## Description and feedback of the ecourse of DYNAMAT project in Pisa

## **Basic description**

Starting date: 16 February 2013

Finished: 31 May 2013

Title of the Course: Mathematics and society

Total number of lectures: 42

Number of students: coming to lectures around 20, totally 29

**Eplatform: moodle** 

https://www.dm.unipi.it/elearning/

Purpose and initial program: based on materials in the ebook, the choice was discussed at the beginning, the program was appropriately modified.

Main topics that were chosen: Napoleon problem, geometric properties of the triangles and quadrilaterals, history of math and teaching in math (games and real life problems), recurrence sequences of numbers (real and complex) and problems from biomedicine, fractals and how to introduce them in class, connection between models in biomedicine, fractals and some problems from dynamical systems, dynamical billiards in ellipse, some chosen topics from probability and combinatory, games and probability.

Tools and software: geogebra especially for geometrical constructions and study, excell in different models in biomedicine, linear programming.

Final exam: components: preparation of individual evaluation form, based on standard Dynamat form, evaluation of ebook and ecourse, preparation and presentation of project based on the course

Competences taken into account in the evaluation of the projects: observation capacity and ability to pose questions and problems "looking around", math content in the project, creativity in presenting and solving the tasks and problems, capacity to present clearly the didactic unit developed in the project and provoke the participation of the audience, capacity to use appropriate software.

## **Outputs and conclusions**

List of some new projects developed after the lectures in the ecourse:

- 1) Qual'e la migliore strategia per avere una maggiore probabilita di vincita nel gioco televisivo "the money drop"?- Mariantonietta De Giglio
- 2) Brachistocrona Elisa Minetti
- 3) Lo studio matematico del cancro Giuseppina Varrecchia
- 4) Crittografia Federica Famoso

- 5) La matematica delle malattie infettive-Teoria e simulazione-Luigi Marangi
- 6) Problem posing in math education Marco Ferrigo
- 7) Aerodinamica e moto Mattia Cordoba
- 8) Frattali-Vania Massai
- 9) Probabilita' e giochi televisivi Valeria De Mattei
- 10) Teorema di Napoleone Carlo Pettito
- 11) Siteswap Daniele Celoria

The variety of arguments proposed by future and in service teachers seems to be surprising. On the other hand it can be connected with the enormous capacities of the human brain to observe, invent and create. However, in some of the cases the new projects were chosen in autonomous way by the participants in the course, without clear direct connection with the concrete arguments proposed during the lectures. The only connecting idea was the hint to "look around us", propose situation from the real life and then (equipped with appropriate math model) try to pose questions, create new math problems. There is obvious a necessary requirement to help students in developing their initial direction for math project.

Summarizing our experience and having in mind some of the math models in neuroscience studied in the course we can give kind of naïve explanation how we tried to activate and provoke the creative capacities of the students.

It is very well known that the work of the brain is based on the mystery how neurons work and interact. In one of the lectures of prof. Iudice (Dept. of Medicine, Pisa University) was shown the following "distance interaction" analogy between "The creation of Adam" of Micchelangelo and the unknown word of neurons



In order to activate students unbounded dynamical creativity and fantasy it is crucial to start with something that is close to their standard (almost) everyday lectures in algorithms in Mathematics. For this we tried to give a balanced lecture course with some basic examples developed clearly and relatively slowly. We used arguments close to the standard programs and tried to "keep them close" following the

idea that math algorithms and software tools are finally only tools. Of special importance for future and in service teachers were lectures specially devoted to this argument and the motivation for our dynamical approach to find attractive models where creativity combined with math tools will give real and beautiful math projects giving satisfaction to their authors. In conclusion, motivating and helping students in their work on the projects we found at the end nice and fruitful final outputs.

## Feedback for the ebook:

In progress, two groups evaluated the ebook: future teachers (9 evaluations) and teachers in service (11 evaluations)

Some of materials have been evaluated very well: probability simulations from Denmark, the project for eggs from Iceland, in some cases the geogebra units from Iceland seem very useful for teachers in service, beautiful art project from Bulgaria should be used for earlier ages of math curricula, fractal units from Austria and Bulgaria, optimization arguments projects developed by Austria and Bulgaria, use of games in primary schools (Slovakia), toxic games (Slovakia), use of complex numbers in geometry (Italy)

Some other materials seem to be difficult for concrete applications: GPS seems not very easy to be used in this moment, some of didactic materials have dominant design and software part and the math content and reasoning should be complemented by new creative problems and solutions (some units devoted to possible geogebra constructions, for example there is a nice proposal to use pseudoinverse matrices in probability paradox model in criminology(Alessandra La Spina and Gergana Georgieva)), in some other cases teachers can find beautiful geogebra designs but less creative math tasks ( art progect from Bulgaria), similar phenomena for some interdisciplinary units (chemistry and math for example)

Other difficulties: in order to develop arguments connected with probability and theory of games some basic introductory lectures are needed, the ebook can not show how to feel this gap, the same is true for some other interesting math models as dynamical system, periodic triangles in ellipse etc, some difficulties have been encountered in giving a reasonable hints to motivated students how to enter interdisciplinary fields ( as math models in biomedicine, chemistry etc).

Proposals for further developments:

- 1. Possible further courses next years where improvements and suggestions from the feedback remarks are taken into account
- 2. Hosting Comenius Assistant. This is general Comenius program for exchange of teachers from different EU countries, the action is COM05. One of participants of our ecourse Dr. Jmmy Mauro won a fund for almost 1 year for teaching and implementing experience from Italian education system in Bulgaria. The school from BG side that applied for this program is High School "Hristo Toprakchiev", Bozhuriste, near Sofia.