Influences on interest in STEM during a Pre-university program

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With a predicted shortage of qualified people for many jobs in science, technology, engineering and mathematics (STEM) extra attention to the development of students' interest in STEM is required. This study gains an insight into the influence on the interests in STEM of students enrolled in a pre-university program called U-Talent. A comprehensive set of interests of the participants are identified and both educational and social factors of influence on interest development are taken into account. This research consists of two parts. The first part is conducted on all the participants of the first year of the U-Talent program (n =95) and included the analysis of motivation letters and questionnaires. The second part was a qualitative multiple case study conducted on a small part of the population and includes data of a diary app and in-depth interviews. The research showed that participants of U-TA are broad interested with a preference for STEM. The most important factors of influence indicated by the research are U-TA, parents, conditions as free will, variation, elaboration, competence and challenge and remaining interests.

Keywords: *STEM, interests, social relations, factors of influence, U-Talent*

Introduction

Several studies have shown that students' interest in science, technology, engineering and mathematics (STEM) decreases during secondary school (Barmby et al., 2008; Frenzel et al., 2010; Speering & Rennie, 1996). Students' interest is closely linked to their career choice and there is a predicted shortage in 2014 of qualified people for many science jobs in the Netherlands (Breugel et al., 2011). At the same time the demand for graduates in the natural sciences is increasing (OECD, 2008). Besides a simple 'supply and demand' more people in STEM professions are needed for the society, for instance, to secure a sufficient and sustainable

energy supply, responsible resource use, efficient healthcare, clever technology development and a sound economy (Boe et al., 2011). Thereby, science is needed in everyday life (Layton, 2008; Reiss, 2007; Roberts, 1982), engaging in science may enrich people's lives and contribute to their individual development (Boe et al., 2011). A better understanding of the influences on interest in STEM could help to promote this interest and therefore it is worth to investigate which factors influence the development of STEM interest, to what extent and in what way.

Already many studies have been conducted in which factors of influence on the development of interest in STEM, or interest in general, have been identified (e.g. Barmby, Kind, & Jones, 2008; Bergin, 1999; Boe et al., 2011; Frenzel et al., 2010; Hulleman & Harackiewicz, 2009; Louwaard, 2013; Osborne, Simon, & Collins, 2003; van der Vlies, 2013; Wentzel, 1998; Zoldosova & Prokop, 2006). For instance, Wentzel indicates a significant relation between students' perceptions of support from their parents, teachers, and peers to aspects of interest and motivation. Although it is known that the relationship between the social network and interest is important, little is found about how exactly the factors relate (Lyons, 2006). One relation between these factors is found by Louwaard, who showed that a lack of stimulation by people in students' social network can lead to a decrease of their interest in STEM.

Participation in pre-university programs, such as Junior College Utrecht (JCU), appears to be beneficial for the interest development in STEM. It has been shown that in general, participants' interest in STEM courses increases during the JCU program (Jongen, 2013). One of the factors of the Pre-university program responsible for the increase of STEM interest is the possibility to meet equal peers, who motivate and inspire the participants (Van der Valk & Eijkelhof, 2007). Other factors indicated by Vrancken en Tromp (2013) are attention to personal development of the students; the focus on the learning process rather than the learning

outcomes; the possibility of choices; research based education; selection criteria; and equal relationship between teachers and students.

The majority of the studies mentioned before consider just one context such as school or science interest. In this way relations between interests of different contexts cannot be tested. A possible relation is that there is some competition between the different interests, for example having multiple hobbies may lead to a low interest in STEM because of a limitation of time. Another possible relation is that people look for some coherence in their various interests, for instance an interest in programming and games in their spare time can lead to an interest in computer science. The proposed study therefore considers multiple interests from both educational as social settings at the same time in order to detect these kinds of relations.

The aim of the purposed research is to gain insight into the influence on interests in STEM of students enrolled in a pre-university program. A comprehensive set of interests of the students will be identified and both educational and social factors of influence on interest development are taken into account.

Theoretical background

Interest. Interest has a powerful influence on attention, goals and levels of learning (Hidi & Renninger, 2006) and has therefore taken a crucial place in the research field of science education. Hidi and Renninger define interest as “a psychological state that, in later phases of development, is also a predisposition to reengage content that applies to in-school and out-of-school learning and to young and old alike” (p. 111). The concept of interest can be distinguished in individual and situational interest. Individual interest refers to interest that is activated internally and situational interest to interest that is environmentally activated. Factors that influence individual interest are for example belongingness, emotions, utility-goal relevance and background knowledge. Examples of factors which influence situational interest

are hands-on, discrepancy, novelty, social interaction, modeling, games and puzzles, content, fantasy and humor (Bergin, 1999).

Interest development. Individual interest is the most powerful, but also the least controllable one. Teachers cannot directly influence students' individual interests, but a high stimulation of situational interest might change a student's individual interest over time (Mitchell, 1993). This is also in line with the model of interest development created by Hidi and Renninger (2006). The model describes the development of interest in four phases: it starts with triggered situational interest, followed by the maintained situational interest which can lead to the phase of emerging (less developed) individual interest, which in turn can lead to the phase of well-developed individual interest.

Focusing on situational interest, the distinction can be made between catching and holding interest. The essence of catching interest lies in finding various ways to stimulate students, for instance through group work, the use of computers, and puzzles. The essence of holding interest lies in finding variables that increase the level of empowerment of students (Mitchell, 1993). A high level of empowerment means that people have the feeling that they add value, that they are part of a team, that they feel competent about their tasks, that they feel challenged, and that their tasks really matter (Van der Valk et al., 2008). Empowerment can be seen as consisting of the dimensions meaningfulness, competence, and impact (Thomas & Velthouse, 1990). Meaningfulness concerns the degree of which students perceive a task or content as personally meaningful and important; competence in the meaning that students feel qualified and capable to perform the necessary activities to reach the goal; and impact in the sense that performing the task is seen as something that matters.

Factors of influence. Both social and educational factors influence students' interest development in STEM. Examples of social factors are family, classmates and teachers (Eccles, 2007; Frenzel et al., 2010; Lyons, 2006; Sjaastad, 2012; Vedder-Weiss & Fortus, 2013). For

instance, parents in general act as role models and expectancy socializers for their children (Frenzel et al., 2010) and parents who are engaged in STEM themselves are a factor of influence on students' interest in STEM by making the choice of STEM familiar (Sjaastad, 2012). Teachers can influence students' interest in STEM by displaying how STEM might bring fulfilment in their life and by giving them a positive experience with the subjects. They can also help students to discover their STEM abilities (Sjaastad, 2012). Lyons identified the background factors gender, socioeconomic status, parent's eduation levels and ethnic identity as factors of influence on interst in STEM. Deci and Ryan (2011) explain with their self-determination theory that conditions supporting the indviduals' experience of autonomy, competence and relatedness have a postive effect on interest development. This theory is aligned with the theory of Bandura (1995) which argues that self-efficacy stimulates interest development.

Interest development of talented students. Van der Valk and colleagues (2008) examined how the different teaching activities of the JCU program influenced students' empowerment, and therefore contribute to the holding of STEM interest. They identified that educational factors of JCU influenced the different dimensions of empowerment, such as the use of (pre)theses, the modules, regular lessons, practical sessions, tests, the accelerated curriculum, the research oriented approach and the advanced and enriching aspect of the program. Also social factors such as the exposure to equal minded students and the atmosphere of JCU determined by the students, teachers and activities influenced students' empowerment and therefore the interest development in STEM.

Louwaard (2013) found other possible factors of influence on interest development of talented students. For example, an increasing difficulty of learning material can cause a decrease of interest. A decrease of interest can also be the result of a lack of stimulation by people of their social network. Increasing of interests during the JCU traject can be related to

the way the learning material is presented by the JCU, the environment consisting of other interested people provided by the JCU, or the activities undertaken by the students themselves outside school.

Research question and purpose

The aim of this study is to gain insight into the influence on the interests in STEM of students enrolled in a pre-university program called U-Talent dedicated to STEM (grade 11-12). This study is explorative of nature and concerns several case studies. We will focus on first year participants of U-Talent in their fifth year of Pre-university education (age 16-17).

Research questions. The following main research question is addressed: *What influences the interests in STEM of students enrolled in a STEM Pre-university program?* In order to answer the main research question two questions are answered:

1. What are the characteristics of students enrolled in a STEM Pre-university program e.g. background, interests, interest development and future perspective?
2. Which factors influence students interests in STEM, to what extent and in what way?

The first sub question considers both STEM-related interests as general interests. This way possible factors as competition or coherence of interests can be detected. By answering the second question both educational as social factors are taken into account. The answer to this questions could help JCU teachers, science teachers and STEM promoters to stimulate the development of students' existing interest in STEM.

Method

This research consists of two parts. The first part is conducted on all the participants of the first year of the U-Talent program (n = 95) and included the analysis of motivation letters and questionnaires. This first part had the purpose to identify key characteristics of the population

in terms of their background, interests and interest development during the pre-university program. Also conjectures about possible factors and their degree of influence on participants' interests in STEM were formed in this part of the research.

For a more in-depth insight into the influence on participants' interests in STEM, the second part was a qualitative multiple case study design conducted on a small part of the total population used in the first part (n = 8). It included the results of the first part of the research, app data and in-depth interviews. The purpose of this part was to test the conjectures formed earlier (to validate) to find other possible factors and to gain a more in-depth image of the extent and the way in which the factors influence the participants' interest in STEM (to illustrate and elaborate).

Research context. This research is conducted under participants of the U-Talent Academy (U-TA) from Junior College Utrecht (JCU). This population was chosen because the intended domain were students who have (or at some point had) an interest in STEM. JCU is an initiative of University Utrecht and 27 secondary schools which offers challenging science education to talented and motivated students in their fifth to sixth year of pre-university education in an academic environment (Eijkelhof & Van der Valk, 2007). In order to participate in the U-TA program, students have to write a motivation letter. If selected, students follow a two-day training program at the university campus every month. The training program provides students to follow lectures by researchers and to conduct research themselves in a university laboratory. In the meantime, they follow advanced STEM courses with extra challenge on their regular schools.

Method part I

Participants

The participants of part one of this research were n = 95 students of the U-talent program in grade 11 (fifth year) between the age of 15 and 17 (M_{age} = 16.3, SD = 0.6). This sample included 47 male and 48 female participants. All the participants of grade 11 were asked to participate in the research.

Data collection

In this part data in the form of motivation letters were collected. Existing data obtained from a questionnaire was used.

Motivation letters. In order to retrieve an overall image of the participants' interests and future vision before participation of U-TA, motivation letters for U-TA had been collected. The U-TA motivation letters are personal documents to others which contain personal feelings, thoughts and experiences (Baarda, Goede, & Teunissen, 2005). The participants wrote their motivation letter for U-TA according a predetermined format (Appendix A) when they were in grade 10 (fourth year). The documents date from May 2013.

Questionnaire. To measure the participants' interest during grade 11 (fifth year) a questionnaire (Appendix B) has been conducted under all current participants of U-Talent in February. This conduction took place in February 2014, nine months after the participants wrote their motivation letter. At that time the participants experienced the JCU program for approximately six months which enabled the participants to reason out of their own experience as JCU students. The used questionnaire was used and validated in former research (Van der Vlies, 2013) and contains both open-ended and multiple choice questions. The questionnaire starts with questions about descriptive information such as name, age, gender, educational year, education of parents, and parents' occupation. The descriptive information is followed by 36

questions divided into two parts: student interests and study and future profession preference. The part about interests has been especially important for this study.

Data Analysis

Motivation letters. The motivation letters were analyzed according to the principle of the spiral of analysing using open, axial and selective coding (Boeije, 2010). The used codes were either literature based or followed bottom-up from the motivation letters. The literature based codes were based on code shemes ‘interesse’ and ‘toekomstbeeld’ from Louwaard (2013) and code sheme ‘interesse’ of Stevenhagen (2015). Eventually the process of coding led to the coding sheme added in appendix C.

Questionnaire. For the first part of the research only the quantitative data of the questionnaire was used. Descriptive statistics were used to give an overview of the participants’ background, social relations, interests, study choice and career choice. Two principal component analysis (PCA) were conducted, one to group the participants’ interests and one to make a distinction betwee the participant’s social relationships. A One way ANOVA was conducted to measure a potential difference of interest in STEM between genders.

Method part II

Participants

The second part of the research was conducted on a subset of the sample of the first part. All the participants of part I were asked to work with the app InTin for a duration of two weeks in order for a small reward. Eventually 12 out of 95 participants filled in the app. These 12 participants were asked to participate in an interview, again in order for a small reward. The respond for this last request was 8 out of 12. The resulting sample consisted of two male and six female participants. All the participants participated voluntary in the study, they were asked

permission to record the interview and to report the findings. Pseudo names were used in order to report the findings anonymous.

Data collection

In this part of the research data was collected through a diary app named ‘InTin’ and semi-structured in-depth interviews.

App InTin. To obtain an overview of the various interests and related social contacts of each of the participants, data of the app InTin have been used. The participants used the app as a sort of diary to document their interests for one week in June 2014. During this week, the students were asked every two hours to report their activities through the app. The app asked which activity the student performed, with whom, and how. The participants were also asked to rate the degree of interests of the activities and related social contacts from 0 to 100. Unfortunately only five out of the eight participants filled in the app in the right way. The app data of the remaining three participants was not useful for this research.

In-depth interviews. The purposes of the interviews was to validate and elaborate the conjectures based on the data retrieved by the document analysis, questionnaire, and app. Interview schemes were used to make sure that the topics and questions that matter would have been addressed during the interviews (Boeije, 2010). These interview schemes have been constructed for each participant separately based on the data resulting from the document analysis, questionnaire (here also the qualitative data was taken into account), and app. Every interview scheme was established according a fixed format and consisted of three parts: interests, factors of influence and future study-/career choice. The interviews were conducted in September, seven months after the conduction of the questionnaires. The participants were in the beginning of grade 12 and their second year of the U-Talent program at this time. The interviews were audio recorded.

Data Analysis

App InTin. The participants' interests and social contacts were retrieved form the app data which resulted in two lists for each participant. One listed the participant's interests and the other the participant's social contacts. Both lists mentioned the degree of interest rated by the participant after each item. The order of the lists is based on these scores on degree of interest with the highest scored item on top and he lowest scored item on the bottom. These lists were validated and supplemented during the in-depth interviews in which the lists were shown to the participants and the participants were asked whether they agreed with the lists and/or they had some additions.

In-depth interviews. To analyze the interviews first the recorded data have been written out resulting in transcriptions. Secondly the transcriptions have been coded by the principle of open coding. Used codes can be divided into four categories: background, main interests and study choice, interest development and factors of influence. The category 'factors of influence' consists of the subcategories: social environment, educational environment and other possible factors. For each participant a vignette have been written based on the coded transcriptions. These vignettes were written according a fixed format responding with the categories of the codes used to encode the transcriptions. The resulting vignettes were sent to the participants for validation by member checking. Respondents' remarks led to reviewed vignettes. These reviewed vignettes were analyzed according a cross case analyses with the focus on the different categories mentioned above.

Results part I

Results motivation letters

The motivation letters have produced information about the participants' interests and their future perspective. The code scheme shows that participants' interests can be divided into

academic topics, non-academic topics and activities. The participants' future perspective is divided into future possible education and future possible career.

Table 1

Participants' Interests in Academic Topics Ordered by Discipline

Interests	*n*
STEM science	65
Biology	16
Mathematics	16
Physics	15
Chemistry	13
Computer Science	3
NLT	4
Social science and humanities	7
Languages	4
History	2
Philosophy	1

Interests. The frequency of mentioned interests in academic and non-academic topics are listed in table 1 and 2 respectively. Almost all the participants wrote something about their interests. The majority (65/95) of the participants wrote that they had an interest in STEM. Only 7 out of 95 participants mentioned an interest in Social science and humanities. Most of the participants also mentioned non-academic topics in which they participate as leisure such as

sports and culture. More than one third (36/95) of the participants mentioned to enjoy exploring and enquiring.

Table 2

Participants' Interests in Non-Academic Topics

Interests	*n*
Sports	23
Art/culture	14
TV, movie, series	12
Reading	4
Nature	3
Puzzles	4
Religion	1
Cuisine	1
Explore/inquiry	36
Debate/discuss	6
Organize	1

Future perspective. Table 3 shows the frequency of the future perspective mentioned. Not all the participants wrote something about their future perspective. Especially future career options were emitted by most of the participants. The majority of the participants who wrote something about future education were considering STEM sciences as future education. Also medical sciences was a frequently requiring interest related to future education. Of the

participants who mentioned something about a future possible career, almost everybody mentioned one or more careers related to STEM.

Table 3

Participants' Future Perspective

Future perspective	*n*
Future possible education	
STEM sciences	30
Medical sciences	18
Social science and humanities	3
Future possible career	
Related to STEM	12
No idea	1
More alternatives	1

Results questionnaire

The questionnaires produced results about the participants' backgrounds, interests and future perspective. They also provided information about possible factors of influence on the participants' interests in STEM, and the extent of this influence.

Preliminary analyses. A principal component analysis (PCA) was run to reduce the thirteen questioned principals in order to use mean scores for Social science and humanities and STEM sciences to indicate interests. Tests were run to validate the suitability of PCA and indicated that the data was likely factorizable. The Kaiser-Meyer-Olkin (KMO) measure was 0.57 and the Bartlett's test of sphericity was statistically significant ($p < .0005$). PCA revealed five components that had eigenvalues greater than one and which explained respectively 21.9%, 14.8%, 10.8%, 9,2% and 8.1% of the total variance. Visual inspection of the scree plot indicated

that two components should be retained. As in addition a two-component solution met the interpretability criterion, two components were retained. This resulted in the components ‘Social science and humanities’ and ‘STEM sciences’ as presented in Table 4.

Table 4

Factor Loadings of a Principal Component Analysis with Varimax Rotation of Disciplines

Interest in	Social science and humanities	STEM sciences
History	**.67**	-.01
Psychology	**.66**	-.15
Philosophy	**.66**	.13
Society	**.61**	-.08
Languages	**.43**	-.13
Biology	**.41**	-.22
Geography	**.36**	-.01
Chemistry	-.29	**.03**
Statistics	.04	**.80**
Mathematics	-.15	**.72**
Informatics	-.23	**.64**
Physics	-.23	**.63**
Economics	.28	**.49**

A second principal component analysis was run in order to make a distinction between the participants’ social relationships. In order to validate suitability, several tests were run. The Kaiser-Meyer-Olkin (KMO) measure was 0.66 and the Bartlett’s test of sphericity was statistically significant ($p < .0005$). PCA revealed four components that had eigenvalues greater

than one and which explained respectively 28.0%, 15.2%, 10.9% and 8.9% of the total variance. Visual inspection of the scree plot indicated that three components should be retained. As in addition a three-component solution met the interpretability criterion, three components were retained. This resulted in the components ‘Friends/teachers JCU’, ‘Friends outside JCU’ and ‘Parents’ as presented in table 5.

Table 5

Factor Loadings of Principal Component Analysis with Varimax Rotation on Social Relations

	Friends Teachers JCU	Friends outside JCU	Parents
JCU Classmates stimulate thinking about STEM	**.78**	.09	-.04
Teacher JCU draws attention to relevant STEM information	**.77**	.06	.08
Importance teachers JCU for STEM interest	**.70**	.01	.03
Importance classmates JCU for STEM interest	**.69**	.16	.15
I ask JCU classmates about STEM	**.64**	.28	.10
I ask Teacher JCU for explanation about STEM	**.56**	.02	-.14
Parents encourage STEM interest	**.52**	-.10	.44
Friends not in JCU ask what I do at JCU	.03	**.77**	.16
Importance friends outside JCU for STEM interest	.00	**.76**	.21
I talk to friends not in JCU about STEM	.30	**.72**	-.11
Importance father for STEM interest	-.05	-.01	**.86**
Importance mother for STEM interest	-.08	.20	**.81**
Parents provide STEM related multimedia	.20	.17	**.34**

Background. Table 6 shows the field of occupation of the participants' parents. The most common field of occupation under the participants' fathers is Science and Technology fathers (*n* = 35). A big difference with the number of participants' mothers in Science and Technology (*n* = 5). The most common field of occupation of the participants' mothers is Care and Welfare (*n* = 53).

Table 6

Field of Occupation of Participants' Parents

	Father		Mother	
Occupation	*n*	%	*n*	%
Care and Welfare	14	14.7	53	55.8
Science and Technology	35	36.8	5	5.3
Economics	27	28.4	15	15.8
Agriculture	4	4.2	2	2.1
Otherwise	10	10,5	10	10.5
None	1	1.1	2	2.1
Missing	4	4.2	8	8.4
Total	95	100.0	95	100.0

Interests. Most participants stated in the questionnaire to have a very broad interest (*n* = 60). This broad interests appears also from table 7 which shows a high score for each discipline (mean > 2.50). The STEM courses biology, chemistry, physics and mathematics scored extra high which indicate that the participants were overall more interested in STEM.

Table 7

Participants' Interest in Academic Topics

Interested in	*M*	*SD*
Biology	**4.96**	1.01
Chemistry	**4.82**	0.84
Physics	**4.68**	0.98
Mathematics	**3.95**	1.45
Psychology	3.51	1.50
Philosophy	3.47	1.60
Computer science	3.24	1.46
Economics	3.22	1.48
Language	3.09	1.38
Statistics	3.04	1.27
Geography	2.99	1.14
History	2.79	1.47
Social Sciences	2.72	1.40

A One way ANOVA was conducted to measure a potential difference of interest in STEM between genders. Inspection of a boxplot made clear that there were no outliers in the data. The interest in STEM was normally distributed, as assessed by Shapiro-Wilk's test ($p > .05$). There was homogeneity of variances, as assessed by Levene's test for equality of variances ($p = .977$). The one way ANOVA showed a significant difference in interest in STEM between boys and girls, $F(1, 91) = 23{,}414$, $p < .0005$, $\omega^2 = 0.19$. Boys ($n = 46$, $M = 0.45$, $SD = 0.9$) were more interested in STEM than girls ($n = 47$, $M = -0.45$, $SD = 0.9$), $F(1, 91) = 23{,}414$, $p < .001$.

Future perspective. Almost all participants (*n* = 83, 87%) knew their favorite field of study. The participants are less certain regard their career choice. Only a small majority (*n* = 57, 60%) indicated their favorite career choice. Striking is that the highest scored field in study choice is different than the highest scored career choice. While the most popular field of study under the participants is Science and Technology (*n* = 48), the participants indicated Care and welfare as the most popular future profession (*n* =23).

Table 8

Participants' Future Perspective

	Study choice		Career choice	
	n	%	*n*	%
Care and welfare	25	26.3	23	24.0
Science and Technology	48	50.5	21	21.9
Economics	7	7.4	5	5.2
Otherwise	3	3.2	8	8.3
Unknown	1	1.1	5	5.2
Missing	11	11.6	33	34.4
Total	95	100.0	95	100.0

Interest development. Most of the participants (*n* = 55) experienced an increase of their interest in STEM during the pre-university program. Only two participants experienced a decrease of their interest in STEM as shown in table 9.

Table 9

Participants' Development of Interest in STEM During the Pre-University Program

	Increase		Decrease	
	n	%	*n*	%
Yes	55	57.9	2	2.1
No	40	42.1	93	97.9
Total	95	100.0	95	100.0

Factors of influence. As shown in table 10 there is a significant difference between the self-reported influence on interest in STEM of the father ($M = 4.91$, $SD = 1.74$) and mother ($M = 4.03$, $SD = 1.65$), $t(94) = 5.456$, $p < .001$, $d = 0.56$. The self-reported influence of classmates of UTA ($M = 4.54$, $SD = 1.48$) differs significantly with the self-reported influence of friends outside UTA ($M = 3.74$, $SD = 1.48$), $t(94) = 4.442$, $p < .001$, $d = 0.455$.

Table 10

Self-reported influence of social environment on participants' interest in STEM

Social environment	*M*	*SD*
Father	4.91	1.74
Mother	4.03	1.65
Teachers U-Talent	4.89	1.28
Classmates U-Talent	4.54	1.48
Friends outside U-Talent	3.74	1.48

Results part II

Part two of the research provided results about the background, interests and future perspective of the 8 case studies. It also provided information about the factors of influence on the interest in STEM of these participants, what they are, in what extent and in what way they influenced the participants' interest in STEM.

Background

Five of the eight participants have a father who have a background in STEM, three of them are currently working in STEM. The fathers of the remaining participants work in the sectors financial (*n* = 2), sports (*n* = 1), education (*n* = 1) and sales (*n* = 1). Only one of the eight participants has a mother who has a background in STEM, none of the participants has a mother who currently works in STEM. The professions of the mothers of the participants can be divided into the sectors health care (*n* = 3), education (*n* = 2), housewife (*n* = 2) and financial (*n* = 1).

Interests

Academic topics related to STEM mentioned as an interest are biology (*n* = 8), chemistry (*n* = 6), physics (*n* = 6), mathematics (*n* = 5), computer science (*n* = 1) and statistics (*n* = 1). Academic topics not related to STEM mentioned are history (*n* = 5), psychology (*n* = 5), philosophy (*n* = 3), economics (*n* = 3), social studies (*n* = 3), languages (*n* = 3), geography (*n* = 1) and school (*n* = 1). Nonacademic topics named by the participants are sports (*n* = 6), reading (*n* = 4), television (*n* = 4), meeting up with friends (*n* = 4), music (*n* = 3), reading STEM related books/magazines (*n* = 2), creativity (*n* = 2), internet (*n* = 2), gaming (*n* = 2), religion (*n* = 1), society (*n* = 1), working (*n* = 1), writing (*n* = 1), cooking/baking (*n* = 1) and museums (*n* = 1). Seven of the eight participants of the case studies have a very broad interests.

Future perspective

Possible future education mentioned are medicine (*n* = 5), civil engineering (*n* = 2), physics (*n* = 2), law (*n* = 2), university college (*n* = 2), biomedical science (*n* = 2), technical administration

(bestuurskunde) (*n* = 1), technical business (technische bedrijfskunde) (*n* = 1), technical planning (*n* = 1), engineering (bouwkunde) (*n* = 1), industrial design (*n* = 1), earth sciences (*n* = 1), econometric (*n* = 1), mechanical engineering (*n* = 1), life science and technology (*n* = 1), maritime engineering (*n* = 1), history (*n* = 1), clinical technology (*n* = 1), computer science (*n* = 1), biology (*n* = 1), psychology (*n* = 1), criminology (*n* = 1), technical medicine (technische geneeskunde) (*n* = 1), astronomy (*n* = 1), dentistry (*n* = 1) and veterinary (*n* = 1) . These can be classified in the disciplines more applied STEM (*n* = 15), health care (*n* = 8), social science and humanities (*n* = 6), more theoretical STEM science (*n* = 3), liberal arts and sciences (*n* = 3). Possible future professions mentioned are architect (*n* = 2), doctor (*n* = 2), city planner (*n* = 1), technical engineer (*n* = 1), pediatrician (*n* = 1), geriatrician (*n* = 1), judge (*n* = 1), police officer (*n* = 1), researcher (*n* = 1), technical doctor (technische geneeskundige) (*n* = 1), pharmacy (*n* = 1), neuroscience (*n* = 1), dentist (*n* = 1) and music teacher (*n* = 1).

Interest development

Five out of eight participants indicate that their general interests changed during the Pre-university program. Two of the participants indicate that their general interests have remained the same, the remaining participant indicates that some of his interests increased while others decreased. All participants indicate that their interests in STEM changed during the Pre-university program. Five of these eight participants specified the change with an increase of interest in biology, one specified it with a decrease of interest in mathematics, another one an increase of interest in mathematics and the remaining participant indicated a decrease of interest in medicine. Six of the participants indicated that their interest in STEM in general increased.

Factors of influence

Factors of influences on participants' interest in STEM emerged in part I are U-Talent's teaching material and approach (the modules and the research project), teachers of U-Talent, classmates of U-Talent, the participants' regular school, participants' parents and friends

outside U-Talent. The role of the factors of influence on the interest in STEM of the participants as well as additional factors were indicated in part II.

U-Talent teaching material and approach. Three participants described the influence of the modules of the U-Talent program on their interest in STEM as a trigger for an interest of a particular topic. For example Toms interest in the subjects 'plants' of the field biology arose because of a module of the U-Talen program:

> "I had signed up for physics but that one was full so I was assigned to biology. And that was about ecology I think, which turned out to be really interesting, yeah actually just fun to do. So that changed it, before I thought about plants as some boring things which grow really slowly and where actually nothing happens. But if you look at it on a bigger scale it is really interesting how it develops."

Another three participants' were influenced by the U-Talent program in the way that it helped them with the choice of their future study/career. Chloe said:

> "I have the feeling that I know now better what I want. Also qua study choice next year. All the different modules of U-Talent gave me a clearer image of how it really is to study in university. And that I know better what I like and do not like because of that. And that might be very different than the ordinary courses in secondary school."

Almost all participants mentioned that the U-Talent program is more interesting than their regular school. Reason for this is the application of STEM related subjects which is shown in U-Talent. Naomi explains:

> "That you can see the application but then real in society. And not like in school were you learn a lot out of books and here you learn more what to do with it. You can say that it goes more into depth, but most of all differently."

Jasper describes the influence of the U-Talent program on his daily life: “Also in everyday life STEM pops faster in my mind. Also by different things than before just because you are on a higher level because of the program”.

U-Talent teachers. Seven out of eight participants indicate the enthusiasm of the teachers of U-Talent as a positive influence on their interest in STEM. Naomi says the following about the teachers of U-Talent:

> “I have to say that they tell it way more interesting over here than in school. So in that perspective, if you listen here you are like ‘wow that is really interesting’ and when they tell the same in school I am like ‘just stop this whole story, I will read from my book’, that.”

Carmen also indicated the enthusiasm of the teachers as a factor of influence but she also said: “But if I find something really interesting, it does not really matter who teaches it, so of course it also depends on the module.” One participant, Clara, said that the teachers of U-Talent do not have a big impact on her interest. She explains: “You have different teachers for different modules and there is not a lot you do with them. So mostly you are doing research or writing by your own. So there is not a lot of contact with the teachers.”

Classmates of U-Talent. Five out of eight participants named the environment with equal peers of U-Talent stimulating. Because it is an environment in which everyone is motivated and interested and in which STEM related conversation topics are common. Naomi describes the atmosphere on U-talent as follows:

> “People ask questions in the class over here, they are really interested. They are here because they want to and they ask questions because they like it, want to know it and are curious. You do not find that in my school. And over here people are talking out of free will about physics and stuff in their break.”

Two participants described that their classmates of U-Talent mainly influenced their study choice. Jasper said the following:

> "We can talk about what we want to do and why so that has definitely influence on each other. Especially your classmates bring new ideas and steer you the most because they are people from your direct environment and have the same age so they have actually the most influence".

Regular school. Five out of eight participants made comments suggesting that their regular school played a factor in the development of their interest. Examples of such comments are "I look forward to physics in school" and "I think that my interest for biology arose because of the biology lessons, because I found it all really interesting".

Parents. The most striking finding was that the majority of the participants ($N = 5$) have a father who works in STEM or has a background in STEM while none of the participants' mothers work in STEM. Also the majority of the participants indicated that their father influenced their interests in STEM by explaining STEM related subjects during their youth. Clara gives two examples:

> "Once we were climbing a mountain and while I was looking at the GPS wondering what a certain number meant, he explained about the sine and the cosine. I really enjoyed that. And another time he explained the abc formula in a snack bar."

Two participants indicated that their interest was influenced by their parents playing a supportive role. Ria explains that her parents influence her interest by just listening to her:

> "It is especially when I come home with something I liked, I tell them about it and then they ask questions about it because they also want to understand it, and I like to explain that kind of things and that makes that I want to understand it

> more because in that case I can explain it more. So I think that in that way they influence me, that I want to tell about it and that they listen to it."

Three participants indicate that their parents do support their interest in STEM but do not influence it. Tom explains:

> "That is because if I engage in something I like, they will encourage it. If I was interested in economy or geography they would also encourage it. And I know that it would always be like that. So that is why it does not have a lot of influence."

Another participant, Carmen indicates that the background of her parents has an influence on her study choice:

> "But I do think that I want to study medicine because my parents are in a kind of the same field. My mother is in healthcare, and they are both in the social field. Not really in companies. Because of that you automatically go in that direction, not that you think like 'I'm going to study economics and work in a company'."

Another interesting phenomenon which seems to occur under some of the participants is that their interests are a sort of combination of the interests of their parents. For example Mabel's father has a background in STEM and her mother works as a preacher and a music teacher. Mabel herself developed an interest in STEM, music and religion. Another example is Clara who considers studying Technical medicine. She indicates that the technical part came mainly from her father's side who studied civil engineering, and that the medical side came mainly from her mother who works as a youth psychologist. Naomi also fits this pattern: her mother is a bookkeeper and her father owns an ICT company and Naomi herself developed an interest in economics and STEM.

Friends outside U-Talent. Five out of eight participants indicate that they have one or more friends with whom they engage in STEM related activities and/or talk about STEM. Carmen says the following about her friends:

> "I have a lot of people that chose kind of the same courses as I did. And that is nice to talk about. Last year we went to a kind of lecture in Amsterdam from a psychiatrist or something, we liked it."

Two participants indicate that they can talk about STEM-related subjects with their friends but that they are not on the same level. Tom explains that a lack of knowledge at his friends side makes it harder to discuss STEM related subjects: "If I explain something about it I often notice that I have to explain it well because otherwise they will lose their interest."

One of the participants, Ria, indicates that she cannot really discuss STEM related subjects with her friends outside the U-Talent program: "If people do not participate in the U-Talent program they soon have something like 'leave it, I do not need to know that'. So I do not really talk about it with them."

Partner. Another possible social factor that came to light during the interviews is the participants' partner. One of the participants indicates that her boyfriend played a major factor in the development of her interest in STEM. This participant, Ria, told that at first she was more interested in history and was not so into STEM. This changed in grade 9 (third class) when she met her boyfriend who was interested into STEM. The following statement of Ria indicates that the influence of her boyfriend have been significant for her interest in STEM: "If I had not known him, I would probably do something with history right now". Ria's boyfriend played a significant role in the development of her interest in STEM.

Conditions. During the interviews it appears that the conditions free will, variation, elaboration, competence and challenge contribute to an increase of interest. Mabel explains that activities which are done out of free will are more interesting than activities which are not: "I

think it depends on the free will, whether I can choose to do a particular thing on a particular time and not because I have to do it". Naomi talks about the variation as a stimulating factor of her interest: "I really enjoy to see that, the variation actually. I do not know how to explain but I like to see different things in my life". Tom's degree of interest is to measure by the amount of elaboration and competence: "If it goes into detail and I can do it without too much effort I often find it interesting". Ria indicates the condition challenge as a factor of influence: "This is more interesting because I have more challenge over here".

Career prospects. As a factor of influence on her interest in STEM, Carmen named her study choice medicine: "Also because I oriented myself on studying medicine, so I think that is just something you want I wanted that it interested me". She also indicates her future perspective as a factor of influence on her interest in STEM: "It is also that there is so much less possible with alpha studies". An internship aroused Clara's interest in medicine: "I think that my interest in medicine is caused by the internship I did in the hospital which made me think that's something I want to do".

Remaining interests. A participant's interest in STEM can be influenced by his/her remaining interests because of a coherence or competition between interests. Chloe explains why she is interested in engineering (bouwkunde) as a future education: "I think definitely designing things, I have always been creative, thinking of new things, designing things, and I also like STEM related subjects, yeah it has to be STEM related". She also feels like there is some competition between her interests: "I want to do all of it, but I do not always have the time, that's a pity sometimes".

Multimedia. Three participants indicated some kind of multimedia as a factor of influence in their interest (in STEM). Ria indicates a computer game as a factor of influence for her interest in history: "History came because one particular game named Assassins Creed in which they give background information of the whole story all the time. I always really enjoyed

to read that, so that is where that interest for history definitely came from". She also mentioned that some tv series affected her: "And there are also really nice hospital series on TV, I know that those do not give a realistic image, but it does affect you". The physicist Walter Louie who Tom first saw at the show 'De wereld draait door' had an influence on his interest for physics: "Walter Louie was at 'De wereld draait door' once and that is a really enthusiastic physicist who arouse my interest in physics even more". Clara used to read a lot of STEM related books as a kid, that might have had some influence on her interest in STEM.

Extracurricular activities. Participation in an excellence program can also play a role in the development of interest (in STEM). Carmen indicated her participation in the excellence program Daarn for writing as a factor of influence on her interest development. Clara indicates that her participation in the mathematics Olympiad led to an increase of her interest in mathematics: "I participated in the mathematics Olympiad which made me like mathematics more than I did before in school".

Critical experience. Sometimes a critical experience influences a participant's interest in STEM. Ria's father was once in a motorcycle accident, this critical moment had an influence on her interest in medicine: "I am the doctors who saved my father forever grateful, because without them he might not be around anymore. It is my dream to do the same. I want to become a doctor so that I can help people and one day make a family happy again, just like the people who saved my father". Clara gives the divorce of her parents as the reason that her interest in museums declined. This might have had an influence on her interest in STEM because among the museums they used to visit where also STEM related museums.

Conclusion

The aim of this study was to gain insight into the influences on the interests in STEM of students enrolled in a pre-university program. This study provided information about the characteristics

of students enrolled in a Pre-university program. The study also provided the factors of influence on the students' interest in STEM, to what extend these factors influence their interest and in what way.

Characteristics

This study provided inside in the participants' background, interests and their development and future perspective.

Background. This study showed that most participants have high educated parents. Disciplines which occur frequently under the participants' parents are STEM and Care & Welfare. The most common discipline under the participants' fathers is STEM, the most common discipline under the participants' mothers is Care & Welfare.

Interests and development. Participants of U-Talent are in general very broad interested. Next to a broad academic interest most are interested in a variety of non-academic interests as sports, art/culture etc. The majority like to explore and inquire. Most participants experienced an increase of their interests in STEM during the pre-university program. Other participants' interest in STEM remained the same during U-TA and only two participants experienced a decrease of their interest in STEM.

Future perspective. Almost all participants had a clear image about their future study choice while a lot of participants did not had their future career choice clear yet. The majority of the participants saw their future perspective in STEM, another popular discipline was Care & Welfare.

Factors of influence

The most important factors of influence on the participants' interest in STEM found in this research are the U-TA, parents, conditions and remaining interests.

U-TA. Almost all students indicated the U-TA as a factor of influence on their interest in STEM. They mentioned the academy's teaching material and approach as positive factors of

influence on their interest in STEM. Main reasons are that U-TA is challenging and that it shows the application of STEM related subjects. This is in line with the research of Van der Valk and colleagues (2008) who identified that educational factors of JCU influenced different dimensions of empowerment. The application of STEM related subjects shown by the program is consistent with the dimensions meaningfulness and impact, while the challenge of the program is consistent with the dimension competence (Thomas & Velthouse, 1990).

The study showed besides educational factors also social factors of the U-TA as an influence on the participants' interests. Teachers of the U-TA had a positive effect on the participants' interest in STEM because of their enthusiasm. This result corresponds with the statement of Sjaastad (2012) that teachers can influence students' interest in STEM by giving them a positive experience with the subjects. The environment with equal peers provided by the U-TA worked stimulating because of equal interests and motivation. This is consistent with the study of Van der Valk and colleagues (2008) which indicated the exposure to equal minded students and the atmosphere of JCU determined by the students and teachers as factors of influence on the students' interest in STEM.

Parents. The research showed two ways in which the parents influence the participants' interest in STEM. One way is that parents can act as a role model as also stated by Frenzel and colleagues (2010). Parents who are engaged in STEM themselves are a factor of influence by making the choice of STEM familiar to their children (Sjaastad, 2012). A lot of participants had interests which were a sort of combination of their parents' interests. Many participants' were exposed to STEM related topics by their parents in their youth. The other way in which parents influenced their children is by playing a supportive role. Not all the participants had parents with a background in STEM but still their parents played a role in their interest development by being supportive.

Conditions. The study showed that the conditions free will, variation, elaboration, competence and challenge contribute to an increase of interest in STEM. That competence, challenge and elaboration are positive factors is consistent with the theory of empowerment. This theory says that two conditions to feel empowered are that people feel competent and challenged and that they feel that their task really matters (Van der Valk et al., 2008). The condition free will is in line with the theory of Bandura (1995) which argues that self-efficacy stimulates interest development. Another theory related is the selfdetermination theory which states that conditions supporting the individuals' experience of autonomy, competence and relatedness have a positive effect on interest development (Deci & Ryan, 2011).

Remaining interests. Participants' remaining interests can play a role in their interests in STEM in two ways. The remaning interests can play as a positive factor because the students are looking for a coherence between their interests. They can aslo play as a positive factor because the students feel some competition between their interest.

Discussion

This study examined possible influences on the interest in STEM of students enrolled in the Pre-university program U-Talent. The present study is unique because it used both qualitative (motivation letters) as quantitative (questionnaires) data to draw an overall picture of the whole population. Later a qualitative multiple case study consisting of app data and in-depth interviews was conducted on a small part of this population. This way a more indepth insight into the influences on the participants' interst in STEM was obtained. Not only provided the study the different fators of influence, it also provided information about the way and extend the factors influenced the participants' interests.

The present study had some limitations. Because it was an ideographic research the results cannot be generalised. The use of several different sources made it impossible to

compare the data in order to map the development of the participants' interests. For example if an interest was not mentioned in the motivation letters it does not meant necessarily that this interest was not present at that time. Because we were not able to map the development almost all the results provided by the research were self reported by the participants.

For further research a longitudal quantitative research is in place. This research should measure the participants' interests consistently during a longer period of time. This way the interest development can be mapped for every participant. By comparing the participants' situations evidence based conclusions can be drawn about the factors which influence students' interests.

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APPENDIX A

Format aanmeldingsbrief

Het JCU wil graag weten wie jij bent en wat je interesses zijn. Schrijf daarom een essay over jezelf. Wie ben jij? Wat vind je leuk om te doen? Wat zijn je toekomstplannen / dromen? Waarom wil je graag naar het JCU? Wat denk je dat het JCU jou kan bieden? En wat kun jij het JCU bieden? Wat hoop je dat je gaat meemaken als je lessen volgt? Etc. Het essay moet minimaal 1 en mag maximaal 2A4'tjes groot zijn.

APPENDIX B

Vragenlijst interesseontwikkeling VWO 5 (U-Talent Academie)

Beste U-TA-leerling,

Wij doen onderzoek naar interesseontwikkeling bij leerlingen die interesse hebben voor bèta. Deze vragenlijst gaat over jouw interesses, sociale omgeving, en studiekeuze. Wij stellen uitgebreide antwoorden erg op prijs. Deze helpen ons een om beeld te krijgen van interesses en veranderingen daarin. Het invullen van de vragenlijst neemt ongeveer 15 minuten in beslag.

In het kader van dit onderzoek willen we je vragen je naam en achternaam in te vullen, anders kunnen we geen ontwikkeling meten. Je antwoorden worden alleen binnen het onderzoek naar interesseontwikkeling gebruikt en niet verstrekt aan derden. Het is mogelijk dat andere onderzoekers binnen dit project je benaderen voor bijvoorbeeld een interview. We vragen ook leerlingen met een Android-telefoon of ze mee willen doen aan vervolgonderzoek met een app vanaf 8 maart.

De vragenlijst bestaat uit 36 vragen. Het gaat erom dat we jouw mening te weten komen. Als je een antwoord wilt veranderen, kruis dit antwoord door en kleur een ander rondje in.

a) Wat is je naam? _____

b) Hoe oud ben je? _____

c) Wat is je geslacht? O Man
O Vrouw

d) In welke jaargroep zit je? O 5 VWO
O 6 VWO

e) Welk beroep hebben je ouders/ verzorgers?

Moeder/ verzorgster:	Vader/ verzorger:
_____	_____
Dit beroep valt onder de sector:	Dit beroep valt onder de sector:
O Zorg en Welzijn	O Zorg en Welzijn

O Bèta en Techniek	O Bèta en Techniek
O Economie	O Economie
O Landbouw	O Landbouw

f) Wat is het hoogst behaalde diploma van je ouders/ verzorger?

Moeder/ verzorgster:	Vader/ verzorger:
O Basisschool	O Basisschool
O VMBO	O VMBO
O HAVO	O HAVO
O VWO	O VWO
O MBO	O MBO
O HBO	O HBO
O WO	O WO

➔ De volgende vragen gaan over **jouw** interesses.

1) Zijn naar jouw idee je **interesses** veranderd ten opzichte van een jaar geleden? (meerdere antwoorden mogelijk; hoeft niet over bèta te gaan!)

O Ja, ik ben nu meer geïnteresseerd in _____

_____

_____

O Ja, ik ben nu minder geïnteresseerd in_____

_____

_____

O Nee, naar mijn idee zijn mijn interesses niet veranderd.

2) Wat zijn de redenen dat deze **interesses** wel/niet veranderd zijn?

_____

_____

_____

_____

3) Is naar jouw idee je **interesse in bèta** veranderd ten opzichte van een jaar geleden? (meerdere antwoorden mogelijk)

O Ja, ik ben nu meer geïnteresseerd in bèta
O Ja, ik ben nu minder geïnteresseerd in bèta
O Nee, naar mijn idee is mijn interesses in bèta niet veranderd.

4) Wat zijn de redenen dat jouw **interesse in bèta** wel/niet veranderd is?

_____

_____

_____

_____

➔ Geef bij de volgende **kennisgebieden** aan in hoeverre je geïnteresseerd bent. Het gaat hier **niet** om schoolvakken.

Ik ben geïnteresseerd in	Niet					Heel erg
5) Wiskunde	O	O	O	O	O	O
6) Biologie	O	O	O	O	O	O
7) Aardrijkskunde	O	O	O	O	O	O
8) Economie	O	O	O	O	O	O
9) Psychologie	O	O	O	O	O	O
10) Talen	O	O	O	O	O	O
11) Informatica	O	O	O	O	O	O
12) Geschiedenis	O	O	O	O	O	O

13) Maatschappijwetenschappen	O	O	O	O	O	O
14) Scheikunde	O	O	O	O	O	O
15) Filosofie	O	O	O	O	O	O
16) Natuurkunde	O	O	O	O	O	O
17) Statistiek	O	O	O	O	O	O

18) Het volgende is op mij van toepassing:

O Ik ben heel breed geïnteresseerd
O Ik ben erg geïnteresseerd in bèta, maar niet zo in andere kennisgebieden
O Ik ben erg geïnteresseerd in één of twee kennisgebieden, namelijk: _____
O Anders, namelijk: _____

19) Hoe belangrijk zijn de volgende personen voor jouw interesse in de bètawetenschappen?

- Vader/verzorger Niet Heel erg

O O O O O O O

- Moeder/verzorgster Niet Heel erg

O O O O O O O

- Docenten van het JCU Niet Heel erg

O O O O O O O

- Klasgenoten van het JCU Niet Heel erg

O O O O O O O

- Vrienden buiten het JCU Niet Heel erg

O O O O O O O

➔ De volgende vragen gaan over de **studie- en beroepskeuzes** die jij wellicht al hebt gemaakt, of gaat maken. We stellen duidelijke uitgebreide antwoorden erg op prijs.

20) Opleidingen van welke faculteit(en) overweeg je? (meerdere antwoorden mogelijk)

O Bètawetenschappen
O Diergeneeskunde
O Geesteswetenschappen
O Geneeskunde
O Geowetenschappen
O Recht, Economie, Bestuur en Organisatie
O Sociale Wetenschappen
O Anders, namelijk: _____

21) Welke vervolg**opleiding(en)** overweeg je?

_____
_____
_____
_____

22) Welke vervolg**opleiding** zou je **nu** kiezen?

_____
_____

23) Waarom kies je voor deze **opleiding**?

_____
_____
_____
_____
_____

24) Ken je iemand met deze **opleiding**?

O Nee
O Ja, iemand in mijn familie
O Ja, mijn docent

O Ja, mijn klasgenoten van het JCU

O Ja, mijn vrienden

O Ja, namelijk: _____

25) Welke **beroepen** zou je wel willen uitoefenen?

_____

_____

_____

_____

_____

26) Welk **beroep** zou je het liefst willen uitoefenen?

_____

_____

27) Waarom zou je dit **beroep** graag uitoefenen?

_____

_____

_____

_____

_____

28) Ken je iemand met dit **beroep**?

O Nee

O Ja, iemand in mijn familie

O Ja, mijn docent

O Ja, mijn klasgenoten van het JCU

O Ja, mijn vrienden

O Ja, namelijk: _____

➔ Geef voor de volgende stellingen aan in hoeverre je het hier mee eens bent.

29) Ik praat met **vrienden** die **niet** meedoen aan U-TA-campusprogramma over bètawetenschappen

Oneens Mee eens

O O O O O O O

30) Ik word aangemoedigd door mijn **ouders/ verzorgers** om mij in de bètawetenschappen te verdiepen

Oneens Mee eens

O O O O O O O

31) **Groepsgenoten van het campusprogramma** zetten mij aan het denken over de bètawetenschappen

Oneens Mee eens

O O O O O O O

32) **Docenten van het U-TA/JCU** trekken mijn aandacht naar informatie die ik relevant vind voor mijn inhoudelijke kennis van de bètawetenschappen

Oneens Mee eens

O O O O O O O

33) Ik stel **groepsgenoten van het campusprogramma** vragen om zelf meer te weten te komen over bètawetenschappen

Oneens Mee eens

O O O O O O O

34) **Vrienden** die **niet** aan het campusprogramma meedoen, vragen mij naar dit programma aan de UU

Oneens Mee eens

O O O O O O O

35) **Ouders/ verzorgers** schaffen multimedia aan die te maken hebben met bèta (tijdschriften, dvd's, boek etc.)

Oneens Mee eens

O O O O O O O

36) Ik vraag **docenten van U-TA** uitleg om meer kennis te krijgen over bètawetenschappen

Oneens Mee eens

O O O O O O O

Bedankt voor het invullen van de vragenlijst!

Deze vragenlijst is een onderdeel van een onderzoek naar interesseontwikkeling van leerlingen aan het U-TA-programma. We hebben nog een verzoek.

We vragen U-Talent-leerlingen met een Android-telefoon (Samsung, Sony, HTC etc) of ze mee willen doen met het invullen van interessevragen die een app aan je stelt. Het is een week lang en dan in het najaar nog een keer een week. Elke twee uur (overdag) krijg je een oproep om te melden of je nog met iets interessants bezig bent geweest. Op deze manier kunnen we de interesseontwikkeling van bèta-geinteresseerde leerlingen volgen.

Onder de leerlingen die deel willen nemen aan het app-onderzoek en de interviews, worden cadeaubonnen verloot. Wil je een kans maken op een cadeaubon, vul dan hieronder jouw e-mailadres en telefoonnummer in. Op deze wijze kunnen we contact met je opnemen.

e-mailadres:

_____

telefoonnummer:

_____

Deze vragenlijst is vorig jaar door Jurg van der Vlies gemaakt en dit jaar aangepast door Myrthe Disselhorst en Arthur Bakker.

Voor meer informatie kun je mailen naar a.bakker4@uu.nl.

APPENDIX C

Codeerschemamotivatiebrief

Thema	Code	Subcode	Omschrijving	Voorbeeld
Interesse	Bèta	Biologie	Wanneer de leerling aangeeft interesse te hebben in aan biologie gerelateerde onderwerpen.	'Ik ben zeer geïnteresseerd in biologie en de werking van het menselijke lichaam vind ik fascinerend.'
		Wiskunde	Wanneer de leerling aangeeft interesse te hebben in aan wiskunde gerelateerde onderwerpen.	'Maar het vak wat nog het meeste in lijn met mijn interesses ligt is wiskunde. Wiskunde is een geweldig vak, omdat er veel logica en regelmaat in zit.'
		Natuurkunde	Wanneer de leerling aangeeft interesse te hebben in aan natuurkunde gerelateerde onderwerpen.	'..ook vind ik natuurkunde erg leuk omdat het veel verklaringen geeft.'
		Scheikunde	Wanneer de leerling aangeeft interesse te hebben in aan scheikunde gerelateerde onderwerpen.	'Scheikunde spreekt me erg aan, omdat het verklaringen geeft over hoe alle stoffen en materialen om ons heen 9in elkaar zitten, maar ook over processen in ons lichaam.'
		Informatica	Wanneer de leerling aangeeft interesse te hebben in aan informatica gerelateerde onderwerpen.	'Een andere nog vrij nieuwe interesse is informatica.'
		NLT	Wanneer de leerling aangeeft interesse te hebben in aan NLT gerelateerde onderwerpen.	'NLT en biologie vind ik de twee leukste bètavakken.'
		Algemeen natuur-wetenschappelijk	Wanneer de leerling aangeeft interesse te hebben in algemene natuurwetenschappelijke onderwerpen.	'Daarnaast vraag ik mij al heel lang af wat een levend wezen of organisme anders maakt dan een complexe zeer precieze reeks opeenvolgende en repeterende (chemische) reacties.'
	Niet bèta	Talen	Wanneer de leerling aangeeft interesse te hebben in aan talen gerelateerde onderwerpen.	'Maar niet alleen met de bètavakken gaat het mij goed af, ik sta ook hoog en heb veel plezier in Latijn, Geschiedenis, Duits, Nederlands en Engels.'
		Geschiedenis	Wanneer de leerling aangeeft interesse te hebben in aan geschiedenis gerelateerde onderwerpen.	'Daarom heb ik dit jaar een extra vak gekozen, te weten geschiedenis, want ik vind geschiedenis ook een interessant vak.'

		Filosofie	Wanneer de leerling aangeeft interesse te hebben in aan filosofie gerelateerde onderwerpen.	'…omdat ik ook aan vakken als filosofie en wiskunde D veel plezier beleef.'
	Algemeen	Ontdekken/ onderzoeken	Wanneer de leerling aangeeft interesse te hebben in onderzoeken/ontdekken.	'Het lijkt me vooral leuk omdat ik dan heel veel zelf moet onderzoeken en ontdekken.'
		Debatteren	Wanneer de leerling aangeeft interesse te hebben in debatteren.	'Ik was afgelopen jaar namelijk lid van de Debating Society bij ons op school.'
		Discussiëren	Wanneer de leerling aangeeft interesse te hebben in discussiëren.	'Vooral discussiëren over interessante vragen vind ik erg leuk, omdat ik dan meerdere ideeën ontdek.'
		Organiseren	Wanneer de leerling aangeeft interesse te hebben in organiseren.	'Het regelen van zaken vind ik heel erg leuk om te doen..'
		Breed	Wanneer de leerling aangeeft een brede interesse te hebben.	'Ik vind heel veel verschillende dingen leuk en het lijkt me dan ook super interessant om van verschillende dingen meer te weten te komen.'
	Verbredend programma	Algemeen	Wanneer de leerling aangeeft momenteel of eerder deel genomen te hebben aan een algemeen verbredend programma.	'Ik heb eenmaal eerder meegedaan aan een door school georganiseerd verdiepend programma, dit was het Delf Scolaire programma voor verdieping in de Franse taal in 3 VWO.'
		Bèta	Wanneer de leerling aangeeft momenteel of eerder deel genomen te hebben aan een verbredend programma gerelateerd aan bèta.	'Ik heb me ingezet voor verschillend excellentie programma's (Wiskunde Top Talent Team, Spreektaal krant en vorig jaar bèta-excellentie).'
	Overige interesses	Geloof	Wanneer de leerling aangeeft tijd te besteden aan het geloof.	'Ten eerste ga ik één avond per week in discussie bij de catechisatie van onze kerk.'
		Sport	Wanneer de leerling aangeeft interesse te hebben in sport.	'In mijn vrij tijd sport ik graag, zo tennis ik twee keer per week.'
		Muziek/dans	Wanneer de leerling aangeeft interesse te hebben in muziek/dans.	'Verder speel ik twee instrumenten en heb ik zangles.'
		Werk	Wanneer de leerling aangeeft tijd te besteden aan een werk.	'Daarbij werk ik elke zondag en soms zaterdags in het Daniel den Hoed ziekenhuis in Rotterdam. Dit is een ziekenhuis gespecialiseerd in het bestrijden van kanker.'

	Computer/internet	Wanneer de leerling aangeeft interesse te hebben in computers gerelateerde onderwerpen.	‘Mijn hobby’s zijn games spelen en tekenen en ik zit vaak achter de computer, waar ik veel op het internet zit, met vrienden chat en soms ook digitale tekeningen maak.’
	Bèta multimedia	Wanneer de leerling aangeeft interesse te hebben in bèta gerelateerde multimedia.	‘..ik lees bijvoorbeeld de KIJK en ben ‘Een kleine geschiedenis van bijna alles’ aan het lezen. Ook lees ik andere boeken over wetenschap.’
	Tv/Films	Wanneer de leerling aangeeft interesse te hebben in televisie kijken.	‘In mijn vrije tijd maak ik mijn huiswerk, kijk ik televisie of pak ik soms een boek.’
	Lezen/schrijven	Wanneer de leerling aangeeft interesse te hebben in lezen/schrijven.	‘Ik neem maandelijks deel aan de leesclub van Frank Oosterom.’
	Puzzels	Wanneer de leerling aangeeft interesse te hebben in puzzels.	‘Ook heb ik bijvoorbeeld altijd al leuk gevonden om wiskundige logica’s en raadsels te vinden en op te lossen.’
	Kunst/cultuur	Wanneer de leerling aangeeft interesse te hebben in kunst/cultuur	‘Ook heb ik KuBV gekozen omdat ik het leuk vind om te knutselen, dit doe ik al van kinds af aan.’
	Voedsel	Wanneer de leerling aangeeft interesse te hebben in voedsel.	‘Ook heb ik altijd veel plezier in koken en bakken, ’s avonds help ik mijn moeder met koken, en bakken doe ik wel minstens één keer per week.’
	Scouting	Wanneer de leerling aangeeft interesse te hebben in scouting.	‘Ik zit op scouting en ik moet daar vaak samenwerken.’
	Natuur	Wanneer de leerling aangeeft interesse te hebben in de natuur.	‘Ik ben heel erg geïnteresseerd in de mens, de natuur en de hele wereld om ons heen in ik hoop dat da ik daar veel meer over te weten kom met behulp van het U-Talentprogramma.’
Toekomst beeld Beroepskeuze	Algemeen bèta	Wanneer de leerling aangeeft later in de bèta richting te willen werken.	‘Ik zie mijzelf later werken in een bètarichting.’
	Geen enkel idee	Wanneer de leerling aangeeft nog geen idee te hebben van een beroep	‘Ik vind de andere vakken echter ook interessant en ik heb nog geen idee welke richting ik later op wil.’
	Meerdere alternatieven	Wanneer de leerling meerdere mogelijke beroepen noemt.	‘Het verandert flink, de ene keer wil ik biomedische wetenschapper worden, de andere keer quantumfysicus en weer een andere keer bedrijfskundige.’

	Iets met wiskunde	Wanneer de leerling aangeeft later iets met wiskunde te willen gaan doen.	‘Dat wil ik gaan studeren omdat ik wiskunde erg leuk vind en ik er later ook wat mee wil doen, maar dan liever de toepassingen van wiskunde vandaar econometrie.’
	Iets met computers	Wanneer de leerling aangeeft later iets met computers te willen doen.	‘Het werken met computers en het maken van programma’s lijkt me geweldig.’
	Dokter	Wanneer de leerling aangeeft later dokter te willen worden.	‘Ik wil, net zoals de mensen die mijn vader hebben gered, dokter worden, zodat ik ook mensen kan helpen en op een dag een gezin weer gelukkig kan maken.’
	Wetenschapper	Wanneer de leerling aangeeft later wetenschapper te willen worden.	‘Toen al vond ik het leuk om wiskunde en natuurkunde te doen en dus kwam ik uit op wetenschapper.’
	Tandarts	Wanneer de leerling aangeeft later tandarts te willen worden.	‘Daarom heb ik vorig jaar mijn beroeps oriënterende stage bij de tandarts gedaan en dit is mij erg goed bevallen.’
Studiekeuze	Medische wetenschappen	Wanneer de leerling aangeeft later een studie aan de faculteit medische wetenschappen te willen studeren.	‘Op dit moment neig ik naar de richting van Geneeskunde of Tandheelkunde.’
	Bèta wetenschappen	Wanneer de leerling aangeeft later een studie aan de faculteit bèta wetenschappen te willen studeren.	‘Na de middelbare school wil ik ook graag de bètakant op en op dit moment gaat mijn voorkeur uit naar farmacie en om vervolgens neurowetenschappen te gaan studeren. Dit kan natuurlijk nog veranderen, maar ik kan met zekerheid zeggen dat ik een bètastudie zal gaan volgen.’
	Recht, economie, bestuur en organisatie	Wanneer de leerling aangeeft later een studie aan de faculteit Recht, economie, bestuur en organisatie te willen studeren.	‘Ik heb niet alleen om die reden een NT-profiel gekozen, maar ook omdat rechten of economie me ook heel leuk lijken.’
	Overig	Wanneer de leerling aangeeft later een studie aan een andere faculteit (dan hierboven vernoemd) te willen studeren.	‘Ik ben dus vrij breed geïnteresseerd maar ben voor later in mijn studie vooral opzoek naar een combinatie van techniek, gezondheid en creativiteit.’
	Geen enkel idee	Wanneer de leerling aangeeft nog geen idee te hebben van een studie.	‘Ik heb eigenlijk nog geen flauw idee wat ik wil gaan studeren en ik denk dat het JCU daar zeker in helpt,

	omdat je bijvoorbeeld meer te weten komt over de bèta studies.’