.

From Maths, we have a lot of volumes which are made by students with a purpose closer to their reality and with achievable and consistent sizes. So, we can calculate lots of volumes!

From Technology, they can study different kind of materials and use different tools in order to design and construct an object in the workshop.

From Arts, they can design the label.

From Language, the can prepare a presentation where communication and publicity are the main challenge.

From Science, the can analyze its content from alimentary point of view or how cans influence environment. Etc.

characteristics	yes/not	argument
Close to the students	✓	A can of juice is close to students and they can pick it up by hand
Interdisciplinary should be intrinsic	✓	Obvious
With an end product	✓	A can of juice with a promotional campaign
Classroom methodology	✓	It's necessary to work with cooperative groups. However each student should make his/her own object.
Coordination of teachers	✓	It's necessary at least in time of execution and because all of us are around of the can and it's company
Evaluation integrated	✓	Every group present to the others their company and their cans. So, the other should calculate the volume of each can and argue that it is 330cm <sup>3</sup> . Teachers are evaluating constantly in order to guide each group.

Table 1: Checking if *Packaging design* is an interdisciplinary activity in context

### Cinema's tricks

Sometimes to learn a theorem can be so difficult to the students because mathematicians love giving importance to formalisms and reasoning.

Our interdisciplinary activity in context consists in creating a short film where there should be a trick of cinema like King Kong's film.

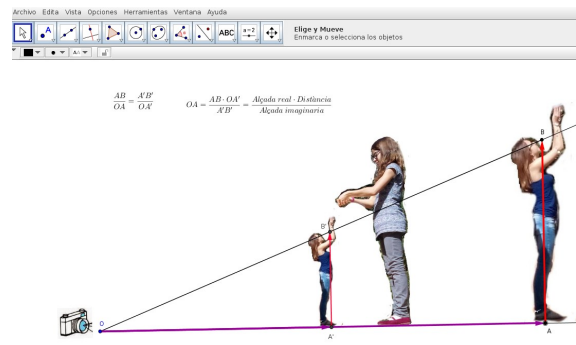


Fig 1: frame of the film made by a group of 12 years students.      Fig 2: Geogebra tool

From Maths, they need to know Thales theorem and use mathematical tools like GeoGebra.

From Technology, they should work with video editors.

From Music, they should prepare sound tracks.

From Language, they should write the dialogues.

From Social sciences or History, they should study the social context or historic context of film.

And so on....

characteristics	yes/not	argument
Close to the students	✓	It's their own tale.
Interdisciplinary should be intrinsic	✓	It is impossible to do a film without linguistic communication, digital competence, artistic and cultural competences, social and civic competences, autonomy, etc.. basic competences.
With an end product	✓	A film.
Classroom methodology	✓	Cooperative groups. Each student should do the best of his/herself
Coordination of teachers	✓	Because we should agree one final product (the film) proposed for each group of students.
Evaluation integrated	✓	Cinema's trick is a flexible activity, so it always is possible to improve at any time of his creative process.

Table 2: Checking if *Cinema's trick* is an interdisciplinary activity in context

## CONCLUSION

Interdisciplinary work is not a story of a specific mathematical activity alone, interdisciplinarity is the essence of learning mathematics.

Often the teaching of mathematics is wickedly static and rigid. We need a revolution in teaching mathematics: teachers should be daring and respectful with the ideas of their students, they should be able to collaborate and coordinate with other teachers of different subjects to achieve promoting students' own ideas, creative ideas in a global context of society. The world is an interconnected system in which each element has a specific function connected to the rest of the other functions. If we teach a parceled education, there won't be future good professionals. Now, more than ever, we need people with good training in competences like cooperate and coordinate with other individuals in order to find the most unusual solutions to future problems of society. It's evident that secondary education should offer interdisciplinary activities in context to achieve it.

## References

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