The influence of sports on a student's health, well-being and school achievements*

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Abstract

The objective of this thesis is to research what the effect is of a particular sports program on the health, well-being and school achievements of students attending the St. Nicolaaslyceum in Amsterdam, The Netherlands. As background may serve, that this particular high school in the first three years of it's roster has regular as well as sport classes (**SC's**), that add two hours of sports weekly. The two hours of sports is the only differentiator between the two classes, the same professors based on identical programs give common lectures. This basic set-up enables a comparison between the two types of classes. However, students for the sport class were selected based on certain criteria. In order to solve this selection bias the dataset from the school was used in combination with a self-made questionnaire. Results implicated that there is evidence for the hypothesis that students in the sports class had significantly lower BMI and better school achievements. Moreover, there were no significant effects found for fourth and fifth graders after finishing the three-year programme, with regard to the achievements of students that attended the sports classes. I did discover however, an effect for fifth and fourth grader related to their psychological well-being.

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1. Introduction

The question is if, and how, students profit from attending this particular SC?

There are three reasons why this question might be relevant for science and society.

First of all, the school has been debating the continuation of the SC's for quite some time. A scientific paper that addresses the impact of the SC's could give more factual input into this discussion based on thorough research.

Secondly, the paper might initiate an expansion of the SC set-up e.g. it is now confined to "VWO" students but could it be extended to "HAVO" students?

Lastly, as the school was in heavy support of the research, I was able to assess the relevant facts and have students fill-out a self-made questionnaire that generated unique and high-quality data. To research the effect of this program could mean a contribution to the existing literature that concerns itself with the correlation of physical exercise (**PE**) and/or academic achievements, health and psychological well-being.

In the past five years a rapid increase of research has been done on the effect of PE on academic achievements. The reason for this, is that despite the potential beneficial health effects of PE a downward trend is shown in opportunities given by schools to do PE in the United States. Schools are pressured to ensure that their students are academically successful and not per-se to keep them physically healthy (Erin K. Howie, Russell G. Pate 2012). However, it is found that the practice and policies of (pre-)schools regarding the physical activity of their students are highly influential (Russel et al, 2004). By researching the effect of PE on academic achievements it is hoped to establish irrefutable evidence that it is also in the self-best interest of schools to provide PE to students. The vast majority of research points out that there is a positive correlation between PE and school achievements, health and psychological well-being. That being said, there are still inconsistencies between different scholars which make it difficult to reach any solid conclusions (Erin K. Howie, Russell G. Pate 2012). To make a strong case for school boards regarding the importance of PE, a carefully designed and highly reliable research must be established that deals with the biases of previous research. I.e. there is a continued effort to improve the quality of research.

So, what are the central biases that the previous studies had to cope with? It is possible to divide the general literature in two types of studies. The first type of research is a correlation based, i.e. cross-sectional. The main problem with this type of research is that it has to cope with so-called "omitted variable biases". Meaning that alternative factors that could explain the correlations are not included such as cognitive skills, parental education, logistic support or even motivation (Thomas J.H Keeley and Kenneth R. Fox 2009). For instance, a study pointed out that there is a positive link between PE and academic performance (Lidner, 2002). However, it did not take into account the effect of parental involvement on school achievement (Jeynes, 2003; Trots et al 2003). More involved parents could help or pressure their children to do PE for instance based on health considerations. Not including parental involvement as a control variable in a model, would lead to "omitted variable bias". To circumvent the modelling problem of including all potential variables correlated to PE and academic achievements, health and psychological well-being, intervention studies come into play.

This second type of research means in practice that the experimenters introduce a physical program at a certain school and then quantify the progress made over time. The main problem in the related existing literature is, that the end results are usually compared to a baseline, which was established before the intervention. In other words, students are *not* randomly assigned to a control group (no sport program) and a treatment group (with sport program). If done properly, all personal characteristics and time effects can be kept "constant". It appears that this has not yet been done (K. Martin, 2010).

Here in it is attempted, to come up with more solid evidence then the previous status quo. The unique and extensive dataset will be used from a high school located in Amsterdam called the St Nicolaaslyceum. At this school there are regular classes and sports classes (**SC**). They differ from each other, only in that the student of an SC gets two additional hours per week to attend a sports programme. This enables a comparison of a control group (regular classes) to a treatment group (SC). Unfortunately the students are not randomly assigned (as would be ideal) to one of the two classes. The students that go to the SC are being selected and also have to apply

for the class. Consequently this leads to a (self) selection bias. Nonetheless, when taking all the selection criteria into account, one may say that the students were conditionally random assigned to one of the classes. I.e. a "quasi-natural" experiment will be used in this research. The literature researched indicates that this has not yet been attempted and therefore could create a different perspective and hopefully improve the overall quality of the research in this area.

2. Literature review

In 2000, the WHO declared that obesity is the number one global epidemic. Besides the US, UK and Germany, the Netherlands has one of the highest rates of overweight people (WHO, 2000). This growing problem is also confirmed for children aged 4-16 (den Hurk et al, 2006) in the Netherlands. Being overweight can have a profound negative effect on health. Causal relationships are found between being overweight and cardiovascular disease, coronary heart disease, cancer and diabetes (McGrinnis and Foege, 1993; WHO, 2000; Philipson, 2001) and more.

It is broadly supported in the literature that doing sports or PE can have positive influence on the physical health. A narrative review done by Warburton (2006) concludes that there is irrefutable evidence for the causal relationship between exercising and the prevention of a variety of chronic diseases (e.g. cardiovascular disease, diabetes, hypertension, cancer, obesity) and that it decreases the chance of a premature death. The importance of the first hypothesis is therefore straightforward. The research conducted at the St. Nicolaaslyceum shows that about 11 per cent of the children are overweight or even obese. In light of the growing problem in general and the findings on the overweight, the focus will lie on the question if the SC can have a decreasing effect on BMI.

Hypothesis 1: *A student in the SC has a lower chance of overweight.*

To test this hypothesis body mass index (BMI) will be used as calculative measurement. Since BMI is as function of length and weight, it is possible to compare people with different postures. To assess whether or not students are overweight the BMI-for Age growth charts are being used (CDC, 2009). These charts take into

account the differences in age and gender when giving the boundaries for a child's (un-)healthy state.

Besides a normal BMI having positive physical health effects, it is also found to have an indirect positive effect on happiness via "perceived" health (Vermaat et al 2006; Hassemen 2000). Leading to the second important part of this research, namely the psychological well-being of the students. Besides perceived health, there are alternative routes in which PE can influence the psychological well-being of students. A population study done in Finland for example concluded that individuals who at least did some type of PE 2-3 hours per week experienced significantly less depression, anger, cynical distrust and stress. Also, these individuals had a higher sense of coherence and a stronger feeling of social integration (Hassemen, 2000). At the University of Bristol a study with nurse students pointed out that there is a significant correlation between PE and self-esteem. However, this was not found when testing the correlation of BMI on self-esteem. This might imply that not all the effects of PE are through BMI (Hawker, 2001). To avoid having to go into the complexity of how exactly PE (directly or indirectly) influences the psychological state, this research will limit itself to the following hypothesis:

Hypothesis 2: *Being in the SC contributes to the psychological well-being of students*

For the grading of the psychological well-being of students the Oxford Happiness Questionnaire (OHQ) is used. The OHQ is found to be significantly correlated to extraversion, neuroticism, psychoticism, satisfaction with life, Self-esteem, life orientation test, life regard index, depression-happiness scale, DH positive items and DH negative items (P. Hills, 2002). The OHQ was tested at the Oxford Brookes University in assignment of the experimental psychological department. The age of the test subjects ranged from 13 to 68 years (M=30, SD=12,9).

The last part of this thesis will concern itself with the effect of the PE on the cognitive functioning of students and their academic achievements. Most intervention studies have concluded that by introducing a sport program, the grades of students were enhanced (Martin, May 2010; Howie and Pate 2012). For instance, a two-year

physical activity intervention was found to improve children's math scores (Hollar D et al, 2010). In addition to the intervention studies, most cross-sectional research also confirms that there is a positive relation between PE and academic achievement (Lidner KJ, 2002; Field et al 2001). Alternatively, it was found that children could spend less time learning academically and substitute this time for physical activity without a decreasing effect on academic achievements (Ahamed et al, 2007).

Because of the explained pitfalls regarding intervention studies and cross-sectional studies, a more thorough clarification might be desirable on how PE could influence academic achievements of students. Budde et al. (2008) concluded that acute coordinative exercise improves attentional performance in adolescents. From a neuroscience perspective, it was confirmed that PE could increase brain nerve growth and brain blood vessel (Cotman and Berchtold, 2000; Herholz, 1987), which in turn could increase academic achievements. Another perspective is given by a research that tested the direct effect of treadmill walking on cognitive control of young adolescents. The results indicated an improvement of the response accuracy, larger P3 amplitude and better academic performances (Hillmann, 2009). From a more behavioural point of view it was found that the social behaviour of students within the classroom reported by teachers was enhanced due to PE. On the other hand, they did not find a positive relation to academic achievements (T. Dweyer, 1979). Contemplating all the above-described research, one may get the suspicion that the SC can also enhance academic achievements of students. Because of the variety in clarifications regarding how sport can influence academics achievements the hypothesis will be restricted to:

Hypothesis 3: *Being in the SC increases the average grades of the students*

All grades were retrieved from the school year 2012-13 and the averaged was calculated per student.

3. Data description

3.1 School description

The St. Nicolaaslyceum high school is located in an affluent neighbourhood in Amsterdam. For students it is possible to get three different levels of schooling HAVO, VWO, Gymnasium[1]. There are more than a thousand students and more than one hundred employees. In October 2012 the school moved to a state of the art building.

As an open catholic school they have a positive attitude to other religions. The central believe is that through helping and caring for each other it is possible to create a social environment in which every student can flourish. An environment to treat everybody equally, but at the same time the individual differences are cherished. Therefore, the school pays special attention to the feelings of safety for all students, so that they can retain their individuality, regardless of their appearances, descent, sexual nature or religion.

3.2 SC description

In the context of this study the school is especially interesting because of the existence of the "Sport+ klas" (SC). The SC is only available for VWO students who are able and willing to attend. They will get exactly the same schedules and teaching as the regular VWO student's apart from two extra hours of a sport program per week. The requirements to get into the SC are at least HAVO/VWO advice from the previous school and a minimum score of 543 on the CITO[2] test. When seated in the SC, students will be in this specific class for three consecutive years. During this period students will learn and be tested in a variety of sport disciplines. After the third year all students (including the "regulars") have to choose a specialization, everybody is mixed and the SC stops.

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[1] VWO & Gymnasium = higher education, HAVO = medium education, VMBO-T = lower education VMBO-K, VMBO-B = lowest education.

[2] CITO is a Dutch uniform nation wide testing programme, scoring pupils of elementary schools to eligibility for high schools, which rank as preparatory academic (VWO & Gymnasium) or higher education (HAVO), medium education (VMBO-T) or lower education (VMBO-K, VMBO-B).

When students apply for the SC based on the minimum requirements, they are invited to a sports day to test their physical abilities. Also their previous teachers are asked to fill in a short competence questionnaire (see appendix 1). After this is done, the school selects the students that are most suitable for the SC. In addition the regular school fee, parents (with children in the SC) will be charged an additional 285, - euro per year. The philosophy and goals behind the SC are to have fun, develop a sport attitude, awakening of own possibilities and develop persistence. Besides this the social ambiance within the class is very important. Tolerance, acceptance and respect are the three core values. This is of course in line with the general philosophy of the school. The only difference is that in the SC students get a social competence report (see appendix 2) on top of their academic achievement report (Source: http://sintnicolaaslyceum.mwp.nl/).

3.3 Questionnaire description

The relevant data were collected in three different ways. First of all the high school itself had an elaborate dataset. It was possible to distillate grades, CITO scores, advices from previous teachers, student personal characteristics and the frequency of absence. Thus, making it possible to identify two of the five abovementioned selection criteria. All data was orderly stored and convertible into a spreadsheet.

Secondly, it was made compulsory for *all* 385 students attending VWO (including SC and non-SC) to fill out the questionnaire. This was done in a controlled environment on the computer under my supervision. In part 1 of the questionnaire general questions were asked that shed light on the parental education levels, relationship status of biological parents, native language, affinity with SC and sport behaviour outside of school (calculated in average hours per week). In the second part the OHQ included in the questionnaire was answered. Giving a grade on a scale from 1 to 7 with respect to the individual's happiness. The third part of the questionnaire comprised of the so-called "reading the Mind in the Eyes" test specially designed for children (S. Baron-Cohen et all, 2001). This revised Eyes test for children is proven to detect subtle individual differences in social sensitivity. Students were also given a

grade in this part, now on a scale from 1 to 10. I translated both tests into Dutch (see appendices 3 & 4).

Thirdly, all students were measured and weighted, after that all data was directly written into a spreadsheet, in order to calculate their BMI. A conscious choice was made to collect the measurements by hand, to avoid any self-reported errors.

3.4 Sample description

Table 1

	# students in the SC	# students normal track	# students side-track	total # of students per class
Column	(1)	(2)	(3)	(4)
First Grade	22	23	-	45
Second Grade	28	27	-	55
Third Grade	27	24	59	110
Fourth Grade	24	25	66	115
Fifth Grade	21	11	28	60
Total	**122**	**110**	**153**	**385**

Table 1 shows the division of students over the SC and the regular classes in each of the five grades of the school year 2012-2013 (all data was gathered at the end of the school year). Column (1) shows all SC students, which are all in VWO track only by definition. Column (2) shows the "regulars", which are all in VWO track only by definition. Column (3) shows students who joined the VWO track in the third year and who are by definition not in the SC. As with regards to these students it was hard to tell whether they would do better on HAVO or VWO. These students start off in a "side-track" for two years and then get redistributed to either the HAVO or the VWO track. Column 3 shows that 59 students came from this side-track to join the VWO track and that 66 students came from the same side-track last year and made it to the next year. The reason for the sudden drop in the number of students in the fifth grade is simple due to fewer applications in that particular year.

4. Theory (the model)

To test the effect of the SC on the variables of interest the selection bias must first be solved. The selection criteria for getting into the SC are: CITO score, advice from

previous school, competence questionnaire report, physical ability and evidently a student has to apply. The easiest way to solve a selection bias is to include all selection criteria in a multiple regression model (Stock & Watson, 2012, pp 271-275). Assuming that all these criteria are included, one may say that the students were conditionally "random" assigned to either the SC or the regular classes. Making it possible to analyse the pure effects of the SC. I.e. when keeping constant all differences (with respect to the selection criteria) between students in the SC's and students in regular classes, it will be possible to isolate the effect of the SC's on the academic achievements, physical health and physiological well-being of students.
The selection problem can be divided into five smaller problems. First I address the selection bias from advice related to the VWO track.

4.1 Selection bias CITO and advice

First, *all* students are selected on the basis of their CITO score. The requirement to get into the SC is to have a score of *at least* 543. In case this criterion is ignored, it would be impossible to separate the effect caused purely by attending the SC as opposed to having a higher CITO score to begin with. Fortunately, the CITO scores for all students are known. By including this in the model as a quantitative measurement, one can estimate the effect of having a higher CITO score. As a result, the effect caused by CITO score from being in the SC is identified and neutralised. I.e. there is a true comparison of SC and non-SC disregarding the influence of a higher CITO score as a requirement to qualify for the SC.
Secondly, the same story holds for the problem that students are partly selected on the basis of the advice given by their previous teacher. The criterion is that students should at least have obtained VWO advice to get in the SC. So, HAVO/VWO advice is a disqualifier. *Since there are also students in the regular and side-track classes with HAVO/VWO advice*, this should be corrected for. As a background, a student with a HAVO/VWO advice and a high CITO score may still qualify for the VWO track or vice versa. In order to eliminate the effect, a dummy variable is created called "VWO", which is 1 if a student has VWO advice and 0 if not. The estimated beta of this variable denotes the effect of having VWO advice on the depending variable.

4.2 Selection bias social competence

Thirdly, students in SC are selected partly based on a social competence questionnaire filled in by their previous teachers (see appendix 1). As will be explained below, this selection method is somewhat vague and appears not to be very influential.
Additionally they are given a social competence report while attending the SC (see appendix 2). The fact that social behaviour is represented as a formal selection criterion and measured during the SC program, could pressure the students to become more aware of their social behaviour and potentially get more competent without any clear relationship with their sporting activities.

To test if students in the SC are socially more competent part three of my questionnaire subjected *all* students to the so-called "reading the Mind in the Eyes" test specially designed for children (S. Baron-Cohen et all, 2001). This revised Eyes test for children is proven to detect subtle individual differences in social sensitivity. All students were given the same set of pictures of eyes (for an example see appendix 4) and had to choose out of four answers that best describe the emotion or thoughts of the person in the photo.

Comparing the grades form "the EYE" test of the SC to that of the regular classes led to the conclusion that there are no significant differences between the two (for STATA output see appendix 5). I.e. there is no direct evidence from the EYE test that students from the SC are socially more competent. After discussing this with the teachers that select the students for the SC they have pointed out that they find it difficult to assess the social competence questionnaire filled out by previous teachers. Every teacher, they argue, gives social competence grades within their own frame of reference, which in turn leads to an arbitrary outcome. The experience of the SC selection making team is that these social questionnaire reports can be very misleading and therefore should be taken into account with caution. Secondly, they told me that never in the ten-year history of the SC it had happened that a student was

dropped out of the SC because of social incompetence. Therefore the assumption is that students in the SC are not socially different.

4.3 Self-selection bias

The fourth problem in regard to the selection bias is self-selection. It could be that students who apply for the SC are different from the regular students when it comes to school achievements, health or psychological well-being because of a natural selection process. For example, it is found that parental involvement can influence academic achievements of students (Jeynes, 2003; Trots et al 2003). More involved parents could help or pressure their children to get into the SC, because of for instance health considerations (as discussed in the introduction). The effect of the SC on academic achievements can then also be explained because of involved parents.

Commonly, a self-selection is resolved by including all control variables that are correlated with the variable of interest and the dependable variable (Stock & Watson, 2012). Or in light of this study, variables that on one hand increase the chance of being in the SC and on the other hand are correlated with health, school achievements and psychological well-being of students. After a broad study of the literature, it was decided to use parental education level as a comprehensive variable with respect to all possible influences of parents. A variety of effects of parental education on their children's health, academic achievements, and mental well-being can be found. For instance a study conducted on six-year-old children in Germany shows that parental education is negatively correlated with obesity (BMI) (Lamerz et al, 2004). Or as stated in the previous paragraph, parent involvement can also be seen as a predictor for academic achievements, (Jeynes, 2003; Trots et al 2003) but it also found that the education level of parents is positively correlated with their involvement (Grolnick and Slowiaczek, 1994).

The second reason for this strategy had a more practical character. It was relatively simple to ask the students in the questionnaire for their parents educational levels compared to figuring out how involved their parents are. All students were asked to state what their parents did after they had finished high school by choosing one of the

following options: none, MBO, HBO, WO[3] or unknown. 107 of the 385 did not know what their parents did after high school, or did not fill out the questionnaire. Examining the dataset it looks like there is enough diversity within these 107 students to not suspect any "attrition biases". Besides parental education levels there is no direct evidence from the literature that more control variables should be included.

In addition to the literature it was asked if the selection team had some other suggestions for control variables. They have said that in general there are more boys that apply for the SC than girls. In order to maintain the balance between boys and girls, the school is more flexible with the selection criteria for girls than for boys. Suggesting that there could be certain gender differences, like differences in school performances, a dummy variable called "man" is included into the model.
Substantiating the possible gender effect is an intervention study conducted on 546 primary school children in Canada. This study shows that girls gained more from doing PE than boys in terms of academic achievements (Shephard and Lavallee, 1994)

4.4 Selection bias physical ability

The fifth and last problem is that students that uphold the basic requirements and that are invited to the sport day are partly selected on their physical performance. On this specific day all students are tested on their physical abilities. This is done via a few exercises in which all students are rated. In other words, it seems likely that the physical more able students are selected to join the SC. Without underestimating nature's gifts, it is assumed that students that are physically more able also practice more. As in line with the literature review this additional practice or PE could in itself have an effect on health, school achievement and psychological well-being of students. I.e. it could be that students in the SC practice more apart from school hours. Not taking this into account would lead to an overestimation of the effect of the SC. To solve this problem all students were asked (in the questionnaire) about the average amount of hours per week spent sporting apart from school hours for instance with a club or "on the street". In this way the additional sporting behaviour of students apart

[3] WO = University, HBO = University of applied science, MBO = middle-level applied education

from school is estimated and can be include as quantitative measurement for physical ability in the model.

Finally, all students were asked what type of sport they practise. After assessing all answers there is no direct evidence that one particular sport was overrepresented. The large variety in sports implicate that one should not be afraid of any particular sports characteristics that influenced the results.

5. Testing the hypothesis (results)

In this section the three mentioned hypotheses from section 3 but before going into the testing a more general overview will be given by table 2.

Table 2

	Sport Class			Regular class		
Variable	**Obs**	**Mean**	**Std. Dev.**	**Obs**	**Mean**	**Std. Dev.**
CITO score	122	544.9508	3.122439	254	543.4409	3.489461
Grade	123	6.74265	.72708	263	6.41383	0.644953
Grade-123	78	7.000205	0.6032937	133	6.527348	0.6413221
Grade-45	45	6.296222	0.7123434	130	6.297692	0.6301501
BMI	106	19.97245	2.24877	224	21.21266	2.957736
BMI-123	71	19.3838	2.208445	122	21.2209	3.120245
BMI-45	35	21.16656	1.839654	102	21.2028	2.72506
OHQ	103	5.430425	0.4842227	215	5.100361	0.6467571
OHQ-123	71	5.42368	0.4862905	114	5.217818	0.6740408
OHQ-45	32	5.445389	0.4869995	101	4.967785	0.59015
The EYE	104	7.221485	0.9892195	220	7.203762	1.102174
The EYE-123	71	7.187955	1.045342	119	7.235584	1.092272
The EYE-45	33	7.293626	0.8668883	101	7.166268	1.118012
Sport	104	8.546538	4.058914	220	5.433045	5.059488

Beginning at the top of table 2 it is shown that the average CITO score is higher than that of students of regular classes. This corresponds with the fact that students in the SC are selected partly based on their CITO scores, making it a legitimate control variable for the rest of the hypothesis testing.

Then sliding to the rows below CITO score, one can see the difference between the average school achievements[4] of all combined SC students compared to those of the "regular" students which is respectively 0,32 points higher. More remarkable however is the difference of about 0.7 points between the combined school achievements from the first three grades compared to that of the fourth and fifth grades of SC students. When making the same comparison for the "regular" students a difference of 0,229 points is attained. In addition to this a difference of about 0,47 points is detected between the average school achievements of the SC, compared to the regular classes for the first three grades. On the contrary, there is no difference findable between the school achievements of the SC compared to the regular classes in the fourth and fifth grades.

Continuing to the rows that concern themself's with the average BMI of students. One is able to conclude that there is a difference between the combined average of the first three grades to that of the fourth and the fifth grades regarding the SC. This may come because of the difference in age when it comes to the physical development. However, when a student attends regular classes it seems likely that there is no difference between the three first grades compared to the fourth and fifth grade. This can be due to an overrepresentation of third graders in the regular classes compared to that of the SC. The reason that one could speak of an overrepresentation might be caused by the fact that third graders could have naturally more developed physics because of their age. As illustrated in table 1 there are 59 additional third grade students that enrolled from the sidetrack into regular classes, which could explain the relatively higher average BMI.

Moving on to the OHQ grades, it is illustrated that there is a difference of about 0.2 points between the regular classes and the SC's for the first, second and third graders. This difference is enlarged in the fourth and fifth grade due to a drop in the average OHQ grade in the regular classes.

Illustrated from the variables called "the EYE-123" and "the EYE-45" the conclusion can be made that there are no real differences between the average grade obtained

[4] Measured by calculating the average grade of all combined exam grades per student.

from “the EYE” test between the two types of classes and between the different grades.

The last variable “sport” gives the average hours spent on sports apart from school hours. When assessing the difference between the regular classes and the SC’s it has been found that students from the SC train about 3 hours more apart from school.

5.1 A student in the SC has a lower change of overweight

To test the hypothesis body mass index (BMI) is used as quantitative measurement estimate of physical health. Since BMI is a function of height and weight, it is possible to compare people with different postures.

The blue lines in figure 1 illustrate the optimal value for the BMI of boys that are in a particular class. The green lines illustrate the optimal boundaries of a boy’s health. Above the upper green lines a student would be overweight or even obese. Below the lower green linens a student would be underweight. The same holds for figure 2 but then for girls. The values of the blue and green lines are different because they correct for age and gender. Boys and girls physical development cannot be compared. For example, it can be seen that on average boys in the first grade should have a BMI between 16 and 22, whereas the upper bound for girls is almost 23. These boundaries were estimated from BMI-for Age charts module made by the Centers for Diseas Control and prevention (CDC, 2009). By calculating the average age of all students in a particular grade it was able to find the adequate boundaries for that grade in regard to gender.

BMI box plots boys

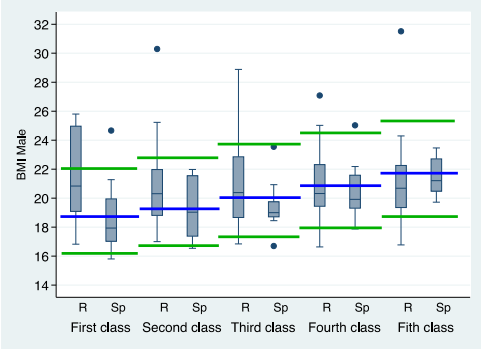

Figure 1

BMI box plots girls

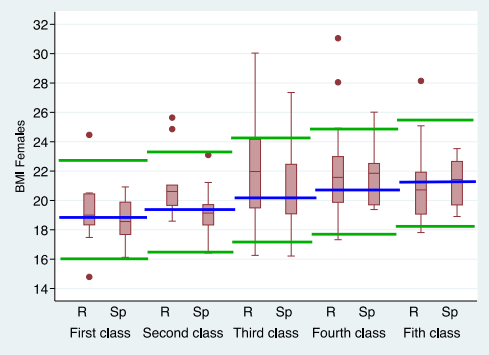

Figure 2

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What can be concluded from these box plots is that students in the SC vary less from the optimal value for girls and boys. This outcome is not surprising and it does not have to mean that this is due to being in the SC itself. For example, this could be caused by the difference in sport behaviour of the SC students apart from school. As table 2 shows it is found that students that are in the SC on average practise 3 hours per week more apart from school hours. So before concluding anything, a more sophisticated model must be used. Nonetheless, the figures make an interesting case for further research into the influence of the SC on BMI.

To test in a more compressive manner the hypothesis that the SC has a decreasing effect on BMI a multiple regression model will be used. Starting off with the base regressions and gradually expanding the model by adding control variables and comparing their mutual differences. Using this approach makes it possible to carefully evaluate the impact of all aforementioned variables discussed in part 4. Furthermore the first, second and third classes are combined to increase the sample size. To prevent overrepresentation of third class students that enrolled from the sidetrack are left out (see table 1). In addition, the command ", robust" is used in STATA when doing all regressions to control for heteroskedasticity.

Body Mass Index 123

	Model 1	Model 2	Model 3	Model 4	Model 5
	b/se	b/se	b/se	b/se	b/se
SC	-1.523***	-1.175**	-1.112*	-1.066*	-1.227*
	(0.44)	(0.42)	(0.47)	(0.48)	(0.59)
sport		-0.133**	-0.148***	-0.127**	-0.097
		(0.04)	(0.04)	(0.04)	(0.05)
cito			0.122	0.125	0.168
			(0.08)	(0.08)	(0.11)
VWO			-0.536	-0.408	-0.824
			(0.60)	(0.61)	(0.74)
grade			-0.696	-0.727	-0.778
			(0.46)	(0.48)	(0.62)
man				-0.224	-0.269
				(0.45)	(0.58)
happy				-0.230	-0.087
				(0.49)	(0.58)
fatherHW					-0.395
					(0.74)
motherHW					0.423
					(0.52)
constant	20.907***	21.707***	-39.536	-39.776	-63.530
	(0.35)	(0.51)	(42.08)	(44.13)	(55.72)
R-sqr	0.080	0.130	0.169	0.155	0.154
Sample size	139	134	131	127	88

* p<0.05, ** p<0.01, *** p<0.001

Table 2

Moving from the first to the second model it is clearly visible that part of the "perceived" effect of the SC is reduced by adding the variable sport. This variable represents the hours spent sporting apart from school hours. It appears that since SC students spent more hours sporting outside school then "regulars", their BMI decreases.

Sliding to the third column all variables that represent intellectual ability are added. None of these variables seem to be significant correlated with BMI. Assuming that grades, CITO scores and VWO can be mutually correlated a joint F-test[5] is performed to control for multicollinearity [6]. The result points out that not even collectively the

[5] The joint F-test tests whether or not a set of variables are jointly significant different from zero. Thus also taken into account their mutual correlations (Stock and Watson, 2012).

[6] The condition in which two or more regressors are highly correlated (Stock and Watson, 2012). The reason why this should be taken into account is that if two variables are highly correlated they take

intellectual ability variables are statistically different from zero (see appendix 7). In addition, it seems that they do not really influence the effect of the SC or sport for that matter. After performing a correlation test (see appendix 8) it appears that these intellectual ability variables were weakly correlated with BMI-123 but not necessarily with the SC. Implying that the effect of the SC was similar because these variables were insignificant but not because they were uncorrelated with the SC.

Shifting from the third to the fourth model the variables man[7] and happy[8] are appended. Again no fundamental changes are detected in the SC variables because of the low and insignificant correlation (almost 0) of these variables with BMI-123.

Finally going to the fifth model, which also includes the parent's education levels in the form of two dummy variables namely: fatherHW[9] and "motherHW[10]. Studying the difference between the betas of the variables in the fourth compared to the fifth model a lot changes. There is a sharp decline in sample size from 127 to 88 students. This drop is accompanied by an overall increase in the standard deviations, implying that the model became less accurate. The drop is due to a large number of students that did not know the educational level of their parents as discussed before in section 5.3. Nevertheless, considering there is no direct suspicion of an attrition bias in combination with the low p-values of the fahterHW (-0,5337)[11] and motherHW (0,8135) one would be inclined to conclude that the education level of parents are of no influence in regard to student's BMI. Consequently, there is no evidence found that it would have an effect on the SC on BMI.

Synthesising all the above, it seems the hypothesis can be confirmed and that indeed the SC has a decreasing effect on the BMI of students in the first, second and third grade of one point and a bit. In hindsight, the only relevant selection criterion in this

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over each others effect which could lead to the appearance that both variables are separately insignificant but in fact jointly there not.

[7] Man is a dummy variable that is zero in case one is a woman and one in case one is a man

[8] The variable happy is a particular grade that one attaind from the OHQ

[9] FatherHW is zero in case the father of a student did not do a follow-up study after high school or did MBO and one if the father did HABO or WO

[10] MotherHW is zero in case the father of a student did not do a follow-up study after high school or did MBO and one if the mother did HABO or WO

[11] A beta of a particular variable is different from zero if its p-value is above 1,96 at a significance level of five percentages. If the p-value is above 2,58 the same can be said only for a significance level of 1 percentage.

respect, was sporting behaviour apart from school. This, not because the other variables were not sufficiently correlated with the SC, but because of the low correlation with BMI-123. Considering that the average BMI is 20,54 with a standard deviation of 2,52 and above the optimal BMI, a decrease of 1 point would mean an almost optimal average BMI.

The second part of this hypothesis would want to concern itself with the same sort of analyses, but then for fourth and fifth graders combined. In this way it would be possible to assess whether having a SC background also has a decreasing effect on BMI. Unfortunately this hypothesis cannot be verified with the existing dataset, because the number of students in the fourth grade differ too much from the fifth grade, in order to make a fair comparison, all results from this test will be unbiased due to the higher number of students in the fourth grade. As illustrated in table 1 there are only 11 students in the fifth grade that had a normal VWO background compared to 21 with a SC background. In addition to this there were 24 students with an SC background and 25 in the regular classes in the fourth grade. On one side assessing the differences per grade would lead to unbiased results because of the low sample size. So combining the two grades would be attractive, because that would increase the sample size. On the other side in this case it could also lead to an unbiased estimate because of the before stated overrepresentations of fourth graders.

5.2 Being in the SC contributes to the psychological well-being of students

The goal in this part is to research if the SC has a positive effect on the attained grades of students in the OHQ. According to analyses in the previous section a comparison will be made between models by gradually introducing control variables.

	Model 1 b/se	Model 2 b/se	Model 3 b/se	Model 4 b/se	Model 5 b/se
SC	0.206*	0.152	0.108	0.099	0.050
	(0.09)	(0.09)	(0.11)	(0.11)	(0.12)
sport		0.020	0.023*	0.019	0.016
		(0.01)	(0.01)	(0.01)	(0.01)
cito			-0.003	-0.007	-0.006
			(0.02)	(0.02)	(0.02)
VWO			-0.098	-0.104	-0.182
			(0.10)	(0.10)	(0.11)
grade			0.123	0.154	0.135
			(0.08)	(0.09)	(0.10)
sidetrack			0.037	0.033	-0.037
			(0.13)	(0.14)	(0.15)
man				0.135	0.101
				(0.10)	(0.12)
divorced				0.041	0.182
				(0.10)	(0.10)
BMI				-0.003	0.003
				(0.02)	(0.02)
fatherHW					0.083
					(0.13)
motherHW					0.255
					(0.13)
constant	5.218***	5.101***	6.224	8.170	7.402
	(0.06)	(0.09)	(8.29)	(8.60)	(9.73)
R-sqr	0.027	0.048	0.071	0.076	0.112
Sample size	183	182	174	170	124

* p<0.05, ** p<0.01, *** p<0.001

Table 3

The first simple model gives the effect of the SC whiteout taking anything else into account illustrates that the effect is 0,2[12]. Going to the second model the effect is downsized with 0,05 points by including extracurricular sporting behaviour. Now the SC looses its significance.

It is not necessarily clear if a student's extracurricular sport activities are intertwined with attending the SC or would have been undertaken regardless. As "regulars" do not spent as much time to non-school sports, there appears to be a strong correlation for the SC population, so, there is enough reason to perform a joint F-test (see appendix 8). The result confirm that the SC and extracurricular sports are jointly still statistically different from zero at a significance level of 1,3 per cent. Meaning, that

[12]The average OHQ grade is 5,29 with a standard deviation of 0,6. On a scale from 1 to 7.

there is still an effect of the SC on the grades of the OHQ but that it runs hand in hand with the effect of non-school sporting behaviour.

The third model controls for the possible intellectual ability effects and the potential difference between students that followed the regular VWO track in comparison to students that came from the side-track. Without going into the significance of these control variables again a joint F-test is conducted which confirms that sport and SC are still jointly different from zero with a significance level of 3,3 percent[13] (see appendix 9).

In the fourth model the variables "divorced"[14], "man" and "happy" are added. After controlling for these variables the joint F-test (see appendix 10) the results point out that SC and sport are jointly insignificant when requiring a significance level of at least five percent. Without going to the fifth model it is clear that the hypothesis cannot be confirmed. There is no evidence for increased feelings of happiness due to being in the SC in the first, second and/or third grade.

After the third class all students from regular classes and the SC are obliged to choose a study specialisation. This causes a mixing of SC and "regulars" in the fourth and fifth grade. In the next part of the analyses the focus will be on students with an SC background and questions whether their psychological well-being is higher compared to students with a regular background.

[13] Note that this is higher then the sole significance level of 4,4 per cent of sports.
[14] A dummy variable that is zero when the biological parents are together and one if they are divorced or split up.

	Model 1 b/se	Model 2 b/se	Model 3 b/se	Model 4 b/se	Model 5 b/se	Model 6 b/se
SC	0.478***	0.396***	0.382**	0.362*	0.278	0.363*
	(0.10)	(0.11)	(0.14)	(0.14)	(0.16)	(0.17)
sport		0.025*	0.026*	0.019	0.027	0.023
		(0.01)	(0.01)	(0.01)	(0.01)	(0.02)
cito			0.013	0.015	0.014	0.023
			(0.01)	(0.01)	(0.01)	(0.01)
VWO			-0.238*	-0.258*	-0.283*	-0.238
			(0.12)	(0.12)	(0.13)	(0.13)
grade			0.139	0.121	0.105	0.149
			(0.09)	(0.10)	(0.11)	(0.10)
sidetrack			-0.022	-0.057	-0.078	0.018
			(0.14)	(0.14)	(0.15)	(0.15)
man				0.155	0.131	0.179
				(0.11)	(0.11)	(0.12)
divorced				-0.192	-0.104	-0.164
				(0.12)	(0.12)	(0.13)
BMI					-0.020	-0.011
					(0.02)	(0.02)
fatherHW						-0.017
						(0.12)
motherHW						0.272*
						(0.12)
constant	4.968***	4.845***	-3.172	-3.733	-2.663	-8.443
	(0.06)	(0.08)	(6.84)	(6.71)	(7.19)	(7.19)
R-sqr	0.116	0.157	0.196	0.235	0.213	0.291
Sample size	131	130	122	119	108	94

* p<0.05, ** p<0.01, *** p<0.001

Table 4

From table 4 it seems like having an SC background in the fourth and fifth class has a significant positive effect on the happiness of students. All models apart from the fifth model show that even when adding control variables the effect of SC is still different from zero at a significance level of at least 5 percent. In the fifth model the significance level on which the effect of the SC would still be statically different from zero is at a significance level of 8 per cent, which is still significant.

Additionally, it seems that having VWO advice in contrast to having HAVO/VWO advice has a relatively negative effect. A suggestion for an explanation is that it could be because students that have received HAVO/VWO advice, but are doing the VWO track are more satisfied with there accomplishments and therefore happier. However, there is no solid evidence for this explanation and as it is outside the scope of this thesis it will be left unexplained.

Thirdly, the sixth model generates evidence that having a mother with a HBO or WO degree, instead of no or an MBO degree has a positive effect on the happiness of students. Similar to the problem described in section 6.1, accompanying the sixth model is a drop in the sample size, making the model less accurate. Consequently, it is hard to tell whether or not it is a useful control variable but it seems not to have changed the effect of being in the SC.

Lastly, adding the control variable "man" and "divorced" seems to be redundant because of their insignificance and low correlation with OHQ grades. Therefore contemplating the above observations, model 3 seems to be the most adequate model.

In summary, the results suggest that being in the SC does not influence the psychological well-being of a student for the first three years. However, in the fourth and fifth grade an SC student's psychological well-being increases. Considering that the average OHQ grade in the fourth and fifth class is about 5,0 (on a scale of 1 to 7) with a standard deviation of 0,6 an increase of about 0,38 (third model) seems to be substantial.

5.3 Being in the SC contributes to the average grades of students

The final hypothesis will be that the SC has a positive effect on the academic achievements of students. The first part of the hypothesis testing will be limited to the effect of the SC on the grades of first, second and third year (table 5). The grades used in the test, were the average of all combined study results (measured on a scale of 1 to 10 with the latter being the top score) of this school year 2012-13.

Grades123

	Model 1	Model 2	Model 3	Model 4
	b/se	b/se	b/se	b/se
SC	0.473***	0.543***	0.363***	0.381***
	(0.09)	(0.09)	(0.09)	(0.11)
sport		-0.015	-0.010	-0.017
		(0.01)	(0.01)	(0.01)
cito			0.040**	0.033
			(0.01)	(0.02)
VWO			0.244*	0.274*
			(0.11)	(0.13)
sidetrack			-0.115	-0.114
			(0.13)	(0.16)
man			-0.370***	-0.292**
			(0.08)	(0.10)
happy				0.109
				(0.08)
fatherHW				0.186
				(0.13)
motherHW				-0.087
				(0.12)
constant	6.527***	6.611***	-14.918	-11.621
	(0.06)	(0.09)	(7.95)	(9.25)
R-sqr	0.118	0.147	0.307	0.322
Sample size	209	187	179	127

* p<0.05, ** p<0.01, *** p<0.001

Table 5

In the previous tables it has been shown that when adding the variable sport a part of the effect of the SC was reduced. The opposite is true in this case. It seems that by adding sport to the model the effect of the SC increases. When evaluating the estimated beta of sport it becomes clear that there is a negative relation between sporting outside school and grades at a significance level of about 11 percent. Therefore it seems like a logical explanation that by filtering the effect of sporting outside of school hours an upward jump is caused in the effect of SC on achievements.

The second observation that can be made from table 5 is that the effect of SC stays different from zero by a significance level of 1 percentage or lower. When adding all possible control variables an effect of about 0,38 points on the average grade of all grades is still apparent. Sliding from the second to the third model it is noticeable that

CITO score and having VWO advice as expected overtake some of the effect of the SC and that by controlling for this a part of the selection bias is solved.

Model three shows that being from a male gender is negatively correlated with grades. Making it a valid control variable in case that man were overrepresented in the SC. However, from appendix 7 this does not seem to be the case because of the low correlation between gender and the SC. From the fourth model it seems like that parent education levels and having a particular OHQ grade did not correlate with academic achievements and therefore appear to be redundant.

In short, it seems like the third model gives the best estimate of the effect of the SC on grades, because it is more accurate then the fourth model (see difference in standard deviations and sample size) but still has the important control variables. Table 5 points out that there is strong evidence that indeed the SC has a positive influence on academic achievement when taken all the control variables into account. So what about the fourth and fifth graders with a SC background?

Grades45

	Model 1	Model 2	Model 3	Model 4
	b/se	b/se	b/se	b/se
SC	-0.001	0.115	-0.017	-0.182
	(0.12)	(0.13)	(0.17)	(0.19)
sport		-0.013	-0.003	0.001
		(0.01)	(0.01)	(0.01)
cito			0.013	0.014
			(0.01)	(0.01)
VWO			0.074	0.073
			(0.11)	(0.11)
sidetrack			-0.094	-0.187
			(0.13)	(0.14)
man			-0.140	-0.206
			(0.11)	(0.12)
happy				0.186*
				(0.09)
fatherHW				0.137
				(0.13)
motherHW				-0.002
				(0.11)
constant	6.298***	6.443***	-0.753	-2.008
	(0.06)	(0.07)	(6.94)	(7.41)
R-sqr	0.000	0.016	0.047	0.108
Sample size	173	131	123	106

* p<0.05, ** p<0.01, *** p<0.001

Table 6

In contrast to the strong evidence found for students in the first, second and third grade there is no evidence regarding the effect of having a SC background on their achievements for fourth and fifth graders. Not even in the first model without control variables. Or in other words there is no evidence found to confirm the hypothesis that fourth and fifth graders with a SC background do better in school.

Outstanding is that in table 6 all control variables and the SC seems to be insignificant apart from having a particular OHQ grade (model four). As discussed in the literature review this measurement is correlated with a variety of psychological phenomena's.

Combing the results from table 5 & 6 suggests that as long as students are in the SC there is a direct positive effect on their average grades. After they get redistributed over the fourth and fifth grades the effect is lost. Considering that the average grade in the first, second and third grade is about 6,7 with a standard deviation of about 0,667 an increase of 0,363 seems to be substantial.

6. Conclusion (discussion)

The first finding is that students in the SC on average are closer to the optimal BMI in the first, second and third grades. However, this can still be caused by e.g. the amount spent on sporting apart from school. Further researching the matter led to the conclusion that when controlling for the selection bias that the BMI of the first, second and third graders is substantially decreased for students in the SC. Controlling for the amount of hours sporting apart from school hours seems to be the most important contributor.

Secondly, there is no evidence for an effect of the SC on the physiological well-being of the students in the first, second and third grades. On the contrary, a positive correlation was found between having an SC background and the physiological well-being of fourth and fifth graders. Although this result seems odd, a possible explanation could have to do something with different phases of puberty and its effect on the psychological well-being of students. Confirming this is the outstanding result

from table 6 that grades from the OHQ seem to be positively correlated with achievements. Therefore it might be recommendable to further research the possible correlation between puberty, sport and OHQ.

Tables 5 & 6 suggest that there is a direct effect of the SC (first, second and third grade) on achievements but no effect on students from the fourth and fifth grade with a SC background. However, this should be interpreted carefully, because the research was limited to data concerning one school year. To find irrefutable evidence one should follow a particular class of students for six consecutive years because then a student is followed throughout its entire school career.

On a more general note it should be emphasised that the effects are not necessarily related to the physical part of the program as such, but could be a result of more enhanced social coherence in these SC's, or because of a joint purpose when training together or simply because of a sporting culture etc. Also one should not underestimate the effect of a highly motivated SC teacher team centralised around the concept of sporting together.

I would like to end this thesis by returning to the reasons why I started this research in the first place. As regards the St. Nicolaaslyceum's continuation of the SC, I would suggest that there is enough evidence that the SC has an important contribution for students concerning their health, well-being and achievements. This leads me to the second point, to recommend making the SC available for all students, or extend the availability of the SC. When controlling for the selection bias the positive effects are still standing. They are not caused by having a particular set of students but by being in an SC. This leads me to believe that it can also be successfully implemented for the regular VWO classes or on other tracks like HAVO and/or other schools.

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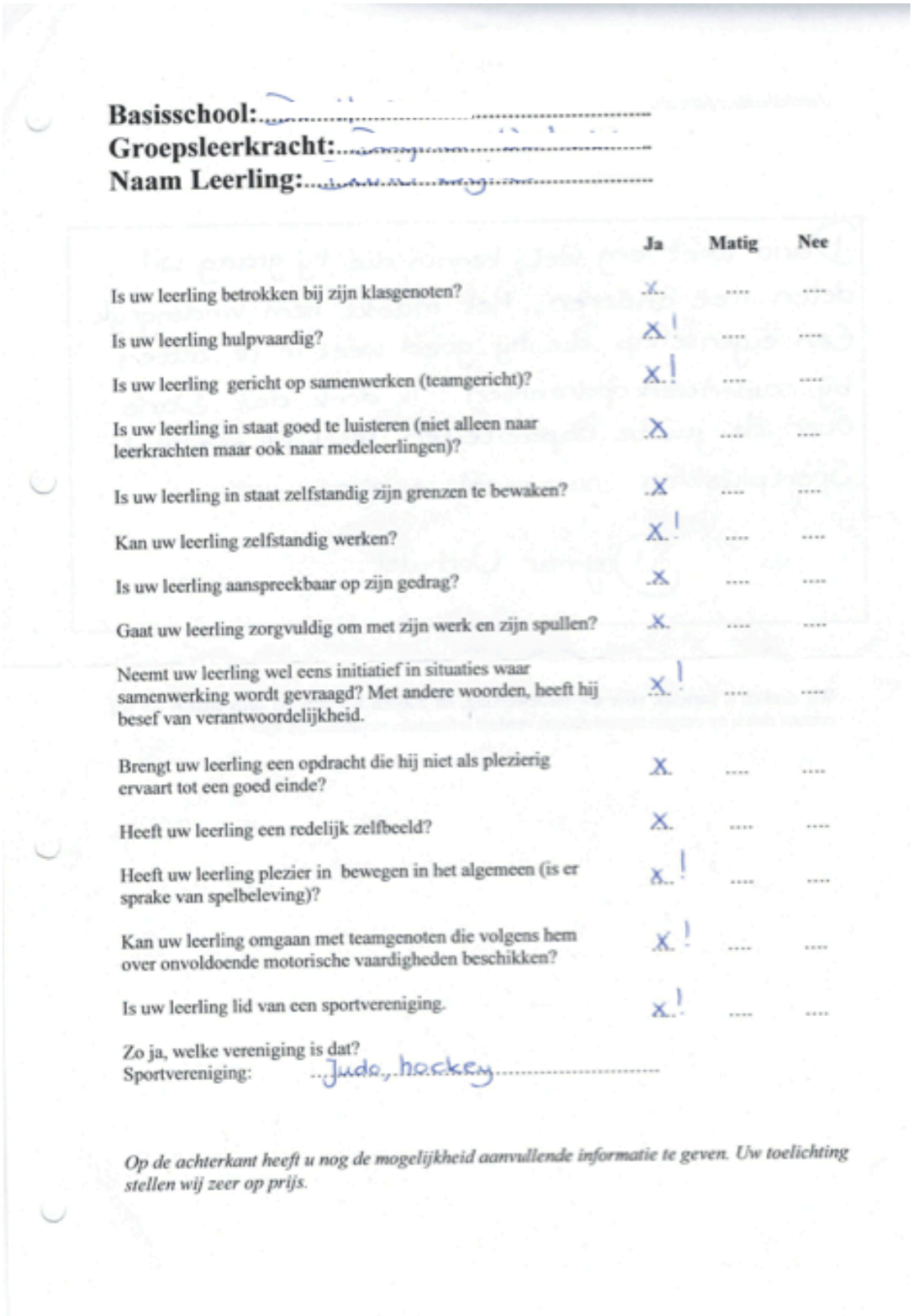
Appendices

Appendix 1: *Social competence questionnaire example filled in by previous teacher*



Basisschool: .....
Groepsleerkracht: .....
Naam Leerling: .....

	Ja	Matig	Nee
Is uw leerling betrokken bij zijn klasgenoten?	X	....	....
Is uw leerling hulpvaardig?	X !	....	....
Is uw leerling gericht op samenwerken (teamgericht)?	X !	....	....
Is uw leerling in staat goed te luisteren (niet alleen naar leerkrachten maar ook naar medeleerlingen)?	X	....	....
Is uw leerling in staat zelfstandig zijn grenzen te bewaken?	X	....	....
Kan uw leerling zelfstandig werken?	X !	....	....
Is uw leerling aanspreekbaar op zijn gedrag?	X	....	....
Gaat uw leerling zorgvuldig om met zijn werk en zijn spullen?	X	....	....
Neemt uw leerling wel eens initiatief in situaties waar samenwerking wordt gevraagd? Met andere woorden, heeft hij besef van verantwoordelijkheid.	X !	....	....
Brengt uw leerling een opdracht die hij niet als plezierig ervaart tot een goed einde?	X	....	....
Heeft uw leerling een redelijk zelfbeeld?	X	....	....
Heeft uw leerling plezier in bewegen in het algemeen (is er sprake van spelbeleving)?	X !	....	....
Kan uw leerling omgaan met teamgenoten die volgens hem over onvoldoende motorische vaardigheden beschikken?	X !	....	....
Is uw leerling lid van een sportvereniging.	X !	....	....

Zo ja, welke vereniging is dat?
Sportvereniging: Judo, hockey

Op de achterkant heeft u nog de mogelijkheid aanvullende informatie te geven. Uw toelichting stellen wij zeer op prijs.

Appendix 2: *Social competence report*

Bijlage behorende bij rapport2

St. Nicolaas lyceum

Naam:.....

Overzicht Persoonlijke Competenties Sportplustraject

Schooljaar 2012/2013

Beethovenplein 2
1077 WT
Amsterdam

020 644 51 51

sint@nicolaas.nl
www.nicolaas.nl

Competenties persoonlijke effectiviteit

	Onvoldoende	Kan beter	Voldoende	Goed
Zelfreflectie	o	o	o	o
Luisteren	o	o	o	o
Samenwerken	o	o	o	o
Toepassen feedback	o	o	o	o
Sportiviteit	o	o	o	o

Competenties resultaatgerichtheid

	Onvoldoende	Kan beter	Voldoende	Goed
Plannen en organiseren	o	o	o	o
Loyaliteit	o	o	o	o
Doorzettingsvermogen	o	o	o	o
Initiatief	o	o	o	o

Ouder/Verzorger: Mentor:

....

Appendix 3: *Oxford Happiness Questionnaire*

Dit was deel 1. In dit deel van de enquête vraag ik je om aan te geven hoe eens of oneens je bent met een aantal stellingen op een schaal van 1 tot 7.

Let op: kies 1 als je het volledig oneens bent met de stelling en 7 als je het volledig eens bent met de stelling.

	Oneens						Eens
Ik ben niet echt tevreden met wie ik ben	○	○	○	◉	○	○	○
Ik ben ontzettend geïnteresseerd in andere mensen	○	○	○	○	○	○	○
Ik vind het leven waardevol	○	○	○	○	○	○	◉
Ik mag bijna iedereen graag	○	○	○	◉	○	○	○
Ik word bijna nooit uitgerust wakker	○	○	○	○	○	○	○
Ik ben niet bijzonder optimistisch over de toekomst	◉	○	○	○	○	○	○
Ik vind de meeste dingen amusant	○	○	○	○	○	○	○
Ik ben altijd toegewijd en betrokken	○	○	○	○	○	○	○
Het leven is goed	○	○	○	○	○	○	○
Ik vind de wereld niet een goede plek	○	○	○	○	○	○	○
Ik lach veel	○	○	○	◉	○	○	○
Ik ben tevreden over alles in mijn leven	○	○	○	○	○	○	○
Ik vind mezelf niet aantrekkelijk	○	○	○	○	○	○	○
Wat ik zou willen en wat ik heb gedaan tot nu toe is niet gelijk aan elkaar	○	○	○	○	○	○	○
Ik ben erg gelukkig	○	○	○	◉	○	○	○
Ik zie schoonheid in sommige dingen	○	○	○	○	○	○	○
Ik heb altijd een opvrolijkend effect op anderen	○	○	◉	○	○	○	○
Ik heb niet genoeg tijd om alles te doen wat ik wil	○	○	○	○	○	○	○
Ik heb het gevoel dat ik niet in controle ben van mijn eigen leven	○	○	○	○	○	○	○
Ik heb het gevoel dat ik alles aan kan	○	○	○	○	○	○	○
Ik ben mentaal volledig alert	○	○	○	○	○	○	○
Ik voel me vaak vrolijk en opgetogen	○	○	○	○	○	○	○
Ik vind het moeilijk beslissingen te maken	○	○	○	○	○	○	○
Ik heb niet echt een doel of bestemming in het leven	○	○	○	○	○	○	○
Ik heb veel energie	○	○	○	○	○	○	○
Ik heb over het algemeen een goede invloed op gebeurtenissen	○	○	○	○	○	○	○
Ik heb geen plezier met andere mensen	○	○	○	○	○	○	○
Ik voel mij niet echt gezond	○	○	○	○	○	○	○
Ik heb niet echt blije herinneringen aan vroeger	○	○	○	○	○	○	○

Appendix 4: *Example of one of the twenty-nine questions of "the EYE" test*

Dit is het einde van deel 2. In het laatste gedeelte zal je 29 foto's te zien krijgen van de ogen van verschillende mensen. Het is de bedoeling dat jij één van de vier meerkeuzeantwoorden selecteert die het beste de emotie van deze persoon beschrijft.

25.

Kijk goed naar de foto hierboven en kies één van de vier antwoorden die het beste beschrijft wat deze persoon denkt of voelt*

- ◯ Jaloezie
- ◯ Bang
- ◯ Ontspannen
- ◯ Haat

Appendix 5: *STATA output on "the EYE" test*

```
. regress Sc123 SC, robust

Linear regression                                      Number of obs =     190
                                                       F(  1,   188) =    0.09
                                                       Prob > F      =  0.7653
                                                       R-squared     =  0.0005
                                                       Root MSE      =   1.075

------------------------------------------------------------------------------
             |               Robust
       Sc123 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          SC |  -.0476286    .159319    -0.30   0.765    -.3619113    .2666542
       _cons |   7.235584   .1002357    72.19   0.000     7.037853    7.433315
------------------------------------------------------------------------------

. regress Sc45 SC, robust

Linear regression                                      Number of obs =     134
                                                       F(  1,   132) =    0.47
                                                       Prob > F      =  0.4963
                                                       R-squared     =  0.0027
                                                       Root MSE      =  1.0626

------------------------------------------------------------------------------
             |               Robust
        Sc45 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          SC |   .1273576   .1866975     0.68   0.496    -.2419485    .4966637
```

```
       _cons |   7.166268   .1115297    64.25   0.000     6.945652    7.386885
------------------------------------------------------------------------------
```

Appendix 6: *Joint F-test (BMI123 model 3)*

. test cito grade VWO

(1) cito = 0
(2) grade = 0
(3) VWO = 0

F(3, 131) = 1.93
Prob > F = 0.1275

Appendix 7: *Correlation test BMI123 (STATA output)*

```
. corr BMI123 SC sport cito VWO grade man happy fatherHW motherHW
(obs=98)

             |   BMI123      SC    sport     cito      VWO    grade      man    happy fatherHW motherHW
-------------+------------------------------------------------------------------------------------------
      BMI123 |   1.0000
          SC |  -0.2513   1.0000
       sport |  -0.1940   0.2444   1.0000
        cito |   0.0364   0.1975   0.1306   1.0000
         VWO |  -0.1066  -0.2142  -0.0061   0.1424   1.0000
       grade |  -0.2032   0.2983  -0.1219   0.2793   0.2526   1.0000
         man |   0.0405  -0.0863   0.1567   0.1767   0.0107  -0.3264   1.0000
       happy |  -0.0467   0.1566   0.1561   0.2274  -0.0832   0.0949   0.0793   1.0000
    fatherHW |  -0.0526   0.0457   0.0169   0.1695   0.0215   0.1647  -0.1558   0.1213   1.0000
    motherHW |   0.0726   0.1492   0.0724   0.2418  -0.0992  -0.0916   0.0763   0.1731   0.1500   1.0000
```

Appendix 8: *Joint F-test (OHQ123, model 2)*

. test SC sport

(1) SC = 0
(2) sport = 0

F(2, 182) = 4.47
Prob > F = 0.0127

Appendix 9: *Joint F-test (OHQ123, model 3)*

. test SC sport

(1) SC = 0
(2) sport = 0

F(2, 174) = 3.46
Prob > F = 0.0335

Appendix 10: *Joint F-test (OHQ123, model 4)*

```
. test SC sport

 ( 1)  SC = 0
 ( 2)  sport = 0

       F(  2,   170) =    2.43
            Prob > F =    0.0907
```