

Pre-university programs and study success

A case study at the "Pre-U of University of Twente"



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Abstract

This research investigates the effects of participation in pre-university activities. For this, the Pre-U of University of Twente has been taken as a case study. The main research question addressed in this research is: "Does participation in a pre-university program lead to more study success and, if so, how can this be explained?". It is expected that students who participated in pre-university activities have more study success in the form of a higher number of study credits than students who did not participate and that students who participated in pre-university activities have more study success in the form of higher average grades in year 1 than student who did not participate.

Surveys among pre-university as well as non-pre-university students are used to collect the data needed for this research. There has been investigated whether participation in pre-university activities leads to more study success via a better study choice, the creation of a sense of belonging and the development of academic competencies. The overall conclusion is that students who have participated in pre-university activities do not score better on these variables than students who did not participate in pre-university activities.

Because of a low number of respondents and other time-related limitations, no hard conclusions can be drawn from this research. The recommendation for follow-up research is to repeat this research with more respondents, include only high intensive pre-university activities, use a more comprehensive conceptual model and use a longitudinal design.

Preface

Before you lies my master thesis “Pre-University programs and study success – a case study at the Pre-U of University of Twente”, which has been written to complete the track Public Management of the master’s degree program Public Administration at the University Of Twente.

In the search for a suitable topic for my master thesis I came into contact with the Pre-U of University of Twente. After a period of brainstorming about a suitable research question and switching topics regarding pre-university programs, the report “Pre-universitaire verrijkingsprogramma's in beeld” got my attention. There is stated that there has been little research towards the effects of participation in pre-university activities. In this area I saw opportunities for conducting my research.

In this preface, I would like to thank various people that helped me while writing my thesis.

First of all, I want to thank my first supervisor Harry de Boer from the research institute CHEPS from the University of Twente for his patience, guidance and useful feedback during the process. I also want to thank Hans Vossensteyn who helped me during the first phase.

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1. Problem definition and research questions

1.1 Introduction

Since the mid-nineties many Dutch universities have established honors-programs and University Colleges. These programs were meant to provide current students more challenge compared to the regular academic education programs (Murad, Simonsz, Tromp, & van der Valk, 2015). Besides this, there was a demand for talent stimulation of students who are not yet attending university. In response to this demand, at the beginning of the twentieth century pre-university enrichment programs evolved.

Pre-university enrichment programs provide selected students in secondary schools opportunities for additional deepening and broadening. The curriculum is provided at a higher cognitive level and covers other subjects than the regular curricula in secondary schools. Most of the universities in the Netherlands have some kind of an enrichment program nowadays: UVA, VU, TU Delft, TUE, RUG, UL, UM, RU, EUR, TiU, UT, UU, and WU all have a pre-university program.

In secondary schools there is increased attention for the enrichment of students who cannot find enough challenge in regular education (Onderwijsinspectie, 2003). Universities can, in collaboration with secondary schools, provide secondary school students enrichment in an academic setting. The rise of the pre-university programs is associated with an increased societal focus on talent development. This increased focus on talent development and stimulation is also reflected in governmental education policies. Examples of such governmental policies in the field of education are the “Sirius Programma” and “het Plan van aanpak Toptalenten”. The Sirius Programma enabled higher education institutions and universities to challenge students to get the best out of them. The Sirius Programma was developed as the ministry of education commissioned the elaboration of an educational program focused on excellence. The emergence of pre-university programs can in this way be seen in a broader context of focus on talent stimulation and development.

Another reason for the rise of pre-university programs was the shortage of beta students. Around 2000, the share of graduated, higher educated beta students in the Netherlands was low in comparison with countries like France and the United Kingdom (Noailly, Waagmeester, Jacobs, Rensman, & Webbink, 2005). To reach more students, beta education had to become more attractive. A growing number of students chooses for beta education: in the period 2000 – 2007, the number of beta students on the universities increased by 46,3% (Ministerie van OCW, 2009). As of 2007 the share of students choosing for beta education remained more or less the same (Ministerie van OCW, 2014). An important success factor in maintaining a larger in and outflow of students in beta education is the so-called chain approach (Ministerie van OCW, 2009). This chain approach aims to make a better connection between secondary school and higher education, as well as higher education and the labor market. Pre-university programs play a role in the improvement of the connection between secondary schools and higher education. With different activities pre-universities can show what universities have to offer in their (beta technical) studies with the aim to make beta technical education more attractive for future students.

Although pre-university programs are different in many ways, there are two common goals identifiable: talent stimulation and study choice orientation (Murad et al., 2015, p. 6). Providing academic training is a central point in every pre-university program. Most of the pre-universities offer several different activities. U-talent from the University of Utrecht offers for example “U-talent Ambitie”, “U-talent Connectie” and “U-talent Open”. The U-talent Ambitie program is the most intensive program, whereas U-talent Connectie and U-talent Open are more accessible and less

demanding. Developing talent, motivating students for beta education and are goals of these programs.

The Pre-University College of the Eindhoven University of Technology also offers several different programs: "Pre-Studeren", "Collegereeks Energy", "Masterclasses", "VWO-werkweek" and "Activities without selection". Although these programs differ on the basis of content and intensity, the goal at the University of Eindhoven is to advance the transition from secondary school to higher education. At the Radboud Pre-University College from the Radboud University of Nijmegen students can choose from four different programs. Two of these programs ("A Mighty Adventure" and the VWO-talent program) mainly focus on the development of academic knowledge and skills. The masterclasses are predominantly aiming for a clearer study choice.

At the University of Twente, the Sirius Programma consists of different excellence programs in the bachelor and master phase. Besides these programs in the bachelor and master phase there are activities for students who are not yet studying at the university. These activities are provided by the Pre-U of University of Twente. The Pre-U of University of Twente offers among others a honoursprogram, masterclasses, a "Tech Bootcamp", "Meesterproefbegeleiding" and "Profielwerkstuk helpdesk".

To date there has been little research on the effectiveness of pre-university programs (Murad et al., 2015, p. 7). More research is needed. Because there are only a few examples of research in this area there is little known about actual revenues for individual students. It is therefore interesting to know if pre-university enrichment programs contribute to the goals of talent stimulation and study choice orientation. It is also interesting to know if this eventually leads to better study results.

One of the few examples of research in which pre-university programs have been researched is that of Oomen, Tromp and Milius (2014) addressing the pre-university program of the University of Utrecht, "Junior College Utrecht". JCU alumni say that they benefit from JCU during their study on several different points. Students indicate that participation in the JCU helped them in making a good and conscious study choice. Furthermore, they say that they felt at home faster because of the familiarity with the university and contact with employees. According to students, this all has lowered the threshold in the transition from secondary school to the university. JCU alumni furthermore indicate that they have a higher work level and lead on content and competencies caused by participation in the JCU.

Following the evaluation of benefits for individual students of the JCU, it seems that these initiatives help students in the transition from secondary school to university. Because there is more and more attention for talent stimulation, it is interesting to know if and how individual students can benefit from participation in pre-university programs. In this study the Pre-U of University of Twente will be taken as a case to identify the effects of participation in pre-university activities on talent stimulation, study choice orientation and study success.

1.2 Problem definition

As stated in the introduction little is known about actual revenues of participation in pre-university activities for individual students. It is interesting to explore whether pre-universities generate the expected effects. There are potentially four actors identifiable who could be interested in a study on the effects of participation in pre-university activities: the government, universities, secondary schools and students themselves. Below there will be a “stakeholder analysis” to describe why, and in what way, these stakeholders have an interest in effectiveness research.

Government

The government annually invests thirty million Euros to stimulate the excellence of primary- and secondary school pupils. According to the ‘strategische agenda hoger onderwijs’ and the ‘kamerbrief plan van aanpak toptalenten’, the government values the goals of study orientation and talent stimulation. These are both goals that can be identified as common for the pre-university programs.

A better connection between secondary- and higher-education to favor study success for students in further education, such as universities, is mentioned: “the most important profit for individual students can be achieved in closer cooperation in the regions, between supplying school and the higher education institutions” (Ministerie van OCW, 2015). Examples of such cooperation are the pre-university programs.

The strategic agenda of the government also pays attention to drop-out: “provide chances for every student in higher education and get them on the right place” (Ministerie van OCW, 2015). One of the goals of pre-university programs is to provide opportunities for pupils to better orientate themselves on future education. A well-informed study choice is something that might contribute to the government’s wish to reduce drop-out rates. Research provides evidence for the fact that a proper study orientation contributes to a proper study choice and therefore a reduction of drop-out rates (Lowis & Castley, 2008; Meeuwisse, Severiens, & Born, 2010; Goovaerts, 2012).

For the government it is interesting to know if pre-university enrichment programs actually contribute to the goals of talent stimulation and study choice orientations. At the moment about ten percent of the budget for pre-university programs comes from the government. Formulated in a different way, it is useful to know if it is worth it for the government to invest in these programs.

Universities

Also the universities should be interested in this kind of research. At this moment the programs are for the biggest part funded by the universities themselves. Because universities invest in these programs, they are interested to know whether pre-university programs contribute to the goals of a better study orientation and academic training.

It is in the interest of every University that future students make proper choices and can start their higher education life well prepared. This could eventually lead to better study results, which is of course welcome since universities want to increase their efficiency to the extent possible.

Besides the wish for efficiency there is also a wish for students with good grades. This seems to be a dilemma; good grades (quality) versus efficiency. Pre-university programs aim to stimulate talent and may also have a positive effect on study results. In this way pre-university programs can maybe help to fulfill both the wish of efficiency and good grades. A positive influence on study success and study choice can help to increase efficiency. The stimulation of talent could possibly result in better grades. For this reason Universities have a stake in knowing if, and in what way, participation in these programs actually leads to better study results and good grades. This information can be used to make future decisions about investments in, and the structuring of, these programs.

Secondary schools

Information about the effectiveness of pre-university programs is also interesting for secondary school organizations because they are the suppliers of students that enroll these programs. The Netherlands aims to be in the top five global knowledge economies. In order to be competitive at this level it is necessary to invest in education (Platform Beta Techniek, 2013). International comparisons show that Dutch education is relatively successful in getting the best out of weaker students. At the same time these comparisons show that the best performing students do not reach the level that is achieved in comparable countries (Platform Beta Techniek, 2013).

Pre-university programs could help to increase the level of performance of best performing students. Collaboration with universities in the form of pre-university programs is something that could contribute to the wish to get more out of the best performing students. Furthermore the quality of education can be improved by collaborating with universities. By collaborating with universities schools can express themselves and distinguish from other schools that do not collaborate. For secondary schools it is therefore worth to know whether their students actually, and if so why, benefit from participation.

Students

Secondary school students are those who attend the activities of pre-university programs. They spend a certain amount of time, probably with all kinds of different motivations. Individual students could be participating because they want to know more about a specific discipline, because they want to be introduced to a certain university or the academic world in general, or because they just like to challenge themselves. Whatever motivation an individual has to participate, for future students it is interesting to know more about the way in which the programs work and in what way they could benefit from participating in them.

1.3 Research questions

Talent stimulation and study orientation are two goals that can be identified as common in the different pre-university programs (Murad et al., 2015, p. 6). Talent stimulation by developing academic competencies and a proper study orientation could theoretically lead to better study results. Because there has been little research it is interesting to investigate if participation in a pre-university program indeed leads to better study results. Furthermore, it is important to know which factors in the pre-university programs contribute to eventual better study results.

Main question:

“Does participation in a pre-university program lead to more study success and, if so, how can this be explained?”

Sub questions:

1. *“How can study success be defined?”*

In order to identify the effect of participation in a pre-university program on study success, it is needed to know what exactly study success is and how to measure this. By looking in the existing literature different approaches will be discussed and compared.

2. *“What factors indicated in the literature generally explain study success?”*

The main question aims to describe a relationship between participation in a pre-university program and study success. To investigate this relation it is inevitable to gain a better understanding of study success. We want to identify the factors that explain and influence study success. This information will be used to select the factors that are possibly addressed by pre-university programs.

3. *“Which factors in the pre-university programs contribute in practice to more study success?”*

The third sub question is formulated to give an explanation for the effect of participation on study results by identifying the factors that have or have not contributed to better study results. In this way more insight is gained about the way in which students can benefit from pre-university experiences.

2. Theory

Participation in pre-university activities might influence study success. Besides such participation prior to university enrollment, there are many other factors that are likely to influence study success. To gain a proper and complete understanding of study success, it is important to know which factors generally explain or predict study success.

2.1 Study success

Study success is the dependent variable in this research and, as a concept itself, can be approached in different ways. "Study success has a number of different meanings ranging from the completion of a study program/qualification to the successful placement of graduates in the labor market, in 'graduate' jobs" (Vossensteyn, 2015). Although different meanings are used, a common feature in different countries across Europe is the successful completion of a study program. In some countries additional aspects are used to set the meaning of study success; completion in a specific time period is sometimes seen as important, but also completion with good grades is mentioned (Vossensteyn, 2015).

Veenman and Verheij (2003) use individual study credits and mean exam grades as measures of study success. Academic progress is also used as a measure of study success (Lindblom-Ylänne & Lonka, 1998). The authors score academic progress on the basis of grades. Past research of Jansen and Bruinsma (2005) defines study success as the average grade after year one. In this study the researchers have investigated the impact of secondary school grades, study behavior and students' perception about their learning environment on study success. Other research (van der Wende, 2011) describes study success in terms of study progress, study achievements and the time in which students graduate.

As shown above, in most studies concerned with study progress, study success is operationalized with quantitative variables like 'the number of earned study credits' or 'mean exam grades'. Also dichotomous variables like 'drop-out' or 'successful completion of first year' are used (Bruinsma & Jansen, 2009).

In contrast to this, van der Heijden, Hessen and Wubbels (2012) have designed study success as an ordinal variable. Categories they use are: stopping study within one year, stopping study later than in the first year or long-term studying, graduating in the third year, and graduating in the fourth year. The researchers noted that a part of these categories describe a lack of study success, rather than study success itself. Another ordinal measure of study success is used by Annema and Ooijevaar (2011) who use the categories of graduating in four years, graduating in five to eight years and not yet graduated.

Considering the overview above, study success is operationalized and measured in different ways. These different ways can roughly be grouped under studies in where a quantitative measurement is used, and studies in where an ordinal measurement is used.

2.2 Factors explaining study success

A working paper, "Drop-out and completion in higher education in Europe" (Vossensteyn, 2015), will be taken as a starting point to identify factors that may predict or influence study success. This will be expanded with other literature sources to give more depth to the overview.

A wide range of different factors influencing study success, either positively or negatively, are identified in this report. It is argued that factors can be identified at different levels: the individual level, the institutional level and the higher education system level. Furthermore, the labor market

may also be of influence on study success (Vossensteyn, 2015). These different levels will be taken as blocks to structure and categorize the different factors.

The report takes the European Union as a whole and describes differences between several European countries regarding their national higher education system. Our research focuses on pre-university activities in one higher education system - the Netherlands. It is therefore not necessary to describe the influence of different higher education systems on study success; no differences in study success can occur as a result of different national higher education systems. Thus, the higher education system level as a potential impact factor on study success will not be discussed in our research.

2.2.1 Individual level

The individual level is interesting because at the individual level students may differ much. These individual differences may partly explain differences in study success. As mentioned by Vossensteyn (2015), student characteristics and their impact on study success is an important element in research regarding study success. These individual level factors are: socio-economic background, gender, ethnic origin, cognitive competencies and motivational disposition, and the student's educational pathway.

Socio-economic background

Socio-economic background is seen as the most important factor influencing study success (Vossensteyn, 2015). Most studies done towards study success indicate that the socio-economic background of students is a very important factor in completing a study program (Quinn, 2013). Sirin (2005) has done a meta-analysis reviewing literature on socioeconomic status (SES) and academic achievement. This meta-analysis includes a sample of 101,157 students from 74 independent samples. He concludes that on the individual level SES has one of the strongest correlations with academic achievement. The socio-economic status of students can affect study success in different ways.

Following Georg (2009), socio-economic status is related to the availability of financial resources while studying, the availability of symbolic resources to integrate in the academic community, and students' academic attainment before entering higher education. Sirin (2005) mentions the same issues related to students' SES. Because of the lack of these resources, students from lower socio-economic backgrounds are less likely to complete their study programs compared to those from a higher socio-economic background (Vossensteyn, 2015). Furthermore, several studies show evidence that students with a lower socio-economic status have to interrupt their studies more often because their financial resources may not be sufficient enough to continue their studies; students have to engage in paid jobs more often and have therefore less time to concentrate on their studies (Heublein, Spangenberg, & Sommer, 2003). Another way in which socio-economic status affects study success is in terms of students' access to social and cultural capital (Vossensteyn, 2015). Students who are raised in families in which parents have also completed higher education have more resources in terms of social and cultural capital compared to their counterparts from lower social-economic backgrounds. An additional problem for students with a lower socio-economic background lies in the fact that they also lack support of their family and external motivation to complete their studies (Vossensteyn, 2015).

Socio-economic status as a concept is the subject of an ongoing dispute about its conceptual meaning and empirical measurement method (Borstein & Bradley, 2003). Sirin (2005) mentions that although there is disagreement about the conceptual meaning, there is agreement on the tripartite definition (Duncan, Featherman, & Duncan, 1972) of SES. This definition takes parental income,

parental education, and parental occupation as most important indicators of SES. Sirin (2005) mentions that these components are unique. He states that each one measures a different aspect of SES.

Of these factors, "parental education is considered as one of the most stable aspects of SES" (Sirin, 2005, p.419). It is seen as stable because it is established at an early age and likely to remain the same. Furthermore, parental education is highly correlated with income (Hauser & Warren, 1997) and therefore also partly covers the component of parental income. Research in were associations between five different indicators of socioeconomic status and three reproductive outcomes are compared, shows that the level of parental education is the best predictor of socioeconomic status (Parker, Schoendorf, & Kiely, 1994).

Gender

Besides socio-economic status, gender also influences study success. Vossensteyn (2015) states that female students perform much better than male students in terms of number and performance; "different scientific studies have shown that gender is an important determinant of study success" (Vossensteyn, 2015, p. 21). It appears to be that females are more successful in terms of completing their higher education degrees in comparison to males. Besides completing a program, they are less likely to switch study programs. A meta-analysis consisting of 369 samples has shown that gender differences favor females in all fields of study (Voyer & Voyer, 2014). The authors add that the effect sizes were small, but consistent enough to draw conclusions. It should be added that, even though gender differences exist, there is no clear and total causal relationship between gender and study success. Interacting and underlying variables take account for the relationship; gender interacts with other characteristics of individual students like socio-economic status or coming from an ethnic minority (Reason, 2009). In study fields where one gender is a minority, students from this gender minority group are more likely to drop-out (Severiens & Dam, 2012).

Ethnic origin

There has already been touched upon ethnic origin as an interacting or underlying variable for gender in relation to study success. Ethnic origin is a determinant of study success and strongly interacts with other individual students' characteristics like socio-economic background and gender. Also in the Netherlands students from ethnic minorities drop-out more frequently, which among other things can also be explained by a lack of financial and cultural resources, as well as a less well-informed study choice (Meeuwisse, Severiens, & Born, 2010). In the Netherlands, the fact that students from ethnic minorities are performing less well is not per se a consequence of ethnic origin itself, but more a consequence of individual characteristics of students from these ethnic minorities (Vossensteyn, 2015).

Cognitive competencies

On the individual level also cognitive competencies and motivational disposition of students can be mentioned as determinants of study success. This is also called "preparedness of the student for higher education" (Vossensteyn, 2015). Different predictors of cognitive competencies are used in the literature. These are for instance: the final school grade or competencies like diligence, motivation and capacity to concentrate (Vossensteyn, 2015). Generally students with low achievements in high school have a bigger chance to drop out in higher education, something which is confirmed in several studies conducted in Germany, the United Kingdom and Spain (Lassibille & Navarro Gómez, 2008; Heublein, Spangenberg, & Sommer, 2003). The level of pre-university competencies is thus an important determinant of study success. This is of course interesting in the case of pre-university enrichment programs; the topic of our research. One of the main goals of these pre-university enrichment programs is to develop academic competencies. Following literature

and theories that show a relation between cognitive competencies and study success, it might be that participation in a pre-university program is positively related to study success.

Motivational disposition

Besides pure cognitive competencies or readiness, other aspects on the individual level play a role; these can be grouped under the title 'motivational disposition of student'. These aspects are self-motivation, self-esteem and self-efficacy. These aspects are negatively related to drop-out; students who lack self-motivation, self-esteem and self-efficacy are more likely to drop-out than those who do not lack these aspects. This is validated by Mäkinen, Olkinuora and Lonka (2004), who found evidence for the suggestion that "students who were committed to the content of the study program, its academic culture, the more instrumental aspects of their study program and/or their career interests, were more likely to complete their study program than students who only had low commitment to the program or career interests" (Vossensteyn, 2015, p. 23). Commitment to the content of the study program is perhaps a result of a good and proper study choice. A good and proper study choice is related to a good study orientation. Study orientation is a main goal of pre-university programs. Participation in such a program could therefore maybe lead to a better study choice and ultimately to better study results. This expectation is also stated in the report: "a number of studies as discussed above revealed that having the right information and realistic expectations about the study program is crucial to the probability of completing the program successfully" (Vossensteyn, 2015, p. 23).

Educational pathway

The last individual factor affecting drop-out is the student's educational pathway (Vossensteyn, 2015). Shortly summarized this has to do with the fact that students who had a straightforward trajectory, in which everything went smooth, have a bigger chance to be successful during their university career.

2.2.2 Labor market level

The labor market can also be linked to study success. There are several factors that have to do with the (state of the) labor market which may influence study success.

Labor market situation

The situation of the labor market may influence completion and drop-out rates (Vossensteyn, 2015). When the labor market situation in a certain country is not good and young people are unable to get a good job this may be an incentive to start in higher education, even though they are not motivated. "Parking lot students" is the term that is used by Becker (2001) for students that only use higher education as a bridge to overcome the time in which they are not employed. This term is used because students who choose to start a higher education degree because of poor labor market perspectives are likely to drop-out when they are offered a job. In this way the labor market situation can influence drop-out rates and study success.

Working while studying

Besides these so-called parking lot students, also working while studying is a labor market related factor that possibly influences study success. Engaging in paid work is a threat to completion because this can negatively influence engagement in studies and therefore study success (Vossensteyn, 2005; Cremonini, Epping, Laudel, & Leisyte, Vossensteyn, 2013). The relation between engagement in paid work and study success is dependent on the amount of hours worked. In short, some paid work is not directly related to drop-out, delay or completion; it only becomes problematic when too much work needs to be done, leaving not enough time for studying.

2.2.3 Institutional level

Factors influencing study success at the institutional level consist of structural as well as procedural aspects (Vossensteyn, 2015). Several different institutional issues that contribute to study success are: institutional commitment and strategy, social integration and student support services, matching of students and programs, clear expectations about study program, clear expectations about learning, teaching and assessment, and monitoring and tracking students.

Social integration and student support services

At the institutional level social integration and student support services are identified as influencers of study success. "Creating a culture of belonging and higher education institutional commitment to students is at the heart of successful retention and success in higher education for all students" (Vossensteyn, 2015, p. 16).

Study success is related to the concept of student retention. Undergraduate retention is the ability of an institution of higher education to retain a student from admission until graduation (Berger & Lyon, 2005). Tinto (1975) published a model about student integration. This model argues that students who socially and academically integrate into the campus community increase their commitment to the institution and are more likely to graduate.

Tinto (1975) argues that a lack of integration in the social system of college will lead to low commitment to that social system. This will, eventually, increase the probability that students leave college. Vossensteyn (2015) argues that interaction with academics and peers provides chances to internalize academic and social values and to integrate into the social communities of the higher education institution. Social integration of students with peers has a positive influence on study success, according to Thomas (2012).

Vossensteyn (2015) states that belonging refers to the students' identification and integration with their higher education institution. Furthermore, "belonging relates to the extent students demonstrate a fit with the program they study" (Vossensteyn, 2015, p. 65). Formulated in another way, "belonging recognizes students' subjective feelings of relatedness to the institution" (Vallerand, 1997).

Osterman (2000) mentions that belonging as a concept has been defined in different ways. These variety of ways in which belonging is defined include relatedness, sense of community, and sense of school membership. The ways in which sense of belonging is measured are also various, including a general sense that one belongs at school, whether the student has a place within a network of peer relationships, and whether the student has bonded with teachers (Nichols, 2006; Faircloth & Hamm, 2005).

A sense of belonging can be created through motivation, academic integration, social integration or the homogeneity of a group. It has been argued that students who are very motivated have a bigger chance to be successful. This motivation can be either intrinsic or extrinsic of nature.

In the literature, sense of belonging is often seen as the result of social and academic integration, instead of being measured and specified as an independent construct (Hausmann, Scholfield, & Woods, 2007). Because sense of belonging is often seen as the result of social and academic integration, we will now look into the concepts of social and academic integration more carefully.

Tinto's model on student attrition (1975) holds that the quality of students' learning as well as their success or failure depends, among other things, on their integration in the community of education.

This is supported by the following statement: “the quality of students’ learning processes, which in turn determines their persistence, is determined by the way in which students interact with staff and teachers, and also by their social interaction with peers” (Severiens & Wolff, 2008, p. 253).

Severiens and Wolff (2008) make a distinction between formal and informal integration. Both formal and informal integration are, according to the authors, important for successful integration. In case of academic integration, formal integration consists of contacts between students and teachers related to the institution itself. On the other hand, informal academic integration means contacts between students and teachers outside the educational environment. In other words: the extents to which students and teachers consider themselves as socially equal (Severiens & Wolff, 2008).

At the level of social integration there is the same distinction between formal and informal integration. Formal integration mainly involves contacts between fellow students on learning matters; one could think of collaborative work in group settings for example. Informal integration is characterized by the frequency of social contacts with fellow students and participation in student activities. “Students who have many friends at university, feel at home and enjoy going to the university have a greater chance of obtaining their degree” (Severiens & Wolff, 2008, p. 254)

Also Osterman (2000) mentions student-teacher relations, peer relations, and involvement in school activities as dimensions of belonging. Student-teacher relations can be compared with academic integration and peer relations with social integration as mentioned by Hausmann, Scholfield and Woods (2007).

The second factor identifiable at the institutional level, student support services, also has an effect on study success (Thomas, 2012). These student support services are formed by different activities. Among these activities is pre-entry preparation. Pre-university programs can be seen as pre-entry preparation because this program is prior to the actual academic study.

Matching students and programs

An interesting issue that is mentioned under the header higher education institution is matching of student and programs. Vossensteyn (2015) mentions research from Austria (Unger M. , et al., 2009), Flanders (Goovaerts, 2012), Germany (Heublein, Schemlzer, & Sommer, 2008), the Netherlands (Meeuwisse, Severiens, & Born, 2010), Switzerland (Wolter, Diem, & Messer, 2013) and the United Kingdom (Lowis & Castley, 2008) which point out the importance of decision making and study choice; this is important for the reduction of incorrect choices and for a better match between students and study program. On the basis of the model presented by Tinto (1993), it is expected that a ‘good’ study choice reduces the chance of drop-out. Other research shows a direct relation between study choice and drop-out (Lacante, et al., 2001).

An important factor in making a proper study choice is the extent to which sufficient information is available for future students. This contributes to a situation in where students make the right choices, something which in turn reduces the chances of wasting resources and limits drop-out (Jongbloed, Kaiser, Salerno, & de Weert, 2004, p. 5).

Besides just the study choice per se, also clear expectations play an important role. Wrong expectations are mentioned as one of eighteen factors related to quitting before graduation (Unger M. , et al., 2009). In the same report is stated that “expectations not met” is the main reason for dropping out, which is mentioned by 15.2% of the students.

There are several other institution-related factors, but since they are not of high importance for our study, we will leave them aside. As we will explain later, our study will focus on pre-university

students from one university; most institutional level factors do therefore not apply for our research purposes.

2.3 Conclusion on the literature overview

The literature overview started with an exposition of different ways of defining and operationalizing of the concept study success. This information will be used in chapter 3 to define and operationalize study success.

Several factors are identified which possibly have an effect on study success or drop-out. Following the categorization of Vossensteyn (2015) these factors can be grouped under three headings, namely: individual, institutional, higher education system, and labor market.

Most of the factors influencing study success can be mentioned on the individual level. Socio-economic status, gender, ethnic origin, cognitive competencies, motivational disposition of the student, and the student's educational pathway are identified as factors that influence study success. Of all these factors on the individual level gender, socio-economic status and cognitive competencies show the strongest correlation with study success.

On the institutional level the match between students and study programs is important for our research purpose. Besides matching students and programs also social integration and sense of belonging are mentioned as influencers of study success. All the other factors on this level are of less importance because we will focus on the effects of pre-university activities from one higher education institution (see also the next chapter).

All the students that will be taken as research objects fall under the same higher education system in the Netherlands. This category of factors influencing study success does therefore not needed to be taken into account as no differences in study success might be explainable by different higher education systems.

2.4 Conceptual model

The aim of this study is to research the relationship between participation in pre-university activities and study success. The literature overview will be used as a guide to construct a conceptual model in which the expected relationships between participation and study success will be presented. In this conceptual model the factors that are expected to be addressed by pre-university programs and may positively influence study success will also be taken up.

2.4.1 Intermediary variables

To understand why participation in pre-university activities might be positively influencing study success, factors that positively influence study success and might also be addressed by pre-university programs must be identified.

Common goals that can be mentioned for pre-university programs are (Murad et al., 2015):

- Talent stimulation
- Orientation on academic studies, in particular on (certain) study programs at the own university
- Providing academic development
- Improvement of the connection between secondary school and academic education
- Let students get acquainted with a specific university

The above listed goals will one by one be discussed and connected to study success theories from the literature overview.

Talent stimulation could be related to the study success factor cognitive or academic competencies, described in the literature. Talent stimulation might help to develop academic competencies, in the literature described as cognitive competencies or preparedness of the student for higher education (Vossensteyn, 2015). By stimulating talent before a student starts his study career at the university, he might be a step ahead in terms of academic competencies. This because they might already develop some academic competencies that are useful at the university. Students who have not participated in pre-university activities might not have developed these competencies already.

Orientation on academic studies, in particular on (certain) study programs at the own university could possibly help to match students and programs. When a student has a proper orientation, the match between students and programs might be better because it offers student a better sight on what their proposed future study contains. The importance of decision making and study choice in relation to study success is mentioned by many different authors (Unger M. , Wroblewski, Latcheva, Zaussinger, Hofman, & Musik, 2009; Goovaerts, 2012; Heublein, Spangenberg, & Sommer, 2003; Meeuwisse, Severiens, & Born, 2010; Wolter, Diem, & Messer, 2013; Lowis & Castley, 2008).

An important part of making a good and proper study choice has to do with the availability of sufficient information (Jongbloed, Kaiser, Salerno, & de Weert, 2004, p. 5). Pre-university activities might help in providing this information. Another aspect of making a good study choice is whether students have the right expectations about the future study program they have in mind (Unger M. , et al., 2009). Pre-university activities offer students possibilities to experience what the daily practice of different study programs or directions is. In this way their expectations may become more clear.

Let students get acquainted with a specific university could be connected to social integration or the creation of a culture of belonging as mentioned by Tinto (1975). By letting students get acquainted with a university, they might feel at home faster. Tinto (1975) and Thomas (2012) argue that when a student is socially integrated in the system of higher education, this increases the commitment to that same system of higher education. This, in turn, increases the chance that a student graduates.

Past research done at the Junior College Utrecht, the pre-university program of the Utrecht University, shows that students who participated in this program felt at home more quickly (Oomen, Tromp, & Milius, 2014). This is mentioned as a possible explanation for the degree of study success among students who attended this program. These findings raise the suspicion that participation in pre-university programs may have a positive effect on social integration and a feeling of belonging. This might positively influence study success.

It could be argued that the goal of *providing academic development* might be also related to the development of academic competencies. Highlighting current topics of the academic world and teaching research skills to future students might contribute to the preparedness of the student for higher education; because students who participated in pre-university activities might in this way already have some knowledge about topics that will be discussed during college. Pre-university students might furthermore have an advantage by already developed research skills that can be used in courses at the university.

The last mentioned goal, *improvement of the connection between secondary school and academic education*, might help making the transition from secondary school to university easier. A better connection between secondary school and academic education could positively influence the integration of a student into the world of higher education because the adjustment to the new environment might be easier.

By reviewing the goals that can be seen as common for the different pre-university programs it is expected that participation in a pre-university program could influence the degree of study success by providing a better study choice, creating a sense of belonging and the development of academic competencies. By including these factors in the causal model there will be tested whether these factors are really addressed by the program and if they influence the degree of study success. These variables can be identified as intermediary variables.

The factors influencing study success on the labor market level will not be used in the conceptual model. The influence of factors like the "labor market situation" and "working while studying" is likely to be the same among students who have participated and students who have not participated.

2.4.2 Control variables

The literature review shows that there are many factors that predict study success. It is likely that also other factors, besides participation in a pre-university program, influence study success. On the individual level students may differ much; individual characteristics are mentioned as possible explanations for differences in the degree of study success.

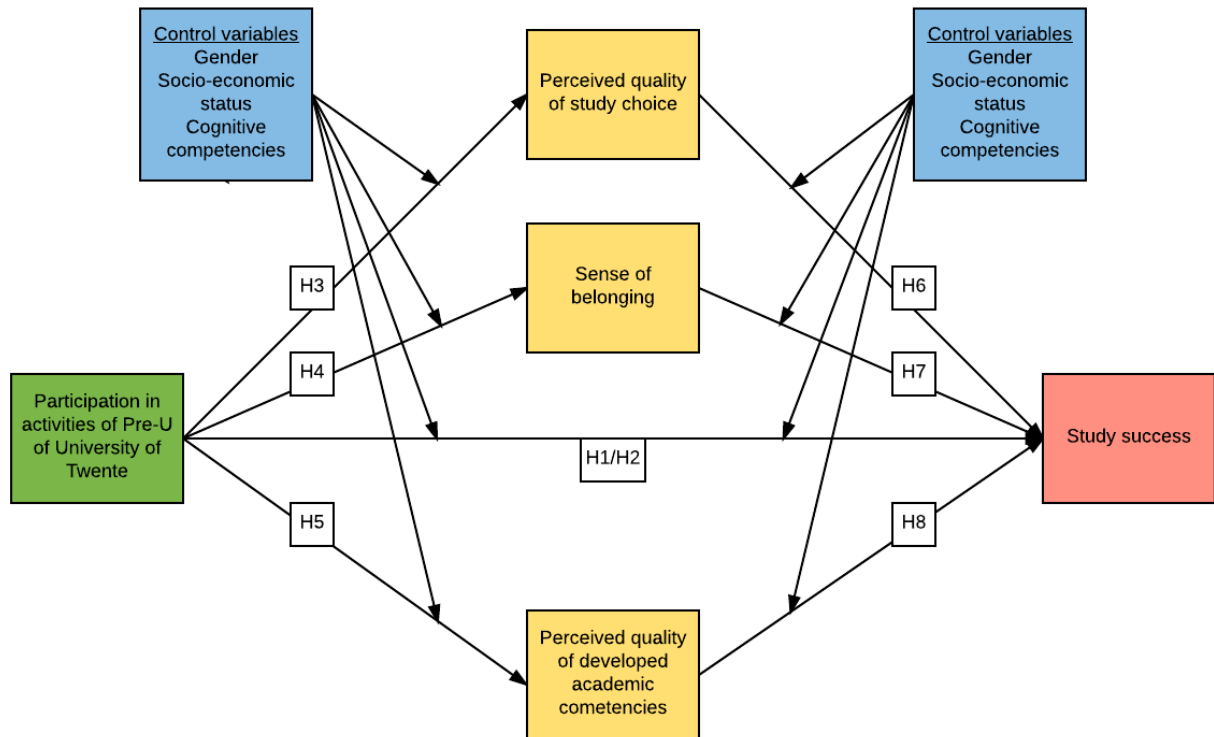
The most important predictors of study success on the individual level are gender, socio-economic status and cognitive competencies. These three variables will be taken as control variables in the conceptual model.

It is possible that these variables have an influence on other relationships in the causal model. For example, maybe there is a significant relation between participation and the perceived developed academic competencies for female students while this relation does not exist for male students.

Furthermore, perhaps there exists relationship between sense of belonging and study success specifically for students with a low socio-economic status. The selected control variables may have their influence on relationships in the causal model in different places.

The conceptual model in fig.1 visualizes the relation between the different variables. On the left side of the model is the independent variable of participation in a pre-university program. Study success, on the right side of the model, is the dependent variable.

Fig.1: Conceptual model



2.5 Hypotheses

The conceptual model presented above shows the expected relationship between participation in activities of Pre-U of University of Twente and study success. By using this model, eight different hypotheses regarding participation in pre-university programs and the dependent variable(s) formulated. These hypotheses are visible in the conceptual model.

Participation and study success

Hypothesis 1: Number of study credits

H1: Students who participated in pre-university activities have more study success in the form of a higher number of study credits than students who did not participate in such activities

Hypothesis 2: Average grade year 1

H2: Students who participated in pre-university activities have more study success in the form of higher average grades in year 1 than student who did not participate in such activities

Hypothesis 3: Participation and perceived quality of study choice

H3: Students who participated in pre-university activities have a higher perceived quality of study choice than students who did not participate in such activities

Hypothesis 4: Participation and sense of belonging

H4: Students who participated pre-university activities have a greater sense of belonging than students who did not participate in such activities

Hypothesis 5: Participation and perceived quality of academic competencies

H5: Students who participated in pre-university activities have a higher perceived quality of academic competencies than students who did not participate

Besides the relationships on the left side of the model regarding participation in pre-university activities and study success, quality of study choice, sense of belonging and quality of developed academic competencies, it is also interesting to see how these intermediary variables relate to study success regardless whether a student has or has not participated in pre-university activities. Therefore three hypotheses regarding the right side of the conceptual model are formulated.

Hypothesis 6: Perceived quality of study choice and study success

H6: Students with a higher perceived quality of study choice have more study success than students with a lower perceived quality of study success

Hypothesis 7: Sense of belonging and study success

H7: Students with a greater sense of belonging have more study success than students with a lower sense of belonging

Hypothesis 8: Perceived quality of academic competencies and study success

H8: Students with a higher perceived quality of academic competencies have more study success than students with a lower perceived quality of academic competencies

3. Research design and methodology

3.1 Case selection

This study aims to identify the effects of participation in pre-university activities on study success. To examine this relationship, the case of Pre-U of University of Twente (Pre-U from now on) will be used. Due to time constraints it was not possible to include other pre-university programs. Because not all the pre-university programs have exactly the same characteristics, it is important to keep in mind that the possibilities for generalization will be limited.

3.2 Case description

The Pre-U provides future students the opportunity to intensively meet with the University of Twente (Pre-U, 2016). In an interactive way of introducing them to academic education, students get the opportunity to discover their talents in the fields of science, technology and society. It is expected that they herewith can successfully prepare themselves on their future studies. This preparation is particularly focused on studies at the University of Twente (Pre-U, 2016). A couple of goals are formulated:

- Talent stimulation and orientation in a specific discipline
- Getting students acquainted with the University of Twente
- Introducing students to the academic world by highlighting current topics and teaching them research skills
- Improvement of the connection between secondary school and academic education

The “mission and vision” of Pre-U states that, in cooperation with the University of Twente, it strives for optimal knowledge- and talent-development. The goal of the Pre-U is to introduce students to academic education at an early age. During the projects and activities of the Pre-U, students get the chance to develop their talents and to have an introduction to academic education.

3.2.1 Different programs of the Pre-U

The Pre-U provides a range of different activities. These activities can be grouped under programs for primary schools and children, activities for 1 – 6th grade VWO students and inspiration and teaching materials for teachers and schools.

This research focuses on the effects of participation in pre-university activities on study success in the first year at the university. It furthermore aims to investigate whether participation in pre-university activities has positive effects on quality of study choice, sense of belonging and academic competencies. These variables relate to the first year at the university and the period in which students make the transition from secondary school to the university.

Because of this reason our focus is on activities for secondary school students. More specified, the focus will be on activities for students in the higher grades. This because these students are specifically concerned with making a study choice and the transition from secondary school to university.

As a consequence, the programs for primary school children and teachers will not be taken into account. Because they are not relevant for the purpose of our research they will not be discussed here.

Honors trajectory

Starting from school year 2016-2017 an honors trajectory for 5th and 6th grade VWO students is added to the program. This new honors trajectory has started this academic year. It is therefore not yet possible to include this program in our research. The honors trajectory will therefore be left aside in our research.

Masterclasses

The masterclasses are academic education programs for VWO-students. During the masterclasses students learn more about a self-chosen discipline. There are masterclasses for 2/3 VWO, 4 VWO and 5/6 VWO students.

2/3 VWO

The masterclasses for students in the 2nd and 3rd grade of VWO provide extra challenge and can help in making the profile choice these students have to make in the 3rd class. During this profile choice, students have to select a special track (society or science) for the last three years of upper secondary school.

4 VWO

The masterclasses for students in the 4th class VWO aim to help by making their “profielwerkstuk” (from now on “profile assignment”). Students can for instance use the subject of the relevant masterclass for their profile assignment. This profile assignment is a final assignment students have to do during secondary school. In this special assignment laid down in a paper, they show their learned skills in a self-chosen project relevant for the special track they have chosen in the 3rd grade.

5/6 VWO

The masterclasses for the 5th and 6th class VWO students are providing extra challenge. Students will be introduced to education that is provided at the University of Twente by means of lectures, practicums, project work and self-study. The masterclasses for 5th and 6th class VWO students have a clear link with bachelor education at the University of Twente. In this way these masterclasses can help students by making their study choice.

“Profielwerkstuk helpdesk”

The “profielwerkstuk helpdesk” is another activity or service provided by the Pre-U of University of Twente. The Pre-U offers help for secondary school pupils in making their profile assignment. This help is offered in different ways.

Firstly, for some subjects the facilities at secondary schools are too limited. Pupils who cannot find the right facilities at their own secondary school, can ask for help at the University.

Besides this, the pre-U provides a database with ideas and subjects. Every idea contains suggestions for research questions, references to concepts and a global explanation of the particular topic.

Secondary school pupils can contact the Pre-U to ask questions regarding their profile assignment. Help is offered in different forms. The Pre-U helps with experiments and provides assistance in searching for literature. Furthermore, pupils can be brought into contact with an expert of the university.

“Meesterproefbegeleiding”

The technasium is a nationwide developed program regarding beta-education for HAVO and VWO pupils. Pupils who choose for the technasium attend the course “research and design (onderzoek & ontwerpen)” next to their regular curriculum. A central issue in this beta-education course is working on technical assignments in a team on project basis. Through an early introduction in different

professions, subjects and issues in the beta technical world, they are being equipped to make a conscious choice and plan a future career in this sector.

In the final year, pupils do not have to take a final exam for the course research and design, but have to perform a so-called "meesterproef" (master test). Pupils are mentored by an expert from the university in doing this master test. The Pre-University of University of Twente plays a role in guiding pupils who chose to do the technasium. The Pre-U arranges the mentors who will advise and supervise the pupils. Contact with this mentor takes place at the University of Twente.

"Tech boot camp"

The tech boot camp is another activity provided by the Pre-U of University of Twente. This boot camp is meant for girls in the 4th, 5th and 6th class of VWO. During a two day camp they are introduced in the technical world and the possibilities of technical education. Next to excursions to technical companies and organizations, they participate in activities like workshops at the campus. In this way, these future students are introduced to technical education and the campus of the University of Twente.

Because the Pre-U offers different sorts of activities, it is reasonable to think that the effects of participation depends on the characteristics of the particular program. The programs differ on the basis of content and intensity. The least intensive activity offered is the profile assignment helpdesk in where students can ask questions about the profile assignment they have to make in the final stage of secondary school. Sometimes these questions are asked via mail and sometimes there is "real life" contact at the university. When the help stays with only answering a question via e-mail, the effect on for instance sense of belonging is probably less than when students actually physically went to the University for Help.

In case of the other activities students always actually visit the University for at least one time, but usually more often. This means that the intensity is higher and therefore the effects of participation on study success (or one of the other variables from our conceptual model) are supposed to be higher.

3.3 Research design

The research design used in this study has a couple of characteristics of a classical experiment. A classical experiment usually consists of three components. These components are: (1) independent and dependent variable(s), (2) pretesting and post testing, and (3) experimental and control groups (Babbie, 2010).

First of all, independent and dependent variables are used. The independent variable is participation in pre-university activities, study success is the dependent variable.

The component of the classic experimental design that will not be used is pretesting and post testing. Pretesting does not take place because study results at the end of the first year will be used. This moment only occurs once for every student. As a consequence of this, pretesting is not possible and also not needed.

The third component of a classical experimental design, experimental and control groups, will be used. An experimental group consists of individuals to whom a stimulus has been administered (Babbie, 2010, p. 233). In case of this research the stimulus is participation in activities from the Pre-U. This stimulus is not really "administered" in the pure essence of the word but these students

chose to participate in these activities. This makes no difference for the fact that this group of students differs from other students in the fact that they had the treatment “participation pre-university activities”.

Students who have not participated will be taken as a control group. Due to natural group characteristics, the respondents were not strictly random assigned to both groups. When random assignment is not possible, the design can be mentioned as quasi-experimental (Babbie & Rubin, 2008). Because non-random assignment of the groups is the case in our research, and pre- and post-testing is not used, the design is quasi-experimental instead of classical experimental.

The research design can furthermore be identified as quantitative. “The distinction between quantitative and qualitative data in social research is essentially the distinction between numerical and nonnumerical data” (Babbie, 2010, p. 23). According to Babbie (2010, p. 394), qualitative research is “the non-numerical examination and interpretation of observations, for the purpose of discovering underlying meanings and patterns of relationships”. Quantitative research is “an enquiry into a social or human problem, based on testing a theory composed of variables, measured with numbers, and analyzed with statistical procedures” (Babbie, 2010, p. 394). Because the survey questions need to be answered on a numerical scale, the data is quantitative. There will also be looked into data in the form of study success figures. This data about study success is also pure numerical and therefore quantitative data.

3.4 Units of analysis

The unit of analysis is “the what or whom being studied” (Babbie, 2010, p. 98). The units of analysis in this research are students of the University of Twente. Both students that have and have not attended a pre-university program are units of analysis. As will be argued in the next sub section, this group will only consist of students that have the Dutch nationality.

Experimental group

The experimental group consists of students who have participated in pre-university activities. To know the study success of this group, data about their study results will be needed. This information could not be obtained directly through the university and therefore students will be asked to provide these data. Via the pre-U of University of Twente the names of these students are available. During the search process for students it became clear that there is no contact information available in the form of addresses, phone numbers or e-mail addresses.

At first this seemed to be a problem but with some creativity a solution was found. Because the research focuses on students who are engaged at the University of Twente there was a demand to know which of the pre-university students continued their studies at the University of Twente. By checking every name of the available name list in the email database of the University the Pre-U students who are enrolled at the University of Twente have been filtered out.

Because this study aims to investigate the relationship between participation in pre-university activities and study success at the end of year one, only students who participated in activities in year 2014 – 2015 or earlier should be questioned. This because this group of students have already completed year one and are therefore comparable on the basis of their study results at the end of year one.

Due to the lack of availability of contact information of students in the cohorts 2014 – 2015 or earlier, there is however chosen to also include students from year 2015 – 2016. The cohort 2015 – 2016 (first year university students in 2016 – 2017) cannot be used to measure effects of participation on study success because these students have not yet finished their first year. Despite this, they can nevertheless be questioned about the effects of participation on quality study choice, quality of academic competencies and sense of belonging.

As elaborated in the case description, different pre-university activities are offered by the Pre-U. These activities are masterclasses, “profile assignment helpdesk”, “master test guidance”, “tech boot camp” and the honors program. The honors program has just started this academic year which can therefore not be included in this research because no student has already completed this program.

The other activities mentioned above have been running for a longer time and are therefore suited to include in this research.

Control group

The control group consists of students, studying at the University of Twente, who have not participated in pre-university activities. This group has been randomly approached during breaks and lecture hours at the University of Twente. In this approach only Dutch students have been asked to fill in the survey because also all the students who did participate in pre-university activities are Dutch. Only students in the Horst building, one of the main teaching facilities at the university, have been approached because this building houses the technical studies. Most of the students that have participated in pre-university activities are nowadays enrolled in beta technical study programs. In this way is hoped that the experimental and control group are as much the same as possible.

3.4.1 Overview of characteristics of both groups

The dataset contains 63 students from which 30 students are in the treatment group and 33 students are in the control group. 105 students with pre-university experiences at the Pre-U of University of Twente have been approached by email to fill in the survey. The response rate among students in the treatment group is 28,57%.

Students in the treatment group are dividable in four different groups on the basis of the type of activity they participated in at the Pre-U; 12 students have had master test guidance, 6 students did the tech bootcamp, 6 students followed masterclasses and another 6 students participated in the profile assignment helpdesk.

The mean age of students who have had experiences with pre-university activities is 18,6. The mean age of students in the control group is 20,4. In the treatment group are 13 male students and 17 female students; in the control group are 25 male students and 8 female students.

The difference between the treatment and control group on the basis of gender is remarkable. Past research provides evidence that gender has an influence on study success. This will be taken into account when performing the tests and the possible influence of the difference in gender will be controlled. The difference in age between the treatment and control group is also notable. In principle this should not be a problem. Students have been explicitly asked how they experienced the first year and not how they experience studying at the University of Twente today.

The level of parental education in the treatment group is on average HBO, the mean level in the control group is also HBO. This means that in the treatment group as well as in the control group the parental level of education, the indicator used for socio-economic status, is on average the same in both groups.

The mean start competencies, operationalized as the math exam grade with which a student graduated in secondary school, is 7,3 in the treatment group. In the control group the average math grade in secondary school is 7,1. There is no significant difference in means according to an independent samples t-test.

On average, the students in the treatment group started their studies in year 2015 – 2016 whereas the students in the control group started in year 2014 – 2015.

Regarding the study program they attend, students in the treatment group are engaged in 13 different studies. The students in the control group are enrolled in 7 different study programs which are all similar to the study programs of students in the treatment group. Most of the respondents in both the treatment and control group study “Civiele Techniek”, followed by “Technische Geneeskunde”, “Industrieel Ontwerpen”, “Werktuigbouwkunde” and “Technische Bedrijfskunde”.

Table 1: Type of study program per group

	Treatment group (N = 30)	Control group (N = 33)	Total
Civiele Techniek	5	7	12
Technische Geneeskunde	4	7	11
Industrieel Ontwerpen	2	7	9
Werktuigbouwkunde	3	5	8
Technische Bedrijfskunde	5	2	7
Advanced Technology	1	3	4
Technische Natuurkunde	1	1	2
Creative Technology	2	0	2
BIT	1	0	1
Technical Computer Science	1	0	1
Scheikundige Technologie	1	0	1
IBM	1	0	1
Atlas	1	0	1

Table 2: Type of Pre-U activity

	N (total = 63)	Percent
None	33	51,6
Meesterproefbegeleiding	12	19,0
Masterclasses	6	9,4
Tech bootcamp	6	9,4
Profielwerkstukbegeleiding	6	9,4

3.5 Data collection

To collect the data a questionnaire has been designed. In the first phase, the students in the control group have been approached by email. In this first email students were asked to participate through telephonic interviews. Even after one initial and one reminder email only three students responded, which means that only three telephonic interviews have been conducted. The choice was made to take an alternative approach and to design a survey based on the questions from the interview protocol established for the telephone interviews.

These telephone interviews with three students can be seen as a test prior to the distribution of the surveys. During these interviews it became clear that all questions were understandable and the students were able to understand and to answer the questions.

The control group has also been approached with the request to fill in the survey.

3.6 Definition, conceptualization and operationalization of variables

The conceptual model, presented in section 2.4 addresses the different variables included in this research and shows how they relate to each other. In this section the independent, dependent, intermediary and control variables will be conceptualized and defined on the basis of the literature overview from section 2.3.

3.6.1 Independent variable

The independent variable in this research is participation in pre-university activities. This variable can be described as dichotomous as well as ordinal. It can be seen as dichotomous because it simply defines whether someone has participated or not. On the other hand it can be seen as ordinal because participation in different activities is possible. The intensity of contact differs per activity which could have an effect on the outcomes. Therefore it must be known in what activity a student has participated in.

Whether a student has participated was not asked in the survey. Prior to the distribution of the survey it was already clear which students are in the treatment group. It is not clear in which type of activity the concerned student has participated in. Therefore this needs to be asked in the survey. The variable participation in pre-university activities will be measured via answers on the following question:

“What pre-university activity did you participate in?”

Meesterproefbegeleiding – Masterclasses – Tech Bootcamp – Profielwerkstukbegeleiding

3.6.2 Dependent variable

Different ways of defining and measuring the dependent variable, study success, are discussed in section 2.3. These different ways of measurement can be grouped under pure quantitative measurements and ordinal measurements.

Some researchers use quantitative variables (Veenman & Verheij, 2003; Lindblom-Ylänne & Lonka, 1998) like individual study credits and mean exam grades to measure study success. Other research by Bruinsma & Jansen (2009) measures study success as a dichotomous variable with values like drop-out or completion of first year. Also ordinal measurements are used (van der Heijden, Hessen, & Wubbels, 2012; Annema & Ooijevaar, 2011). Categories that are used in this ordinal approach are:

stopping study within one year, stopping study later than in the first year or long-term studying, graduating in the third year, and graduating in the fourth year. As noted by the researchers, some of these categories describe a lack of study success rather than purely describing study success.

The grade with which a student is graduated is not taken into account in the ordinal measurement method, which makes a comparison between students less detailed. For this reason there is chosen to use a quantitative measurement of study success instead of an ordinal measurement. Besides this, most of the students who were questioned via surveys have not yet had the chance to graduate due to the time they have attended university. Only if groups of students who attended a pre-university program five years ago were asked to fill in a survey, this ordinal measurement could be used. Taking these two arguments into account, the best choice is to use a quantitative measurement.

This quantitative measurement consists of a combination of the number of study credits earned and mean exam grades. In this way past research of Lindblom-Ylänne and Lonka (1998) and Veenman and Verheij (2003) is followed. The time period where these measurements will relate to is the end of the first year. This because in this way also students who participated in 2015 can be examined.

Furthermore, several authors emphasize the importance of the so-called "first year experience" for the adjustment to the university environment and future study results; "it is widely recognized that the quality of the first year experience (FYE) establishes how well students adjust academically, socially and emotionally to the university environment which in turn affects their academic performance and retention (Tinto 1987; Tinto 1993; Krause et al., 2005; de Beer, Smith & Jansen 2009)" (Gilbert Hunt, et al., 2002, p. 1). For this study, the definition of study success will be "the number of study credits earned and mean exam grades at the end of the first year".

Study success will be measured via answers to the survey questions:

"What number of study credits did you earn at the end of year 1?"

"What was the mean exam grade with which you ended year 1?"

3.6.3 Control variables

Gender

Gender is an important predictor of study success. Generally it can be said that female students achieve better results compared to male students (Jansen, 1996; Jansen, 2004; Richardson & Woodley, 2003; Shah & Burke, 1999; Simonite, 2003; van den Berg, 2002; van der Hulst & Jansen, 2002; Vossensteyn, 2015). Gender will be taken as a control variable, with two values: male or female.

Gender simply defines if a student is male or female. Gender will be measured via the survey question:

"What is your gender?"

Socio-economic status

Although there is an ongoing dispute in the scientific world about the conceptual meaning of socio-economic status, there is agreement on the definition. In this definition there are three indicators that are seen as the most important indicators of socio-economic status, namely: parental income, parental education and parental occupation (Duncan, Featherman, & Duncan, 1972).

Of these three indicators parental education is seen as the most stable. This because it is established at an early age and likely to remain the same (Sirin, 2005, p. 419) and is highly correlated with parental income (Hauser & Warren, 1997). For this reason parental education also covers parental income partly. As mentioned in the literature overview, a comparison between five different indicators of socio-economic status and three reproductive outcomes shows parental education as the best predictor of socio-economic status (Parker, Schoendorf, & Kiely, 1994).

Because of the different arguments given above, the variable socioeconomic status will be measured by using parental education as indicator. For this study, the operational definition of socioeconomic status is then: "the highest level of parental education". This variable is ordinal.

Responses to the following survey question will be used as measurement of socio-economic status:

"What is the highest level of education completed by your parents?"

Cognitive competencies (before starting university)

Cognitive competencies are also called preparedness of the student for higher education. By reviewing the existing literature it becomes clear that different predictors are used to measure cognitive competencies. These predictors are, amongst others, final school grade and several competencies like diligence, motivation and capacity to concentrate. Most of these competencies are hard to measure via surveys. For this reason, the math exam school grade will be used as an indicator for cognitive competencies.

The mean exam grade of all courses would give a more nuanced picture but it is more likely that students still know their math exam grade. By taking math grade as an indicator, students do not have to calculate their mean grade. Furthermore, the math exam grade seems to be a very good indicator of future study success (Zwaan, 2011; Freijer, 2013; van der Heijden, Hessen, & Wubbels, 2012). This leads to the following operational definition of cognitive competencies (before starting university): "math exam grade with which a student graduated in secondary school".

The cognitive competencies with which a student starts his academic career will be measured via responses to the survey question:

"What was the math exam grade with which you graduated in secondary school?"

3.6.4 Intermediary variables

"Intermediary variables" are the factors that could possibly be addressed by the pre-university programs and which, following literature, may be of influence on study success.

Sense of belonging

Considering the given overview about sense of belonging in the literature overview, the following definition of sense of belonging will be used: "Sense of belonging is determined by the extent to which a student is socially and academically integrated, as well as the extent to which he or she is related or connected to the institution".

The survey questions regarding sense of belonging should thus cover the topics of social and academic integration and relatedness or connectedness of a student to the institution and his or her

study program. Sense of belonging will be measured via answers on a ten-point scale regarding the following statements:

"My teachers and professors are easily approachable"

"I cooperate often with my fellow students to work on study related activities"

"I feel at home at the university"

"I often take part in non-study related activities"

"Even outside lecture hours I can easily ask my teacher a question"

Quality of study choice

A sub part of this research focuses on the effect of participation in a pre-university program on the quality of study choice.

Following the literature overview, future students are able to make a good study choice when the right information is available and when they have the right expectations about a study program. Right expectations can help to avoid disappointments about the study program.

The definition for quality of study choice which will be used in this study is "the quality of a study choice is determined by the extent to which a student makes a well-informed choice and the extent to which he or she has clear expectations about the study program".

Perceived quality of study choice will be measured via answers on a ten-point scale regarding the following statements:

"I made the right study choice"

"When I had to make my study choice I had a clear view on what the study program contains"

"I made a well-informed study choice"

"My expectations about the study program turned out to be right"

"Did you change or switch your study program?"

Perceived quality of developed academic competencies

"The competencies of the student for higher education are seen as major determinants for study success" (Vossensteyn, 2015, p. 23). The fact that competencies of students are important influencers of study success seems very obvious. On the other hand it is vaguer what exactly these competencies must contain. This is something that will probably differ for each study program.

Since the exact needed academic competencies are depending on the type of study, it is hard to formulate an overall definition of good academic competencies. It is reasonable to say that the quality of academic competencies is dependent on the extent to which the competencies are useful during a study program.

Quality of developed academic competencies is defined in the following way: "the quality of developed academic competencies depends on the extent to which they are useful in practice".

Although it is hard to formulate a definition of academic competencies that applies to all forms of academic education, a couple of broader competencies can be identified that are needed to successfully complete an academic education program. In the literature a competence is defined as a combination of knowledge, skills and attitudes needed for the execution of societal and professional tasks.

There are seven “learning target areas” identifiable that give coherent criteria for developing, describing, analyzing and evaluating bachelor and master curricula in terms of academic development (van Santen & Meijers, 2003). Each of these seven learning target areas should be addressed in the curriculum of academic education. Because every study program differs on the basis of content, the specific interpretation of these learning areas differs depending on the program. Although there are differences, following van Santen and Meijers (2003) the competencies mentioned in these seven areas can be seen as universal for every academic education program.

Besides two questions about the extent to which a student feels confident about his or her knowledge level and capacities, three broad statements have been formulated that should apply to all academic education programs.

Perceived quality of academic competencies will be measured via answers on a ten-point scale regarding the following statements:

“I felt confident about my knowledge level when I started studying (think of knowledge level math, English, etc.)”

“I think that I have enough capacities to successfully complete my study program”

“I can understand and interpret the theoretical concepts as well as the methods and techniques of my study program well”

“I can work well together with fellow students (I have responsibility and am able to make compromises when needed)”

“I am able to reason logically and to reflect on my own thinking and acting during research and design activities”

3.6.5 Survey questions for pre-university students

There are some questions added for pre-university students only. Again, the following statements must be answered using a ten-point scale.

“To what extent has participation in the pre-university program influenced your study choice?”

“To what extent has participation in the pre-university program helped you develop academic competencies that were useful during your first year?”

“To what extent did you make a more well-informed study by participating in the pre-university program?”

“To what extent has participation in the pre-university program helped you feel at home more quickly at the university?”

3.7 Data processing

Participation in Pre-U activities is expected to be correlated with the creation of a sense of belonging, the development of academic competencies and a study choice of good quality. Via these intermediary variables it is expected that participation in Pre-University activities is also correlated with study success. These relationships are tested by using the survey data collected among students who have participated and students who have not participated in Pre-U activities.

3.7.1 Combining survey questions items and constructing overall score variables

The data provided by the questions regarding “sense of belonging”, “perceived quality of study choice” and “perceived quality of academic competencies” has been combined to form an overall score for these variables. Each of these variables are tested with 5 survey questions that had to be answered on a ten-point scale. These answers are combined in SPSS resulting in a possible score between 0 and 50. To reduce this to a ten-point scale again, the combined scores have been divided by 5.

In this way not all the individual items measuring sense of belonging, quality of study choice and quality of developed academic competencies must be considered, but an overall score representing each intermediary variable can be used. To know whether the individual items can be combined into one scale, the mutual correlations among the different items have been tested using Cronbach’s Alpha.

Table 3: Cronbach’s Alpha intermediary variables

	Cronbach’s Alpha	N of items	Cronbach’s alpha if item deleted				
			1	2	3	4	5
Quality of study choice (N = 63)	0,79	4	0,70	0,68	0,79	0,77	X
Quality of developed academic competencies (N = 63)	0,68	5	0,64	0,55	0,62	0,68	0,62
Sense of belonging (N = 62)	0,70	5	0,69	0,60	0,62	0,65	0,71

Quality of study choice

Regarding quality of study choice, the first four questions have been answered on a ten-point scale. The last question “did you change or switch you study program” only has two possible answers, namely yes or no. For this reason this specific item can’t be combined with the other items. “Did you change or switch study program” will therefore not be used in the overall scale.

Regarding the other items the Cronbach’s Alpha has a value of 0,794 which means that they are suited to be combined. Furthermore, the removal of none of the items leads to a higher Cronbach’s Alpha.

Quality of developed academic competencies

Cronbach’s Alpha has a value of 0,675 which is close to 0,7 and therefore acceptable to be combined. The Cronbach’s Alpha does not increase if one of the five items will be removed and therefore the items can be combined into one overall scale representing academic competencies.

Sense of belonging

The Cronbach's Alpha of 0,700 is sufficient enough to say that the items can be combined in one overall scale. Only the deletion of the fifth question "I often take part in non-study related activities" leads to an increase of Cronbach's Alpha with 0,007. Because this is a negligible difference all the items will be combined.

3.7.2 Crosstabs

In the previous section is discussed how the different items measuring quality of study choice, sense of belonging and quality academic competencies are combined into overall scales. The values of these scales range from 0 to 10. The first step in comparing the treatment group to the control group is the use of crosstabs. Because these values vary between 0 and 10, these scales are not very suitable for the use of crosstabs; they would become very unclear and not easy comparable.

For this reason the scales have been reclassified. By using the "recode into different variables" procedure in SPSS a new variable representing quality of study choice, sense of belonging and academic competencies has been made. Values between 0 and 4,9 are recoded into low, values between 5,0 and 7,9 into medium and values between 8 and 10 are recoded into high. Crosstabs will be used to clarify the relationships represented by hypothesis 1, 2, 3, 4 and 5.

3.7.3 Comparing means using independent samples t-tests

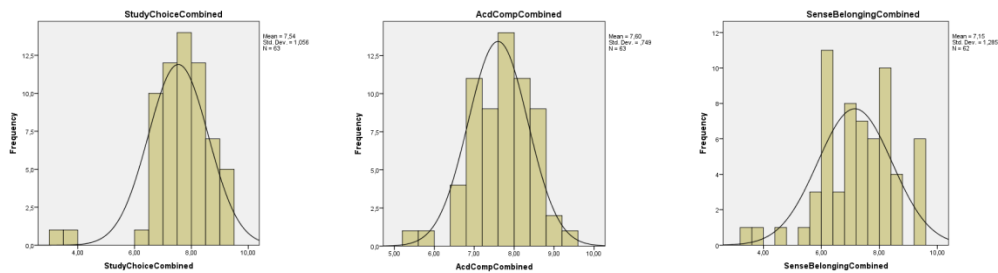
Mean scores on the intermediary variables in the treatment and control group are compared by using independent samples t-tests. The direct effects of participation in Pre-U activities on study success have not been examined with independent samples t-tests. This because the N in the treatment group is too low for both indicators (average grade in year 1 and number of credits earned in year 1) used to measure study success (N = 9 and N = 7) to conduct statistical analyses. We will therefore limit ourselves to the use of frequency tables for the purpose of examining the effects of participation in Pre-U activities on study success.

There are a couple of conditions to be met for using a t-test (SPSS Tutorials: Independent Samples t Test, sd). The data must meet the following requirements: (1) continuous dependent variable (i.e., interval or ratio level), (2) independent variable that is categorical (i.e., two or more groups), (3) cases that have values on both the dependent and independent variables, (4) independent samples/groups (i.e., independence of observations), (5) random sample of data from the population, (6) approximately normal distribution of the dependent variable for each group, (7) homogeneity of variances, (8) no outliers.

All the conditions mentioned above will now be discussed regarding the data concerned in this research. (1) the dependent variable is continuous because the measurement level is interval. (2) the independent variable is categorical as it consists of two groups; students who have participated and students who have not participated. (3) all cases have values on both the independent and independent variables. (4) the treatment group and control group are independent of each other as the treatment group is approached by email while the control group is approached in real life. There is no chance that subjects in the treatment group are also in the control because they would have noticed that they already filled in the survey. Furthermore, the groups do not influence each other on the variables that are tested. (5) the sample of the population is randomly selected because in the treatment group all the possible students have been approached whilst students in the control group

are randomly picked and asked to fill in the survey. (6) the normal distribution will be discussed below. (7) the variances are approximately homogeneous and there are no (8) extreme outliers.

With regards to the extent to which the dependent variable(s) are normally distributed, a couple of numbers and figures will now be discussed (respectively: study choice, academic competencies and sense of belonging).



As the figures above illustrate, the three intermediary variables are not perfectly normally distributed but approximately they are (with the exception of number of study credits earned). A test for skewness has also been carried out. In this test there is a distinction between the control- and treatment group.

A value close to or higher than 1 or close to or lower than -1 indicates a large skewness. In case of study choice, the skewness in the participation group is -1,775 whereas the skewness in the no participation group is 0,048. The overall skewness when both groups are combined is -1,622. This large skewness can be explained by two outlying values in the treatment group, visible on the left side in the first histogram above. For this reason there is assumed that the distribution is normal by approximation.

The distribution histogram of the variable academic competencies shows a more normal distribution. In the participation group the skewness is -0,067, in the no participation group the value for skewness is -0,902. The value for skewness when there is no distinction made between the treatment- and control group is -0,396. Taking these arguments into account there can be said that the distribution of the variable academic competencies is approximately normal in both groups.

For sense of belonging holds that the distribution histogram shows a bit skewness on both sides. The skewness in the participation group is -0,278 whereas the skewness in the no participation group is -0,815. Both groups combined have a skewness of -0,541. There will be assumed that there is an approximately normal distribution.

As argued above, for all the variables there can be concluded that they are approximately normally distributed. Only for study choice this assumption is doubtful, mostly caused by two outlying variables on the left side. Because all the other conditions needed to conduct are met, independent samples t-tests have been used to compare the means across both groups. This in order to test hypothesis 3, 4 and 5.

3.7.4 Regression analysis

Hypotheses 7, 8 and 9 cover the expected relationships on the right side of the conceptual model regarding the effects of quality of study choice, sense of belonging and quality academic competencies on study success. To test these hypotheses no distinction has to be made between the treatment- and control group. This because they purely focus on the effects of the intermediary variables on study success regardless whether a student participated in Pre-U activities; all the students' data about these variables can be used together. To test these hypotheses, both a multilinear regression analysis and bivariate regression analyses can be carried out.

Multilinear regression can be used to measure the combined effects (R^2) of quality of study choice, sense of belonging and academic competencies on study success. When interested in the multiple R^2 value, for a medium effect, Green (1991) recommends a minimum sample size of $N > 50 + 8(k)$, where k is the number of independent variables. This means that the minimum sample in our research size should be 74 ($50 + 8 \times 3$). Our sample size of 63 does not meet the requirements and therefore the multiple regression analysis will be omitted.

Bivariate regression analyses can be used to identify the effects of the intermediary variables on study success apart from each other. Our sample size of 63 is small but large enough, so bivariate regression analyses have been conducted.

3.7.5 Control variables

In the conceptual model three different control variables are included: gender, socio-economic status and cognitive competencies.

There is no difference on the basis of socio-economic status between the two groups. The variable used for the operationalization of socio-economic status, parental education, is the same in both groups. As a consequence, the variable of socio-economic status does not need to be used as control variable because no differences can occur as a consequence of socio-economic status.

The same goes for the control variable cognitive competencies. An independent samples t-test has shown that there is no significant difference in the variable math exam grade, used as operationalization of cognitive competencies. Also this control variable will thus not be used.

Regarding the last control variable, gender, there are certainly differences between the treatment and control group. The difference in gender is statistically significant, so gender will be used as control variable.

Another variable which is not per se a control variable is the type of pre-university activity a student has participated in. Because, as argued in chapter 4, the activities differ on the basis of content and intensity, the effects could arguably differ per type of activity. Therefore there will be controlled for type of activity.

4. Results

In this chapter the results will be discussed. Paragraph 4.1 is about the relation between participation in pre-university activities and the intermediary variables. In paragraph 4.2 the direct relation between participation and study success will be investigated. The last paragraph, 4.3, is about the effects of the intermediary variables on study success.

4.1 Participation and intermediary variables

Table 4: participation by quality of study choice

Study choice	Low (%)	Medium (%)	High (%)	<u>Total</u>
Participation	2 (6,67)	17 (56,67)	11 (36,67)	30
No Participation	0 (0,00)	20 (60,60)	13 (39,40)	33
<u>Total</u>	0	37	24	63

Table 5: participation by sense of belonging

	Low (%)	Medium (%)	High (%)	<u>Total</u>
Participation	2 (6,67)	19 (63,33)	8 (26,67)	30
No Participation	1 (3,03)	20 (60,60)	12 (36,36)	33
<u>Total</u>	3	39	20	62

Table 6: participation by academic competencies

	Low (%)	Medium (%)	High (%)	<u>Total</u>
Participation	0 (0,00)	20 (66,67)	10 (33,33)	30
No Participation	0 (0,00)	20 (60,60)	13 (39,40)	33
<u>Total</u>	0	40	23	63

Following the conceptual model it is assumed that participation in pre-university activities has a positive influence on quality of study choice, sense of belonging and academic competencies. The tables above show that this is not the case for our sample: the distribution of low, medium and high is approximately the same in both groups. For both groups applies that 60 - 70% of the students have a medium and 25 – 40% have a high score on every variable. In the participation group 2 students (6,67) have a low score on quality of study choice and sense of belonging whereas 1 student in the control group has a low score on sense of belonging. These numbers indicate that students who participated in pre-university activities do not score better on these three variables than students who have not participated. This is confirmed when the means of both groups are compared on these variables.

Table 7: t-test participation and intermediary variables (mean and standard deviation)

N	Study Choice	Sense of Belonging	Academic Competencies
Participaton (SD)	7,43 (1,30)	6,94 (1,35)	7,59 (0,82)
No Participation (SD)	7,64 (0,78)	7,35 (1,22)	7,61 (0,69)
T () =	-,759	-1,252	-,102
P	-0,450	0,219	0,919
N	61	60	61

On average, the treatment group ($M = 7,43$; $SD = 1,30$) has a lower score than the control group ($M = 7,64$; $SD = 0,78$) for the variable quality of study choice. This is the opposite from what we expected based on our conceptual model. This means difference is however not significant: $t(61) = -,759$, $p = -,450$. For sense of belonging the means of the the treatment group ($M = 6,94$; $SD = 1,35$) are lower than the means of the control group ($M = 7,35$; $SD = 1,22$). This difference is also not significant: $t(60) = -1,252$, $p = 0,219$. The treatment group ($M = 7,59$; $SD = 0,82$) has on average a lower score for the last intermediary variable, academic competencies, compared to the control group ($M = 7,61$; $SD = 0,69$). This difference in means is again not significant: $t(61) = -,102$, $p = 0,919$.

When means are compared between specific activities and the control group, also no significant differences are found. These figures can be found in the appendix (table 15, 16, 17, 18).

Table 8: Self-indicated effects of participation on study choice

	Influence of participation on study choice (N = 29)				Effect of participation on informed study choice (N = 29)			
	Avg.	Low	Med.	High	Avg.	Low	Med.	High
	4,00	15	10	4	1,62	14	12	3
%		51,7	34,5	13,8		48,3	41,4	10,3

Table 9: Self-indicated effects of participation on sense of belonging and academic competencies

	Influence of participation on sense of belonging (N = 29)				Effect of participation on academic competencies (N = 29)			
	Avg.	Low	Med.	High	Avg.	Low	Med.	High
	4,41	17	10	2	3,67	17	10	2
%		56,7	33,3	6,7		56,7	33,3	6,7

For the sake of completeness table 8 and 9 show the data gathered by the questions that are formulated for the treatment group only. These questions directly asked students what they think the influence of participation was on their study choice itself, the effect on the degree to which they made an informed choice, the influence on sense of belonging and the effect on academic competencies.

In line with the earlier presented findings, the majority of these students who participated in Pre-U activities indicate that participation does not have a positive effect on study choice, sense of

belonging and academic competencies. 50% or more of the students indicate low effects on each of the four issues and the number of students stating that the Pre-U activities have had a significant influence is very low.

No significant differences in means have been found between the treatment and control group. This means that participation in pre-university activities does not have a positive effect on quality of study choice, sense of belonging and academic competencies. This finding is confirmed by the answers pre-university students gave to the questions directly asking for the effects of their participation.

4.2 Pre-University activities and study success

In the previous section turned out that participation in Pre-U activities does not have a positive effect on quality of study choice, sense of belonging and academic competencies, in contrast to what was expected. Because the expectation was that participation in pre-university activities has a positive effect on study success via these intermediary variables participation can, according to the conceptual model, not have a positive effect on study success. Because it is possible that the model is wrong, the direct relation between participation in pre-university activities and study success has also been tested.

Table 10: average grade of students in year 1 by participation

Avg. grade year 1	Participation (N = 9)		No Participation (N = 31)	
	Freq.	%	Freq.	%
6,00	0	0	5	16,13
6,30	0	0	1	3,25
6,50	1	11,11	2	6,45
6,80	0	0	1	3,25
7,00	5	55,55	12	38,71
7,10	0	0	1	3,25
7,20	0	0	1	3,25
7,50	0	0	5	16,13
8,00	3	33,33	2	6,45
8,30	0	0	1	3,25
Total	9	100,00	31	100,00

Table 11: number of credits earned by students in year 1 by participation

Study credits year 1	Participation (N = 7)		No Participation (N = 31)	
	Freq.	%	Freq.	%
30,00	2	28,57	0	0
45,00	1	14,29	8	25,81
52,50	0	0	1	3,23
54,00	0	0	1	3,23
55,00	0	0	2	6,45
60,00	4	57,14	16	51,61
Total	7	100,00	31	100,00

The tables regarding the distribution of number of study credits earned in year 1 and average grade in year 1, create the image that students who participated in pre-university activities did not perform better than students who did not participate. What stands out is that in the participation group 2 students have earned only 30 credits, whereas in the control group every student earned at least 45 credits. Notable is also that an equal percentage in both groups earned the maximum achievable number of study credits.

4.2.1 Control variables

Table 12: study success by gender (means and standard deviation)

	Study credits year 1	Grade year 1
Mean Man (SD)	53,37 (9,58)	7,02 (0,67)
Mean Woman (SD)	54,50 (7,22)	7,08 (0,46)
T () =	(33) = -,358	(38) = -,303
P	0,723	0,764

Several control variables were added to the conceptual model. It has already been mentioned that the treatment and control group do not differ on the basis of their socio-economic status and cognitive competencies. This leaves gender as the only control variable left. In table 14 can be seen that gender has no influence on study success in our sample. Because - as said in 3.7.3 - the N in the treatment group is too low to conduct statistical analyzes, the means across the groups per activity and the treatment group have not been compared.

4.3 Intermediary variables and study success

Relationships between participation and the intermediary variables have been tested in section 4.1. These relationships are all located on the left side of the conceptual model. The right side of the model will be tested in this section. These are the relationships between the intermediary variables and study success regardless whether a student has or has not participated in pre-university activities.

Table 13: Bivariate regression analysis intermediary variables on number of study credits earned in year 1

<u>Intermediary variable</u>	beta *	t-value	P	Adj. R²	F
Quality of study choice (N = 63)	0,118 (0,921)	0,671	0,500	-0,016	0,464
Sense of belonging (N = 63)	0,285 (2,225)	1,707	0,097	0,053	2,915
Academic competencies (N = 62)	0,101 (1,280)	0,586	0,562	-0,020	0,343

* The first coefficient is the standardized coefficient, between brackets the unstandardized b is presented.

Table 14: Bivariate regression analysis intermediary variables on average grade year 1

<u>Intermediary variable</u>	beta *	t-value	P	Adj. R²	F
Quality of study choice (N = 63)	0,214 (0,123)	1,353	0,184	0,021	1,831
Sense of belonging (N = 63)	0,222 (0,125)	1,406	0,168	0,024	1,977
Academic competencies (N = 62)	0,263 (0,220)	1,682	0,101	0,045	2,829

* The first coefficient is the standardized coefficient, between brackets the unstandardized b is presented.

Table 13 and 14 show that quality of study choice does not explain study success , either in the case of the amount of credits earned in year 1 or the average grades in year. In the multiple regression models, quality of study choice fails to explain both indicators for study success (respectively p = 0,500 and p = 0,184).

The same applies for the two other independent variables in this model. Neither sense of belonging (respectively p = 0,097 and p = 0,168) nor academic competencies (respectively p = 0,562 and p = 0,101) explain both indicators for study success.

There are no significant relationships between the independent and dependent variables. Even when we would use a 90% confidence interval, the explanatory power of the model remains marginal at best. The expected relationships between perceived quality of study choice, sense of belonging and perceived quality of developed academic competencies and study success have not been found within our sample.

5. Conclusion

This chapter will draw a conclusion by using the research findings presented in the previous chapter. The aim of this research was to investigate the effects of participation in pre-university activities on study success via the intermediary variables quality of study choice, sense of belonging and academic competencies. The overall expectation was that students engaged in pre-U activities would have a higher quality of study choice, a higher sense of belonging and a higher level of academic competencies. This in turn would lead to a higher level of study success, measured by two indicators. These expectations have been derived from the conceptual model established in chapter 2. In the previous chapter these expectations of the conceptual model have been tested.

5.1 Research questions and hypotheses

This research started with the following main question:

“Does participation in a pre-university program lead to better study results and, if so, how can this be explained?”

To answer this question, three sub questions have been formulated which will now be answered.

1. “How can study success be defined?”

2. “What factors indicated in the literature generally explain study success?”

The first two sub questions have been answered by means of literature review. In section 2.1 different ways of defining and operationalizing study success have been discussed. From this discussion, we decided to use the following definition for our research:

“the number of study credits earned and mean exam grades at the end of the first year”

The second sub question was used to focus and structure our research. Previous research about factors that generally explain study success has been used to construct the conceptual model. Factors that are expected to explain study success can be classified into different levels: the individual level, the institutional level and the labor market level. Most of the factors influencing study success are on the individual level. Socio- economic status, gender, ethnic origin, cognitive competencies, motivational disposition of the student, and the student’s educational pathway are identified as factors that influence study success. Of all these factors on the individual level gender, socio-economic status and cognitive competencies show the strongest correlation with study success. A number of these factors have been selected for the purpose of our research. These factors are:

Sense of belonging (from the institutional level, where factors such as social integration were mentioned), the perceived quality of study choice and the development of academic competencies (individual level).

3. “Which factors in the pre-university programs do or do not contribute to better study success?”

Based on the literature review, three different main factors were selected that are indicated in the literature as predictors of study success. Moreover, they are expected to be addressed by pre-university programs. These factors were quality of study choice, sense of belonging and academic competencies. According to the pre-university activities offered by the Pre-U of University of Twente - as documented in “Pre University jaarprogramma masterclasses and honourstraject” (2016), which

describes the different goals of their activities - these three factors are supposed to be effects of participating in Pre-U activities.

Study choice

Regarding quality of study choice, we have not found a difference between the two groups that we have investigated. Students that have participated in Pre-U activities do not value their study choice higher of quality than students who have not undertaken such activities. For none of the pre-university activities a difference has been found between the treatment and control group. On average the score for quality of study choice in the treatment group on a ten-point scale is 7,4, which can be considered as a fine score. In their own eyes students that have been participating in Pre-U activities make a proper and good study choice. This however also applies to students that have not been participating in such activities. This means that we reject hypothesis 3 that states: Students who participated in pre-university activities have a higher perceived quality of study choice than students who did not participate in such activities.

This outcome is further supported by answers on the questions directly asking students in the treatment group for the effect of participation on study choice (*"To what extent has participation in the pre-university program influenced your study choice?"* and *"To what extent did you make a more well-informed study by participating in the pre-university program?"*).

Sense of belonging

With respect to sense of belonging, as an explanatory factor for study success, there is no significant difference between the treatment and control group in our research sample. With an average score of 6,9 on a ten-point scale, one could conclude that the UT-university students who participated in Pre-U activities feel at home at the university; have a good sense of belonging. However, we cannot conclude that this is due to the fact that they have participated in one of the Pre-U activities, as they feel not significantly better than students from the control group. The expectation that students with pre-university have a greater sense of belonging has not been met. Therefore, hypothesis 4 - Students who participated pre-university activities have a greater sense of belonging than students who did not participate – must be rejected.

This outcome has been confirmed when asking the students with pre-U experience directly about the impact of pre-U activities in relation to their sense of belonging (*"To what extent has participation in the pre-university program helped you feel at home more quickly at the university?"*).

Academic competencies

The mean value for the quality academic competencies is 7,6 for students with Pre-U experience, which indicates a fairly good score. The expectation that these UT-students have developed a higher level of academic competencies than UT-students without such experience has however proven not to be true. Hypothesis 5, assuming that students who participated in pre-university activities have a higher perceived quality of academic competencies than students who did not participate, must be rejected.

When asking the UT-students with pre-U experience directly about the effect of participation in one of the pre-U activities supports this outcome (*"To what extent has participation in the pre-university program helped you develop academic competencies that were useful during your first year?"*). The average score of 3,67 on a ten-point scale means that many UT-students with pre-U experience do not have the idea that pre-U activities have helped them to develop academic competencies that were useful during their first year

Our main research question ***“Does participation in a pre-university program lead to better study results and, if so, how can this be explained?”*** is hard to answer on the basis of our findings. Our hypotheses (1 and 2) was that UT-students that had participated in one of the pre-U activities would have a higher level of study success after one year than students who are lacking such an experience. At face value, the study success in terms of the average grade after one year (hypothesis 1) and the number of obtained credits in year one (hypothesis 2) of UT-students with pre-U experience is not better than the success of other UT-students (see table 10 and 11). Apparently, taking part in one of the pre-U activities does not lead to better study success and both hypotheses 1 and 2 should be rejected.

This conclusion is however somewhat premature and need to be qualified and nuanced. First, unfortunately the number of valid cases with respect to the treatment group (those with pre-U experience) is very limited (N=9 and N=7) and do not allow for statistical testing. Hard conclusion cannot thus been dawn. Secondly, we should bear in mind that the intensity of the pre-U activities varies and particularly for those activities where actual contact with university staff or ‘being at campus’ is limited, one might wonder if there realistically could be an effect. We return to this matter in the final section when we recommend about avenues for future investigations. Thirdly, the control group has a bias. Due to the research design chosen, we could only gather information about students who still follow a UT education program. We have not been able to select UT-students that have dropped out – this could explain the high rates of study success in the control group, which, if this is being the case, explain why they at face value perform as good as the UT-students that have a pre-U experience. We will address this ‘flaw’ in our research design in the final section as well.

Finally, we looked at the factors that could explain the differences in study success. The effects of quality of study choice, sense of belonging and academic competencies on study success have also been tested. Needless to say that because there is hardly any variance, at least to the (limited) extent that we could observe, in the dependent variable, none of the potential factor explain study success, as also has become clear from the regressions we ran on these relationships (see section 4.3). This means that based of the findings of this study among UT-students, we must reject hypotheses 6, 7 and 8. The perceived quality of study choice, the student’s sense of belonging and the quality of academic competencies do not explain study success.

5.2 Reflections

A survey is used to measure the effects of participation in pre-university activities on study success. The questions measuring the variables have been formulated by using relevant literature. During telephonic pilot interviews all the students were able to understand and answer the questions. The internal validity therefore seems good, although it is doubtful whether the conceptual model is complete enough. There must be added that the internal validity of this research is threatened by problems regarding the composition of the control group. Further details about these problems will be given below.

Regarding the external validity there are difficulties with generalizing the results to other pre-university programs. This research is conducted at the University of Twente and because pre-university programs differ per university, it is unknown if the results of this research also apply to other pre-university programs.

From the literature review about study success various factors emerge that can explain study success. Although we had good reasons to expect that participation in pre-university activities could have been one of these factors, other factors seem to be more important. Three factors – quality of study choice, sense of belonging and academic competencies - were expected to be addressed by pre-university activities. The results show that participation in pre-university activities has no significant effects on these variables. In the end, participation has no positive effect on study success.

The results of this research have been rather disappointing. Not because of the outcomes as such – the rejection of the hypotheses – but because of several limitations that prevents us from drawing strong conclusions. In this final section we will address some of these issues and give some suggestions for future research.

The sample size turned out to be too small. The survey has been completed by 30 students with pre-university experiences. In the absence of more contact information, this was the highest achievable number of respondents. This low number of respondents makes significant effects very improbable. Greater numbers could lead to more variance in the dependent variable(s).

In addition, there is a distortion in the composition of the control group. Students in the control group have been approached outside lecture hours in the canteen of the Horst. Most of these students were working on projects or other study related activities. This may indicate that these are dedicated students and are therefore more likely to have good study results. Furthermore, the fact that these students are present at the university indicates that they did not drop out. In this way only students that are successful in terms of continuing their studies are in the control group. This does not only indicate a sufficient level of study success but also a satisfaction with their study choice. The average age in the control group is significantly higher than in the treatment group, which entails the risk of rationalization afterwards. Despite the fact that during the taking of the surveys it has been made clear that experiences of the first year are concerned, it may be possible that students look more positively at their first year afterwards.

Another possible explanation for the lack of variance is that not all the activities of the Pre-U are equally intensive. 20% of the respondents in the treatment group only have experiences with profile assignment assistance, which only consists of one-time contact via telephone or email, or at most one meeting in real life at the university. In advance it was already expected that the effects would be limited for these kind of activities.

Although it seems that the Pre-U students in this research are not doing better than the non-Pre-U students, this does not per se indicate that participation has not had any effect. Students might still

have benefited from participating. About 30 – 40% of the students in the treatment group indicate medium effects of participation on their study choice, the development of academic competencies and the extent to which they felt at home faster. 6 – 10% indicate high effects of participation on these issues. The majority of the scores in the treatment group are most satisfactory, but they are only no better than those of the other students. But, as said above, these scores are possibly biased. Perhaps the scores of Pre-U students would have been worse if they had not participated. This is something that cannot be measured in the research design used in this study.

In the appendix (table 17) the mean (treatment group) answers on the questions measuring the underlying indicators of the intermediary variables can be seen. The mean values give an indication on what points improvement is possible. 10 out of 14 questions have on average been answered with a value higher than 7. On a ten-point scale this is a good score. Only question 3, 10, 12 and 14 show a mean score lower than 7. The Pre-U of University of Twente could work on clarification of what specific study programs contain. The possible influence of the Pre-U of University of Twente on the issues regarding question 10 and 14 seems minimal. These are not really issues the Pre-U can provide for improvement. However, the Pre-U could insist on the approachability of teachers outside lecture hours. This because the score of 6,48 show that on this specific issue there is room for improvement.

5.2.1 Recommendations for future research

Keeping in mind the limitations of this research as described in the previous section, we will now give some suggestions for future research.

Because quality of study choice, sense of belonging and academic competencies only explain a small part of study success, the conceptual model is not complete enough. There are, as shown by the results, a lot of other factors that must have an influence on study success. Future research should use a more comprehensive model with more factors possibly explaining study success. These factors could also be measured in a different way than was done in this study. By using interviews, for example, more specific information can be gathered.

The second recommendation is to use larger numbers and include only Pre-U students who have experiences with the intensive activities. When larger numbers are used, more reliable outcomes can be expected and significant variances will be more likely. By including only students who participated in the intensive activities, effects of pre-university activities may be more reasonably expected.

The occurrence of bias in the control group is the third recommendation. Firstly, students in the treatment- and control group should differ less on the basis of their age. Secondly, also dropped out students should be approached to prevent that only successful students are in the control group.

With regards to the research design, the fourth recommendation is to do a longitudinal study. As said before, it is unknown how Pre-U students would have scored without the experience of participating in pre-university activities. By following Pre-U students over time, the effects of participation can be investigated more precisely.

6. Literature

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7. Appendix

Table 15: T-test intermediary variables comparing tech bootcamp and control group

	Study Choice	Sense of Belonging	Academic Competencies
Mean Tech Bootcamp (N = 6)	7,7083	7,7200	7,1000
Mean no participation (N = 33)	7,6364	7,3455	7,6061
T () =	(37) = -,210	(36) = -,631	(37) = 1,712
P	0,835	0,532	0,095

Table 16: T-test intermediary variables comparing masterclasses and control group

	Study Choice	Sense of Belonging	Academic Competencies
Mean Masterclasses (N = 6)	7,9167	7,4667	7,9000
Mean no participation (N = 33)	7,6364	7,3455	7,6061
T () =	(37) = -,799	(37) = -,227	(37) = -,937
P	0,429	0,822	0,355

Table 17: T-test intermediary variables comparing tech PWS helpdesk and control group

	Study Choice	Sense of Belonging	Academic Competencies
Mean PWS helpdesk (N = 6)	6,000	5,9667	7,2000
Mean no participation (N = 33)	7,6364	7,3455	7,6061
T () =	(5,297) = 2,027	(37) = 2,570	(37) = 1,241
P	0,095	0,014	0,223

Table 18: T-test intermediary variables comparing tech meesterproefbegeleiding and control group

	Study Choice	Sense of Belonging	Academic Competencies
Mean Meesterproefbegeleiding (N = 12)	7,7708	6,8333	7,8667
Mean no participation (N = 33)	7,6364	7,3455	7,60617
T () =	(43) = -,494	(43) = 1,215	(43) = -1,091
P	0,624	0,231	0,281

Table 19: Mean answers in the treatment group on questions measuring intermediary variables

Int. variable	Question label	Mean treatment group (N =30)
Quality of study choice	1. Did student make right study choice?	7,97
	2. Did student make a well informed study choice?	7,57
	3. Did student have a clear view on study program?	6,93
	4. Where the expectations about study program met?	7,27
Quality of academic competencies	5. Was student confident about knowledge level?	7,37
	6. Did student think he/she has enough capacities?	7,57
	7. Can student understand concepts, methods and techniques?	7,40
	8. Can student work well together with fellow students?	7,97
	9. Is student capable of logical reasoning and critical reflection?	7,63
Sense of belonging	10. Does student often cooperate with fellow students?	6,80
	11. Are teachers easily approachable?	7,23
	12. Are teachers easily approachable outside lecture hours?	6,48
	13. Does student feel at home at the university?	8,60
	14. Does student often participate in non-study activities?	5,70

Survey

Q1 Wat is je geslacht?

- ☐ Man
- ☐ Vrouw

Q2 Wat is je leeftijd?

- ☐ Leeftijd: _____

Q3 Wat is het hoogste opleidingsniveau van je ouders? (hoogste kiezen)

- ☐ Opleidingsniveau: _____

Q4 Welke opleiding volg je?

- ☐ Opleiding: _____

Q5 Wanneer ben je begonnen aan deze opleiding?

- ☐ 2013 - 2014
- ☐ 2014 - 2015
- ☐ 2015 - 2016
- ☐ 2016 - 2017

Q6 Wat was het wiskundecijfer waarmee je geslaagd bent op de middelbare school?

- ☐ Cijfer: _____

Q7 Aan welke pre-university activiteit(en) heb je deelgenomen? (meerdere antwoorden mogelijk)

- ☐ Tech bootcamp (voorheen techniek meidenkamp)
- ☐ Masterclasses
- ☐ Profielwerkstuk helpdesk
- ☐ Meesterproefbegeleiding

Q34 In welk schooljaar heb je deelgenomen aan deze activiteit(en) (meerdere antwoorden mogelijk)

- ☐ 2012 -2013
- ☐ 2013 -2014
- ☐ 2014 - 2015
- ☐ 2015 - 2016

Q8 Welk aantal punten heb je behaald aan het einde van jaar 1? (tot 1 september betreffende jaar)

☐ Aantal studiepunten: _____

Q9 Met welk gemiddelde cijfer heb je je vakken in jaar 1 afgesloten?

☐ Gemiddelde cijfer: _____

Q10 Ben je geswitcht van studie?

- ☐ Ja
- ☐ Nee

Q11 Ik voelde mij zeker over mijn kennisniveau toen ik begon met studeren (denk hierbij aan bijvoorbeeld kennisniveau wiskunde, Engels).

- ☐ 0
- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6
- ☐ 7
- ☐ 8
- ☐ 9
- ☐ 10

Q12 Ik vind dat ik over voldoende capaciteiten beschik om mijn opleiding succesvol af te ronden.

- ☐ 0
- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6
- ☐ 7
- ☐ 8
- ☐ 9
- ☐ 10

Q13 Ik werk vaak samen met mijn collega studenten aan studie gerelateerde activiteiten (denk hierbij aan samen leren, samen werken aan projecten of opdracht enz.).

- ☐ 0
- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6
- ☐ 7
- ☐ 8
- ☐ 9
- ☐ 10

Q14 Mijn docenten zijn makkelijk te benaderen.

- ☐ 0
- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6
- ☐ 7
- ☐ 8
- ☐ 9
- ☐ 10

Q15 Ook buiten college tijden om kan ik mijn docent gemakkelijk een vraag stellen.

- ☐ 0
- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6
- ☐ 7
- ☐ 8
- ☐ 9
- ☐ 10

Q16 Ik heb de juiste studiekeuze gemaakt.

- ☐ 0
- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6
- ☐ 7
- ☐ 8
- ☐ 9
- ☐ 10

Q17 Ik heb een goed geïnformeerde studiekeuze gemaakt.

- ☐ 0
- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6
- ☐ 7
- ☐ 8
- ☐ 9
- ☐ 10

Q18 Ik voel mij thuis op de universiteit.

- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6
- ☐ 7
- ☐ 8
- ☐ 9
- ☐ 10

Q19 Ik neem vaak deel aan niet onderwijs gerelateerde activiteiten (denk hierbij aan borrels of andere activiteiten van bijvoorbeeld de studievereniging of studentensportvereniging).

- ☐ 0
- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6
- ☐ 7
- ☐ 8
- ☐ 9
- ☐ 10

Q20 Toen ik mijn studiekeuze moest maken had ik een helder beeld van wat de opleiding inhoudt.

- ☐ 0
- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6
- ☐ 7
- ☐ 8
- ☐ 9
- ☐ 10

Q21 Ik kan de theoretische concepten en begrippen alsmede de methoden en technieken van mijn vakgebied goed begrijpen en interpreteren.

- ☐ 0
- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6
- ☐ 7
- ☐ 8
- ☐ 9
- ☐ 10

Q22 Ik kan goed projectmatig samenwerken met anderen (ik heb verantwoordelijkheidsbesef en kan waar nodig compromissen sluiten)

- ☐ 0
- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6
- ☐ 7
- ☐ 8
- ☐ 9
- ☐ 10

Q23 Ik ben in staat logisch te redeneren en kritisch te reflecteren op mijn eigen denken en handelen tijdens onderzoek- en ontwerpactiviteiten

- ☐ 0
- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6
- ☐ 7
- ☐ 8
- ☐ 9
- ☐ 10

Q24 De verwachtingen die ik had van de opleiding zijn tot nu toe juist gebleken.

- ☐ 0
- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6
- ☐ 7
- ☐ 8
- ☐ 9
- ☐ 10

Q25 In welke mate heeft het deelnemen aan pre-university activiteiten jouw studiekeuze beïnvloedt?

- ☐ 0
- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6
- ☐ 7
- ☐ 8
- ☐ 9
- ☐ 10

Q26 In hoeverre heb je tijdens het deelnemen aan pre-university activiteiten competenties ontwikkeld die jou hebben geholpen in je eerste jaar?

- ☐ 0
- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6
- ☐ 7
- ☐ 8
- ☐ 9
- ☐ 10

Q27 In hoeverre heb je een beter geïnformeerde studiekeuze gemaakt door het deelnemen aan pre-university activiteiten?

- ☐ 0
- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6
- ☐ 7
- ☐ 8
- ☐ 9
- ☐ 10

Q28 In hoeverre heeft het deelnemen aan pre-university activiteiten er voor gezorgd dat je je sneller thuis voelde op de universiteit?

- ☐ 0
- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6
- ☐ 7
- ☐ 8
- ☐ 9
- ☐ 10