Impact evaluation of the Science Team K project

THE THINK TANK
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DANISH | SCIENCE FACTORY

Forord

Denne rapport er en evaluering af projektet Science Team K og effekterne af projektet efter 10 år.

Science Team K var en lokalt forankret indsats, som havde til formål at undersøge, om man kunne øge antallet af unge i Kalundborg og omegn, som ville vælge naturfag både i gymnasiet og senere på de videregående uddannelser. 2.500 elever fra grundskoler og gymnasier deltog sammen med deres naturfagslærere i projektet i perioden 2003-2006. Projektet blev finansieret af Lundbeckfonden og udført af Danish Science Factory i samarbejde med en lokal projektledelse.

Udover at skabe konkrete målbare resultater, havde Science Team K desuden som langsigtet mål at indsamle erfaringer til inspiration for fremtidige lokale indsatser på naturfagsområdet samt at skabe konkrete undervisningsforløb og samarbejdsmodeller, der kunne anvendes i andre lokalområder.

Evalueringen viser grundlæggende, at svaret på projektets hovedspørgsmål er nej. Andelen af elever fra projektskoler og Kalundborg Gymnasium, der søger en naturfaglig uddannelse, er præcis på samme niveau, som før projektet. Det samme er tilfældet for elevernes karakterniveau generelt og i specifikke fag.

At Science Team K som enkeltprojekt ikke har kunnet aflæses i et konkret studievalg efter ti år, siger imidlertid ikke meget om projektets samlede potentiale. Science Team K har bl.a. medvirket til udviklingen af 25 såkaldte Science-kommuner, samt til en kommunalpolitisk indsats med fokus på science-strategier i flere kommuner. Og for få dage siden har den norske regering med direkte afsæt i de danske Science-kommuner afsat 20 mio. kr. til en lignende norsk indsats. Denne opskaleringen af projektet er et bevis for, at projektet har skabt en strømning, der gør værdien af projektet svær at kvantificere. Så på trods af den umiddelbart ringe evaluering kan projektet ende som særdeles værdifuldt for samfundet.

Der synes generelt at være en fantastisk strøm af offentligt og privat finansierede projekter, der har til formål at innovere, eksperimentere og udforske inden for folkeskolen. Projekter som Science Team K har som sådan et kæmpe potentiale som videnfundament for de nationale tiltag, som fx folkeskolereformen, som er nødvendige for, at folkeskolen kan udvikle sig i takt med vores omgivende samfund.

Desværre lider projekterne ofte under uklarhed ift. mål og mission, hvilket naturligt afstedkommer svage konklusioner og resultater. Samtidig blokerer dårlig kommunikation, urealistiske målsætninger og ufærdige evalueringer alt for ofte den videndeling, der kunne kvalificere projekterne. Risikoen er, at ellers gode projekter har svært ved at blive forlænget men også, at projekter og den viden, de genererer, glemmes, når reformer er på den politiske dagsorden.

Lundbeckfonden, Danish Science Factory, Institut for Naturfagenes Didaktik på KU og DEA mener, at det er på tide at gøre op med den evalueringskultur, der hersker i disse projekter. Vi mener, at alle projekter af en vis størrelse skal have klart definerede, realistiske mål, og at en efterfølgende evaluering er mindst lige så naturlig som en indledende idé. Det er vores moralske pligt at sikre, at den viden, som skabes i projekter, lever videre.

Men hvad skal vi så gøre ved det?

I England har man oprettet et center, der skal tage hånd om indsamling af brugbar viden. Med det sigende navn ”The Alliance for Useful Evidence” vedligeholder centeret et netværk, hvor parterne leverer brugbar viden fra eksperimenter og projekter inden for de sociale videnskaber. Hvis erfaringen fra projekter i højere grad kunne videregives, ville det betyde, at fremtidige projekter eller samfundsreformer kunne nyde godt af disse.

Det er i hvert fald på tide, at vi begynder at forholde os til måden, vi evaluerer på og til, hvad vi får ud af projekterne. Science Team K er et fremragende eksempel på et projekt, der fra starten har haft klart definerede mål og som havde til formål at indsamle nødvendige erfaringer til inspiration for lignende indsatser i andre lokalområder.

God læsning.

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Læs mere om Science Team K på www.scienceteam.dk

TÆNKETANKEN DEA

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DEA

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Introduction

In the period between 2003 and 2006, the Lundbeck Foundation invested 8.9 million Danish kroner in Science Team K, a project whose main goal was to improve teaching in the natural sciences and technology in order to increase interest in these subjects among students attending elementary and high schools in the region of Kalundborg, in the western part of the island of Zealand, Denmark. Science Team K was envisioned as a trial of a locally embedded project model aimed at improving the teaching of science subjects, from which the Lundbeck Foundation would draw important lessons for the design and implementation of future projects of a similar kind.

Science Team K was therefore thoroughly evaluated both from 2003 to 2006 and in the years following. However, it is only now, 10 years after the project started, that it is possible to measure whether the project has had an impact on students' educational careers; this is the purpose of the present evaluation. The work behind this report has been carried out by the think tank DEA, which together with the Lundbeck Foundation, also co-sponsored the evaluation.

DEA's mission is to promote intelligent and effective investments in research, education and innovation that contribute to higher growth and productivity. We believe that a systematic approach of conducting rigorous impact evaluations[1] of public and private initiatives within the education sector, and disseminating and using the findings of these evaluations, is necessary to ensure that Denmark makes constant progress in improving the quality and relevance of its educational system.

Unfortunately, this has not been common practice in the Danish education sector. As the productivity commission highlighted in its report from December 2013, reforms have only to a very limited extent been organised to ensure systematic quantitative impact evaluations. This has seriously impaired the country's capacity to inform future reforms based on sound evidence-based knowledge of what works and what does not.

Science Team K is an example of how this problem can be addressed by integrating the planning and budgeting of rigorous evaluations right from the first stages of the project design. We believe valuable lessons can be drawn from this experience and were therefore very pleased to carry out the evaluation.

We have evaluated whether Science Team K has increased the percentage of students choosing upper secondary and tertiary education programs with strong science components and whether the project has improved general academic achievement and academic achievement in science subjects in both the 9th grade exit exams from lower secondary education and in upper secondary education. Overall, our results show that Science Team K did not have any impact in terms of these educational outcomes. However, had the evaluation been designed at the same time as the project, the

[1] Not all project, program or policy evaluations are impact evaluations. The Abdul Latif Jameel Poverty Action Lab, an organisation that has been key in disseminating the use of policy impact evaluations worldwide, defines an impact evaluation as follows. *"Impact evaluations estimate program effectiveness usually by comparing outcomes of those (individuals, communities, schools, etc.) who participated in the program against those who did not participate. The key challenge in impact evaluation is finding a group of people who did not participate, but closely resemble the participants had those participants not received the program. Measuring outcomes in this comparison group is as close as we can get to measuring 'how participants would have been otherwise'."* (Povertyactionlab.org, 2014)

information gained could have been richer and more useful for informing the development of future projects. A prospective design of the evaluation would have most likely led to greater efforts being made to collect data on specific aspects of the project, which could have been used in conjunction with registry data.

The report is structured as follows. Section 1 describes Science Team K and the context in which it was designed and implemented and briefly summarises some key findings from the evaluations carried out during and immediately after the end of the project. Section 2 explains the methodology used to carry out the present impact evaluation and presents the results. Section 3 presents the conclusions of the evaluation.

Section 1. Description of Science Team K

Project context, objectives and design

a. Context

Science Team K was born from the context of a deep concern, reflected for example in the national government's platform of 2001, about the lack of interest in the natural sciences and technology prevailing among Danish youth, which manifested itself at all levels of the education system. Results from the PISA tests (Programme for International Student Assessment) of the OECD (Organisation for Economic Co-operation and Development) made public in 2000 and 2003 placed Danish 15-year-olds below the OECD average in scientific literacy. Furthermore, there was a large gender gap that did not reflect the common trend within the OECD, with Danish girls performing significantly worse than boys. These results were further complemented by those of the Relevance of Science Education (ROSE) project, an international comparative study of 15-year-old attitudes and interests in science education, science and technology. ROSE results showed that Danish students regarded science and technology teaching as less relevant to their everyday lives and their professional future compared with their counterparts.

The Lundbeck Foundation shared the preoccupation with the low level of interest in science and technology among Danish youth and has a specific interest in reversing this trend. The Foundation is a controlling shareholder of two Danish pharmaceutical companies that perform research at the highest level, H. Lundbeck A/S and ALK -Abello A/S. The Foundation therefore was and still is interested in increasing the numbers of highly qualified graduates from Danish universities specialising in biomedicine and the natural sciences. Furthermore, the Foundation pours a significant amount of its resources into research grants within these fields and is therefore interested in more talented students pursuing careers within the natural sciences.

In this context, in 2002 the Lundbeck Foundation contacted the Danish Science Factory (DSF) requesting that they draw up a proposal for a project that would test an initiative to increase youth interest in pursuing a career within the natural sciences. DSF proposed a three-year project that would aim to increase interest in physics and chemistry in a defined geographical area by involving the local elementary and high schools, as well as local government and firms. Of the three areas considered, DSF chose the Kalundborg area to be the one best suited for the project, as it had a natural center in the only local high school.

In the beginning of 2003, the Lundbeck Foundation entered into a collaboration with DSF in which the Foundation committed itself to sponsoring the project with 7.9 million Danish kroner over a period of three years, with DSF as project leader. In 2006, the Foundation donated an additional 1 million Danish kroner to Science Team K to strengthen the future sustainability of the project.

When reading the present evaluation, it is important to keep in mind that the Science Team K project was implemented during a period in which the Danish education system was affected by a variety of reforms with potentially large effects on the outcomes of student education. Among these reforms were the reform of upper secondary education, which became effective in the school year 2005–2006 (Gymnasiereformen); the reform of the exit tests for 9th grade students in 2006; and the Municipal Reform, which became effective 2007 (Strukturreformen).

One of the main goals of the Gymnasiereform was to improve student competency in the natural sciences and technology. The reform introduced an obligatory preparatory course in science for all students in the general gymnasium (STX) targeted towards supporting and raising engagement and curiosity in science. Furthermore, the reform introduced the requirement for all students to study physics and mathematics at C level and two additional natural science courses at B and C level.

The reform of the 9th grade exit exams introduced in 2006 made these tests mandatory for all students and, in an effort to improve the standing of the natural sciences, introduced physics and chemistry as a mandatory test.

The Municipal Reform of 2007 introduced a new geographical division of municipalities, which reduced the number of municipalities from 270 in 2006 to 98 in 2007, and introduced significant changes in the responsibilities and financing of municipalities. As primary and lower secondary schools in Denmark are the responsibility of municipalities, the reform also led to an increase in the number of schools closing or merging, and therefore to significant changes in school administration in the years following the reform. More importantly for Science Team K, the reform merged all but one of the original participating municipalities (Tornved) plus another municipality (Høng) into the new Kalundborg municipality. It is therefore not far-fetched to assume that the conditions for co-operation between participating schools changed.

b. Objectives and success criteria

The main objective of Science Team K was **to increase interest in science and technology among children and youth in the Kalundborg area in order to increase recruitment to these subjects in both the upper secondary and higher education levels.**

The project had two additional subsidiary objectives to ensure that the lessons learned locally from the implementation and evaluation of Science Team K would contribute effectively to national efforts to improve teaching and recruitment to science and technology. The ambition of the projects, besides delivering concrete results for the Kalundborg area, was to develop a model, the "Science Team K" model, which could later be used to strengthen science education and recruitment in other areas of the country.

Subsidiary objectives:

1. **To create a methodology to implement an effort in a local area that can be used as a model in other areas.**
2. **To develop specific teaching practices and co-operation models that can be used in other local areas.**

The project design also included three success criteria which were related to the main objective of the project, that is, to the specific impact of the project in the Kalundborg area.

Success criteria:

1. Elementary and high school teachers improve their qualifications and become academically and pedagogically inspired.
2. Teaching in the natural science subjects improves and becomes more exciting for students through, for example, the introduction of non-traditional teaching tools.
3. New networks and forms of collaborations are established between elementary and high schools and between schools and external partners, including public and private firms and workplaces.

c. Project design

Science Team K was designed as a four-year project to strengthen science teaching, especially in physics and chemistry, in the 7^{th}–10^{th} grades and high school of the Kalundborg area starting in the school year 2003–2004. The project was based on a "something-for-something" model, where stakeholders, including schools, the local municipality and firms were expected actively to engage and make an effort to ensure that the project took strong roots in the community so that a local science culture was developed.

The Danish Science Factory acted as the central project manager with reference to a steering committee chaired by the Lundbeck Foundation. The DSF central project management was complemented by a local project manager, an employee at the local high school (Kalundborg Gymnasium and HF[2]) who was partially freed up to perform local project organisational tasks. An important part of the project organisation was the establishment of local networks. One of these was the teachers' network, which consisted of teachers and leaders from a number of the schools as well as the project management. This group was often consulted to co-ordinate and discuss the project's development. Similarly, school leaders met on a regular basis for meetings with the project management to discuss the project's conditions.

Teaching was the project's focal point, which made science teachers its target group. At the time the project started, 17 schools and one gymnasium took part. This included three independent schools and a private school. In total, there were approximately 80 science teachers in these schools in the year 2003–2004.

The project aimed to reach all teachers, not just the most engaged ones, so all schools made the commitment to allow 20 hours per year to all science teachers to participate in the project's activities. However, the project also had the philosophy that specific initiatives should emerge

[2] HF is the Higher Preparatory Examination, one of the four upper secondary education programmes in Denmark.

organically from individual teachers or networks of teachers so that in fact the project would have the most engaged teachers as its main drivers.

These two aspects of the project, the inclusion of all teachers plus the specific focus on engaged teachers, were reflected in the core components of the project:

1. **Fund for teaching initiatives:** This was the largest project component in terms of funding; 2.1 million Danish kroner was allocated to it. STK teachers alone or in teams could submit applications for funds for equipment and activities to implement their own educational projects. Each application was required to include a project description, including didactic considerations, budget and a strategy to communicate experiences to other teachers. Applications were handled by a grant committee comprising a secondary school and a high school teacher, the Danish Science Factory director and the project manager.

   Most grants funded the purchase of teaching equipment, teacher training to develop specific teaching methods, projects to facilitate the transition from lower secondary education to high school, and clubs and field trips for engaged students. Applications for the purchase of general teaching equipment, such as laptops, were not accepted by the committee.

   The committee received a total of 117 applications distributed fairly evenly in four application rounds, of which 86 were successful. All available funds were used, and of the 80 teachers who were eligible to apply, 45 received funds. Just under half of the funds went to high school projects and the average allocation was around 25,000 Danish kroner, varying from 2,500 to 170,000.

2. **Teacher training**: 15% of the project funds were earmarked for professional training courses and seminars for teachers. The project managers expected that if a teacher needed more than the initially allocated 20 hours to participate in project activities, the schools' general budget would cover this. It turned out, however, that teachers' schedules were already saturated and schools assigned very few funds for new activities. Therefore, the planned activities aimed at teachers had to be reduced, mainly to inspirational activities after working hours, for example conferences, study groups and excursions, and training in the use of new teaching equipment.

3. **Network formation:** The project also had a considerable focus on the establishment of strong networks. This applies to both formal networks created under the project (the teacher's network, the project coordination group and the steering committee) and informal networks that were established ad hoc in connection with teacher projects (for example, teacher training and the project's opening and closing events).

4. **Collaboration with firms:** Science Team K also placed a strong emphasis on involving local businesses in science education and on giving students and schools the possibility to gain inspiration from them. A teachers' committee worked together with local companies to create a catalogue of visits and lectures that could complement science teaching, which was then handed over to all science teachers.

Summary of key findings from previous evaluations of Science Team K

As mentioned previously, one of the key elements of the Science Team K design was the inclusion of both quantitative and qualitative evaluations that would take place during and after implementation of the project. The objective of these evaluations was twofold: they were meant to give valuable feedback to the project management in the course of the project and to create a pool of experiences that could be used in the design of new projects following the Science Team K model. The evaluations made to date[3] have assessed the project with respect to its subsidiary objectives; however, their conclusions have been useful in evaluating the impact of the project with respect to its main objective.

For instance, as part of its evaluation, DPU applied the ROSE survey to a large and representative sample of 8th–10th graders from Science Team K schools in 2004 and 2006. The intention was to gauge whether the project had an immediate impact on student attitudes towards science education, science and technology. The results indicate that the project may have had a different effect on girls than on boys. This possibility has been taken into account in the current impact evaluation.

Broadly, the results from the ROSE survey show that the attitudes of students in STK schools were significantly less positive than the national average (measured in 2003) both in 2004 and 2006. They also show that among girls from STK schools, there was a statistically significant improvement in attitudes towards science between 2004 and 2006. When students were asked to state how much they liked specific subjects and to self-assess their performance in them, once again between 2004 and 2006 there was a significant increase in the percentage of girls in STK schools answering that they liked and did well in physics and chemistry.

Other studies carried out by DPU have included surveys of science teachers in 2004 and 2006, teachers heading projects from the teaching initiatives fund in 2006, interviews with the headmasters from all STK schools, and in-depth case studies of local science cultures at three STK schools.

These studies have also provided an important insight for the current evaluation: that the implementation of STK was very diverse across schools. This was due to a variety of factors, for instance, differences in the pre-existing conditions at each of the schools in terms of teachers' pool, teaching infrastructure, science teaching budget and leadership type. The key stakeholders' reaction to the project also differed across schools; they presented high levels of engagement from the beginning in some schools, but were more skeptical and slower to take advantage of the possibilities provided by the project in other schools. All in all, schools had different levels of teacher and leadership engagement, so that in some schools, the project was led and kept afloat by a few enthusiastic teachers, whereas in other schools there was a more systematic effort to use the project as a way to redefine the strategy for science teaching. These differences could be expected to affect the way the project impacted students across schools in terms of intensity and timing. This insight has also been considered when conducting the current evaluation.

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[3] The Danish Pedagogical University (DPU), now the Department of Education at Århus University, has co-financed (together with Lundbeck Foundation and the Danish National Graduate School of Science and Mathematics Education, NADIFO) and carried out all evaluations up to now.

Section 2. Impact evaluation of Science Team K

The purpose of the current impact evaluation was assess whether the Science Team K project fulfilled its main objective, which was **to increase interest in science and technology among children and youth in the Kalundborg area in order to increase recruitment to these subjects both in the upper secondary and higher education levels.**

The project's success was measured in terms of the following educational outcomes:

- increased completion of upper secondary education programs with science subject
- increased recruitment to science degrees in higher education
- increased overall academic performance and performance in physics and chemistry in lower secondary education
- increased overall academic performance and performance in science subjects in upper secondary education

Methodology

To assess whether Science Team K affected the performance of students in terms of these outcomes, we used a difference-in-differences method. This method consists in comparing outcomes experienced by a treatment and a control group both before and after an intervention has taken place. In our case the intervention is the STK project and the treatment group is the group of students attending 7th–10th grade, gymnasium and HF at the schools that participated in the project. We have constructed two different control groups, the first consisting of all students attending 7th–10th grade, gymnasium and HF in the rest of Denmark, the second one of students attending these same grade levels in the former Esbjerg[4] municipality.

The main assumption behind the difference-in-differences method is that in the absence of the intervention, the trend in the outcomes of interest would have been the same for the treatment and the control group. In the case of the present evaluation, this means that we are assuming that, for instance, the percentage of gymnasium graduates taking a science higher education degree would have changed at the same rate in Kalundborg as in the control group in the absence of Science Team K. Using the whole of Denmark as a control group is the most natural choice, as this captures the most general development in the outcomes of interest whose trend is largely unaffected by specific developments taking place at a more local level. However, this general development might be strongly driven by what happens in the largest Danish cities, which could in principle experience very different patterns than Kalundborg.

We have therefore chosen Esbjerg as an alternative control group following Jan Sølberg, who wrote his PhD thesis "*Developing Local School Science Cultures*" using the Science Team K project as its empirical subject. Esbjerg is an area that is relatively similar to Kalundborg, as they are both mid-sized industrial ports and relatively far away from the largest urban areas.

[4] The former Esbjerg municipality was merged with the former Bramming and Ribe municipalities to form the new Esbjerg municipality as a result of the Municipal Reform of 2007.

Individual educational outcomes vary greatly according to a host of parameters, some of which we can take into account in our analysis by using information available through the Danish registers. We have included variables that capture individual characteristics, parental characteristics, school characteristics and class characteristics. Only those variables exogenous to the treatment have been included; this means that individuals have not been self-selected into the treatment group in a way that is correlated with these variables, and none of the included variables can be considered to be an outcome of the intervention.

For example, while there is a very likely connection between high school grades in physics and chemistry and the choice of a higher education degree with science components, we have not included grades in physics and chemistry as an explanatory variable in our analysis of higher education choice because it is likely that Science Team K had a direct impact on student's physics and chemistry grades.

To estimate the effect of Science Team K on a students' likelihood of completing an upper secondary education or a higher education degree in science, we estimate a probit model that can be captured by the following equation:

$$\text{Probability}(Science\ education = 1 |\ STKschool, T2, x_1, x_2, \dots, x_k)$$
$$= G[\delta_0 + \delta_1(STKschool) + \delta_2(T2) + \delta_3(STK\ school * T2) + \beta(X)]$$

where

- G is the standard normal cumulative distribution function,
- $STK\ school$ is a variable that equals 1 if the student has attended 7th , 8th and 9th grade at a school affected by the Science Team K, and 0 otherwise,
- $T2$ is a variable that equals 1 if the student has attended 7th, 8th or 9th grade in the period after the Science Team K project was introduced
- X is a vector of explanatory variables

To estimate the effect of Science Team K on a student's academic performance in terms of grades, we have used ordinary least squares regression to estimate equations of the type:

$$Grade = \delta_0 + \delta_1(STKschool) + \delta_2(T2) + \delta_3(STK\ school * T2) + \beta(X)$$

In both equations:

- δ_1 defines the estimated average difference in the outcomes of interest between schools affected by Science Team K and schools not affected by it before STK was introduced,
- δ_2 defines the estimated average difference in the outcome of interest between students attending schools before and after STK was introduced
- δ_3 is the difference-in-differences estimator, which gives the estimated effect of Science Team K, as it defines the estimated average difference between the following two differences: the difference between students attending STK schools before and after the

project and the difference between students not attending STK schools before and after the project.

All data for our analysis have been drawn from the Danish registers. We carried out the analysis in two separate parts. We estimated first the effects of Science Team K for students treated in 7th–10th grade, and then for students treated in high school. Although we used the same methodology for both parts, the population and outcomes are different. The following two sections of the report deal with each of these two parts in detail.

Part 1: Effect of STK treatment in 7th–10th grade

Outcome variables

When analysing the effects of being exposed to Science Team K in 7th–10th grade, we have focused on the following primary and secondary outcome variables.

Primary outcome variable

- Completion of an upper secondary education program with strong science components within 5 years after finishing lower secondary education or completion of a vocational education and training program with strong science components within 6 years after finishing lower secondary education. In what follows, this outcome will be referred to as "Completion of Science Youth Education".

The following upper secondary educational programs have been defined as having strong science components:

- STX (general high school) or HF (higher preparatory examination) in which the student has taken at least one science subject at the highest level (A-level). The following are considered science subjects: physics, chemistry, physics and chemistry, geography, natural science, physical geography, computer science, science, astronomy, biotechnology and biology. [5]
- HTX (higher technical examination) with any combination of subjects.

Vocational education and training programs have been defined as having strong science components if they are within the following three entry clusters:

- Motor vehicle, aircraft and other means of transportation
- Production and development
- Electricity, management and IT

Secondary outcome variables

- Grade point average for all subjects in the lower secondary education exit exams taking place in the 9th grade[6], excluding optional courses.

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[5] The Danish names for these science subjects are: fysik, kemi, fysik-kemi, geografi, naturfag, naturvidenskabelig faggruppe, naturgeografi, datalogi, science, astronomi, bioteknologi, and biologi.

[6] Since 2006, all students have been required to take the 9th grade exit exams, where physics and chemistry are one of the mandatory subjects.

- Grade point average in physics and chemistry in the lower secondary education exit exams taking place in the 9^{th} grade.
- Grade point average for completed upper secondary education programs (STX, HF, HTX and HHX).
- Grade point average in science subjects at all levels for completed upper secondary education programs (STX, HF, HTX and HHX).

Population

Our population of interest consists of students attending 7^{th}, 8^{th} or 9^{th} grade in all state, private, independent and boarding schools in Denmark in the period from school year 1998–1999 to school year 2009–2010. The data include information for the 8^{th} grade onwards for all periods, but 7^{th} grade information is only available from the school year starting in 2006. We have therefore had to assume that all students attending 8^{th} grade in 1998–2006 attended 7^{th} grade at the same school the preceding year.

To eliminate most concerns about self-selection to the program, we have restricted our sample by eliminating students who changed from a school affected by Science Team K to one not affected by it, and vice versa. This also ensures that all students from a given cohort graduating from a school affected by Science Team K have been exposed to the project for the same number of years. [7]

We constructed the treatment and control groups used in the evaluation by allocating students to different groups depending on which kind of school they went to (i.e. one affected by the STK project or not) and the year in which they completed their lower secondary education. In Table 1 we show how this allocation has resulted in eight different groups.

TABLE 1

	School year during which the student finished lower secondary education (9^{th} or 10^{th} grade)											
School type	1998–1999	1999–2000	2000–2001	2001–2002	2002–2003	2003–2004	2004–2005	2005–2006	2006–2007	2007–2008	2008–2009	2009–2010
At STK school	1			2			3				4	
At control group	5			6			7				8	

Students in groups 1–4 have all attended schools taking part in the STK project, whereas students in groups 5–8 have not., We are not able to determine whether students in groups 4 and 8 had completed youth education within five or six years after finishing 9^{th} or 10^{th} grade, or their grades for these programs. Therefore these two groups have been excluded from the analysis of completion of youth education and academic achievement during youth education.

Students in group 2 attended lower secondary schools affected by the STK project before the project began. However, if these students chose to continue to gymnasium or HF in Kalundborg municipality

[7] We have also excluded students who have attended more than one school in the same school year.

they would have been subject to the STK project. As this could in principle affect their educational outcomes during youth education, groups 2 and 6 were excluded from the analysis regarding completion of youth education and academic achievement during youth education.

All groups have been included in the analysis regarding academic achievement during lower secondary school because the data on grades for the 9th grade exit exams are available for all groups and because exposure to STK treatment during gymnasium would not have affected these outcomes.

The groups used in the evaluation according to the different outcome variables are shown in Table 2.

TABLE 2: TREATMENT AND CONTROL GROUPS

Outcome variables	Treatment group	Control group
Youth education: completion of a science program and academic achievement	Pre-intervention: 1 Post-intervention: 3	Pre-intervention: 5 Post-intervention: 7
Grades in 9th grade exit exams	Pre-intervention: 1 and 2 Post-intervention: 3 and 4	Pre-intervention: 5 and 6 Post-intervention: 7 and 8

Results

Comparison of outcomes without additional controls

In the following tables, we report the differences in the outcome variables for the treatment and control groups without considering any additional control variables.

In terms of the primary outcome of interest, completion of science youth education, it can be seen from Table 3 that students in Kalundborg were less likely to complete in the pre-treatment period than were students in the rest of Denmark, and that the percentage of students completing, fell in both groups in the post-treatment period. However, the drop was larger in Kalundborg. This difference in evolution between the two groups is not statistically significant (Table 4).

TABLE 3: COMPLETION OF A SCIENCE YOUTH EDUCATION WITHIN 5–6 YEARS AFTER FINISHING LOWER SECONDARY EDUCATION

Group	Percentage of students that did not complete	Percentage of students that completed
Kalundborg 1998–2001	90.8	9.2
Kalundborg 2004–2008	92.4	7.6
Rest of DK 1998–2001	87.5	12.5
Rest of DK 2004–2008	89.6	10.4
Total	89.0	11.0

TABLE 4: PERCENTAGE OF STUDENTS COMPLETING A SCIENCE YOUTH EDUCATION WITHIN 5–6 YEARS AFTER FINISHING LOWER SECONDARY EDUCATION, DIFFERENCES BETWEEN GROUPS

Group	1998–2001	2004–2008	Before –after difference	Difference –in– differences	p-value	N before	N after
Kalundborg	0.09	0.08	–0.02	.	.	1135	2835

Rest of DK	0.12	0.10	–0.02	0.00	0.66	155597	382704
Esbjerg	0.11	0.11	0.01	–0.02	0.07	2557	6142

Table 4 also reports the results when using Esbjerg as the control group instead of the rest of Denmark. Once again, the pre-treatment percentage of students completing was lower in Kalundborg. However, whereas Kalundborg experienced a fall in the numbers completing a science youth education, Esbjerg experienced an increase. This difference was statistically significant at the 10% confidence level, which could indicate that the Science Team K project had a negative impact on the primary outcome of interest.

Moving to the secondary outcomes of interest, Tables 5 and 6 report the pre- and post-treatment grade averages for the 9th grade exit tests in all subjects and in physics and chemistry. The average grades for all subjects increased in all three groups (Kalundborg, rest of Denmark and Esbjerg) but increased significantly less in Kalundborg. In contrast to this, the grades for exit tests in physics and chemistry decreased in all three groups, and there was no statistically significant difference between the treatment and control groups.

TABLE 5: GRADE POINT AVERAGE FOR THE 9TH GRADE EXIT TESTS IN ALL SUBJECTS, DIFFERENCES BETWEEN GROUPS

Group	1998–2004	2004–2010	Before –after difference	Difference –in– differences	p-value	N before	N after
Kalundborg	5.67	5.80	0.12	.	.	1351	3506
Rest of DK	5.95	6.29	0.34	–0.22	0.00	167876	485551
Esbjerg	5.87	6.19	0.32	–0.19	0.03	2577	7576

TABLE 6: GRADE POINT AVERAGE FOR THE 9TH GRADE EXIT TESTS IN PHYSICS AND CHEMISTRY, DIFFERENCES BETWEEN GROUPS

Group	1998–2004	2004–2010	Before –after difference	Difference –in– differences	p-value	N before	N after
Kalundborg	5.76	5.58	–0.18	.	.	991	3321
Rest of DK	5.99	5.90	–0.08	–0.10	0.44	138109	463337
Esbjerg	5.99	5.78	–0.21	0.03	0.84	2081	7188

Finally, looking at the results for academic achievement in upper secondary education programs (Tables 7 and 8), we find that in the pre-treatment period, both the average grade for upper secondary programs and the average grade for science subjects in these programs were lower in Kalundborg than in the two control groups. In the post-treatment period, average grades for youth education programs decreased in Kalundborg, whereas they increased in both control groups, and this difference in the evolution was statistically significant. Conversely, averages for science subjects in youth education programs increased more in Kalundborg than in both control groups. However, this difference was not statistically significant at the conventional confidence levels.

TABLE 7: GRADE POINT AVERAGE FOR UPPER SECONDARY EDUCATION (ALL SUBJECTS)

Group	1998–2004	2004–2010	Before –after difference	Difference –in– differences	p-value	N before	N after
Kalundborg	6.20	6.01	–0.19	.	.	389	958
Rest of DK	6.39	6.64	0.25	–0.43	0.00	73155	151693
Esbjerg	6.30	6.50	0.20	–0.38	0.01	1155	2360

TABLE 8: GRADE POINT AVERAGE FOR UPPER SECONDARY EDUCATION (SCIENCE SUBJECTS)

Group	1998–2004	2004–2010	Before –after difference	Difference –in– differences	p-value	N before	N after
Kalundborg	5.98	6.42	0.44	.	.	297	702
Rest of DK	6.38	6.73	0.34	0.09	0.58	54746	112543
Esbjerg	6.25	6.44	0.18	0.25	0.20	776	1769

Results from the statistical analysis using background variables as controls

Descriptive statistics of background variables

Table A1 lists all the variables used in our statistical analysis. In Table A2 we report, for the treatment and control groups respectively, the mean during the pre-treatment period for all background variables used in our statistical analysis. Table A2 also reports the t-test for whether the difference in means between Kalundborg and Denmark, and Kalundborg and Esbjerg was statistically significant.

Some of the key differences in the background variables between the treatment and control groups are the following. There was a significantly higher proportion of native Danes in the treatment group than in either control group. Also, students from Kalundborg were more likely to attend state schools than private, independent or boarding schools compared with students in the rest of Denmark, but less likely to attend state schools compared with students from Esbjerg.

In terms of parental characteristics, students in Kalundborg were overall in a disadvantaged socio-economic position compared with students in the control groups. Parental income was lower in Kalundborg, except when comparing the mother's income with that of the control group from Esbjerg. In terms of their position in the labour market, parents from the treatment group were more likely to be on disability pensions than were their counterparts in the control groups. Finally, in terms of educational attainment, a larger share of parents in Kalundborg had completed post-secondary vocational training. However, a smaller share of parents in Kalundborg had a tertiary education degree and a larger share had only completed primary education.

As expected, these differences between treatment and control groups in the parental characteristics of individual students were also present when looking at the average parental characteristics of students attending the 8th grade at the same school.

We present the corresponding table for the post-treatment period in Table A3. Overall, the differences between the control and treatment groups persist.

The next step in our analysis was to carry out probit regressions including all background variables as control variables to determine whether Science Team K had an impact on the probability of completing a youth education program with strong science components five to six years after graduating from lower secondary school. Table A4 presents the results for the analysis. Results in columns 1 and 2 refer respectively to the analysis using the rest of Denmark and Esbjerg as control groups.

The results using controls largely replicate those obtained by comparing the proportions of students completing a science youth education in the pre- and post-treatment periods. Students from Kalundborg were less likely to complete a science youth education in the pre-treatment period; however, this difference was not statistically significant. Also, there was a fall in the number of students completing science youth education in the post-treatment period in both the treatment and control group when looking at Denmark as a whole. Finally, the coefficient for our key variable, Kalundborg_After, shows that Science Team K did not have an effect on the proportion of students completing youth science education when looking at the rest of Denmark as a control group. However, when using Esbjerg as a control group, it appears that Science Team K might have had a negative effect on the proportion of students completing science education.

Concentrating on column 1, the rest of the coefficients point to the following countrywide trends in completion of youth science education:

- Students attending boarding schools are significantly less likely to complete a youth science education than students attending state, private or independent schools.
- Looking at students in terms of gender and origin, males of non-Danish origin and second-generation females are the most likely to complete youth science education, whereas Danish females are the least likely, followed by Danish males and immigrant females.
- Students with parents with higher incomes are more likely to complete a science youth education, and the likelihood is also higher, the higher the level of parental educational attainment.
- Students whose parents were unemployed or on disability pensions at the time the student was 13 years old are less likely to complete a youth science education than students whose parents are employed.
- We find no clear pattern between average parental characteristics for students in the same grade level and school and the probability of completing a science youth education.

We now turn to the analysis concerning educational attainment in lower secondary school, measured by the grades achieved in the 9th grade exit exams, both on average and in physics and chemistry. Table A5 presents the results. Columns 1 and 2 are obtained using the rest of Denmark as a control group, and columns 3 and 4 using Esbjerg as control. Once again, our results largely replicate those obtained by comparing the evolution in grades without controls. Grades in physics and chemistry fell countrywide in the post-treatment period, and Kalundborg followed the same trend, which indicates that Science Team K had no effect on students' academic achievement in physics and chemistry.

Contrary to this, our results indicate that average grades for 9th grade exit exams fell in Kalundborg in the post-treatment period while remaining largely unchanged in the rest of Denmark and in Esbjerg. The remaining question is whether this negative development in Kalundborg can be attributed to Science Team K. It could be that if the project disrupted the balance between different subjects at the schools in a way that teaching in non-science subjects worsened, while teaching in science subjects did not improve or at least not in a way that actually raised achievement in the exit examinations.

Looking now at the rest of the coefficients in columns 1 and 2, we find the following countrywide trends in 9th grade academic achievement:

- Students attending private and independent schools achieved higher grades, followed by those in state schools. Students in boarding schools had significantly lower levels of achievement.
- Danish females achieved higher grades both on average and in physics and chemistry than all other groups. Students of non-Danish origin achieved significantly lower grades than Danish students, the only exception being second-generation immigrant females, who achieved higher grades in physics and chemistry compared with Danish males.
- Students from more privileged households in terms of parental income, educational attainment and labour market attachment achieved higher grades.

Finally, we turn to the analysis of academic achievement in upper secondary education. For this analysis we have restricted the sample to include only those students who have completed an upper secondary education program (STX, HF, HTX or HHX) within five years of graduating from lower secondary education (9th or 10th grade). Students who have completed a vocational training program or have not completed any kind of youth education are not part of the analysis. Also, for students who have completed more than one upper secondary education program, we have included only one of their results in the analysis in the following order of priority: STX, HF, HTX, HHX. In our regressions, we have included three dummy variables that equal 1 if the student finished a HF, HTX or HHX program to control for differences in grade levels for the different programs and for selection of specific kinds of individuals to each of the programs.

The results are reported in Table A6. In column 1, the outcome variable is the grade point average for the completed educational program, with the rest of Denmark as the control group. In column 2, the outcome variable is the average grade for all science subjects taken during upper secondary education, with the rest of Denmark as the control group. Columns 3 and 4 show the results for the same outcome variables but using students from Esbjerg as the control group.

The results largely confirm the insights we gained by comparing pre- and post-treatment outcomes without controlling for other variables.

In the post-treatment period, our difference-in-difference estimator shows that Kalundborg experienced a negative evolution in average grades for youth education programs compared with the rest of Denmark (but not Esbjerg) and that this difference was statistically significant. This means that there is a possibility that the project had a negative effect on general academic achievement for upper secondary programs.

On the other hand, averages for science subjects in youth education programs increased more in Kalundborg than in either control group. However, this difference is not statistically significant at the 5% confidence level. Therefore, we cannot reject the hypothesis that Science Team K had no effect on academic achievement in science subjects in upper secondary programs.

The rest of the coefficients give us the following insights into the trends in academic achievement in upper secondary education in Denmark:

- The highest average grades in all subjects and in science subjects are achieved by students attending STX compared with the three other types of programs.
- Students who attend private and independent schools or boarding schools during lower secondary education achieve higher overall grade point averages than students attending state schools. Students from boarding schools also fare better in science subjects.
- Danish females achieve higher overall averages and averages in science subjects than Danish males. Students of non-Danish origin achieve significantly lower grades.
- Students with wealthier parents and parents with higher educational attainment levels achieve higher grades in upper secondary education. Students whose parents were unemployed at the time the student was 13 years old achieve lower grades than those whose parents were employed or self-employed.

Sensitivity analysis

While performing our research about the Science Team K project, we came across a number of questions related to the analysis, inspired for instance by the results of previous evaluations of the project, which address in this section.

One of the questions we sought to answer was whether the Science Team K project could have led to a change in the composition of youth education programs chosen by students. In our main results we found that the percentage of students from Kalundborg completing science youth education programs within five years after finishing lower secondary school had not increased more than observed in the rest of Denmark. However, the project could have changed the composition of the choice of science youth education programs chosen by students in Kalundborg compared with the rest of Denmark.

To check whether this was the case, we ran three separate probit regressions using the same control variables as in our main analysis for the following three outcome variables: completion of a general upper secondary education program (STX or HF) with strong science components; completion of a technical upper secondary education program with strong science components (HTX); and completion of a vocational education program with strong science subjects.

We found no evidence that there has been a change in the composition of choices for science youth education in Kalundborg compared with the rest of Denmark; the difference-in-differences estimator was statistically insignificant in all three regressions. Doing the same exercise, but using Esbjerg as the control group, we found that the negative result from our main analysis was mainly driven by a greater fall in Kalundborg than in Esbjerg in the proportion of students completing a science STX or HF.

Previous evaluations of Science Team K carried out by DPU have hinted at the possibility that the project could have a differential effect in terms of gender, that is, that the project could have affected girls' educational outcomes in a different way than it affected boys. To gauge whether this is a possibility, we have repeated all of the regressions from the main analysis allowing for gender-specific effects of STK. We find no evidence for the hypothesis that Science Team K had a greater positive effect on girls than on boys. We do find, however, that when using the rest of Denmark as the control group, the negative effect of the project on average grades for upper secondary education is driven by girls.

We have also tried to gauge whether the effects of Science Team K were different for the different cohorts. This tests two opposite hypotheses. (1) The effect of the project could have been larger for the cohorts exposed to it earlier, and would wear out for later cohorts, either because of an announcement effect, or because teachers and headmasters could have been more enthusiastic in the beginning. (2) The effect of the project would not be visible in the years directly after its implementation because school culture changes slowly and because it would take time for teachers and schools to learn how to exploit fully the new equipment, knowledge and networks acquired during the course of the Science Team K project.

To measure this, we have repeated the regressions carried out for our main analysis, allowing for cohort-specific effects of STK. We find no evidence for either a positive or negative time trend in the effect of the project that could have led to the insignificant results we observed in our main analysis.

The last sensitivity check we carried out involves our sample selection method. As explained in the previous section, we removed the observations of those students who changed from a school affected by the project to one not affected by it, and vice versa, between 7th and 9th grade. However, we did not remove the observations of those students who changed schools within the control group. To make sure that this restriction, which only affected the treatment group, was not affecting our results, we repeated our analysis using the sample that excludes all students that changed schools between 7th and 9th grade. Our initial results did not change when this additional restriction was imposed.

Part 2: Effect of STK treatment in gymnasium and HF

Outcome variables

When analysing the effects of being exposed to Science Team K in high school (gymnasium or HF), we focus on the following primary and secondary outcome variables:

Primary outcome variable

- Starting a tertiary education program with strong science components 27 months (2 years plus 3 months of summer vacation) after completing high school. The following programs have been defined as having strong science components: tertiary education programs in the areas of the natural sciences, health science and technology offered by Danish universities, University Colleges (*Professionshøjskoler)*, Academies of Professional Higher Education (*Erhvervsakademier)* or equivalent institutions. For a more specific definition see Appendix A.

Secondary outcome variables

- Grade point average for completed general upper secondary education programs (STX and HF)
- Grade point average in science subjects at all levels for completed general upper secondary education programs (STX and HF)

Population

Our population of interest consists of students attending general upper secondary education (STX and HF) in all state gymnasiums in Denmark in the period from school year 2001–2002 to school years 2009–2012. We have excluded students who attended the same grade level for more than one school year. We have also restricted our sample by eliminating students who have changed from a school affected by Science Team K to one not affected by it, and vice versa, as well as students who did not take any science courses during their STX or HF.

For the analysis regarding our primary outcome variable of interest, we have also excluded those students who finished their upper secondary later than July 2010, because the interval between this time and the latest registry information we have available is less than 27 months (which is the longest time a student can take between finishing upper secondary education and starting a science tertiary education and still show a positive outcome in our data).

We have constructed the treatment and control groups using the same logic as for the analysis of the effect of the project in 7^{th}–10^{th} grade. Students have been allocated to different groups depending on which kind of school they went to (i.e. one affected by the STK project or not) and the year in which they completed their upper secondary education. In the table below, we show how this allocation has resulted in four different groups.

TABLE 9

<table>
<tr><td></td><td colspan="11">School year during which the student finished upper secondary education (STX or HF)</td></tr>
<tr><td>School type</td><td>2001–2002</td><td>2002–2003</td><td>2003–2004</td><td>2004–2005</td><td>2005–2006</td><td>2006–2007</td><td>2007–2008</td><td>2008–2009</td><td>2009–2010</td><td>2010–2011</td><td>2011–2012</td></tr>
<tr><td>At STK school</td><td colspan="3">1</td><td colspan="6">2</td><td colspan="2">3</td></tr>
<tr><td>At control group</td><td colspan="3">4</td><td colspan="6">5</td><td colspan="2">6</td></tr>
</table>

Students in groups 1, 2 and 3 all attended a gymnasium taking part in the STK project, whereas students in groups 4, 5 and 6 did not. Students in groups 1 and 4 attended upper secondary schools before the project began, whereas students in groups 2, 3, 5 and 6 did so after the project began. Our analysis consists in comparing the change in outcomes (between the pre- and post-treatment periods) experienced by students attending gymnasium that took part in the project with the change in outcome experienced by students in the control group.

The groups used in the evaluation according to the different outcome variables are shown in Table 10.

TABLE 10: TREATMENT AND CONTROL GROUPS

Outcome variables	Treatment group	Control group
Starting a tertiary education program with strong science components	Pre-intervention: 1 Post-intervention: 2	Pre-intervention: 4 Post-intervention: 5
Grade point average in science subjects and for completed general upper secondary education programs (STX and HF) .	Pre-intervention: 1 Post-intervention: 2 and 3	Pre-intervention: 4 Post-intervention: 5 and 6

Results

Comparison of outcomes without additional controls

Tables 11–16 summarise the differences in the outcome variables for the treatment and control groups without taking any additional control variables into account.

The percentage of students from Kalundborg Gymnasium starting a tertiary education program with strong science components increased from 22.5% in the pre-treatment period to 27.7% in the post-treatment period. However, the same trend was present in the rest of Denmark and in Esbjerg and there was therefore no statistically significant difference between the treatment and control groups.

TABLE 11: PERCENTAGE OF STUDENTS STARTING SCIENCE TERTIARY EDUCATION 2 YEARS AFTER FINISHING GYMNASIUM OR HF

Group	Percentage of students not starting	Percentage of students starting
Kalundborg 2001–2004	77.5	22.5
Kalundborg 2004–2010	72.3	27.7
Rest of DK 2001–2004	76.5	23.5
Rest of DK 2004–2010	71.8	28.2
Total	73.3	26.7

TABLE 12: PERCENTAGE OF STUDENTS STARTING SCIENCE TERTIARY EDUCATION 2 YEARS AFTER FINISHING GYMNASIUM OR HF, DIFFERENCES BETWEEN GROUPS

Group	2001–2004	2004–2010	Before –after difference	Difference –in– differences	p-value	N before	N after
Kalundborg	0.22	0.28	0.052	.	.	489	969
Rest of DK	0.24	0.28	0.05	0.00	0.85	55354	119062
Esbjerg	0.27	0.33	0.07	-0.02	0.62	992	2152

We obtained very similar results when comparing the evolution in grades for upper secondary education. In Kalundborg, grade point averages for STX and HF and grade averages for science subjects increased in the post-treatment period relative to the pre-treatment period (although only the latter increase was statistically significant). However, the same trend was present in the rest of the Denmark and in Esbjerg, with no statistically significant differences between the groups.

TABLE 13: AVERAGE GRADES FOR STX, DIFFERENCES BETWEEN GROUPS

Group	2001–2004	2004–2012	Before –after difference	Difference –in– differences	p-value	N before	N after
Kalundborg	6.48	6.48	0.00	.	.	383	1328
Rest of DK	6.68	6.88	0.20	-0.19	0.13	45,408	177,680
Esbjerg	6.61	6.67	0.05	-0.05	0.74	832	3295

TABLE 14: AVERAGE GRADES FOR SCIENCE SUBJECTS IN STX, DIFFERENCES BETWEEN GROUPS

Group	2001–2004	2004–2012	Before –after difference	Difference –in– differences	p-value	N before	N after
Kalundborg	6.43	6.69	0.26	.	.	383	1323
Rest of DK	6.56	6.76	0.20	0.06	0.68	45,557	177,665
Esbjerg	6.39	6.45	0.06	0.19	0.24	834	3295

TABLE 15: AVERAGE GRADES FOR HF, DIFFERENCES BETWEEN GROUPS

Group	2001–2004	2004–2012	Before –after difference	Difference –in– differences	p-value	N before	N after
Kalundborg	5.36	5.52	0.17	.	.	107	178
Rest of DK	5.62	5.93	0.31	-0.14	0.62	9906	15318
Esbjerg	5.79	5.66	-0.14	0.30	0.40	160	184

TABLE 16: AVERAGE GRADES FOR SCIENCE SUBJECTS IN HF, DIFFERENCES BETWEEN GROUPS

Group	2001–2004	2004–2012	Before –after difference	Difference –in– differences	p-value	N before	N after
Kalundborg	5.20	5.46	0.26	.	.	108	178
Rest of DK	5.41	5.63	0.22	0.05	0.90	10001	15428
Esbjerg	5.59	4.95	-0.65	0.91	0.06	162	186

These results indicate that the Science Team K project did not contribute to the increase in the number of students from Kalundborg Gymnasium choosing tertiary education programs with strong science components, nor did it contribute to improving their academic achievement. In the following paragraphs we present the results for our statistical analysis controlling for student, parents and class characteristics.

Results from the statistical analysis using background variables as controls

Descriptive statistics of background variables

In Table A7 we report the mean values during the pre-treatment period of all background variables used in our statistical analysis. The table also reports the t-test for whether the difference in means between Kalundborg and Denmark, and Kalundborg and Esbjerg was statistically significant. Table A8 reports the same variables and differences but for the post-treatment period. We find that students in Kalundborg were relatively disadvantaged in socio-economic terms compared with the rest of Denmark, although the differences between the two groups are smaller than when looking at students in 7^{th}–10^{th} grade.

The first part of our statistical analysis consisted in estimating the effect of Science Team K on the probability of choosing a tertiary education program with strong science components. We used four different probit regressions to carry out this analysis (Table A9). Column 1 presents the results for the regression based on the population of all STX students in Denmark, column 2 for the population of STX students in Kalundborg and Esbjerg, column 3 for the population of all HF students in Denmark, and column 4 for the population of HF students in Kalundborg and Esbjerg.

Our results show that the percentage of students choosing a science tertiary education programs prior to Science Team K was lower in Kalundborg than in the rest of Denmark and Esbjerg. The only exception were HF students in Kalundborg compared with HF students in Esbjerg. However, these pre-treatment differences were not statistically significant. Furthermore, the share of students choosing a science tertiary education program increased countrywide in the post-treatment period. Our difference-in-differences estimator shows that the increase in Kalundborg was not statistically significant compared with the rest of the country or Esbjerg for any of the samples.

The second part of our statistical analysis consisted in estimating the effect of Science Team K on the academic achievement of students in Kalundborg Gymnasium and HF. We carried out ordinary least squares (OLS) regressions for two different dependent variables, the grade point average for upper secondary education and the grade point average for all science subjects taken during upper secondary education. Table A10 reports the results for STX students and Table A11 the results for HF students.

The results from the regressions were very similar to those we obtained when using no control variables. We found that the evolution of overall and science grades in Kalundborg Gymnasium was not statistically significantly different from the evolution of grades in the control groups, either for STX or for HF students, even taking into account differences in student characteristics.

From the rest of the coefficients in column 1 in Table A9, and columns 1 and 3 in Tables A10 and A11, it is possible to discern some countrywide trends in terms of educational outcomes during and after gymnasium and HF. For example, Danish students have higher grades in STX and HF relative to students of non-Danish origin. However, students of non-Danish origin graduating from STX or HF are more likely to choose a science tertiary education than are Danish students; among Danish students, females are more likely to choose science studies than males. Also, students whose parents have higher levels of education are more likely to start a science tertiary education program, and they also tend to have higher grades.

Sensitivity analysis

To evaluate the effect of the STK project on educational outcomes, we carried out further sensitivity analyses to test whether our main results could be hiding different treatment effects for different student groups.

The first of these tests was to check whether the project had a different effect on females than on males. We repeated all of the regressions from the main analysis allowing for gender-specific effects of STK. We found no evidence for the hypothesis that Science Team K had a different effect on females than on males.

The purpose of the second test was to determine whether the Science Team K project had different effects on different cohorts of students, as we did in the first part of our analysis. We found that students graduating from high school in the year 2005–2006 achieved lower grades in science subjects than students graduating in the years before or after. Apart from this, we found no evidence for either a positive or a negative time trend in the effect of the project that could lead to the insignificant results we observed in our main analysis.

In our main analysis, we found that Science Team K had no effect on the average grades for science subjects at any level (A, B or C level). This includes the great majority of students in both STX and HF. In the third test we looked at whether the program had a different effect on students whose course choices reflected a greater interest in science. The test consisted of checking whether Science Team

K had a different effect on grades for science subjects at the A level only, and at the A and B levels only. The results are the same as for our main analysis: we found that Science Team K had no significant effect on science grades.

Section 3: Conclusions

The main goal of Science Team K was to increase the interest in science and technology among children and youth in the Kalundborg area in order to increase recruitment to these subjects at both the upper secondary and higher education levels. The project sought to achieve this by making an extraordinary amount of economic and technical resources available to science teachers in the 7^{th}–10^{th} grades and gymnasium classes. The hope was that by gaining access to better equipment, training and networks, science teachers would both upgrade their qualifications and become inspired to teach in new ways, and that this would lead to better teaching. The project also hoped to contribute to building a stronger science culture both at the school and at the municipal level by engaging schools, the public administration, and public and private firms in the area.

The project has been subject to previous quantitative and qualitative evaluations which concluded that the results of Science Team K have been mixed: some schools and some teachers achieved a very high level of engagement with the project, whereas others made only minimal use of the available resources. These evaluations have also contributed a breadth of insights into which specific school circumstances led to greater or less engagement of the teachers.

The purpose of the current evaluation was to measure the impact of the project on students, and whether it was successful in fulfilling its main objective. We conducted statistical analyses based on more than 10 years of registry data to estimate the effect of Science Team K on the educational outcomes of students in Kalundborg; namely, on their academic achievement in lower and upper secondary education, and on the probability of choosing upper secondary and tertiary education programs with strong science components.

We used the population of students in Denmark and the population of students in Esbjerg, a municipality relatively similar to Kalundborg, as control groups in a difference-in-differences analysis and found that the project did not have a significant effect on educational outcomes. Based on some of the findings from the previous evaluations, we conducted sensitivity tests to check whether the program had different effects on different groups of students. We found no evidence of such differential effects.

While conducting the present evaluation, we have gained useful insights into how to improve the quality of impact evaluations of future projects. That an impact evaluation was budgeted and planned for during the project design phase was a very positive step forward, and in this way Science Team K can set an example for other projects and programs. The previous quantitative and qualitative evaluations have also been fundamental in informing and raising the quality of the present impact evaluation. These types of evaluations should continue to be part of any evaluation strategy, as they give powerful insights into the mechanisms and behaviours that occur during project implementation, which are essential for understanding and interpreting the results of the impact evaluation.

However, we find that the impact evaluation could have benefited from thorough design prior to project implementation. Ideally, during the design phase of an impact evaluation the project team should formulate an expected results chain, together with hypotheses about how the intervention will affect different groups and which intermediate and final outcomes it will lead to. This type of exercise helps clarify the methodology and data necessary to measure the impact of the project, and should be used to design a baseline survey, which we believe this impact evaluation could have benefited from. A baseline study would have allowed us to look in more detail into the differences experienced by the different schools because it could have collected information on, for instance, teachers, teacher–student links, school budgets and project participation, which are essential in understanding the outcomes for each school. Formulating hypotheses about the project's effect on specific student groups during the project design stage would have also allowed for a richer impact evaluation.

References

Andersen, N., Busch, H., Horst, S., & Troelsen, R. (Eds.). (2003). Fremtidens naturfaglige uddannelser. Naturfag for alle - vision og oplæg til strategi (Vol. 7). Copenhagen: Undervisningsministeriet, Uddannelsesstyrelsen. [online] Available at: http://pub.uvm.dk/2003/naturfag/pdf/indhold.pdf

Busch H., Sølberg J., Horn F., Science Team K (project)., Dansk Naturvidenskabsformidling (2006). *Science Team K: slutrapport fra evalueringen af et lokalt forankret naturfagsprojekt.* Danmarks Pædagogiske Universitet. [online] Available at: http://www.formidling.dk/graphics/DNF/skole/Science%20Team%20K/Pdf/DPU-evalueringsrapport3010.pdf

Danmarks Evalueringsinstitut (2012) *Det naturvidenskabelige fagområde før og efter reformen. Effekter af gymnasiereformen.* [online] Available at: http://www.eva.dk/projekter/2010/effekter-af-gymnasiereformen/rapport/det-naturvidenskabelige-fagomrade-for-og-efter-reformen/download

Dansk Naturvidenskabsformidling. *Science Team K- en ambitiøs indsats for naturvidenskab og teknik blandt børn og unge.* [online] Available at: http://www.formidling.dk/graphics/DNF/skole/Science%20Team%20K/Pdf/Projektbeskrivelse.pdf

Formidling.dk. (2014) Dansk Naturvidenskabsformidling - Science Team K. [online] Available at: http://www.formidling.dk/sw460.asp [Accessed: 3 Apr 2014].

Gertler, P. J., Martinez, S., Premand, P., Rawlings, L. B., & Vermeersch, C. M. (2011). *Impact evaluation in practice.* World Bank Publications. [online] Available at: http://siteresources.worldbank.org/EXTHDOFFICE/Resources/5485726-1295455628620/Impact_Evaluation_in_Practice.pdf

OECD (2004). *Learning for Tomorrow's World: First Results from PISA 2003.* OECD [online] Available at: http://www.oecd.org/edu/school/programmeforinternationalstudentassessmentpisa/34002216.pdf

OECD/UNESCO-UIS (2003) Literacy *Skills for the World of Tomorrow: Further Results from PISA 2000*. OECD. [online] Available at: http://www.oecd.org/edu/school/programmeforinternationalstudentassessmentpisa/33690591.pdf

Povertyactionlab.org. 2014. Impact Evaluation | The Abdul Latif Jameel Poverty Action Lab. [online] Available at: http://www.povertyactionlab.org/methodology/what-evaluation/impact-evaluation [Accessed: 3 Apr 2014].

Roseproject.no. (2014) ROSE in brief | ROSE. [online] Available at: http://roseproject.no/?page_id=4 [Accessed: 3 Apr 2014].

Science Team K (2006). *Projektledelsens erfaringer og anbefalinger fra perioden 2003-2006.* [online] Available at: http://www.formidling.dk/graphics/DNF/skole/Science%20Team%20K/Pdf/STK-rap2_version.pdf

Sølberg, Jan. *Udvikling af lokale naturfaglige kulturer. Barrierer og muligheder for skoleudvikling i forbindelse med Science Team K projektet.* (Developing Local School Science Cultures: Opportunities and constraints for improvement of school science practice) [online] Available at: http://lnk.wikispaces.com/file/detail/Udvikling+af+lokale+naturfaglige+kulturer.pdf

Appendix A

Table A1: List of background variables used in the statistical analysis

Students' characteristics	Gender
	Origin
	Proportion of immigrants
	Proportion of second generation immigrants
Parents' characteristics*	Income (in thousand Danish kroner)
	Labour market status
	Highest level of education
School characteristics	State, private, independent or boarding school
Class characteristics**	Average income of the mothers
	Average income of the fathers
	Average level of education of the parents

*Measured at the time the student is 13 years old for the analysis of the impact of Science Team K on 7th–10th grade students and at the time the student is 16 years old for the analysis of the impact on Gymnasium and HF students

**Averages of parental characteristics of students attending the same school and grade level

Table A2: Descriptive statistics for background variables for 7th–10th grade students in the pre-treatment period, treatment and control groups

		Kalundborg	Rest of Denmark			Esbjerg		
		Mean	Mean	t-test		Mean	t-test	
Students' characteristics	Proportion of males	0.51	0.50	–0.72		0.51	–0.44	
	Proportion of Danes	0.95	0.91	–5.71	***	0.91	–5.33	***
	Proportion of immigrants	0.05	0.05	1.38		0.06	2.64	**
	Proportion of second generation immigrants	0.01	0.03	7.40	***	0.02	5.94	***
Mothers' characteristics	Income (10,000 DKK)	16.09	17.61	5.95	***	15.85	–0.88	
Labour market status	Self-employed	0.05	0.05	0.70		0.03	–3.52	***
	Employee	0.73	0.76	3.11	**	0.74	0.74	
	Unemployed	0.04	0.04	–1.31		0.04	–0.80	
	Student	0.01	0.01	1.01		0.02	1.59	
	Pensioner	0.06	0.04	–6.59	***	0.04	–4.82	***
	Other	0.10	0.10	–0.37		0.14	3.98	***
Highest level of education	Primary school	0.37	0.31	–5.77	***	0.37	0.34	
	General upper secondary	0.03	0.03	1.24		0.02	–1.96	*
	Vocational upper secondary	0.00	0.01	3.31	***	0.01	2.84	**
	Post-secondary vocational training	0.36	0.34	–1.87	*	0.32	–3.36	***
	Short-cycle tertiary education	0.04	0.04	0.22		0.04	0.38	
	Academic Bachelor's	0.19	0.22	3.38	***	0.21	2.41	**
	Professional Bachelor's	0.00	0.00	0.50		0.00	–0.26	
	Master's	0.01	0.04	7.47	***	0.02	3.29	***
	PhD	0.00	0.00	1.47		0.00	–0.03	
Fathers' characteristics	Income (10,000 DKK)	26.65	29.55	4.91	***	28.14	3.00	**
Labour market status	Self-employed	0.10	0.13	4.15	***	0.08	–3.36	***
	Employee	0.76	0.75	–1.12		0.78	2.47	**
	Unemployed	0.03	0.03	–0.47		0.02	–1.49	
	Student	0.00	0.00	0.65		0.00	1.04	
	Pensioner	0.07	0.04	–6.62	***	0.04	–5.35	***
	Other	0.04	0.05	1.87	*	0.07	4.88	***
Highest level of education	Primary school	0.34	0.26	–8.91	***	0.27	–5.92	***
	General upper secondary	0.03	0.03	0.72		0.02	–2.23	**
	Vocational upper secondary	0.00	0.01	3.04	**	0.01	4.13	***
	Post-secondary vocational training	0.47	0.45	–2.28	**	0.44	–2.18	**
	Short-cycle tertiary education	0.04	0.05	2.29	**	0.06	3.30	***
	Academic Bachelor's	0.09	0.12	4.36	***	0.15	6.90	***
	Professional Bachelor's	0.00	0.00	2.10	**	0.00	–0.28	
	Master's	0.03	0.08	8.85	***	0.05	3.50	***
	PhD	0.00	0.00	2.39	**	0.00	–0.06	
School characteristics	State school	0.85	0.82	–3.86	***	0.91	7.38	***

	Independent or private school	0.14	0.15	0.86		0.09	–6.65	***
	Boarding school	0.01	0.03	6.59	***	0.00	–3.89	***
Class characteristics	Average income of the mothers	16.29	17.62	14.81	***	15.89	–4.51	***
	Average income of the fathers	27.05	29.51	13.62	***	28.16	6.97	***
	Proportion of mothers with primary school education	0.36	0.31	–16.34	***	0.37	3.98	***
	Proportion of mothers with general upper secondary education	0.03	0.04	11.82	***	0.03	–4.75	***
	Proportion of mothers with post-secondary vocational training	0.36	0.34	-8.37	***	0.32	-15.81	***
	Proportion of mothers with short-cycle tertiary education	0.04	0.04	1.30		0.04	1.52	
	Proportion of mothers with Academic Bachelor's	0.20	0.22	9.61	***	0.21	7.07	***
	Proportion of mothers with Master's	0.01	0.04	25.71	***	0.02	15.87	***
	Proportion of fathers with primary school education	0.33	0.26	-30.88	***	0.27	-23.22	***
	Proportion of fathers with general upper secondary education	0.03	0.04	10.24	***	0.03	1.77	*
	Proportion of fathers with post-secondary vocational training	0.47	0.44	-10.25	***	0.44	-12.28	***
	Proportion of fathers with short-cycle tertiary education	0.04	0.05	12.20	***	0.06	17.75	***
	Proportion of fathers with Academic Bachelor's	0.09	0.12	19.14	***	0.15	31.23	***
	Proportion of fathers with Master's	0.03	0.09	26.58	***	0.05	13.09	***

***,** and * indicate statistical significance at 0.1, 1 and 5% level, respectively

Table A3: Descriptive statistics for background variables for 7th–10th grade students in the post-treatment period, treatment and control groups

		Kalundborg	Rest of Denmark			Esbjerg		
		Mean	Mean	t-test		Mean	t-test	
Students' characteristics	Proportion of males	0.51	0.51	–0.29		0.50	–0.47	
	Proportion of Danes	0.92	0.90	–4.36	***	0.90	–3.94	***
	Proportion of immigrants	0.05	0.04	–2.52	**	0.05	–0.87	
	Proportion of second generation immigrants	0.03	0.06	7.79	***	0.05	6.38	***
Mothers' characteristics	Income (10,000 DKK)	21.67	23.48	6.38	***	21.05	–2.14	**
Labour market status	Self-employed	0.04	0.04	1.60		0.03	–1.32	
	Employee	0.75	0.78	3.77	***	0.75	0.24	
	Unemployed	0.12	0.11	–2.34	**	0.13	2.52	**
	Student	0.00	0.00	1.19		0.01	1.57	
	Pensioner	0.05	0.04	–5.31	***	0.04	–1.96	*
	Other	0.04	0.03	–1.56		0.03	–2.36	**
Highest level of education	Primary school	0.26	0.21	–7.04	***	0.26	–0.48	
	General upper secondary	0.03	0.04	3.07	**	0.03	–1.64	
	Vocational upper secondary	0.01	0.02	2.92	**	0.02	1.63	
	Post-secondary vocational training	0.44	0.39	–6.18	***	0.40	–3.68	***
	Short-cycle tertiary education	0.05	0.04	–2.87	**	0.04	–3.49	***
	Academic Bachelor's degree	0.18	0.22	6.58	***	0.23	6.18	***
	Professional Bachelor's degree	0.01	0.01	2.49	**	0.01	1.75	*
	Master's	0.02	0.06	9.85	***	0.02	0.69	
	PhD	0.00	0.00	3.13	**	0.00	0.08	
Fathers' characteristics	Income (10,000 DKK)	33.47	36.94	5.06	***	34.83	2.27	**
Labour market status	Self-employed	0.09	0.10	2.73	**	0.07	–4.05	***
	Employee	0.76	0.77	1.52		0.79	4.03	***
	Unemployed	0.07	0.06	–1.87	*	0.07	0.39	
	Student	0.00	0.00	0.16		0.00	–0.39	
	Pensioner	0.05	0.04	–4.34	***	0.04	–3.15	**
	Other	0.03	0.03	–1.22		0.03	–0.19	
Highest level of education	Primary school	0.28	0.22	–7.85	***	0.24	–4.04	***
	General upper secondary	0.03	0.04	1.06		0.02	–4.52	***
	Vocational upper secondary	0.01	0.01	2.92	**	0.02	4.65	***
	Post-secondary vocational training	0.52	0.45	–8.39	***	0.47	–4.49	***
	Short-cycle tertiary education	0.05	0.06	2.40	**	0.07	3.12	**
	Academic Bachelor's	0.07	0.12	7.82	***	0.13	8.57	***
	Professional Bachelor's	0.00	0.01	4.28	***	0.00	2.45	**
	Master's	0.04	0.09	10.68	***	0.04	2.24	**
	PhD	0.00	0.01	4.78	***	0.00	1.64	

School characteristics	State school	0.91	0.84	–12.11	***	0.91	0.15	
	Independent or private school	0.09	0.15	10.62	***	0.09	–0.40	
	Boarding school	0.00	0.01	6.20	***	0.00	1.66	*
Class characteristics	Average income of the mothers	21.76	23.53	17.44	***	21.24	–5.69	***
	Average income of the fathers	33.19	36.92	18.23	***	34.91	10.24	***
	Proportion of mothers with primary school education	0.26	0.22	–24.36	***	0.26	–2.36	**
	Proportion of mothers with general upper secondary education	0.04	0.06	25.84	***	0.04	0.43	
	Proportion of mothers with post-secondary vocational training	0.44	0.39	–25.89	***	0.40	–18.89	***
	Proportion of mothers with short-cycle tertiary education	0.05	0.04	–16.38	***	0.04	–21.86	***
	Proportion of mothers with Academic Bachelor’s	0.18	0.23	28.10	***	0.23	29.74	***
	Proportion of mothers with Master’s	0.02	0.06	33.15	***	0.02	5.52	***
	Proportion of fathers with primary school	0.28	0.22	–30.85	***	0.24	–19.45	***
	Proportion of fathers with general upper secondary	0.04	0.05	11.47	***	0.04	–4.50	***
	Proportion of fathers with post-secondary vocational training	0.51	0.44	–30.90	***	0.47	–21.99	***
	Proportion of fathers with short-cycle tertiary education	0.05	0.06	13.67	***	0.07	18.63	***
	Proportion of fathers with Academic Bachelor’s	0.08	0.12	38.71	***	0.13	47.86	***
	Proportion of fathers with Master’s	0.04	0.10	34.37	***	0.05	11.34	***

***,** and * indicate statistical significance at 0.1, 1 and 5% level, respectively

Table A4: Probit estimates of the effect of Science Team K on the probability of completing a youth education with strong science components

	Control Group	
	Rest of Denmark	Esbjerg
	(1)	(2)
Kalundborg	–0.083	–0.050
	(0.057)	(0.074)
After	–0.047***	–0.003
	(0.007)	(0.060)
Kalundborg, after	–0.067	–0.205*
	(0.071)	(0.086)
Boarding school	–0.255***	0.000
	(0.021)	(.)
State school	0.000	0.000
	(.)	(.)
Independent or private school	0.005	0.121
	(0.008)	(0.064)
Danish, male	0.000	0.000
	(.)	(.)
Danish, female	–0.144***	–0.089*
	(0.006)	(0.037)
Immigrant, male	0.114***	0.182
	(0.025)	(0.157)
Immigrant, female	0.023	0.182
	(0.026)	(0.168)
Second generation immigrant, male	0.206***	0.197
	(0.024)	(0.223)
Second generation immigrant, female	0.184***	0.290
	(0.024)	(0.198)
Income, mother	0.002***	0.005*
	(0.000)	(0.002)
Income, father	0.000**	0.000
	(0.000)	(0.001)
Primary school, mother	0.000	0.000
	(.)	(.)
General upper secondary education, mother	0.254***	0.144
	(0.016)	(0.137)
Vocational upper secondary education, mother	0.324***	0.540***
	(0.022)	(0.151)
Post-secondary vocational training, mother	0.175***	0.168***
	(0.008)	(0.050)
Short-cycle tertiary education education, mother	0.385***	0.371***
	(0.014)	(0.095)
Academic Bachelor’s, mother	0.313***	0.344***
	(0.009)	(0.059)
Professional Bachelor’s, mother	0.317***	–0.691
	(0.036)	(0.436)
Master’s, mother	0.405***	0.542***
	(0.015)	(0.140)
PhD, mother	0.523***	0.608
	(0.045)	(0.552)
Primary school education, father	0.000	0.000
	(.)	(.)
General upper secondary education, father	0.245***	0.317**
	(0.016)	(0.121)

Vocational upper secondary education, father	0.245***	0.165
	(0.026)	(0.167)
Post-secondary vocational training, father	0.168***	0.150**
	(0.008)	(0.050)
Short-cycle tertiary education, father	0.357***	0.245**
	(0.013)	(0.086)
Academic Bachelor's, father	0.390***	0.365***
	(0.010)	(0.066)
Professional Bachelor's, father	0.254***	0.393
	(0.034)	(0.376)
Master's, father	0.467***	0.399***
	(0.012)	(0.097)
PhD, father	0.706***	0.321
	(0.029)	(0.408)
Self-employed, mother	–0.006	-0.208
	(0.013)	(0.111)
Employee, mother	0.000	0.000
	(.)	(.)
Unemployed, mother	–0.088***	-0.093
	(0.013)	(0.088)
Student mother	0.006	-0.147
	(0.032)	(0.221)
Pensioner, mother	–0.087***	-0.208
	(0.019)	(0.132)
Other, mother	–0.075***	-0.161
	(0.016)	(0.115)
Self-employed, father	0.017*	-0.110
	(0.009)	(0.073)
Employee, father	0.000	0.000
	(.)	(.)
Unemployed, father	–0.156***	-0.199
	(0.015)	(0.106)
Student, father	–0.132*	0.000
	(0.066)	(.)
Pensioner, father	–0.161***	-0.144
	(0.018)	(0.114)
Other, father	–0.195***	-0.299*
	(0.020)	(0.141)
Average income of the mothers	0.002	0.010
	(0.001)	(0.009)
Average income of the fathers	0.003***	0.003
	(0.000)	(0.005)
Proportion of mothers with general upper secondary education	–0.286***	–0.193
	(0.077)	(0.721)
Proportion of fathers with general upper secondary education	–0.081	–0.173
	(0.077)	(0.717)
Proportion of mothers with post-secondary vocational training	0.209***	0.599*
	(0.039)	(0.274)
Proportion of fathers with post-secondary vocational training	0.198***	0.025
	(0.038)	(0.303)
Proportion of mothers with short-cycle tertiary education	0.368***	–0.015
	(0.089)	(0.704)
Proportion of fathers with short-cycle tertiary education	0.420***	0.128
	(0.074)	(0.552)
Proportion of mothers with academic Bachelor's	–0.115**	–0.449
	(0.044)	(0.340)
Proportion of fathers with Academic Bachelor's	0.194***	–0.066
	(0.054)	(0.426)

Proportion of mothers with Master's	–0.263**	–1.502
	(0.087)	(1.036)
Proportion of fathers with Master's	0.237***	0.981
	(0.063)	(0.772)
Constant	–1.761***	–1.913***
	(0.025)	(0.173)
Number of observations	357 510***	8307***
Model degrees of freedom	50	48
Pseudo R-squared	0.044	0.057

Standard errors are shown in parentheses.

***,** and * indicate statistical significance at 0.1, 1 and 5% level respectively

Table A5:OLS estimates of the effect of Science Team K on overall grade point averages and grade point averages in science subjects in upper secondary education programs

	Rest of Denmark Overall GPA	Rest of Denmark Science GPA	Esbjerg Overall GPA	Esbjerg Science GPA
	(1)	(2)	(3)	(4)
Kalundborg	–0.004	–0.213	–0.000	–0.070
	(0.109)	(0.142)	(0.135)	(0.183)
After	0.173***	0.220***	–0.151	–0.054
	(0.013)	(0.017)	(0.104)	(0.143)
Kalundborg, after	–0.343**	0.096	–0.258	0.173
	(0.131)	(0.172)	(0.154)	(0.207)
STX	0.000	0.000	0.000	0.000
	(.)	(.)	(.)	(.)
HF	–0.900***	–1.034***	–0.885***	–1.102***
	(0.017)	(0.026)	(0.125)	(0.185)
HTX	0.004	–0.369***	0.046	–0.381*
	(0.018)	(0.022)	(0.125)	(0.156)
HHX	–0.375***	–0.013	–0.376***	1.780
	(0.013)	(0.144)	(0.081)	(1.157)
Boarding school	0.156***	0.188***	–0.725	
	(0.042)	(0.056)	(1.424)	
State school	0.000	0.000	0.000	0.000
	(.)	(.)	(.)	(.)
Independent or private school	0.054***	–0.001	0.030	0.041
	(0.013)	(0.017)	(0.116)	(0.151)
Danish, male	0.000	0.000	0.000	0.000
	(.)	(.)	(.)	(.)
Danish, female	0.463***	0.405***	0.416***	0.422***
	(0.010)	(0.013)	(0.068)	(0.093)
Immigrant, male	–0.723***	–0.530***	–0.515	–0.337
	(0.051)	(0.070)	(0.300)	(0.408)
Immigrant, female	–0.371***	–0.445***	–0.613*	–0.881*
	(0.046)	(0.059)	(0.286)	(0.360)
Second generation immigrant, male	–0.555***	–0.530***	–0.739	–1.125
	(0.046)	(0.063)	(0.434)	(0.583)
Second generation immigrant, female	–0.213***	–0.301***	–0.578	–0.494
	(0.042)	(0.054)	(0.357)	(0.454)
Income, mother	0.002***	0.002***	0.004	–0.001
	(0.000)	(0.001)	(0.004)	(0.005)
Income, father	0.001***	0.001***	0.004*	0.002
	(0.000)	(0.000)	(0.001)	(0.002)
Primary school education, mother	0.000	0.000	0.000	0.000
	(.)	(.)	(.)	(.)
General upper secondary education, mother	0.547***	0.494***	0.840***	0.504
	(0.027)	(0.035)	(0.233)	(0.319)
Vocational upper secondary education, mother	0.437***	0.381***	1.067***	1.162**
	(0.037)	(0.050)	(0.267)	(0.366)
Post-secondary vocational training mother	0.193***	0.200***	0.218*	0.191
	(0.015)	(0.020)	(0.091)	(0.130)
Short-cycle tertiary education, mother	0.487***	0.487***	0.812***	1.009***
	(0.025)	(0.033)	(0.163)	(0.217)
Academic Bachelor’s, mother	0.666***	0.627***	0.689***	0.607***
	(0.016)	(0.022)	(0.103)	(0.140)
Professional Bachelor’s, mother	0.732***	0.638***	0.679	0.275
	(0.059)	(0.073)	(0.406)	(0.513)

Master's, mother	1.190***	1.076***	1.086***	1.231***
	(0.025)	(0.031)	(0.233)	(0.295)
PhD, mother	1.584***	1.510***	1.183	0.773
	(0.075)	(0.088)	(0.922)	(1.064)
Primary school education, father	0.000	0.000	0.000	0.000
	(.)	(.)	(.)	(.)
General upper secondary, father	0.527***	0.481***	0.439*	0.372
	(0.027)	(0.034)	(0.198)	(0.251)
Vocational upper secondary education, father	0.399***	0.334***	1.007***	0.560
	(0.042)	(0.057)	(0.263)	(0.374)
Post-secondary vocational training, father	0.148***	0.185***	0.131	0.080
	(0.014)	(0.020)	(0.091)	(0.128)
Short-cycle tertiary education, father	0.347***	0.364***	0.343*	0.292
	(0.023)	(0.031)	(0.148)	(0.201)
Academic Bachelor's, father	0.632***	0.595***	0.534***	0.447**
	(0.018)	(0.024)	(0.115)	(0.154)
Professional Bachelor's, father	0.693***	0.607***	0.418	0.087
	(0.054)	(0.068)	(0.591)	(0.895)
Master's, father	0.971***	0.930***	0.927***	0.713***
	(0.020)	(0.026)	(0.158)	(0.202)
PhD, father	1.233***	1.282***	1.179*	1.417*
	(0.049)	(0.058)	(0.600)	(0.694)
Self-employed, mother	0.027	0.026	–0.311	–0.555*
	(0.022)	(0.029)	(0.177)	(0.250)
Employee, mother	0.000	0.000	0.000	0.000
	(.)	(.)	(.)	(.)
Unemployed, mother	–0.173***	–0.197***	–0.225	–0.252
	(0.024)	(0.032)	(0.161)	(0.220)
Student, mother	–0.009	–0.016	0.189	–0.122
	(0.058)	(0.073)	(0.349)	(0.421)
Pensioner, mother	0.005	–0.059	0.148	0.108
	(0.036)	(0.048)	(0.243)	(0.336)
Other, mother	0.040	0.042	0.069	0.082
	(0.030)	(0.039)	(0.214)	(0.291)
Self-employed, father	0.137***	0.136***	0.042	0.033
	(0.015)	(0.020)	(0.123)	(0.171)
Employee, father	0.000	0.000	0.000	0.000
	(.)	(.)	(.)	(.)
Unemployed, father	–0.149***	–0.220***	–0.040	–0.759**
	(0.027)	(0.036)	(0.198)	(0.268)
Student, father	0.158	0.121	–0.516	–1.114
	(0.119)	(0.151)	(1.019)	(1.351)
Pensioner, father	–0.043	–0.023	0.284	0.024
	(0.034)	(0.044)	(0.200)	(0.268)
Other, father	–0.171***	–0.194***	0.568*	0.205
	(0.038)	(0.050)	(0.237)	(0.328)
Average income of the mothers	–0.002	–0.003	0.038*	0.032
	(0.002)	(0.002)	(0.017)	(0.022)
Average income of the fathers	0.003***	0.004***	–0.005	–0.003
	(0.001)	(0.001)	(0.009)	(0.012)
Proportion of mothers with general upper secondary education	–0.163	–0.398*	1.484	0.057
	(0.138)	(0.181)	(1.270)	(1.688)
Proportion of fathers with general upper secondary education	–0.328*	–0.222	0.587	3.497*
	(0.137)	(0.177)	(1.266)	(1.679)
Proportion of mothers with post-secondary vocational training	0.084	0.073	0.546	0.805
	(0.071)	(0.094)	(0.487)	(0.657)
Proportion of fathers with post-secondary vocational training	0.322***	0.421***	0.121	0.289
	(0.070)	(0.093)	(0.544)	(0.725)

Proportion of mothers with short-cycle tertiary education	–0.082	–0.144	0.021	–1.133
	(0.158)	(0.206)	(1.210)	(1.643)
Proportion of fathers with short-cycle tertiary education	–0.198	–0.132	0.058	–0.568
	(0.133)	(0.175)	(0.967)	(1.301)
Proportion of mothers with Academic Bachelor's	0.714***	0.623***	0.626	0.576
	(0.079)	(0.104)	(0.593)	(0.790)
Proportion of fathers with Academic Bachelor's	0.069	0.012	0.867	0.972
	(0.097)	(0.127)	(0.746)	(1.020)
Proportion of mothers with Master's	0.460**	0.246	–1.784	–2.765
	(0.153)	(0.195)	(1.761)	(2.365)
Proportion of fathers with Master's	–0.312**	–0.361*	0.322	0.379
	(0.111)	(0.142)	(1.358)	(1.819)
Constant	5.123***	5.063***	4.395***	4.411***
	(0.048)	(0.064)	(0.318)	(0.428)
Number of observations	187 590***	139 293***	4040***	2933***
Model degrees of freedom	53	53	53	52
R-squared	0.134	0.096	0.132	0.105

Standard errors are shown in parentheses.

***,** and * indicate statistical significance at 0.1, 1 and 5% level, respectively

Table A6: OLS estimates of the effect of Science Team K on the grade for physics and chemistry and the average grade for all subjects in the 9th grade exit exams

	Rest of Denmark Physics and chemistry	Rest of Denmark Average grade	Esbjerg Physics and chemistry	Esbjerg Average grade
	(1)	(2)	(3)	(4)
Kalundborg	–0.090	–0.009	–0.126	0.022
	(0.110)	(0.058)	(0.140)	(0.076)
After	–0.218***	0.001	–0.213*	0.006
	(0.012)	(0.007)	(0.099)	(0.055)
Kalundborg, after	0.048	–0.153*	0.076	–0.215*
	(0.125)	(0.067)	(0.156)	(0.085)
Boarding school	–0.507***	–0.807***	–0.135	–0.489
	(0.051)	(0.026)	(0.852)	(0.433)
Public school	0.000	0.000	0.000	0.000
	(.)	(.)	(.)	(.)
Independent or private school	0.306***	0.114***	0.255*	–0.093
	(0.013)	(0.008)	(0.110)	(0.064)
Danish, male	0.000	0.000	0.000	0.000
	(.)	(.)	(.)	(.)
Danish, female	0.131***	0.564***	0.127*	0.494***
	(0.009)	(0.005)	(0.061)	(0.035)
Immigrant, male	–0.755***	–0.764***	–0.634*	–0.679***
	(0.045)	(0.025)	(0.259)	(0.147)
Immigrant, female	–0.471***	–0.264***	–0.660*	–0.252
	(0.045)	(0.025)	(0.286)	(0.160)
Second generation immigrant, male	–0.434***	–0.352***	0.094	–0.030
	(0.034)	(0.019)	(0.252)	(0.144)
Second generation immigrant, female	–0.111***	0.128***	–0.435	0.186
	(0.033)	(0.019)	(0.246)	(0.143)
Income, mother	0.009***	0.008***	0.017***	0.015***
	(0.000)	(0.000)	(0.003)	(0.002)
Income, father	0.002***	0.002***	0.005***	0.003***
	(0.000)	(0.000)	(0.001)	(0.001)
Primary school education, mother	0.000	0.000	0.000	0.000
	(.)	(.)	(.)	(.)
General upper secondary education, mother	0.984***	0.958***	0.772***	0.692***
	(0.025)	(0.015)	(0.202)	(0.117)
Vocational upper secondary education, mother	1.139***	1.066***	1.571***	1.574***
	(0.033)	(0.020)	(0.248)	(0.145)
Post-secondary vocational training, mother	0.489***	0.455***	0.459***	0.487***
	(0.013)	(0.007)	(0.081)	(0.046)
Short-cycle tertiary education, mother	1.125***	0.987***	1.093***	1.059***
	(0.024)	(0.014)	(0.160)	(0.093)
Academic Bachelor's, mother	1.212***	1.104***	0.970***	1.071***
	(0.015)	(0.009)	(0.100)	(0.057)
Professional Bachelor's, mother	1.473***	1.457***	0.820*	1.163***
	(0.048)	(0.028)	(0.351)	(0.208)
Master's, mother	1.715***	1.482***	1.056***	1.422***
	(0.025)	(0.015)	(0.248)	(0.146)
PhD, mother	2.255***	1.765***	2.305*	2.431***
	(0.071)	(0.042)	(0.969)	(0.581)
Primary school education, father	0.000	0.000	0.000	0.000
	(.)	(.)	(.)	(.)
General upper secondary	1.088***	1.021***	1.393***	1.181***

education, father	(0.026)	(0.015)	(0.201)	(0.117)
Vocational upper secondary education, father	0.984***	1.017***	1.412***	1.185***
	(0.041)	(0.024)	(0.246)	(0.145)
Post-secondary vocational training, father	0.423***	0.361***	0.441***	0.355***
	(0.012)	(0.007)	(0.078)	(0.044)
Short-cycle tertiary education, father	0.942***	0.780***	0.910***	0.747***
	(0.021)	(0.012)	(0.138)	(0.079)
Academic Bachelor's, father	1.297***	1.125***	1.364***	1.100***
	(0.017)	(0.010)	(0.114)	(0.065)
Professional Bachelor's, father	1.365***	1.268***	2.130***	1.780***
	(0.052)	(0.031)	(0.555)	(0.333)
Master's, father	1.674***	1.396***	1.935***	1.544***
	(0.020)	(0.012)	(0.171)	(0.100)
PhD, father	2.209***	1.694***	2.283***	1.600***
	(0.050)	(0.030)	(0.628)	(0.370)
Self-employed, mother	0.094***	0.080***	0.177	0.072
	(0.021)	(0.012)	(0.161)	(0.094)
Employee, mother	0.000	0.000	0.000	0.000
	(.)	(.)	(.)	(.)
Unemployed, mother	–0.307***	–0.287***	–0.400**	–0.249**
	(0.021)	(0.012)	(0.140)	(0.079)
Student, mother	0.285***	0.251***	–0.029	0.495*
	(0.056)	(0.032)	(0.372)	(0.209)
Pensioner, mother	–0.050	–0.075***	–0.139	0.037
	(0.029)	(0.016)	(0.181)	(0.102)
Other, mother	–0.002	–0.082***	0.013	0.014
	(0.028)	(0.015)	(0.187)	(0.102)
Self-employed, father	0.083***	0.026**	–0.077	–0.106
	(0.014)	(0.008)	(0.113)	(0.065)
Employee, father	0.000	0.000	0.000	0.000
	(.)	(.)	(.)	(.)
Unemployed, father	–0.442***	–0.378***	–0.480**	–0.497***
	(0.024)	(0.013)	(0.158)	(0.089)
Student, father	–0.005	–0.016	0.525	0.716
	(0.119)	(0.067)	(0.740)	(0.433)
Pensioner, father	–0.273***	–0.256***	–0.016	–0.121
	(0.027)	(0.015)	(0.176)	(0.096)
Other, father	–0.354***	–0.282***	–0.243	–0.139
	(0.032)	(0.018)	(0.199)	(0.109)
Average income of the mothers	0.001	0.017***	–0.009	0.020*
	(0.001)	(0.001)	(0.014)	(0.008)
Average income of the fathers	0.005***	0.008***	–0.011	0.008*
	(0.001)	(0.000)	(0.007)	(0.004)
Proportion of mothers with general upper secondary education	0.023	0.650***	0.727	1.875***
	(0.126)	(0.072)	(0.998)	(0.560)
Proportion of fathers with general upper secondary education	–0.044	0.243***	2.158*	1.583**
	(0.128)	(0.073)	(1.064)	(0.610)
Proportion of mothers with post-secondary vocational training	–0.146*	0.282***	0.123	0.491
	(0.069)	(0.039)	(0.479)	(0.269)
Proportion of fathers with post-secondary vocational training	0.598***	0.552***	1.236*	–0.001
	(0.066)	(0.037)	(0.483)	(0.269)
Proportion of mothers with short-cycle tertiary education	0.326*	0.364***	0.010	0.920
	(0.151)	(0.086)	(1.103)	(0.633)
Proportion of fathers with short-cycle tertiary education	0.695***	1.149***	1.803*	0.947
	(0.120)	(0.068)	(0.854)	(0.489)
Proportion of mothers with Academic Bachelor's	0.130	0.293***	1.132	0.859**
	(0.075)	(0.043)	(0.580)	(0.327)
Proportion of fathers with	–0.040	0.415***	0.466	0.698

Academic Bachelor's	(0.091)	(0.052)	(0.687)	(0.390)
Proportion of mothers with Master's	0.025	0.072	0.911	-0.806
	(0.141)	(0.081)	(1.564)	(0.902)
Proportion of fathers with Master's	–0.329**	-0.038	-1.036	0.471
	(0.106)	(0.060)	(1.076)	(0.610)
Constant	4.014***	3.378***	3.743***	3.097***
	(0.044)	(0.025)	(0.289)	(0.161)
Number of observations	543 576***	588 612***	12 300***	13 475***
Model degrees of freedom	50	50	50	50
R-squared	0.100	0.235	0.090	0.224

Standard errors are shown in parentheses.

***,** and * indicate statistical significance at 0.1, 1 and 5% level, respectively

Table A7: Descriptive statistics for background variables for Gymnasium and HF students in the pre-treatment period, treatment and control groups

		Kalundborg	Rest of Denmark			Esbjerg		
		Mean	Mean	t-test		Mean	t-test	
Students' characteristics	Proportion of males	0.33	0.36	1.11		0.39	2.12	**
	Proportion of Danes	0.96	0.94	–1.17		0.94	–1.00	
	Proportion of immigrants	0.04	0.04	–0.19		0.04	0.23	
	Proportion of second generation immigrants	0.01	0.02	2.20	**	0.02	1.61	
Mothers' characteristics	Income (10,000 DKK)	21.99	22.48	0.74		20.99	–1.49	
Labour market status	Self-employed	0.06	0.05	–0.50		0.03	–2.73	**
	Employee	0.80	0.83	1.53		0.86	2.76	**
	Unemployed	0.02	0.02	–0.34		0.01	–1.63	
	Student	0.02	0.01	–2.01	**	0.01	–1.56	
	Pensioner	0.05	0.03	–1.90	*	0.04	–0.74	
	Other	0.05	0.05	0.51		0.05	0.25	
Highest level of education	Primary school	0.25	0.19	–3.21	**	0.22	–0.97	
	General upper secondary	0.04	0.04	–0.89		0.02	–2.25	**
	Vocational upper secondary	0.01	0.01	0.46		0.01	0.20	
	Post-secondary vocational training	0.28	0.29	0.37		0.27	–0.36	
	Short-cycle tertiary education	0.04	0.05	0.14		0.05	0.62	
	Academic Bachelor's	0.35	0.35	–0.08		0.38	1.12	
	Professional Bachelor's	0.00	0.00	0.42		0.00	–0.51	
	Master's	0.03	0.08	4.30	***	0.05	1.66	*
	PhD	0.00	0.00	0.45		0.00	–1.43	
Father's characteristics	Income (10,000 DKK)	32.86	36.30	2.00	**	33.47	0.50	
Labour market status	Self-employed	0.13	0.13	–0.04		0.06	–4.50	***
	Employee	0.78	0.78	0.39		0.84	3.10	**
	Unemployed	0.02	0.02	0.49		0.02	0.39	
	Student	0.00	0.00	0.36		0.00	–0.02	
	Pensioner	0.04	0.03	–0.98		0.03	–0.88	
	Other	0.03	0.03	–0.31		0.04	0.90	
Highest level of education	Primary school	0.18	0.16	–1.40		0.17	–0.48	
	General upper secondary	0.04	0.04	0.76		0.03	–0.03	
	Vocational upper secondary	0.00	0.01	1.56		0.01	1.83	*
	Post-secondary vocational training	0.45	0.37	–3.78	***	0.34	–4.06	***
	Short-cycle tertiary education	0.05	0.05	0.28		0.06	0.85	
	Academic Bachelor's	0.18	0.19	0.94		0.26	3.58	***
	Professional Bachelor's	0.00	0.01	1.84	*	0.00	1.22	
	Master's	0.10	0.16	3.64	***	0.11	0.62	
	PhD	0.00	0.01	1.05		0.01	0.26	

Class characteristics	Average income of the mothers	21.15	21.90	5.29	***	20.52	–6.80	***
	Average income of the fathers	31.96	35.19	9.29	***	32.54	2.32	**
	Proportion of mothers with primary school education	0.27	0.21	–22.18	***	0.24	–11.78	***
	Proportion of mothers with General upper secondary education	0.05	0.05	–1.30		0.03	–19.15	***
	Proportion of mothers with Post-secondary vocational training	0.28	0.29	1.34		0.27	–6.77	***
	Proportion of mothers with short-cycle tertiary education	0.04	0.05	8.94	***	0.05	12.58	***
	Proportion of mothers with Academic Bachelor's	0.33	0.33	0.85		0.36	9.53	***
	Proportion of mothers with Master's	0.03	0.08	18.97	***	0.05	22.07	***
	Proportion of fathers with primary school education	0.20	0.17	–10.08	***	0.18	–8.31	***
	Proportion of fathers with general upper secondary education	0.04	0.05	8.53	***	0.04	–3.02	**
	Proportion of fathers with post-secondary vocational training	0.45	0.37	–19.47	***	0.36	–38.02	***
	Proportion of fathers with short-cycle tertiary education	0.06	0.05	–3.14	**	0.07	10.54	***
	Proportion of fathers with Academic Bachelor's	0.17	0.19	11.47	***	0.26	30.52	***
	Proportion of fathers with Master's	0.08	0.16	16.53	***	0.11	9.83	***

***,** and * indicate statistical significance at 0.1, 1 and 5% level, respectively

Table A8: Descriptive statistics for background variables for Gymnasium and HF students in the post-treatment period, treatment and control groups

		Kalundborg	Rest of Denmark			Esbjerg		
		Mean	Mean	t-test		Mean	t-test	
Students' characteristics	Proportion of males	0.36	0.38	1.47		0.37	0.53	
	Proportion of Danes	0.95	0.92	–3.64	***	0.93	–3.11	**
	Proportion of immigrants	0.03	0.03	–0.11		0.03	0.14	
	Proportion of second generation immigrants	0.02	0.04	4.89	***	0.04	4.23	***
Mother's characteristics	Income (10,000 DKK)	26.47	28.77	4.57	***	26.64	0.35	
Labour market status	Self-employed	0.04	0.05	0.97		0.04	–1.44	
	Employee	0.83	0.84	0.85		0.85	2.03	**
	Unemployed	0.05	0.05	0.53		0.06	0.94	
	Student	0.00	0.00	0.45		0.00	–0.12	
	Pensioner	0.04	0.03	–3.35	***	0.03	–2.38	**
	Other	0.03	0.03	–0.65		0.02	–1.51	
Highest level of education	Primary school	0.15	0.13	–2.22	**	0.16	1.02	
	General upper secondary	0.03	0.04	2.65	**	0.02	–1.70	*
	Vocational upper secondary	0.02	0.02	0.65		0.02	0.04	
	Post-secondary vocational training	0.37	0.30	–5.89	***	0.32	–3.62	***
	Short-cycle tertiary education	0.05	0.05	–0.79		0.05	–0.11	
	Academic Bachelor's	0.33	0.34	1.14		0.38	3.20	**
	Professional Bachelor's	0.01	0.01	1.04		0.01	0.81	
	Master's	0.05	0.10	7.13	***	0.05	0.10	
	PhD	0.00	0.01	2.10	**	0.00	–0.70	
Father's characteristics	Income (10,000 DKK)	37.70	44.18	4.65	***	41.49	3.93	***
Labour market status	Self-employed	0.10	0.11	0.94		0.09	–1.75	*
	Employee	0.79	0.80	0.67		0.82	2.45	**
	Unemployed	0.04	0.04	–0.20		0.04	–0.09	
	Student	0.00	0.00	0.21		0.00	–0.63	
	Pensioner	0.05	0.04	–2.54	**	0.03	–2.41	**
	Other	0.02	0.02	–0.41		0.02	0.21	
Highest level of education	Primary school	0.18	0.14	–5.22	***	0.15	–2.85	**
	General upper secondary	0.05	0.05	–0.33		0.03	–4.19	***
	Vocational upper secondary	0.01	0.01	1.64		0.02	3.39	***
	Post-secondary vocational training	0.46	0.36	–7.23	***	0.40	–3.82	***
	Short-cycle tertiary education	0.07	0.07	–0.07		0.07	0.41	
	Academic Bachelor	0.15	0.18	3.49	***	0.22	5.87	***
	Professional Bachelor	0.01	0.01	2.04	**	0.01	0.06	
	Master's	0.08	0.16	8.31	***	0.10	2.14	**
	PhD	0.00	0.02	4.16	***	0.01	1.75	*

Class characteristics	Average income of the mothers	24.85	27.76	22.50	***	25.89	11.72	***
	Average income of the fathers	35.37	42.52	23.63	***	40.04	30.07	***
	Proportion of mothers with Primary school	0.18	0.15	–24.87	***	0.17	–7.34	***
	Proportion of mothers with General upper secondary	0.04	0.06	30.83	***	0.04	–13.61	***
	Proportion of mothers with Post-secondary vocational training	0.38	0.31	–33.26	***	0.33	–41.02	***
	Proportion of mothers with short-cycle tertiary education	0.05	0.05	–16.25	***	0.05	–8.89	***
	Proportion of mothers with Academic Bachelor's	0.30	0.34	21.54	***	0.37	44.59	***
	Proportion of mothers with Master's	0.04	0.10	31.33	***	0.04	8.81	***
	Proportion of fathers with primary school education	0.21	0.15	-37.27	***	0.17	-39.11	***
	Proportion of fathers with general upper secondary education	0.05	0.06	7.89	***	0.05	-16.43	***
	Proportion of fathers with post-secondary vocational training	0.47	0.37	-37.74	***	0.41	-55.81	***
	Proportion of fathers with short-cycle tertiary education	0.06	0.06	2.95	**	0.07	12.69	***
	Proportion of fathers with Academic Bachelor's	0.13	0.18	44.57	***	0.21	83.90	***
	Proportion of fathers with Master's	0.07	0.17	34.28	***	0.10	27.63	***

***,** and * indicate statistical significance at 0.1, 1 and 5% level, respectively

Table A9: Probit estimates of the effect of Science Team K on the probability of starting a tertiary education program with strong science components

	Sample and control group			
	STX students Rest of Denmark	STX students Esbjerg	HF students Rest of Denmark	HF students Esbjerg
	(1)	(2)	(3)	(4)
Kalundborg	–0.085	–0.198	–0.066	0.286
	(0.075)	(0.143)	(0.167)	(0.414)
After	0.090***	0.027	0.230***	0.501
	(0.010)	(0.108)	(0.026)	(0.305)
Kalundborg, after	0.012	–0.192	0.270	0.419
	(0.089)	(0.206)	(0.213)	(0.518)
Danish, male	0.000	0.000	0.000	0.000
	(.)	(.)	(.)	(.)
Danish, female	0.101***	0.076	0.250***	0.270
	(0.008)	(0.047)	(0.026)	(0.173)
Immigrant, male	0.571***	0.116	0.486***	0.085
	(0.038)	(0.210)	(0.105)	(0.640)
Immigrant, female	0.416***	0.071	0.579***	0.442
	(0.030)	(0.182)	(0.086)	(0.601)
Second generation immigrant, male	0.389***	0.156	0.452***	0.000
	(0.040)	(0.258)	(0.127)	(.)
Second generation immigrant, female	0.469***	0.183	0.389***	1.028
	(0.031)	(0.254)	(0.099)	(0.702)
Income, mother	0.001**	0.002	–0.001	–0.009
	(0.000)	(0.002)	(0.001)	(0.011)
Income, father	–0.000	0.002	0.001*	0.003
	(0.000)	(0.001)	(0.001)	(0.006)
Primary school, mother	0.000	0.000	0.000	0.000
	(.)	(.)	(.)	(.)
General upper secondary education, mother	–0.029	–0.018	–0.104	–1.021
	(0.021)	(0.162)	(0.066)	(0.603)
Vocational upper secondary education, mother	0.062	–0.058	–0.073	0.339
	(0.032)	(0.220)	(0.116)	(0.818)
Post-secondary vocational training, mother	0.032**	0.035	0.054	0.214
	(0.012)	(0.067)	(0.029)	(0.192)
Short-cycle tertiary education, mother	0.080***	0.095	–0.001	0.129
	(0.019)	(0.106)	(0.065)	(0.430)
Academic Bachelor’s, mother	–0.017	–0.010	0.017	0.031
	(0.012)	(0.069)	(0.034)	(0.222)
Professional Bachelor’s, mother	–0.082	–0.183	0.130	
	(0.049)	(0.320)	(0.220)	
Master’s, mother	0.050**	–0.167	0.128	1.637*
	(0.018)	(0.138)	(0.075)	(0.757)
PhD, mother	0.207***	0.454	–0.406	
	(0.047)	(0.655)	(0.394)	
Primary school education, father	0.000	0.000	0.000	0.000
	(.)	(.)	(.)	(.)
General upper secondary education, father	0.004	0.175	0.093	–0.631
	(0.020)	(0.133)	(0.063)	(0.616)
Vocational upper secondary education, father	–0.008	0.314	0.183	0.000
	(0.035)	(0.184)	(0.129)	(.)
Post-secondary vocational training father	0.056***	0.040	0.075**	0.228
	(0.012)	(0.067)	(0.029)	(0.181)
Short-cycle tertiary education, father	0.094***	–0.072	0.078	0.058

	(0.018)	(0.107)	(0.052)	(0.335)
Academic Bachelor's, father	0.046***	–0.033	0.090*	0.338
	(0.014)	(0.078)	(0.040)	(0.242)
Professional Bachelor's, father	–0.059	0.000	0.044	0.000
	(0.040)	(.)	(0.181)	(.)
Master's, father	0.132***	0.096	0.082	–0.578
	(0.015)	(0.098)	(0.055)	(0.685)
PhD, father	0.328***	0.287	0.307	
	(0.032)	(0.304)	(0.185)	
Self-employed, mother	0.000	0.000	0.000	0.000
	(.)	(.)	(.)	(.)
Employee, mother	0.002	–0.082	0.040	0.064
	(0.017)	(0.117)	(0.055)	(0.421)
Unemployed, mother	–0.013	0.061	0.080	–0.154
	(0.026)	(0.174)	(0.077)	(0.573)
Student, mother	–0.053	–0.616	0.115	0.000
	(0.053)	(0.359)	(0.131)	(.)
Pensioner, mother	–0.003	0.168	–0.025	0.290
	(0.029)	(0.187)	(0.081)	(0.516)
Other, mother	0.028	0.038	0.029	0.475
	(0.029)	(0.194)	(0.080)	(0.574)
Self-employed, father	0.000	0.000	0.000	0.000
	(.)	(.)	(.)	(.)
Employee, father	–0.037**	0.058	0.019	–0.000
	(0.011)	(0.081)	(0.035)	(0.274)
Unemployed, father	–0.098***	0.354*	0.028	0.542
	(0.025)	(0.168)	(0.068)	(0.443)
Student, father	–0.156	0.000	0.225	
	(0.100)	(.)	(0.232)	
Pensioner, father	–0.072**	0.220	0.064	0.380
	(0.025)	(0.156)	(0.065)	(0.417)
Other, father	–0.090**	–0.021	0.117	0.219
	(0.031)	(0.176)	(0.078)	(0.486)
Average income of the mothers	0.006**	0.064	0.023**	–0.030
	(0.002)	(0.040)	(0.008)	(0.118)
Average income of the fathers	–0.001	–0.036	0.001	0.051
	(0.001)	(0.026)	(0.004)	(0.075)
Proportion of fathers with primary school education	–0.125	–0.647	1.657***	–20.197*
	(0.145)	(1.756)	(0.472)	(8.060)
Proportion of mothers with primary school education	0.637**	–3.590	–0.302	26.198*
	(0.194)	(3.654)	(0.696)	(10.275)
Proportion of mothers with general upper secondary	0.445	–7.320	1.685	9.048
	(0.267)	(5.644)	(0.894)	(13.590)
Proportion of fathers with general upper secondary education	–0.623**	–2.694	0.801	–8.820
	(0.205)	(2.935)	(0.650)	(8.788)
Proportion of mothers with post-secondary vocational training	0.822***	–2.282	–0.082	21.476*
	(0.169)	(2.758)	(0.639)	(10.092)
Proportion of fathers with post-secondary vocational training	0.144	–0.502	0.865*	–22.821**
	(0.117)	(1.574)	(0.411)	(7.112)
Proportion of mothers with short-cycle tertiary education	0.812**	–5.213	–0.394	2.991
	(0.251)	(3.397)	(0.912)	(10.679)
Proportion of fathers with short-cycle tertiary education	0.969***	–0.010	2.170**	6.817
	(0.206)	(1.684)	(0.665)	(9.162)
Proportion of mothers with Academic Bachelor's	0.550**	–5.249	–0.134	7.002
	(0.168)	(2.860)	(0.614)	(8.652)
Proportion of fathers with Academic Bachelor's	0.262	–0.994	0.718	–16.341*
	(0.134)	(1.586)	(0.476)	(6.697)
Proportion of mothers with Master's	0.000	0.000	0.000	0.000

	(.)	(.)	(.)	(.)
Proportion of fathers with Master's	0.000	0.000	0.000	0.000
	(.)	(.)	(.)	(.)
Constant	–1.601***	3.624	–2.769***	–1.688
	(0.137)	(3.244)	(0.532)	(8.507)
Number of observations	141 220***	3714**	17 351***	446**
converged	1	1	1	1
Model degrees of freedom	48	46	48	40
Pseudo R-squared	0.009	0.016	0.026	0.133

Standard errors are shown in parentheses.

***,** and * indicate statistical significance at 0.1, 1 and 5% level, respectively

Table A10: OLS estimates of the effect of Science Team K on overall grade point averages and average grades in science subjects in general upper secondary education (STX)

	Dependent variable and control group			
	Overall GPA Denmark	Science grades Denmark	Overall GPA Esbjerg	Science grades Esbjerg
	(1)	(2)	(3)	(4)
Kalundborg	–0.072	–0.038	–0.083	0.141
	(0.109)	(0.120)	(0.191)	(0.209)
After	0.035*	0.013	–0.259*	–0.209
	(0.014)	(0.016)	(0.125)	(0.138)
Kalundborg, after	–0.077	0.132	–0.222	–0.086
	(0.124)	(0.136)	(0.205)	(0.225)
Danish, male	0.000	0.000	0.000	0.000
	(.)	(.)	(.)	(.)
Danish, female	0.487***	0.390***	0.543***	0.452***
	(0.010)	(0.010)	(0.060)	(0.066)
Immigrant, male	–0.621***	–0.719***	–0.689*	–0.769*
	(0.052)	(0.057)	(0.274)	(0.301)
Immigrant, female	–0.253***	–0.439***	–0.261	–0.706**
	(0.041)	(0.045)	(0.249)	(0.274)
Second generation immigrant, male	–0.427***	–0.522***	–0.358	–0.439
	(0.046)	(0.050)	(0.300)	(0.330)
Second generation immigrant, female	–0.110**	–0.260***	–0.334	–0.742*
	(0.036)	(0.039)	(0.262)	(0.288)
Income, mother	0.003***	0.003***	0.002	0.004
	(0.000)	(0.000)	(0.003)	(0.003)
Income, father	0.001***	0.001***	0.004***	0.004***
	(0.000)	(0.000)	(0.001)	(0.001)
Primary school education, mother	0.000	0.000	0.000	0.000
	(.)	(.)	(.)	(.)
General upper secondary, mother	0.617***	0.484***	0.507*	0.261
	(0.026)	(0.029)	(0.198)	(0.217)
Vocational upper secondary, mother	0.545***	0.473***	0.773**	0.768**
	(0.038)	(0.041)	(0.247)	(0.272)
Post-secondary vocational training, mother	0.206***	0.193***	0.070	0.048
	(0.016)	(0.017)	(0.088)	(0.097)
Short-cycle tertiary education, mother	0.576***	0.511***	0.659***	0.637***
	(0.024)	(0.026)	(0.141)	(0.155)
Academic Bachelor’s, mother	0.715***	0.594***	0.552***	0.418***
	(0.016)	(0.018)	(0.091)	(0.100)
Professional Bachelor’s, mother	1.021***	0.803***	0.800*	0.354
	(0.049)	(0.054)	(0.320)	(0.352)
Master’s, mother	1.226***	1.016***	1.033***	0.780***
	(0.022)	(0.024)	(0.174)	(0.191)
PhD, mother	1.553***	1.440***	1.722**	1.202
	(0.056)	(0.062)	(0.663)	(0.729)
Primary school education, father	0.000	0.000	0.000	0.000
	(.)	(.)	(.)	(.)
General upper secondary education, father	0.628***	0.539***	0.664***	0.668***
	(0.025)	(0.027)	(0.173)	(0.190)
Vocational upper secondary education, father	0.471***	0.398***	0.692**	0.569*
	(0.041)	(0.045)	(0.223)	(0.245)
Post-secondary vocational training education , father	0.194***	0.222***	0.251**	0.182
	(0.015)	(0.016)	(0.085)	(0.094)
Short-cycle tertiary education, father	0.392***	0.394***	0.428**	0.363*

	(0.022)	(0.024)	(0.133)	(0.146)
Academic Bachelor's, father	0.713***	0.633***	0.746***	0.603***
	(0.017)	(0.019)	(0.100)	(0.110)
Professional Bachelor's, father	0.688***	0.582***	0.766	0.838
	(0.046)	(0.050)	(0.420)	(0.461)
Master's , father	1.092***	0.990***	1.218***	0.996***
	(0.018)	(0.020)	(0.127)	(0.140)
PhD , father	1.412***	1.365***	1.507***	1.511***
	(0.039)	(0.043)	(0.401)	(0.433)
Self-employed, mother	0.000	0.000	0.000	0.000
	(.)	(.)	(.)	(.)
Employee, mother	–0.030	–0.018	0.243	0.234
	(0.021)	(0.023)	(0.151)	(0.166)
Unemployed, mother	–0.235***	–0.265***	0.003	0.146
	(0.033)	(0.036)	(0.220)	(0.242)
Student, mother	0.034	–0.009	0.566	0.615
	(0.069)	(0.076)	(0.436)	(0.479)
Pensioner , mother	–0.028	–0.040	0.007	0.065
	(0.036)	(0.040)	(0.232)	(0.256)
Other, mother	–0.002	–0.016	0.069	0.055
	(0.037)	(0.040)	(0.252)	(0.277)
Self-employed, father	0.000	0.000	0.000	0.000
	(.)	(.)	(.)	(.)
Employee, father	–0.103***	–0.104***	–0.145	–0.045
	(0.015)	(0.016)	(0.103)	(0.113)
Unemployed, father	–0.313***	–0.349***	–0.479*	–0.454*
	(0.031)	(0.034)	(0.210)	(0.230)
Student, father	–0.096	–0.101	–0.423	0.241
	(0.133)	(0.145)	(0.926)	(1.018)
Pensioner , father	–0.137***	–0.206***	0.026	0.104
	(0.030)	(0.033)	(0.198)	(0.218)
Other, father	–0.170***	–0.208***	–0.019	0.148
	(0.039)	(0.042)	(0.230)	(0.252)
Average income of the mothers	0.018***	0.016***	0.008	–0.031
	(0.002)	(0.002)	(0.033)	(0.037)
Average income of the fathers	–0.002*	0.000	0.006	0.020
	(0.001)	(0.001)	(0.016)	(0.018)
Proportion of, fathers with primary school education	1.272***	1.692***	4.424*	4.742*
	(0.184)	(0.201)	(2.123)	(2.334)
Proportion of mothers with primary school education	–2.234***	–2.604***	–4.436	–4.892
	(0.243)	(0.266)	(3.673)	(4.039)
Proportion of mothers with general upper secondary education	–1.155***	–0.875*	–8.558	–2.921
	(0.325)	(0.356)	(4.583)	(5.040)
Proportion of fathers with general upper secondary education	–0.601*	0.546	2.374	–1.097
	(0.255)	(0.279)	(2.814)	(3.093)
Proportion of mothers with post-secondary vocational training	–2.162***	–1.965***	–2.231	–1.149
	(0.206)	(0.226)	(3.020)	(3.322)
Proportion of fathers with post-secondary vocational training	2.047***	2.563***	3.563*	1.878
	(0.144)	(0.158)	(1.729)	(1.902)
Proportion of mothers with short-cycle tertiary education	–4.059***	–3.763***	0.329	6.131
	(0.311)	(0.340)	(3.310)	(3.639)
Proportion of fathers with short-cycle tertiary education	1.502***	1.526***	3.089	2.311
	(0.253)	(0.277)	(2.234)	(2.454)
Proportion of mothers with Academic Bachelor's	–1.555***	–1.695***	–2.494	–1.937
	(0.209)	(0.228)	(2.853)	(3.138)
Proportion of fathers with Academic Bachelor's	1.649***	1.867***	1.844	0.360
	(0.170)	(0.186)	(1.890)	(2.078)
Proportion of mothers with Master's	0.000	0.000	0.000	0.000

	(.)	(.)	(.)	(.)
Proportion of fathers with Master's	0.000	0.000	0.000	0.000
	(.)	(.)	(.)	(.)
Constant	5.606***	5.314***	4.908*	5.368*
	(0.161)	(0.176)	(2.399)	(2.636)
Number of observations	204 710***	204 812***	5369***	5367***
Model degrees of freedom	48	48	48	48
R-squared	0.123	0.084	0.111	0.082

Standard errors are shown in parentheses.

***,** and * indicate statistical significance at 0.1, 1 and 5% level, respectively

Table A11: OLS estimates of the effect of Science Team K on overall grade point averages and average grades in science subjects in general upper secondary education (HF)

	Dependent variable and control group			
	Overall GPA Denmark	Science grades Denmark	Overall GPA Esbjerg	Science grades Esbjerg
	(1)	(2)	(3)	(4)
Kalundborg	–0.202	–0.308	–1.139*	–0.229
	(0.228)	(0.319)	(0.461)	(0.618)
After	0.247***	0.158**	–0.352	–0.444
	(0.037)	(0.051)	(0.381)	(0.507)
Kalundborg, after	0.081	0.334	–0.003	0.308
	(0.288)	(0.402)	(0.600)	(0.806)
Danish, male	0.000	0.000	0.000	0.000
	(.)	(.)	(.)	(.)
Danish, female	–0.016	–0.168***	0.088	0.287
	(0.032)	(0.045)	(0.218)	(0.293)
Immigrant, male	–1.499***	–1.395***	–0.819	–0.846
	(0.139)	(0.195)	(0.851)	(1.144)
Immigrant, female	–1.402***	–1.534***	–1.451	–0.010
	(0.121)	(0.168)	(0.899)	(1.210)
Second generation immigrant, male	–1.091***	–1.134***	–2.433	–1.737
	(0.156)	(0.218)	(1.316)	(1.771)
Second generation immigrant, female	–1.141***	–1.642***	–2.563**	–3.210**
	(0.119)	(0.166)	(0.881)	(1.184)
Income, mother	–0.003*	–0.000	–0.001	–0.008
	(0.002)	(0.002)	(0.014)	(0.019)
Income, father	0.001	0.000	0.007	0.011
	(0.001)	(0.001)	(0.007)	(0.010)
Primary school education, mother	0.000	0.000	0.000	0.000
	(.)	(.)	(.)	(.)
General upper secondary education, mother	0.618***	0.476***	0.147	0.009
	(0.084)	(0.117)	(0.695)	(0.934)
Vocational upper secondary education, mother	0.494***	0.467*	1.928	2.736*
	(0.145)	(0.203)	(1.011)	(1.360)
Post-secondary vocational training , mother	0.141***	0.126*	0.306	0.162
	(0.039)	(0.055)	(0.255)	(0.342)
Short-cycle tertiary education, mother	0.453***	0.445***	1.562**	2.687***
	(0.085)	(0.119)	(0.599)	(0.806)
Academic Bachelor's, mother	0.696***	0.551***	0.682*	0.480
	(0.045)	(0.063)	(0.290)	(0.389)
Professional Bachelor's, mother	1.091***	0.488		
	(0.266)	(0.373)		
Master's , mother	1.329***	1.181***	1.336	1.829
	(0.094)	(0.131)	(0.876)	(1.178)
PhD , mother	1.287**	2.186***		
	(0.414)	(0.581)		
Primary school education, father	0.000	0.000	0.000	0.000
	(.)	(.)	(.)	(.)
General upper secondary education, father	0.625***	0.557***	–1.003	–1.416
	(0.083)	(0.115)	(0.546)	(0.734)
Vocational upper secondary education, father	0.488**	0.232	–1.375	–2.779
	(0.170)	(0.237)	(1.121)	(1.507)
Post-secondary vocational training , father	0.076*	0.081	–0.399	–0.176
	(0.038)	(0.053)	(0.238)	(0.319)
Short-cycle tertiary education, father	0.351***	0.278**	–0.004	0.000

	(0.069)	(0.097)	(0.444)	(0.596)
Academic Bachelor's, father	0.549***	0.479***	–0.170	–0.103
	(0.053)	(0.074)	(0.330)	(0.443)
Professional Bachelor's, father	0.669**	0.558	3.699	6.029*
	(0.229)	(0.316)	(2.187)	(2.942)
Master's , father	0.762***	0.567***	–0.035	–0.417
	(0.070)	(0.098)	(0.605)	(0.814)
PhD , father	1.176***	1.327***		
	(0.234)	(0.328)		
Self-employed, mother	0.000	0.000	0.000	0.000
	(.)	(.)	(.)	(.)
Employee, mother	–0.134	–0.152	–0.322	–0.212
	(0.073)	(0.101)	(0.519)	(0.698)
Unemployed, mother	–0.072	–0.120	–0.550	–0.643
	(0.100)	(0.140)	(0.694)	(0.933)
Student, mother	–0.070	0.205	0.438	1.111
	(0.181)	(0.251)	(1.206)	(1.622)
Pensioner , mother	–0.187	–0.151	–0.080	–0.515
	(0.106)	(0.148)	(0.658)	(0.881)
Other, mother	–0.237*	–0.288	–0.236	–0.161
	(0.107)	(0.149)	(0.729)	(0.981)
Self-employed, father	0.000	0.000	0.000	0.000
	(.)	(.)	(.)	(.)
Employee, father	–0.193***	–0.212**	–0.496	–0.537
	(0.047)	(0.065)	(0.350)	(0.471)
Unemployed, father	–0.139	–0.386**	0.357	0.354
	(0.087)	(0.122)	(0.599)	(0.806)
Student, father	0.325	0.621		
	(0.319)	(0.447)		
Pensioner , father	–0.128	–0.310**	–0.506	–0.800
	(0.084)	(0.117)	(0.560)	(0.753)
Other, father	–0.098	–0.186	–0.761	–1.116
	(0.105)	(0.146)	(0.681)	(0.902)
Average income of the mothers	0.012	0.002	0.069	–0.042
	(0.009)	(0.013)	(0.129)	(0.173)
Average income of the fathers	–0.004	0.000	0.040	0.057
	(0.005)	(0.006)	(0.071)	(0.096)
Proportion of fathers with primary school education	2.264***	3.107***	7.790	11.404
	(0.627)	(0.876)	(8.458)	(11.364)
Proportion of mothers with primary school education	–2.934**	–2.266	–12.816	–31.191*
	(0.905)	(1.266)	(10.510)	(14.122)
Proportion of mothers with general upper secondary education	1.208	3.290*	–15.307	–35.780
	(1.153)	(1.611)	(15.627)	(21.002)
Proportion of fathers with general upper secondary education	3.342***	3.840**	14.105	21.511
	(0.868)	(1.212)	(9.456)	(12.693)
Proportion of, mothers with post-secondary vocational training	–3.450***	–1.886	–10.403	–29.671*
	(0.806)	(1.127)	(10.022)	(13.446)
Proportion of fathers with post-secondary vocational training	0.730	0.393	8.214	4.677
	(0.534)	(0.746)	(7.699)	(10.356)
Proportion of mothers with short-cycle tertiary education	–4.181***	–4.124*	–31.034*	–56.728**
	(1.182)	(1.650)	(13.126)	(17.512)
Proportion of fathers with short-cycle tertiary education	0.115	1.021	6.457	24.964
	(0.875)	(1.220)	(10.966)	(14.611)
Proportion of mothers with Academic Bachelor's	–1.724*	–0.641	–7.932	–32.039*
	(0.786)	(1.099)	(9.400)	(12.623)
Proportion of fathers with Academic Bachelor's	–0.021	–0.359	1.441	3.780
	(0.616)	(0.862)	(7.696)	(10.325)
Proportion of mothers with Master's	0.000	0.000	0.000	0.000

	(.)	(.)	(.)	(.)
Proportion of fathers with Master's	0.000	0.000	0.000	0.000
	(.)	(.)	(.)	(.)
Constant	6.896***	5.839***	8.475	28.582*
	(0.667)	(0.932)	(9.396)	(12.583)
Number of observations	21 972***	22 145***	545***	548**
Model degrees of freedom	48	48	44	44
R-squared	0.084	0.040	0.141	0.131

Standard errors are shown in parentheses.

***,** and * indicate statistical significance at 0.1, 1 and 5% level, respectively

Appendix B

Tertiary education programs with strong science components

	UNI-C's intermediate grouping (*mellemgruppe*)
Short-cycle programs (*Korte videregående uddannelser*) offered by academies of professional higher education (*Erhvervsakademier)* or equivalent institutions	Short cycle programs in the areas of: Technology and transport, Information Technology, Bio-laboratories and Health • *Mellemgruppe* = 502, 503, 504, 506
First cycle tertiary education degrees (*Mellemlange videregående uddannelser*) offered by university colleges (*Professionshøjskoler)* or equivalent institutions	Professional bachelor (*professionsbachelor*) in health science or technology • *Mellemgruppe* = 652,656 Other first-cycle education programs in health science and technology • *Mellemgruppe*=673, 676
First and second cycle (*Mellemlange og lange videregående uddannelser*) tertiary education degrees offered by universities	Bachelor, Master or PhD degree in natural science • *Mellemgruppe* = 694, 704, 724, 854 Bachelor, Master or PhD degree in health science • *Mellemgruppe* = 694, 706, 726, 856 Technological Master or PhD degree • Mellemgruppe = 703, 723, 853