

“ICTs in the Air”, a program for ICT-talented learners

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Abstract. Because of the predicted shortage of ICT workers a local program has been set up to make young students (age 14-18 y) more enthusiastic about informatics and ICTs. In the program students perform assignments that are created by local ICT companies and institutions. The program is open for older students to get a grade for the subject informatics and for younger students to recognize their interest in ICTs at all.

The program for a student lasts for 1 or 2 years and consists of four different projects in one year. The subject content is delivered through so called “batches”. In general the students are rather satisfied about the setup of the program. They like the topics, the guidance and most of them are considering a follow up study in the ICTs. They want more variety and depth in the projects. We conclude that the program is stimulating young people to consider a study in ICTs and it provides an more longitudinal curriculum to higher ICTs Education. Problematic is to find the right pedagogical approach in the program for all different students to organise and finance it, and to involve companies and institutes for higher education.

Keywords. Informatics, curriculum, secondary education, shortage ICT-workers

1 Introduction

In 2015 the European Commissioner Digital Single Market Andrus Ansip warned about a predicted shortage of more than 800,000 skilled ICT workers by 2020 [1]. It is not difficult to find more reports and warnings about the need for ICT-skilled workers in general and ICTs professionals in particular. Just a quick scan about this issue brings about many sources. Headlines like: “44,500 new job openings predicted for ICT workers in Ireland in the next six years” [3] and “Canada needs 218,000 more ICT workers” [4] are examples. The Australian Computer Society published a report on the need for ICT-workforce, “Australia’s Digital Pulse Key challenges for our nation – digital skills, jobs and education”[5].

There are differences between European countries and Europe and the rest of the world and the lack of skilled personal is not existing to the same extent in all fields of the ICTs, but the general warning is serious enough to take action. In the Netherlands the number of reports about a predicted shortage of ICT workers is growing steadily. Especially those regions in the country that have lots of industries and companies that are totally dependent on the application of ICTs or are in the ICT business themselves are worried that this shortage will be a cause for economic decline in the near future [6].

However another problem emerges here. Despite the fact that ICTs are more and more part of the daily life of kids, less and less pupils are really choosing the subject informatics in the higher secondary and vocational education. Furthermore not every school offers the subject in its curriculum (it is not obligatory in the Netherlands) partially because of a lack of good informatics teachers.

In the economic region of Amsterdam this phenomenon was first identified and a program was started called “ICT in de Wolken” in Dutch. In this article we will use the English translation “ICTs in the Air”, because “de wolken = the clouds” refers too much to *The Cloud*, which is not the intentional meaning of the name. In this paper we will describe targets, set-up and first results of the program and will end with some recommendations for a follow-up.

2 The program “ICT in the air”

In Amsterdam four related secondary schools started “ICTs in the Air” in order to make pupils of the higher forms of general secondary education (age 16-18 y) more enthusiastic about a future career in informatics or ICTs. During their first year the city of Almere, 30 km from Amsterdam, located in the new province Flevoland adopted the idea and made a start in the year 2014, in close co-operation with the starters in Amsterdam. However in Almere the scope of the project was broader. It was also aimed at vocational education (age 14-16 y) and in the second year also at whiz kids from the lower forms of general secondary education (age 13-15 y). Furthermore the project in Almere was open for *all* students of *all* secondary schools in the city, even the schools where the subjects informatics or ICTs were not offered.

We will limit our description in this paper to the project as it runs in Almere.

2.1 General targets of the project

Overall the main goal of the program is to promote a study and a career in ICTs. Therefore we seek a close cooperation between secondary education, higher education and trade and industry. In the ideal situation the program could be part of a longitudinal learning path in ICTs from primary, through secondary, to tertiary education. Another also somewhat more idealistic feature of the program is the emphasis it puts on developing specific talents of students. In the national educational community this is a highly debated objective for *all* students in general education, to give special attention to their specific talents, to recognize them and to elaborate on them. Finally the program is a test case for working with mixed groups of students from different schools, ages and intellectual level.

More specifically the aims of the program can be described as follows:

- a. Satisfying the needs of some gifted students to explore their abilities in the field of ICTs.
- b. Recognizing special talents of students in this field.

- c. Making the students familiar with a study in ICTs in higher education.
- d. Making the students familiar with the way of working in ICTs in companies and other economic areas.
- e. Making it possible to choose the subject ICTs or informatics even when the “own” school is not delivering those subjects.
- f. Offering a realistic environment of project based assignments in ICTs.
- g. Developing presentation skills, planning skills, collaboration skills and reflective skills.

For achieving these aims we have identified three main groups of students for which the project is suitable.

1. Students of higher secondary to meet all curriculum requirements for the subject informatics. So instead of following the subject within the school these students participate in the project for two or three years in order to get a certificate for the subject as part of their diploma.
2. Students of vocational education as an integral part of the so called “ICT route” which delivered them a partial certificate.
3. Students of lower forms of secondary education who are enthusiastic and perhaps want to continue their school career in ICTs.

2.2 Outline of the program

In the ideal situation, the yearly program exists of a variety of time limited projects of around 8 weeks. They all reflect a specific area in the field of ICTs. A project is set up in close cooperation with a company working in the field, whereas the project assignment is relevant for the kids as well as for the company involved. The company acts as a customer for the students. The first day of the project the company presents itself and the field of labour. In the last week of a project the results are presented to the company. In the other 6 weeks the students all come together, once a week, out of the regular school hours, in one of the participating schools for higher education during 2 hours. They work in heterogeneous groups of three, four or five persons. They use the scrum way of working in which they can be appointed to different roles and in which they have to deliver the product in two or three steps and phases.

Before or during a project the students need more background knowledge. We set up a series of so called “batches” which they can study to be able to perform the project assignment. In some cases the students “earn” a badge just by doing a certain project.

Fig. 1 shows the list of badges that is used [1].

Badges		
1. Algoritmen en datastructuren-0	14. ICT in de Wolken omgeving-0	27. Python-1
2. Arduino-0	15. ICT in de Wolken omgeving-1	28. Regexp-0
3. Arduino-1	16. Javascript voor games-0	29. Scrum-0
4. Blender-0	17. Linux-0	30. Scrum-1
5. CSS-0	18. Linux-1 (shell scripting)	31. SQL-0
6. CSS-1	19. Netwerken-0	32. Storyboard-0
7. Databases-0	20. Netwerken-1	33. Unity-2D-0
8. Databases-1	21. Ondernemen-0	34. Unity-3D-0
9. Git-0	22. Photoshop-0	35. Video-0
10. Hardware-0	23. PHP en MySQL-0	36. Web-0
11. Hardware-1	24. Programmeren in JavaScript-0	37. Web-1
12. HTML-0	25. Programmeren in JavaScript-1	38. Web-2
13. HTML-1	26. Python-0	39. Web-3

Fig. 1. Badges used as shown at the website of the program

In Almere the program started in the second half of school year 2014-2015. From that moment on the program continued in the school year 2015-2016 with new students starting in October 2015. This year 2016-2017 is the first year where the new students were selected in June 2016, before the school year started. So a group of some 42 kids is now attending the program. It exists of 29 boys and 13 girls. 8 of them continued the program for the second year.

2.3 Description of the third year

In order to get an impression of the different projects we will describe the set-up of this running school year. We developed 8 projects to choose from.

1. *Improving a website*
In order to inform students in Almere a website was designed and built by a professional company Mediamere [2]. The students got the assignment from this company to improve the website, to add extra functionality and to implement that in a test environment.
2. *Creating a website*
A company called Inzights created a website for delivering data from the Dutch parliament: notes, memorials, reports, minutes, etc. The students had to make a concept of this site for a different target group: youngsters that are not automatically interested in politics.
3. *Creating an app for healthcare*
Cinnovate is a company specialized in designing applications to help people with disabilities or elderly people in general. The students were asked to inform themselves about special needs for these groups and design and implement an app to support such people.

4. *Analysing Bigdata*

BigData Value Centre is a company which is providing the questions as well as the answers for all kinds of purposes using bigdata that are relevant and free accessible.



Fig. 2. A presentation of the results of analysing a big number of tweets

The students investigated tweets with a tweet logger in order to predict the winner of a national song contest. With their presentation at the end, three weeks before the final, they were able to do that correctly! See figure 2.

5. *Robots*

In co-operation with the readership Robotics of one of the partners in the program the University of Applied Sciences Windesheim, the students are going to work with three different robots. The question is simple to make the robot do something relevant and useful.

6. *Witchworld*

In Almere a group is ambitious to set up the largest fairy-tale world in the country. In "ICTs in the Air" students are challenged to make a living fairy-tale. See figure 3.



Fig. 3. Preparing for the presentation of a rotating globe

7. *Virtual reality*

Createlab is designing VR-environments for customers who want to have a real 3D-experience of a building or local situation they have drafted. With the help of the company the students are going to do this themselves.

8. *IBM Poseidon*

The purpose of this project is to fulfil optimal conditions for a plant to grow with the least quantity of water. It makes the students aware of the worldwide problem of shortage of water. Are we capable to program an algorithm, taking into account the weather conditions, the humidity of the ground, etc? A Raspberry-Pi is used to really test the algorithm.

During the year teachers from the two institutes for higher education offer some guidance about specific branches of ICTs science.

3 Evaluation

From the beginning on we have asked the students to notice and evaluate their results in a digital portfolio. The main purpose of that is to force them to look back, to reflect on their results and on the collaboration in the group and to record their learning achievements. At the end of every project the students also got a rating from the teachers coaching them. At several moments in the program we have asked the students their opinion about the program as a whole. Some of them have expressed their comments in a video that was recorded. They are shown at the website of the project. See figure 4.



Fig. 4. At the website students tell about their experiences with the project

Most of the students express their satisfaction with the program, they value the opportunity they are given to explore their ability and interest in ICTs and ICT related issues. They value the guidance of the teachers.

3.1 Digital survey in 2017

In February 2017 a small digital survey was carried out. We got results from 22 students [4]. 14 of them started this year with the program, 8 in the previous year.

7 students are from lower secondary, 15 from the upper classes. Most of them (16) say they are working some 2-4 hours per week on the program, 4 students exceed this time. Generally speaking 15 students are (very) satisfied, 7 are not. 6 of all students are satisfied with the collaboration in the group, 14 only now and then, 1 is not satisfied about this aspect at all. 13 students value the projects as “well to perform with a little help”, 4 value them as “rather easy”, 5 give mixed answers to this question. Here some of the students say that the heterogeneous groups cause too much difference between the students, and they ask for more homogeneous grouping.

The students are very satisfied about the guidance in the project, only 1 student is not. About working with the (obligatory) portfolio the reactions are varied. 6 students claim that it is very worthwhile to do this, 9 think it is valuable but not pleasant, 5 do not see the added value of it. 1 student doesn't answer to this question.

Finally we asked the students to rate the program:

2 value it as “not good”, 3 as “fair”, 16 as “good” and 1 even as “excellent”.

The key question was if the student is planning to continue with the program, and even will apply for a further study in ICTs. 15 students want to continue the program, 13 think about going to study ICTs. 3 students think they are not going on in this field.

3.2 Qualitative evaluative remarks

From various sides we gathered qualitative remarks about the value of the program. Generally speaking the program meets its objectives and the parties involved express their appreciation of the program and the efforts put in it.

Nevertheless there are worries about the continuity and sustainability of the program. More specifically:

1. With respect to the pedagogical aspects the program is extremely difficult to manage by the guiding teachers. They need many professional skills to serve the needs of a so differentiated group of students, with respect to level, age and delivering school. It is time consuming, complicated because of the flexible content, and puts a big burden on them because it is not within the regular frames they are used to at school.
2. The schools involved are not very happy with the financial and organizational aspects of the program. It is more costly than “regular” education and it takes a lot of effort to facilitate the teachers and to find additional finances for realizing the program. Schools which are only participating by sending some students, are even more distant to the program and it is hard to really involve them.
3. The trade and industry follows a bit of a wait-and-see policy. Especially for small companies the involvement with respect to time and energy discourages them to cooperate. They do not see immediate profit and the long term profit is too far away.

4. The institutes for Higher Education are also assuming an attitude of expectation. They want to see immediate results in the number of students applying for their ICTs branches.
5. Generally speaking the way we are able to realize this type of education, aimed at developing talents with children, is in the Netherlands a highly political and pedagogical objective. This type of program meets those kinds of objectives very much. But the reality shows that it will be hardly reachable to organize more of these type of programs for developing personal talents of students.. The energy for organizing it, funding and executing, is beyond the regular possibilities of the educational system.

Acknowledgments. The author would like to thank Eddy van Onzen, Bert van Middelweerd and Carolyne Nibte for guiding the students in this amazing program.

References

1. A Digital Single Market for Europe, European Commission, Brussels, May, 2015
https://ec.europa.eu/commission/sites/beta-political/files/2-years-on-dsm_en_0.pdf
2. “Europe faces 800,000 shortfall in skilled ICT workers by 2020“, V3 news, April 2015
<http://www.v3.co.uk/v3-uk/news/2403908/europe-faces-800-000-shortfall-in-skilled-ict-wo>
3. “44,500 new job openings predicted for ICT workers in Ireland in the next six years”, Siliconrepublic, Nov. 2013
<https://www.siliconrepublic.com/jobs/44500-new-job-openings-predicted-for-ict-workers-in-ireland-in-the-next-six-years>
4. “Canada needs 218,000 more ICT workers”, MTS Business Hub, Febr. 2017
<https://businesshub.mts.ca/h/i/329974971-canada-needs-218-000-more-ict-workers>
5. Australia’s Digital Pulse Key challenges for our nation – digital skills, jobs and education, Australian Computer Society, 2015
<https://www2.deloitte.com/content/dam/Deloitte/au/Documents/Economics/deloitte-au-economics-australias-digital-pulse-240614.pdf>
6. ICT-sector has an growing need for well equipped ICT-workers. April 2017, Nu.nl, Brancheorganisatie Nederland ICT,
<http://www.nu.nl/carriere/3975386/ict-sector-heeft-groeiende-behoefte-goed-geschoold-personeel.html>
7. See: <https://info.nl/basis/index.php/Badges>
8. See: www.ictindewolken-almere.nl
9. See: <https://nl.surveymonkey.com/results/SM-B27YRR8G/>