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Abstract

Since a couple of decades, authors are running towards the vanishing student motivations. They have applied a large amount of teaching tools or methods as the slide rule, overhead projector, programmable calculator, software, internet, moodle and supervised projects. Project based learning is one of them. Initially used in an Erasmus background, that is placement in a foreign partner university for three months, the project based learning technique is now applied in projects supervised by local teachers. The main goal is to increase the autonomy of students. The paper deals with one project in connection with robotics and using the modern MOOC technique. The term MOOC stands for Massive Open Online Course. A free access to the course is done by the internet.

At the Valenciennes Institute of Technology, some supervised projects are focusing on electronics, process control, physics, maths or electrotechnics applied to robotics. The Lego Mindstorms NXT or an homemade solar tracker rover or the French NAO humanoid make up the working platforms. Every use of any platform should gather and apply the knowledge of the previous domains. The students have to balance their mind from theory to application. Mainly, they should identify the required knowledge, and thus learn it, understand it and apply it by their own. As working alone seems a challenge, the difficulty can be fixed by the reverse learning technique. In particular the Massive Online Open Course, MOOC in short offers a new way to make students more autonomous. One example of a recent MOOC experiment given here has been done in the robotics framework. It proposes first to work in a theoretical domain laying on hard sciences then to apply the new concepts using a Matlab software or building and programming a Lego object by the way an intelligent arm.

The MOOC concerns here over ten thousand worldwide participants. In the Institute of Technology, two groups have been formed for the MOOC. A local one is composed of six students from first year course in Electrical Engineering domain. Four Finnish students in second grade in Information Technology course form the second group. Their three months stay in France has been possible thanks to the Erasmus+ students exchange. In France, the students have been working and supervising weekly by teachers in Maths, Mechanics, Control and English language all the MOOC long. In Finland students worked by their own.

The positive behaviour of students working in total autonomy is significant for the first module. The second module is requiring closer help by local supervisors. A final survey given to the students after the last session confirms the teachers feeling. This experiment should be renewed next academic year.

Keywords : project based learning, motivations, technology, robotics teachings.

1 INTRODUCTION

It is a fact: as the student motivation is vanishing, the teacher's energy should grow in order to keep students on the educational trail. Massive education, running technology, educational tools, easy and quick access to old and recent informations on any domain are some of the reasons that motivate conversely the teacher to find new acquiring method. The use of internet is a tool not the aim as Steve Wheler said.[1]

At the Valenciennes Institute of Technology, a group of teachers researchers has been working together to improve the students behavior towards to sciences. Since 20 years the teachers share their experiences on domains as electronics, electrotechnic, process control and applied mathematics. They try to find common interests for this aim. Thus, years after years, the collaboration started with

discussions on academic subjects as applied maths to electronics and process control and robotics but also on others as the sun trajectory, solar tracker, solar rover, a science fair, Lego mindstorms projects and robotics. The common thread for all activities or projects or exchanges in any case is how to boost up the motivation of students and increase their concentration. Moreover as a water mark the dynamic behavior of the teachers involved in projects have motivated during two decades other colleagues to join the group. Their amount proves this fact.

One of the starting point and subject was the Erasmus exchanges in the European Union. The faithful University of Brasov in Romania walks with us since 20 years. The relationships with foreign universities has been increased since that date. By the way, the universities of applied sciences in Pori(Finland), Oulu (Finland) , Osnabrueck(Germany), Cartagena (Spain), Leiria (Portugal), Bialystok(Poland), Warsaw (Poland) contribute to feed all motivations. [2]

Another relay of motivation was the science fair organized at the Valenciennes Institute of Technology.

The week of science is a French national event also existing in other countries. Organized for 17 years by the educational ministry, the event involves researchers in order to make school-goers more sensitive to science and technology. A team of teachers and their students from the Institute of Technology of Valenciennes participate to this meeting since ten years. Ten- year old school-goers are invited at the university with their teachers, determined parents and scientific animators. All activities are built in connection with the different research topics as automation, ergonomics, renewable energies -in particular solar energy- and applied geometry. However, researchers use these connections to motivate their students. Confronted to non-academic activities such as organizing the time-table of the week, preparing the paper support for activities, searching pedagogical explanations relevant to the understanding of the young ones, the students actually change their behavior for the better.[3]

Among technical subjects the sun is a favorite one for all people in the north of France. First youngers, adults and elders are running after and under the sun. Second the solar energy offers main applications in the electrical engineering domain as photovoltaic panels and converters , sun trajectory and solar trackers, specific algorithms to set up in order to optimize the solar energy.[4,5,6]

Always in the energy domain, some french Institutes of technology and engineers schools are using electric vehicles as go-karts or electric bikes considered as a teaching tool and a research platform. In order to increase the student motivation, the main objective is to participate to a yearly pedagogical challenge for electrical vehicles. In addition the side objectives are to make students more sensitive to sustainable development and clean energy, to increase their practical skills on electrical vehicles. Since seven years an association devoted to the educational applications of electric go-karts is managing this challenge ending the academic year.[7,8,9]

The academic syllabus of the Electrical Engineering and industrial data processing taught inside the french Institutes of Technology offers a course called Industrial Ethernet and remote control with the internet. The aim of this module consists in making students more sensitive to the uses of ethernet as an industrial communication solution. In firms the students will have to maintain equipment such that packaging machines, collective boilers or water treatment plant. As a pedagogical support the Spykee robot platform is used for two main reasons. First its possibilities are matching the previous objectives. Then, as it is a regional product, that implies the maintenance and improvements can be effective with a short delay. The robot can be used at different levels of applications with respect to the user's basic knowledge.[10]

Robotics is becoming a leading subject in education. This domain is spreading itself worldwide. The connection with robotics started a couple of years ago in Erasmus background exchanges with the University of Brasov. It welcomes since 20 years students for a 3 months placement. The recent placement propositions are pointing up on virtual prototyping. The virtual product development replaces traditional material object test with digitized form product by building product's digital model. It offers to analyze product's static and dynamic characteristics on the circumstance of digital state, and rebuilds and improves the original design. The virtual prototype technology carries out any product optimization. Virtual prototype technology is a kind of engineering method which can shorten new product development cycles by replacing expensive physical prototypes with virtual digital models. The subject detailed here deals with a virtual prototyping using Delphi programming environment. The example based teaching method is thus applied. There are several potential

advantages of example based learning programs, including the ability for people to learn from their homes and study without the assistance of an instructor. As the use of computers in life is increasing, all teaching methods and strategies should be renewed to match with the advancement of technology.[11,12,13,14]

Recent experiences and positive results about MOOC let us think to build a project based on MOOC and a subject in connection with Electrical engineering. This is described in the next sections.

2 THE SCIENTIFIC ASPECTS OF MOOCs.

This section focuses on the scientific aspects of the chosen MOOCs devoted to robotics initiation and robotics vision.

In order to prepare the students for the forthcoming weeks and in particular to be more autonomous, some lessons have been given weeks before the starting point of MOOC. Thanks to the collaboration of colleagues, the students receive additional lessons in English conversation, mechanical engineering and process control and maths. The basic skills required by the Mooc are not taught in the IUT.

2.1. First MOOC : robotics initiation

As mentioned above, the students received additional lessons in English oral comprehension, robotics based maths as matrices usage and fondamentals in geometry in relationships with mechanics and control process.

In particular in maths domain the MOOC is focusing on frames, matrices and geometrical transformations. A 3D vector given in a fixed frame e.g. the arm fixed station robot is transformed in another vector in the local frame linked to the arm. This needs to describe a matrix that models the basic representation of the arm. Any geometrical transformation of an object fixed to the arm also needs a matrix either for the representation and also for further calculus on 3D coordinates. For further use, homogenous coordinates are also another efficient tool but not easy for the first grade students.

In mechanical domain the MOOC is pointing up direct and inverse kinematics where the links with robots and interactions are usefull. Kinematics is describing all the trajectories of points, the velocity and acceleration. All these basements offers the students to go one step beyond. By the way, all direct or inverse motions can be used to image recognition, the first step being the basics of vision.

2.2. Second MOOC : robotics vision

The starting point for vision is vision itself. A large and historical part of vision is given to the students. Generalities have been given on vision, colors, optical illusions and 3D. Lessons in 3D geometry follow. The mathematical modelling of objects in real life in a computer requires skills on projection, homography, all using homogenous coordinates. The computing representation of objects and their related functions are eased by a huge amount of procedures and programs provided by the software.

The Image Processing Toolbox™ provides reference-standard algorithms, functions, and apps for image processing, analysis, visualization, and algorithm development. The main functions are concerned with acquiring images, analyzing colors and shapes and measurements of detected objects as colors, shapes, surfaces and positions. The last subject puts together all puzzle parts in a robotics enevironment. By the way how to pilot a robot arm from the images capture by a webcam to its analysis through the Matlab™ software.

3 THE PEDAGOGICAL ASPECTS OF MOOC

As described above, all conditions have been gathered in the Electrical Engineering department to use a MOOC on robotics, vision and control (http://www.petercorke.com/MOOCs.html). The first letter for Massive states for the number of audience, here ten thousands. The course free of charge is qualified by Open. Online means the internet usage for lessons. The access to the MOOC is time limited for eight weeks. About ten thousands worldwide have been interested to the lectures. Some are coming from secondary schools. If some teachers and retired teachers are also participating, the main amount is due to the students groups mainly in bachelor or master of sciences/technology. For this typical subject, 150 nationalities are represented. No assessable and assessable quizzes and exercices on programmation are proposed to the audience each week. A final certificate of participation is given to the attendants filling all items (see the website).

The first mooc is concerned with robotics initiation during eight weeks. The weeks are organized as follows. Details can be found following the link.

(https://moocs.qut.edu.au/learn/introduction-to-robotics-february-2015-814)

The first week is devoted to the Matlab software installation, Matlab robotic and vision toolbox. In addition, the attendants are invited to improve through videos online their skills in maths (https://fr.khanacademy.org) in Matlab software (http://fr.mathworks.com). The other weeks are concerned with maths, geometry robotics lessons within two hours video each. The system offers an access to the discussions forum and a reference book [16].

In the Valenciennes Institute of Technology ten students in first and second grade of electrical engineering course chose to follow the course and made efforts to stay aware and active each week in addition to their academic course. The students mainly follow the two hours lessons on the internet at home during the week end. Thursday afternoon is planned for supervised projects. The supervisor answers to questions, gives help for translation, solves technical problems, gives help for debugging programs. Students answer to assessable quizzes. The teacher's help is mainly required for first grade students who have not received before some basic knowledge on the Matlab software. One of the author of the article also takes part to the whole MOOC. After the first 8 weeks half of them continue.

The second mooc activity points on robotics vision. The schedule is the same as the first part except the contents. A certificate of participation is given to the listener under certain rules. It takes account of the results of quizzes, the right running of matlab programs and a robotics application using all the given knowledge e.g. moving a webcam in a lego arm and recognizing an object.

(https://www.qut.edu.au/study/short-courses-and-professional-development/short-courses/robotic-vision)

For the second part of the MOOC in the IUT, 3 Erasmus students in Bachelor of technology coming from the university of applied sciences in Pori in Finland plus 2 local interested by robotics vision joined the group.

At the end of the road trip, five hundreds of the audience received the certificate of participation, and one hundred ended the last and optional practical examination. In the IUT, 2 students obtained this certificate. A questionnaire has been given the ten participants and all answered. The Items and their marks are given on table 1. The scale in use was form 1=not at all to 5=decidely.

Difficulty of the Mooc	4
Workload from the Mooc	3
Mooc has boosted exchanges between students	4
Mooc has boosted exchanges between students and teachers	2
Mooc gave a complement to local teaching	3
Mooc has improved my skills in English	2
Mooc has broadened my horizons	4
Mooc has made me want to study abroad	3
I would like to follow an other mooc next year	4
Mooc experience was positive	4

Table 1. Local satisfaction measurements of the mooc

The questionnaire has been filled down by students helped by the supervisors. Overall the mooc experience was satisfying for students and teachers. The next section will draw some conclusions on this new and pedagogical event.

4. CONCLUSION

The paper presents a recent experience on MOOC usage. The acronym MOOC states for Massive Open Online Course. That means, a set of 2 times 8 lessons of 2 hours each are given through an internet site. The authors are running for decades to the vanishing motivation of their students. Since 20 years, they consumed their energy to find new teachings methods. A yearly national science fair, the sun trajectory programming, an autonomous solar rover, Lego Mindstorms applications, virtual prototyping placement are the main subject in use. They are using the project based learning technique. An experience based on a MOOC is now described. The robotics and robotics vision are the subjects. This mooc is concerned with 10 thousands attendants. After the two MOOC sessions, over five hundred listeners obtained the certificate of participation on ten thousands attendants at the beginning.

Locally, the questionnaire answers confirm the teachers feeling. The wind of difficulties getting up is blowing the students motivation. Fifty percent of the students group including a girl obtained the certificate of participation. The debriefing with students after the mooc and the questionnaire answers light up useful comments. The negative issue states on the second session. The second mooc has been less attractive for our students for the following reasons:

- too much workload in addition to their basic work,
- the French students on first grade are not prepared to be autonomous by comparison to their finnish friends,
- two weeks vacation for students,
- heavy schedule
- difficulty getting up in connection of maths computer science, process control and mechanics,

Conversely, the positive issues the mooc are more numerous.

The students mentioned the large availability of their teachers in real time even on the internet, as one teacher ‘s participation that *keeps going the interest said Justine.* The students work alone in front of a screen. They watch videos lessons and have an access to the discussion forum. They also answer quizzes and exercises in real time. On their points of view they think not to receive enough help in real time. The students need direct and useful exchanges with the teachers and their friends in the lab room. This labroom equipped with a coffee pot improves all dialogs inside the group. On the point of view of teachers, the main effect is due to the multidisciplinary team built for these two sessions. The certificate obtained by the students labeled their cv.

For the next academic year new students planned to participate to a mooc devoted to computer science with oriented object programming based on C++.

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