PREPARING FOR UNIVERSITY SUCCES: UNIVERSITY COLLABORATION WITH SECONDARY SCHOOLS FOR IMPROVING SCHOOLSTUDENT'S CAREERS, TEACHERS PROFESSIONALISATION AND CURRICULUM DEVELOPMENT

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ABSTRACT

In our symposium we discuss 20 years of Dutch practice about the cooperation between universities and secondary schools in preparing students for successful studying. Though the increasing numbers are worth to mention and clarify, not all problems have been solved. As the main values, we state that a good cooperation between schools and universities in educational programs stimulates the study success rates in the universities. Due to better preparation, teacher professionalization and attention for quality of enrolment the study success is increasing. But in practice, there is a lot to discuss about content, organisation, ownership and long term investments. In our symposium we will address three kind of perspectives on these problems: the governmental / state level, the university level and the school level. Representatives of the Ministry of Education, universities and school boards will elaborate their problems, plans and actions for improvement on these three levels. We will show interesting successes in qualitative and quantitative pictures, but also a lot of questions left for further research, policy and practical actions. The symposium will be organized around information about these three perspectives and audience participation by Q&A's and cases.

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We will focus on the practices of two Technical Universities and their school networks: TU Delft and TU Twente. TU Delft has a network of 59 participating schools, TU Twente has 26 schools,. A yearly amount of about 5.000 students and 450 teachers of secondary schools involved in the educationals preparation programs. Both the universities and the schools are proud on the cooperation within these networks: they contribute in ownership and actions with workforce of experts and teachers and with cash money.

1 INTRODUCTION

1.1 Context

How can we better connect secondary school curriculum and university research themes to prepare secondary school students for university? How do we strengthen collaboration between school teachers and university experts especially in the science & technology field? And how can we develop this school-university-networks in a sustainable way?
This symposium is focused on pre-university educational programs for secondary school students as preparation for successful studying in universities. The cooperation between university and schools supports school careers and study choices through focusing on the educational connection, teacher professionalization and curriculum development in the STEM-fields. After years of national policies on strengthening STEM-education our school/university-network has learned much about development and maintenance of cooperation and organization: e.g., physic teachers together with university experts developing lessons and instructions, lab experiments on quantum physics for use by secondary schools. Secondary school teacher are being empowered by their participation in curriculum teams. Also, this unique situation offers university students the opportunity to work in our pre-university programs and schools.

1.2 Problem analysis

Helping and supporting young students with the transition from secondary school to universities in combination with strengthening study success rates in higher education is a comprehensive challenge. The last 20 years national and institutional policy has addressed these issues as main topics. A lot of practices have been appeared, with good and less good examples. Unfortunately, systematic research on causal effects of interventions and factor is still missing. Therefore, it is good to stress and explain the educational importance of systematic practices linked on vision and theory, policy matters, and other practices.
Our symposium will focus on the issue of cooperation within regional networks of universities and schools for secondary education. The rational for this cooperation is supporting young students in their school careers by three kind of activities: content driven experiences for school students, curriculum development with teachers and experts and teacher professionalization. Yearly, we welcome each about 6.000 school students in our Pre-U programs for different kind of structural education

activities like masterclasses, workshops, lab-experiments as well as event-wise activities like challenges, school camps and showcase experiments. Where the structural education driven activities have a regional approach, the event-wise activities have both a regional and national reach.
In the symposium we will present and discuss three perspectives: 1. the rational, the vision and the EU/Dutch national policy [1] and institutional policy that has been a strong support for developments and practices; 2. The daily practice and organization of the structural education programs and the event-wise activities; 3. A school leader will discuss the experiences of the network partner schools with our cooperation, the experiences of school students and teachers and the relevance of network building as well as adjusted institutional policy making as a backbone for daily practices.

2 APPROACH: THREE PERSPECTIVES

2.1 Perspective 1. Rational, vision and policy

Since 2002/2003 the EU-policy and Dutch national policy on R&D [2] started to stress the meaning and relevance of STEM-education and STEM-related jobs. In fact, for Dutch situation it was necessary to repair the decline for years in the field of STEM-related subjects in education and labour market. After years of low interest in these subjects by young adults the policy has been focused towards reparation and stimulation of qualitative strong education in these fields. In the period the Nationa Dutch STEM Platform was established to organise the activities at a national level, exchange good practices and monitor the process of all contributors and partners. One of the factors was a better organization of cooperation between secondary and higher education. A lot of universities have chosen to work with a kind of pre-university program. The aim of all these pre-university programs was stimulation of better study program choices by content driven experiences and successively a higher success rate in higher education for individuals, education tracks and institutions. In general, the pre-university programs put together the work of university experts, teachers of secondary schools and students.
In our symposium we will give a short overview of EU/Dutch policy, the institutional policies and organizational implementation questions and conditions since 2003. Also, we give insight into different kinds of visions behind the model of pre-university programs. The vision, rational and policy stimulation are essential conditions to build practices for youth empowerment in their school careers and build a sustainable network of cooperating schools and universities as divided parts of a school system.

2.2 Perspective 2. Pre-Universities, Teacher professionalisation & Schools Network: dialy practices and research orientation

The second part of the symposium will show and discuss the university point of view for organizing a pre-university program in a network with secondary schools. As a centre of knowledge, the university has to play a role at the content level but also

often as the initiator of a lot of organizational processes. Besides the organization of education programs like workshops, masterclasses and honours programs for secondary school students it is worthwhile to collect data, monitor and evaluate.
The TU Delft and University of Twente has a lot of experience with a large responsibility for students in (co)creating educational programs together with school teachers [3]. Therefore, in our context it was a logical choice to bring in the fresh and bright experiences of a large student group, besides a small expert staff. E.g., the practice of Pre-U at the University of Twente has been running for about 10 years. Therefore, we are able to present and discuss some interesting research data about participation, reach, quality issues and appreciation by schools and students. Causal relations between pre-university interventions and effects on study choice and success rate are difficult to investigate, but we can show some interesting findings in correlational predictions. Examples are found in the data about the relation between chosen school subjects, study choices and study success rate in the first year of higher education. Another example can be found in the data about hours of learning investment / participation, study choices and study career.
Based on the practice, the daily experiences and joy of students and schools, and the evaluation data, we draw the conclusion it is worthwhile to share the practices, experiences, tops & tips with other school practitioners. Further, we will discuss our findings and practices with earlier published research by Michels & Eijkelhof (2018) [4] and Vulperhorst c.s. (2017) [5].

2.3 Perspective 3. View point and experiences of a school leader

The third part of the symposium is dealing with the viewpoint of secondary schools participating in programs for pre-university students and teacher professionalization. Two secondary school leaders as members of our partner schools will tell and discuss the daily organization within a school, the questions a school is dealing with, how to learn within her own school and from other schools in the network of partner schools and the university. Central viewpoint will be the relevance of pre-university programs in the school path of young adults, but also in the contribution to curriculum, teacher professionalization and school development. The cooperation with a university and other schools have brought to school an open mind set with an external orientation. Further, the structured way of feedback on student performance to the school has an impact on curriculum and education discussions within the school.

The school leaders will discuss the advantages and challenges of being a partner in a joint network of schools and universities. The discussion will give many insights in school internal arguments and decisions before starting, developing and participating in these networks.

3 RESULTS

3.1 Tables

The National Dutch STEM Platform has adequate information on their website about numbers in the STEM-fields [6]. Table 1 shows the national numbers of secondary school students who are choosing STEM-oriented school profiles [6]. These profiles provide access to academic technical and science study programs. From 2003 up to 2018 we see a strong increase in the STEM-fields. The main part of this progress is due to girls: they are changing their choices towards the STEM-fields over the years.

Table 1. National increase STEM-profiles in schools (numbers of students)

Year	NT-profile	NG-profile	NT&NG-profile	Total
2003	23.153	39.807	9.378	72.338
2010	31.337	46.378	27.163	104.878
2018	44.577	62.255	18.955	125.787

Following the increasing numbers of school students choosing for STEM-profiles we expect an increasing amount of student influx in STEM study programs. Table 2 shows the data since 2005 up to 2018 [6]. We see an increase indeed, but not proportionally. This is called the STEM-leak in the system. A lot of girls are choosing study programs outside the STEM-fields.

Table 2. National increase STEM-influx Dutch universities (numbers of students)

Year	Science	Engineering & Technology	Agriculture & Technology	Total
2005	4.852	6.950	1.429	13.231
2010	7.255	8.960	2.631	18.846
2018	11.626	15.717	4.128	31.471

At the SEFI-Conference 2020 we will examine these numbers in more details.

Both TU Delft and TU Twente have organized regional networks with secondary schools. The TU Delft network contains 59 schools; the Twente network 26 schools.
For teachers the school/university networks organize meetings for instruction, curriculum development and teacher professionalisation. In 2019 the network of the TU Delft organized for secondary school teacher over 70 meetings divided over all science topics in schools. In total more than 450 teachers participated in 2019. Physics, Chemistry and Nature, Life & Technology were very popular topics. The network of Twente is smaller and shows a proportional amount of activities for school teachers. Chemistry teacher professionalization was very popular in 2019.
Also, at the SEFI-Conference 2020 we will examine these numbers in more details.

The same school-university networks deliver programs for secondary school students from year 1 up to year 6. Yearly, large numbers of school students participate in educational programs like masterclasses, workshops and skills-labs. In practice, target groups which are involved are defined as very smart kids but also regular school kids who can get some support. The programs are mostly running on-campus. Numbers vary between 15 pupils to 150 per program. Besides the educational programs, there are also daily events organized which often contain. The yearly basis is about 5.000-6.000 school students that will be reached and participate.

4 CONCLUSION AND DISCUSSION

The Dutch national policy on stimulation of the STEM education in secondary and higher education started in 1998. Now, 20 years later, we can show some good practices and increasing numbers but also a lot of questions too. Founding networks between universities and schools is very fruitful for a good preparation for study success and worthwhile to explain at the SEFI Conference 2020.

Starting with the student's educational success in higher education in the STEM-fields it is obvious there is interest for the universities to start a good cooperation with secondary schools. The main interest is the quality of the yearly enrollments. The quality of the enrollment is related to the quality of the educational programs in secondary schools. And this quality is dependent on the quality of the teachers. Therefore, it is worthwhile to cooperate as networks in teacher training and professionalization programs. The teacher approach has to be integrated with the network activities for the school students.
Beside the quantitative and qualitative information and practices we will discuss problems of content approaches, policy issues and organisational implementation. Examples of big questions are the long term support of the Ministry of Education, the acceptance in the institutional policy and the link between experts and school teachers. There is also a challenge in the coherence with outreach agenda and societal impact of research groups.
Our contribution to the SEFI-conference 2020 will be a symposium with three perspectives from policy to organization of the networks and examples from the daily practices. The symposium will be organized around information about these three perspectives and audience participation by Q&A's and cases.

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