MIND THE GAP
Promoting Girls and Women in Stem

VhTo
NATIONAL EXPERT ORGANISATION ON GIRLS/WOMEN AND SCIENCE/TECHNOLOGY

Needs analysis report - The Netherlands

Index

Erasmus+

Chapter 1: Deskresearch

Theoretical background on gender and STEM

Girls and women are underrepresented in science, engineering, technology and (to a lesser degree) mathematics (STEM) compared to their male counterparts - not only in the Netherlands, but also in other countries. However, the situation in the Netherlands is somewhat exceptional in that we are often one of the lower ranking countries. In international research a number of determinants for the under-representation of girls/women in STEM have been appointed, including girls' lower self-concepts, non-stimulating learning environments, lack of female role models, stereotyped associations in society about girls/women and STEM, fertility/lifestyle factors, and career preferences of girls and women.

Neuroscientific research has shown that there is no difference to speak of between girls and boys in terms of aptitude for STEM. Whether and to what extent talents that you are born with develop depends on the environment in which you grow up: society (economy, culture etc.), your family and parents, school (teachers and school careers advisers), your contemporaries and so on.

Implicit or subconscious gender-stereotypical beliefs and associations can influence how girls and boys perform and to what men and women aspire with respect to STEM. Everyone has automatic and often less conscious preferences and beliefs that help to form a basis for their thoughts and emotions. An implicit stereotype (for instance the association between science and masculinity) is so strong that it influences the way that we judge situations in a way that we cannot consciously control. An analysis of the data generated by Harvard University's Implicit Association Test (US, gender section, more than half a million tests completed worldwide) reveals that more than 70% of the respondents, both male and female, implicitly associate science with masculinity and the arts and social sciences with femininity, even if they consider themselves to have egalitarian views. Of 34 nations around the world, Dutch people have highly gender-stereotypical associations: the most gender-stereotypical associations between gender and science were found in Tunisia, followed by, in tied second place, the Netherlands, Hungary and Romania. These researchers also examined the relationship between the degree of implicit gender stereotyping and performance in mathematics and science for each country that took part in TIMMS 2003 and 1999. This relationship proved to be positive: the stronger the gender-stereotypical associations in relation to mathematics and science (= masculine) in a country, the greater the gender gap in performance (boys perform better). This can be extrapolated to other 'markers' of diversity in the labour potential for STEM, such as interest, participation and leadership.

Impact of rolemodels

When it comes to STEM, girls have much fewer role models to emulate than boys after all, most girls have few to no female STEM professionals as an example in their immediate environment.

Facts & figures

Eurostat, the statistical office of the European Union, has carried out an international comparative analysis of students enrolled in tertiary education. Particularly in the case of

science, the Netherlands features at the bottom of the scale with just 19% female students in 2009 (compared for example to Turkey with 41.5%, Finland with 39.1%, the UK with 36.8% and Spain with 34.9%; Italy has as much as 51.4% female science students). Also in terms of participation in technology study programmes, the Netherlands is close to last with 16.1%. The strikingly low participation of women in higher STEM education in the Netherlands probably goes hand in hand with Dutch girls' considerably lower self-concept in relation to science subjects compared to boys, whilst these girls achieve practically the same results in science subjects as boys. This low self-concept could once again have to do with the fact that Dutch people score highly when it comes to associating gender stereotypes compared to people in many other countries.

Share of women among tertiary students	2012
EU (28 countries)	54,9
EU (27 countries)	54,9
Belgium	55,5
Bulgaria	54,6
Czech Republic	57,2
Denmark	57,4
Germany	50,1
Estonia	59,2
Ireland	50,9
Greece	49,1
Spain	53,6
France	54,8
Croatia	56,7
Italy	57,5
Cyprus	53,1
Latvia	59,6
Lithuania	58,4
Luxembourg	52,1
Hungary	55,5
Malta	56,1
Netherlands	51,4
Austria	53,4
Poland	59,9
Portugal	53,5
Romania	54,3
Slovenia	57,7
Slovakia	59,6
Finland	53,7
Sweden	59,7
United Kingdom	56,3

Iceland	62,5
Liechtenstein	34,6
Norway	60,1
Switzerland	49,3
Former Yugoslav Republic of Macedonia, the	53,3

'science, math and computing'	2012
Turkey	:
United States	:
Italy	51,9
Romania	51,7
Portugal	46,9
Cyprus	45,6
Bulgaria	44,8
Sweden	42,4
Croatia	41,8
Slovenia	41,0
Slovakia	40,7
Poland	40,0
Lithuania	37,8
Finland	37,7
EU (28 countries)	37,3
Iceland	37,3
Estonia	37,2
Former Yugoslav Republic of Macedonia, the	37,1
Ireland	36,8
Greece	36,3
United Kingdom	36,1
Czech Republic	35,8
Austria	35,8
France	35,4
Germany	35,1
Norway	34,6
Denmark	34,2
Hungary	33,5
Spain	33,4
Switzerland	32,7
Latvia	32,3
Luxembourg	31,8
Malta	31,5
Belgium	26,5
Japan	25,2
Netherlands	22,6

engineering, manufacture and	2012

construction	
EU (28 countries)	25,1
EU (27 countries)	25,1
Belgium	20,8
Bulgaria	29,8
Czech Republic	25,8
Denmark	34
Germany	18,6
Estonia	25,9
Ireland	15,1
Greece	26,1
Spain	26,5
France	25,8
Croatia	27,7
Italy	30,9
Cyprus	26,5
Latvia	21,5
Lithuania	19,4
Luxembourg	19,4
Hungary	18,8
Malta	23,1
Netherlands	18,2
Austria	24,6
Poland	31,9
Portugal	26,1
Romania	30,7
Slovenia	25,1
Slovakia	29,8
Finland	18,8
Sweden	29,4
United Kingdom	19
Iceland	31,6
Liechtenstein	45,6
Norway	26,7
Switzerland	17
Former Yugoslav Republic of Macedonia, the	37,4

Unfortunately, there are no figures available for VET-students, that will make it impossible to have an international comparison of the enrolment of female students in VET-education.

VET education in the Netherlands

Learners leaving primary education at age 12 go on to various schools in the secondary education category. From the third year at lower secondary level (14 year-olds) onwards, about a quarter of students follow programmes that can be characterised as pre-vocational (part of preparatory secondary vocational education (VMBO)). For learners not

capable of entering pre-vocational education, separate labour-oriented practical training is offered (praktijkonderwijs). There are two types of programmes at upper secondary level that provide general education:

- upper secondary general education (HAVO) and
- pre-university education (VWO).

Upper secondary vocational education (MBO) is also available. Three structural elements determine this type of education: differentiation according to level, programme orientation and learning pathway:

- level: upper secondary vocational education has four levels corresponding to EQF levels 1 to 4. At which level students start depends on what prior education they have and the diploma obtained. There are no minimum admission requirements for levels 1 and 2 in this type of education; however, this will change in the near future. From summer 2014 onwards, only the level 1 programmes will be without a threshold. It is possible to move (upwards) within upper secondary vocational education and the highest level 4 (EQF 4) gives access to associate degree or bachelor programmes in higher professional education (HBO) offered by universities of applied sciences;
- Programme: vocational training programmes are offered in four sectors; green/agriculture, technology, economics and care and welfare. There are a total of 237 dossiers that describe interrelated qualifications; there are 612 different diplomas;
- Learning pathway: upper secondary vocational education has a school-based pathway (BOL) and a dual pathway (BBL). In the school-based pathway, students spend at least 20% of their time on work placement. In the dual pathway, students have jobs that they combine with a course of study (apprenticeship); this often involves four days' work a week and one day at school.

Higher professional education (HBO) is open to students with upper secondary general education diplomas. Transferring to this type of higher education is also possible with a diploma at level 4 of upper secondary vocational education: 50% of students with a qualification at MBO-4 level enter the job market while the other half go on to higher professional education. The majority of these students pursue a four-year professional bachelor degree programme. Moreover, in recent years two-year associate degree programmes have been developed (short-cycle higher education) and students with a bachelor degree can transfer to a professional master degree programme, albeit still to a limited extent.

There is no institutional framework for continuing vocational education and training (CVET). Provision is market-driven with many suppliers. Social partners can stimulate CVET with help from their branch-specific training and development funds. Publicly-financed part-time/dual initial VET can also function as CVET for adults.
In upper secondary vocational education the national qualification structure defines qualifications' desired outcome. Social partners and education, represented in sectorial institutions, have the legal task to develop and maintain these qualifications. Once determined by the Ministry of Education, Culture and Science/Economic Affairs, schools develop – in cooperation with training firms curricula based on the qualification profiles.

Distinctive features of VET

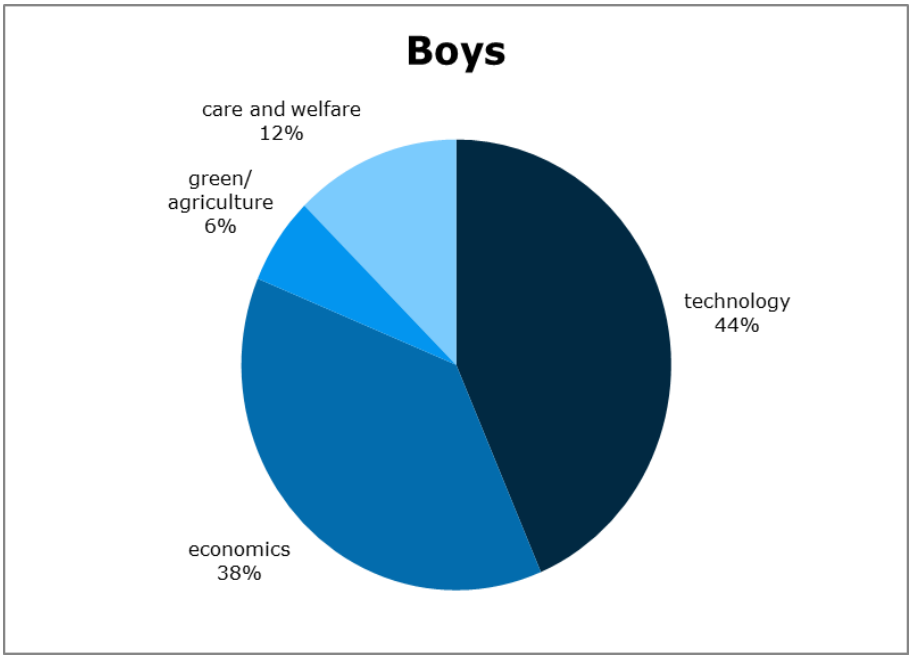
Compared to other countries, upper secondary VET in the Netherlands has the following special characteristics:

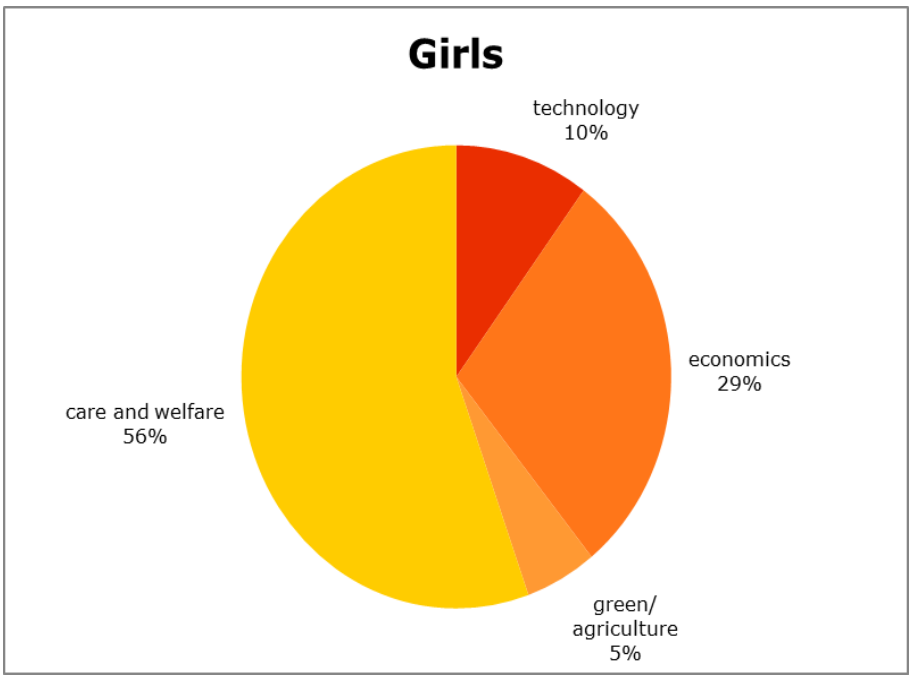
- Vocational education and training (VET) is the joint responsibility of government, social partners and educational institutions. The business community plays a relevant part in developing qualifications and providing apprenticeships;
- publicly-funded providers of VET programmes are multisectoral, large regional institutions (averaging 12 000 students at each regional training centre (ROC) and several specialist schools, including agricultural training centres). ROCs provide vocational education for young people and adults (IVET), in addition to general Adult education; they are active on the continuing VET market with privately-funded programmes. Government-regulated IVET programmes are also provided by privately-funded institutions. The heterogeneous and multifunctional nature of upper secondary VET is unique compared to other countries;
- The two learning pathways in upper secondary VET lead to the same diplomas. They operate like a system of communicating vessels so that the learning pathways' volume of intake can move with the economic trend: increase of students in the school-based pathway during a period of economic recession and decrease in the dual pathway; and the opposite during a period of boom;
- Educational institutions are given a high degree of freedom to design vocational education as they see fit. The VET law provides a broad framework only outlining some key elements at system level; institutions receive a lump sum for their tasks.

The Dutch upper secondary VET works towards developing talents of its highly heterogeneous student population – from students who transfer to higher education right down to students for whom obtaining a minimal basic qualification is too difficult. VET has to be accessible and attainable for all target groups.

Gender in VET STEM education in the Netherlands

As mentioned before, VET-students follow one out of four tracks: green/agriculture, technology, economics and care and welfare. Few girls choose the track 'technology'.





Recent developments

It has become clear in recent years that girls and women are no less capable in STEM than boys and men. It is rather implicit gender-stereotypical associations from their environment (parents, teachers) that encourage boys to join the STEM highway and that discourage girls (particularly in the Netherlands) from taking this route. The problem is therefore not a lack of ability. The fact that women are still underrepresented in STEM is an undesirable situation for all parties. After all: Society needs more STEM specialists in order to face up to current and future challenges. STEM companies and institutions benefit from employing a wider range of professionals, including women, because this provides more ideas and lines of approach when it comes to tackling social issues. Everyone should have the opportunity to develop their abilities, including girls and women with a flair for STEM. Freedom of choice exists in principle, but as long as social norms, gender stereotypes and expectations form a barrier between women and STEM, there is no real freedom of choice.

Contact with female STEM professionals is essential to the decision-making process of female HAVO and VWO pupils. They can have a positive impact on the main questions that influence the decision-making process, namely: 'Can I do this and do I want to do this?' Female role models can help to improve girls' negative self-concept in relation to STEM by setting girls positive examples in these areas. Moreover, bringing girls into contact with role models from a range of STEM positions and careers gives them an idea of the full range of possibilities within STEM.

Teachers

Gender awareness must form part of the basic knowledge of every teacher, and must therefore be embedded in the curriculum for teacher-training courses and teaching

refresher courses. Teachers must be able to independently use research results in the field of gender and STEM. They must also be able to interpret quantitative data (for instance on intake, dropout rates, graduation, performance) in a way that provides an insight into any gender differences within their study programme, study programme cluster or faculty, as well as in relation to other, similar study programmes, study programme clusters or faculties.

The experiences of alumni (both women and men) could play a more prominent role in educational innovation.

Preconditions

When developing policy and activities designed to successfully attract, retain and ensure the graduation of both female and male students, schools will have to take into account a number of preconditions:

- Chain approach

Collaboration with all relevant parties: secondary education, the STEM business community and other partners within the region.

- Integrated approach

An approach that simultaneously tackles all fronts, designed to attract and retain female students and ensure the successful progression onto the STEM labour market. An individual focus on either intake, or progression, or graduating students is not effective in the long term.

- Longitudinal approach

Not a collection of one-off uncoordinated activities, but instead a sound longrange strategy which is regularly evaluated in terms of effect and process, and adjusted in the interim where necessary.

- Gender expertise

The appointment of a 'gender expert' with specific tasks or a gender core team within the STEM study programmes.

- Gender mainstreaming of policy and activities

It is important that STEM study programmes examine for all policy intentions and resulting activities whether these are equally effective for both female and male students.

- Specific gender policy

Where there is a severe gender imbalance in the student population, additional measures to redress the balance must be taken for as long as this situation persists. An explicit focus must temporarily be placed on the target group, for instance information activities specifically aimed at girls in secondary education who are the potential next generation of female STEM

Dutch networks supporting women in STEM

National	
Nimf (natuurkundigen, informatici, mathematici)	http://www.stichtingnimf.nl/: informal network of female physicists and computer scientist
VWI (Wageningse ingenieurs)	http://www.vwi-netwerk.nl/ Network for Wageningen University Alumni Women (Vrouwennetwerk Wageningse Ingenieurs) with around 450 members. The aim of this Network is to stimulate the professional development and personal growth of its members. The Network connects the strength of women,

	with a BSc, MSc or PhD degree, who feel committed to the life sciences.
Bouwnetwerk	http://www.bouwnetwerk.net/ Bouwnetwerk is a Dutch national network for women in leading roles in the building industry: architecture, landscaping, construction, project development, municipalities and related fields. Bouwnetwerk provides opportunities for networking and provokes stimulating debate at meetings held at top end sites all over the Netherlands. We meet six times a year. Besides these meetings, once a year, an excursion abroad is organised (mainly situated in Europe). Bouwnetwerk aims to increase the number of women at top positions through research and debate. Several well-known companies have successfully been challenged by Bouwnetwerk to improve the situation in their company. Bouwnetwerk has approximately 160 members. A five-member board is responsible for the development and organisation, supported by various committees.
Vrouwennetwerk Kivi	https://afdelingen.kiviniria.net/nvi KIVI is the Dutch association for engineers and engineering students. With 20,000 members KIVI is the largest engineering association in the Netherlands. All engineering disciplines are organized within KIVI.
Vrouwennetwerk KiViNiria	http://afdelingen.kiviniria.net/nvi
Girl geek dinner	www.girlgeekdinner.nl Girl Geek Dinner is a social event that is intended to encourage women to explore science, technology, and other traditionally male-dominated areas. The idea behind the Girl Geek Dinner is simple - they invite women who are kicking-ass in their respective fields, and ask them to give an informal talk, where they can describe themselves and their work. This is followed by a Q&A session.
Informal networks on learning to code	PyLadies Rails Girls JDuchess, Django Girls
Girls in Tech	http://www.girlsintech.nl/nl/ Girls in Tech' (GIT) is a global organization focused on the engagement, education and empowerment of influential women in technology. Created in February 2007 by Adriana Gascoigne, GIT was born out of a need to provide a place for women to cultivate ideas around their careers and business concepts involving technology and entrepreneurship. Girls in Tech is headquartered in the USA and has multiple chapters around the world, including North America, Asia-Pacific, Europe, the Middle East, Africa and South America. Girls in Tech NL is the local chapter in the Netherlands, created in July 2014.

Most big companies (like the multinational IBM, CISCO, Oracle etc) have a network of female employees, some of them have a specific network for female STEM employees. Also the majority of universities have networks of female researchers in place, for instance http://www.dewis.tudelft.nl/ of the technical university Delft.

Although there are several networks in the Netherlands for women in STEM there are almost none networks for women in STEM who are educated on the level of VET, most of them work for small to medium sized corporations who tend not to have a female network or a diversity and inclusion policy.

Gender awareness training for teachers

Genderblender information leaflet for teachers	http://www.cps.nl/publicaties-uitgeverij/1401/alle-publicaties/2350/hijzijwijzer
Tips and tricks for teachers on diversity and gender	https://www.leraar24.nl/dossier/4049/hijzijwijzer-gender-denken-en-doen#tab=0

VHTO is the sole provider in the Netherlands of gender awareness trainings for teachers, from primary to university level.

Chapter 2: focus groups

Although VHTO has an extensive networks of schools and teachers, recruiting for the focus groups wasn't fairly easy. Teachers of the VET-colleges are very busy and very much focused on their key priority, education. The teachers needed to ask permission from the administration to cooperate in Mind the GAP and because of the fact that the project is rarely new, most administrative were reluctant to take part. That is why we chose to have several small focus groups and interviews with individual teachers and students.

Most teachers already are aware of the work that VHTO is doing and the need for more gender inclusive recruitment and curriculum, especially for technical colleges. Nevertheless the most striking aspect for the teachers is, that there are so few girls studying at their department, that it is almost impossible to think about changing the way they teach and the curriculum as the first step is to recruit more girls and the set up a network with pre-vet colleges to inform girls at an early age about the possibilities of studying and working in STEM.

Description of the target group

VET teachers		
Hein van Otterloo	Teacher and counselor: Radius college	12th of March
Adrienne Mutsaers	Work placement advisor: Alfa College	20th of March
Irma Oomen	Teacher Alfa College	20th of March
Alfons Brink	Teacher human technology: Alfa College	20th of March
VET students		
Jolien	Student Radius: media and	12th of March

	IT	
Aimee	Student Alfa College: Human technology	20th of March
Jennifer	Student Alfa College: Human technology	20th of March
Ayde	Student Alfa College: Human technology	20th of March
Mirthe	Student Alfa College: Human technology	20th of March

The focusgroups and individual interviews were led by Carolien de Neeve, a staff member and VET-specialist of VHTO. Before the actual face-to-face meetings, Carolien had several phone calls and email contact to inform the teachers about the project and the goals of the focusgroups. The interviews took place at two different VET-colleges in the Netherlands. Both the two colleges have worked with VHTO in the past, in order to attract more girls for their schools. Most technical VET colleges experience a decrease in student enrolments, that is most of the time one of the reasons that the schools are trying to change their recruitment policies. If schools are even aware of the need to become more gender inclusive, the focus is on recruitment. In the Netherlands most VET-colleges have a marketing team who is in the lead for student recruitment. That is the first step to take, but it became clear when reaching out to college for participating in the Mind the GAP project, that is most of the times the only step the school are willing (and able) to take. When we reached out to the teachers about the gender awareness training, most of the time we got the following response 'if we don't have any female students, why should we change our way of teaching to become more gender aware", and even the teachers who were very much in favour of a gender awareness programme at the school replied 'first try and encourage more girls to choose for our college, the next step will be to adapt the curriculum'. The two teams, marketing and teaching staff, often do not work closely together: illustrated by a quote from one of the marketing manager replying to his teacher college: 'well if I am trying to bring in the girls in, it doesn't make any sense if they drop out during their first year because of the way you are teaching!'. Although that mark was made as a yoke, the message was clear.
The gap between the marketing material and real life was also mentioned by the students, who felt that their expectations didn't come true. The image that got from the marketing material and open days was from reality. The open day felt more like a sales pitch. The students would be willing to advice on the improvement of the open days and marketing material.

Training in general
As said teachers are very busy and most of their time is allocated for teaching. Some school offer training and on the job courses for their teachers. But that is not the case for most colleges. The college that participated in the focus group has so called 'study weeks' scheduled at the end of each school year, within that week many different training sessions are planned. It would be a possibility to schedule the 'Mind the gap' during that week. Furthermore some teachers act as 'teach the teachers', they train their fellow teachers.

Retention
For teachers it is not easy to have an insight in the retention numbers, as those numbers are being collected at administrative level. Although the female students that enrol are

mostly talented students some of them drop out. It should be strongly advised to have so called 'exit meetings' with those individual girls to investigate the cause of their dropping out. And it is also important to track the enrolment and retentions numbers and as individual teachers be aware of those numbers.

School choice of students
The students were asked how they made the decision to go to this particular college. They replied that the open day was key and interestingly one of the students said that she didn't feel her subject of study (i.e. human technology) is technical or difficult (although her subject is indeed considered to be technical!). One of the girls has an acquaintance (mother of a school friend) who works in the field of human technology.
They also mention the important role of their parents; some parents weren't well informed about the different paths their daughters could choose. The girls also mention that the female teachers act as role models and stress the importance to have a strong connection with their mentor (every school class has a mentor). Although most girls are reluctant to show up for 'girls only events', the change to meet (and share experiences) the other female students is most of the time an eye opener and a very positive experience.

Recommendations

- Improve the link between the marketing and the teachers
- Realistic marketing material and open day activities
- Invite female students to give feedback on the marketing material, for instance the website, social media and open days activities
- Incorporate the gender awareness training in the already existing training activities
- Have regular face to face meetings with the female students
- Have exit meetings with girls who drop out
- Invite parents to open days, have specific session for parents of daughters to inform them about STEM
- Organise 'female students only events', always link the event to content, (not only a high tea but try and organise and interesting event and invite only the female students), connect first years students with third and fourth year students. Set up a community of female students to create a sense of belonging

Chapter 3: online survey

Teachers
The survey was translated into Dutch and online distributed through the VHTO-newsletter, social media and mostly within the VHTO network of VET-colleges. The survey was translated into Dutch, the concrete results (in Dutch) can be found in annex 3. A short summary in English will be presented here.
The vast majority of participants were male with an average age of 50. Most of them teach a subject within the STEM-area; some of them taught more general subjects and they all studies a STEM-subject themselves. Interestingly according to the teachers, parents are essential. That is also one of the results from the students survey, as the students argue that they speak mostly with their parents about the choice they have to make (in contrast to speaking with teachers and school counsellors). They agreed on the lack of role models. Striking is that the teachers are not interested in a specific training

that could give tools to support girls in STEM, some illustrating quotes from the individual teachers:

- I treat everybody (regardless of gender) with the same respect so that kind of training is not for me
- Lack of time
- I don't feel like doing it!!

But interestingly one other teachers replies: I would really hope that all my male colleagues have such training.
As those replies indicate, the area of 'gender and stem' is very sensitive, people tend to either react politically correct or feel 'attacked'. The first and most difficult step is to raise awareness.

Girls

The survey was translated in to Dutch and a paper based version was distributed during a big event held in Amsterdam to inform pre-vet students on career options. Furthermore the survey was distributed at one college and a few female VET-students, who are good contacts of VHTO, were asked to fill in the online version. In order to have mix of students just before the moment they have to make a decision for a specific track and to question female students who already have chosen for a science based track. The results were inserted in the online tool to compare all results in one database. The main findings are:

- Big influence of parents (more than teachers or school counsellors)
- Big influence of peers
- Most of them didn't know any females working in STEM
- The ones who are STEM-students, all have a family relative (mostly fathers) working in STEM
- Widespread use of social media, most students say that their schools use a 'WhatsApp-group' per class

The concrete results (in Dutch) can be found in annex 1 en 2.

Resources

- Cedefop ReferNet Netherlands (2012). VET in Europe: country report Netherlands. https://cumulus.cedefop.europa.eu/files/vetelib/2012/2012_CR_NL.pdf
- http://www.vhto.nl/fileadmin/user_upload/documents/publicaties/Internationaal/LR_VHTO_GENDER_ENGELS_TOTAAL.pdf

Annexes

1. Survey pre-vet students:

vmbo_leerlingen.pdf

2. Survey vet students:

mbo_leerlingen.pdf

3. Survey VET-teachers

vet_docenten.pdf