Integrating New Technologies in Schooling - A Radical Cross-Curricular Approach. Two Innovative Examples

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Abstract:
With Europe facing a severe economic crises, budget cuts in all areas and a growing unemployment, initiatives taken in school are more important than ever bearing in mind that not only the future labour force is educated in school but the future of Europe itself. Within the framework of European projects in the field of science education and education itself, Austria took a few measures to radically change the interaction in class by piloting various projects and initiatives. Looking at innovation, classroom settings, technology and the student's motivation, it became clear that a radical mix-up is needed to push the boundaries set to innovation in class traditionally. The key aspect to bear in mind is a cross-curricular and project-based approach that strengthens not only professional skills and knowledge but team building and social competences as well. In the following paper, it is described how building a 3D printer and quadrocopters can be integrated in various subjects appealing students in a new way and encouraging young girls to consider science careers.

Keywords:
cross-curricular, science education, employment, IT, teachers, innovation, classroom interaction. future classroom, initiative, student-centered, quadrocopter, 3D-printer

Introduction:

All over Europe we seem to be facing the same problems when it comes to the popularity of science in school in general and using new technologies in an integrative way in class in particular, which seems to be leading to a huge lack of interest in that field among youngsters oll over Europe and consequently giving up Europe's top position as an innovative environment. This does not only affect the amount of research done in Europe, Asia is a much faster growing market, but also the job situation across Europe which, to put it positively, had seen better days. Even in the two worst years of the recent economical crises in Europe the IT market was the only one with a steady growth of 2%. However, in school very rarely emphasis are put on the science education in general and the integration of IT-tools in particular. Referring to the ESSIE[1] study done by the European commission in 2011, Europe's schools are well equiped but the use of it is very little. 15 per cent of

[1] http://ec.europa.eu/digital-agenda/en/news/ict-education-essie-survey-smart-20100039 30.03.2014

all teachers are integrating new technologies regularly, but a much higher percentage prepares their lessons using new technologies. Asking students starting secondary one, this survey is more accurate than anything done before because schools were not able to fine-tune the numbers. [2]

Following the results of the survey, there are issues with the infrastructure put forward by a lot of teachers but in those schools where the infrastructure is put together nicely, the use of ICT is still very little. The other part of the general problem is that there is no emphasis on science in schools and therefore interests are fading despite having much better job opportunities in the future. Especially young women still tend to chose the more „traditional" jobs for women and consequently a huge reservoir and potential workforce is being unused. The European Commission as well as the industry partners, i.e. the ERT[3] (European Round Table of Industrialists), have identified that problem very quickly and are trying take measures to invert that trend. The European education project inGenious was born, where industry partners test out their teaching materials in school[4]. In addition to the iTEC[5] project, with its main goal to anticipate the pedagogical demands of the future classroom, the future classroom lab[6] situated in the European Schoolnet in Brussels shows us how to think out of the box when it comes to designing any classroom interaction in the future.

Austria's examples:

Following the spirit of the projects mentioned before, innovative teachers within the pretorian group of ENIS Austria[7] designed a radical approach to the classroom interaction whilst still using a more or less traditional setting in school. Before getting into it, it is important to point out that every change, every innovative initiative starts with the teacher having an idea to improve his/her classes and to inspire young people. The principal of each school may set the overall climate, but changes happen within the perspective classes.

The Quadrocopter:

Trying to integrate as many science subjects in school as possible, one pilot teacher came up with the idea to build quadrocopters in school. Building them, one can integrate woodwork to build it, maths to program the algorithm, physics to understand the aerodynamics, chemistry to understand

[2] http://ec.europa.eu/digital-agenda/en/news/ict-education-essie-survey-smart-20100039 30.03.2014

[3] http://www.ert.eu 30.03.2014

[4] http://www.ingenious-science.eu/web/guest;jsessionid=6CE8F3E033C6E02FDE90944E3C8B21C4 30.03.2014

[5] http://itec.eun.org 30.03.2014

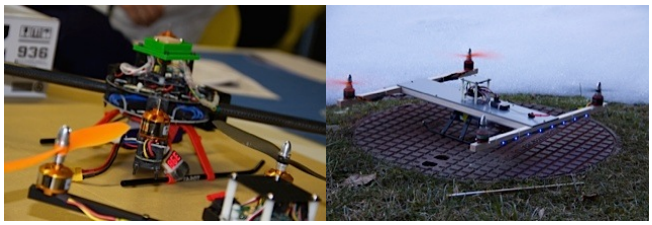
[6] http://fcl.eun.org 30.03.2014

[7] http://www.enis.at 30.03.2014

the batteries and even language classes to design a manual. That way it makes it a lot easier for a group of teachers to collaborate, still be within the curriculum and get the time resources required. Building it from different materials gives them additional options as there are ones made out of plastic, carbon fibre, aluminum and you can build one from scratch using wood.

Picture 1: The quadrocopter model fully built during a pilot workshop in Bad Hofgastein, Salzburg, Austria, in Mai 2013.

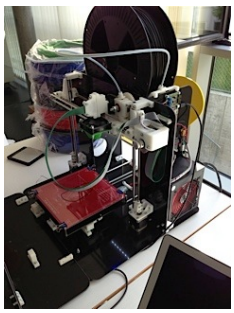
Picture 2: A Team of teachers building the quadrocopter and testing the new classroom scenario and its pedagogical usefulness during the pilot workshop in Bad Hofgastein, Salzburg, Austria, in Mai 2013.



Picture 3: Two built models of the quadrocopter. The first one made out of aluminum using a set, the second one built from scratch using wood. Both were built during the pilot workshop in Bad Hofgastein, Salzburg, Austria.

Picture 4: The navigation of the quadrocopter even works using 3D glasses and a camera in the front of the quadrocopter. Bad Hofgastein, Mai 2013.

In a specifically designed workshop the Federal Ministry of Education used resources from a EU project, to design a classroom scenario, test it and submit it to the Europan level with it being very well received and qualified as highly innovative. Seeing the actual classroom interaction in person with the students and evaluating it for the iTEC project[8], I can tell that the interest among youngsters grew and girls tend to be a lot more involved and actually leading these classes.

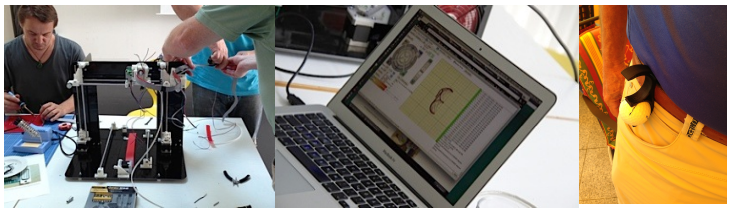


The 3D-Printer:

Another example of thinking very well outside the box, was building a 3D printer, which did not only increased the professional skills and the theoretical thinking among students but also added a creative element to the process.

Picture 5: A model of the 3D printer during the pilot workshop in Bad Hofgastein, Salzburg, Austria in June 2013.

First things first! A trained person can build it up in 20 hours so more time needs to be considered in school depending on the skill level and the number of students. With better students and a lot of teams it can be build quicker than that. The subjects involved were woodwork, IT, physics, chemistry and mathematics. The woodwork teacher would be in charge of building the basics of the 3D printer. The IT teacher laid the foundation for understanding how it should be wired, the chemistry teacher explained the fundamentals using a 3D printer with liquid plastics and the maths teacher helped with the algorithms. Once built, it can be used for creativity - i.e. designing your own objects using the free google sketch-up tool - or even maths printing out a rotating integral and consequently making maths a lot less abstract.



Picture 6: Teachers building the 3D printer, designing an object in google sketch-up and transferring the modell to the printer software and the finished product during the pilot workshop in Bad Hofgastein, Salzburg, Austria in 2013.

While looking at this scenario, one may thinks that it is too complex to use in school, that there are too many resources needed and that it would be hard to integrate in class. In fact, the opposite is true. Having had the privilege to observe the implementation of it, it can be stated that the students

[8] http://itec.eun.org 30.03.2014

catch up on it a lot faster than their teachers thought they would in the beginning being surprised that it was not too difficult at all. After the first two lessons, some students became experts helping the teacher with difficult tasks and almost unknowingly increased their knowledge. Interestingly enough it was reported, but not verified, their grades got better in the other subjects, too and the classroom climate became a lot more co-operative and friendlier to improve the social dynamics of the class helping the teachers in other subjects to deal with that class. In all fairness, implementing new ideas is not the solution to everything but it turns out, it can change a bit. As a result of these measures taken by just one teacher, other teachers have been asked to implement it as the involved students talked to their peers and their parents about it creating pressure from the bottom, as more students and parents asked for that innovation.

These recent trends are not merely enough but a starting point to take innovation within the traditional classroom setting to the next level. Being involved in different EU projects like mentioned in the introduction, all teachers, students and even policy makers involved get inspired by looking at other examples in Europe and exchanging with international colleagues to push the borders as we are all facing the same problem and waiting for policy makers to demand any changes seems to be a waste of time - more specifically denying our children a competitive advantage later in life. Therefore the same group of teachers found a way to integrate the 3D scanner and the mindstorm where robots are controlled with thoughts. On March 28th, 29th and 30th, we invited a few teachers to test the new scenario again. The rule of thumb is, if they get excited after an hour, their students will normally get excited either.

Conclusion:

Despite being aware of the challenges we are facing all across Europe, the economical crisis dictated budget cuts in the education system of all countries bearing in mind that the well educated youth is the only way to put Europe in a leading position again when it comes to a knowledge based economy and research. The unemployment rates of young people are not only alarming but reflect the cultural climate Europe is taking measures in that area. Not reacting now, future generations will have a significant disadvantage when they enter the competitive job market after finishing their education. According to the ESSIE study mentioned before, only 30 % of the youth are having digital skills which means that 70 % are having a huge competitive disadvantage[9]. European projects within the seventh framework of the European Commission offered a few opportunities to

[9] http://ec.europa.eu/digital-agenda/en/news/ict-education-essie-survey-smart-20100039 30.03.2014

set measures on a more or less small-scale-level, the Horizon 2020 program is going to be more focussed on academical research. Especially the iTEC project and its result, the future classroom lab, are perfect examples of borders being pushed in education. Austria's radical approach came together due to a heated debate on the European level on how to finally define „innovation" and trying to think very well outside the box seemed to be a step in the right direction. Again, all supporting factors play a major role on how an initiative will sustain but it has got to start with the key players involved, how are the students and the teacher creating something new within a given framework. Einstein once defined insanity as doing the same thing over and over again and expecting different results[10], but that is exactly what is happening at the moment in all education systems with no-one taking action. On top of that, we need to find a way to assess students in a more realistic way and not just by grades. *„Everyone is a genius but if you judge a fish on its ability to climb a tree, it will live his whole life believing that it is stupid."*[11]

Albert Einstein so properly said what is still true today. Not one student is like another and therefore the assessment needs to be reconsidered as we are treating every student like he is like his peer. there is a difference between providing the same opportunities and treating everyone the same. That is exactly what is being criticized by industry partners within the inGenious[12] project. The real life and life in school seem to be two completely different pair of shoes which is a shame because we need to find ways to adequately adapt to the demands of life after school while still providing education independently. The two examples shown before are another way to approach science, inquiry-based learning and teaching, a student-centered approach and provoking curiosity. It is important to highlight that it is not a question of the curriculum - the integration of the curriculum is up to the imagination of each and every teacher, nor is it a question of a highly sophisticated infrastructure, it is all about being innovative and creative. The students respond very well to those kind of initiatives, as do the parents. The next step would be to broaden these initiatives to school-company-cooperations.

[10] http://www.brainyquote.com/quotes/quotes/a/alberteins133991.html 30.03.2014

[11] http://capitalogix.typepad.com/public/2011/10/albert-einstein-said-everybody-is-a-genius-but-if-you-judge-a-fish-by-its-ability-to-climb-a-tree-it-will-live-its-whol.html 30.03.2014

[12] http://ingenious-science.eu 30.03.2014

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