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Swedish Education in Science and Technology: Expansion and Transformations

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I. Summary

In Sweden, as in many other countries, there has been an intense public debate on the shortage of students in science and technology. Politicians and policy-makers, spokesmen for the industry, educational institutions and teacher unions agree together with many others on that this is a fatal problem, the solution of which is of crucial importance to the future of our nation. Therefore it seems somewhat paradoxical that in fact that the number of students in science and technology did increase dramatically in Sweden during the last decade, both at the secondary and at the tertiary level, not only in absolute figures but also compared to students with other orientations. In this respect the Swedish situation differs from the situation in several other European countries.

In order to understand this expansion and the attendant social and institutional transformations we have used our own datasets on all Swedish students in secondary and higher education during the years 1991-2001. The data show that the 1990's expansion of upper secondary and higher education in general and in science and technology education in particular has indeed been remarkable. I has, however, been accompanied by profound transformations of the educational system[1] and changes in how different social groups make use of this system. From a sociological point of view an important change is the shift in the recruitment profiles. The social origin of students in science and technology is more modest than before and their school credentials are poorer. A plausible hypothesis is that many problems commonly interpreted as consequences of a shortage of students or of negative attitudes towards science and technology are related to this social degradation. There are also significant and in some respects widening hierarchies between different educational institutions to take into account, as well as striking differences between the sexes. In the paper we try to explore those differences, mainly by the utilisation of simple correspondence analysis in much the same manner as Pierre Bourdieu and his collaborators did in their studies in the 1980's on French grandes écoles.[2]

One important finding in our studies on upper secondary education is that the science track—or to be more precise: the natural science specialisation within the natural science programme—is the élite track par preference, both with respect to the recruitment of pupils (high social origin, successful previous school achievements) and with respect to the future it offers in higher education, on the job marked and in other social settings. Its position at the summit of the upper secondary school hierarchy has been even more accentuated during the course of the 1990's. In order to understand how the Swedish system operates and how it is operated by different social groups one must keep in mind that the science track is favoured by almost all kinds of élites. It is thus not only, or not even primarily, a preparation for going into let's say engineering. The cultural élite and (albeit to a somewhat lesser degree) the

[1] For a short presentation in English of the current organisation of the Swedish upper secondary education see http://www.skolverket.se/english/system/upper.shtml. Information on Swedish higher education is to be found at http://www.hsv.se/.

[2] P. Bourdieu and Monique de Saint Martin: "Agrégation et ségrégation. Le champ des grandes écoles et le champ du pouvoir", *Actes de la recherche en sciences sociales*, vol. XIII, n° 69, septembre 1987, pp. 2-50, and P. Bourdieu "Variations & invariants. Éléments pour une histoire structurale du champ des grandes écoles", *Actes de la recherche en sciences sociales*, vol. XIII, n° 70, novembre 1987, pp. 3-30. Revised versions in P. Bourdieu: *La noblesse d'État. Grandes écoles et esprit de corps*. Paris: Minuit, 1989.

economic élite as well as other social fractions with a fair-sized amount of symbolic or economic resources tend if possible to send their offspring to the science track.

When it comes to higher education in science and technology the expansion and the morphological changes of the student population has dislodged some of the established hierarchies and relations. A number of prestigious engineering programmes have lost somewhat of their élite character and most of the shorter engineering programmes have become even more dominated by male students from lower social classes. However, this does not mean a general levelling of the field but rather the emergence of new polarities and a more fine-grained differentiation among educational tracks and between the symbolic assets provided by those tracks. A Master of science in engineering (civilingenjörsexamen) is in itself less than before a guarantee for a prosperous future. Your educational investments have to be undertaken at a suitable university, within a suitable programme and together with suitable course mates.

II. A Widening Supply of Upper Secondary Education in Technology and Natural Science

The upper secondary school was reformed in the beginning of the 1990's. The idea of a unified upper secondary school—which in a sense became true in 1971, when all kinds of upper secondary education from the traditional *gymnasium* preparing for higher education to schools for vocational training were brought together in one organisation, *gymnasieskolan*—was enhanced one step further. The previous differences in programme length (programmes preparing for higher education being three to four years and the vocational training mainly two years) were abolished and all educational programmes became three years long. Furthermore, all secondary school study programmes were made homogenous in terms of status as regards formal qualification for the entry into post-secondary education. However, the shift towards a unified upper secondary education system was accompanied by a parallel shift from a bureaucratic, rule-based management of the education system to a goal and result-oriented type of management ("decentralisation"). Great freedom was given to upper secondary schools to create their own local "profiled" versions of the 16 national study programmes, creating a previously unknown heterogeneity of upper secondary education programmes. Also, in 1992, Sweden opted for a voucher system in all compulsory education, giving families the right to freely "invest" the public funding for the schooling of their children into any private ("independent") school, regardless of district or municipality boundaries. The conditions for establishing independent schools at the upper secondary level were improved radically at the same time. Thus the 1990's witnessed, especially in the large cities, a rapid expansion of independent schools, both at primary and secondary levels, and also in public schools a sharp increase of secondary school study programmes with a local "profile". As a consequence, the tendency towards homogenisation inherent in the reform of upper secondary education in 1991 was counter-balanced by the creation of an educational market in which both schools and students and their families have to compete. The bad economic tides in the 1990's made an early entry into the labour market an even more unrealistic possibility than before, imposing the necessity for the students to stay within the education system. Consequently the educational competition became even more intense.

In the following section, we will discuss the transformations in the morphology of upper secondary study programmes over the last 15 years with a special focus on education in technology and natural science. A more static analysis of the relation between the different study programmes at the turn of the century will also be given. First, some methodological issues will be discussed.

To Trace the Morphology of the Study Programmes

In order to understand the recruitment to the upper secondary school over time, a number of obstacles have to be taken into account. The first is the design of the upper secondary school, which changed profoundly in the beginning of the 1990's. Concerning the study programmes in technology and natural sciences, Table 1 illustrates the changes.

Table 1. Upper Secondary Education in Technology and Natural Sciences, 1971-2003.

1971-1995	1991-2000	2000-
Technology, 2 years	—	—
Technology, 3 years (4 years –1989)	Natural science, specialisation Technology (year 2-3)	Technology
Natural science, 3 years	Natural science, specialisation Natural science (year 2-3)	Natural science, specialisation Natural science (year 2-3) Natural science, specialisation Mathematics and computer sciences (year 2-3) Natural science, specialisation Environmental science (year 2-3)

The two year, less theoretical and more vocational oriented technology programme, did in fact cease to exist before 1991; the programme attracted only 0,2 % of all pupils in 1986. The two formerly distinct different theoretical programmes for technology and natural science were in 1991 integrated into one programme, the natural science programme, although the different tracks were reconstructed within the two specialisations, technology and natural sciences, optional from the second year. This one-programme solution did not last long—in 2000, the two tracks were again separated as different programmes. Simultaneous, the natural science programme was divided into three specialisations, Natural science, which is a continuation of the former specialisation, and two new ones, Mathematics and computer sciences, and Environmental science.

Furthermore, the "decentralisation" and "heterogenisation" of upper secondary education have created a more diversified landscape of education, leaving the researcher with a substantial problem of classifying the actual content of more or less obscure programmes. A tendency is that the specially designed programmes that may be impossible to classify according to the established tracks or programmes, became more and more important choices for pupils. Also, local specialisations have increased up till recently and these are sometimes difficult to classify adequately. There is reason to believe that the differences between schools, with regard to social recruitment, the academic content of the programme, the composition and competence of the teaching staff, etc., have amplified over the last years, making comparisons more difficult. In some municipalities, the choice of study programme determines the choice of school, thus creating an incentive for pupils to make tactical choices of programmes in order to be admitted to the school of preference.

A third obstacle is that the relative weight of an upper secondary education has changed over time. The expansion of higher education in the 1990's in combination with the economic recession led to a devaluation of degrees from upper secondary school. The study programmes were affected in different ways. The natural science programme, traditionally the most prestigious programme in terms of social recruitment, proportion of pupils with high school performance and pupils continuing to higher education after the degree, could better resist this development, while less prestigious programmes such as technology and economics, suffered double. The last mentioned two programmes had previously the advantage of having a dual purpose. On the one hand, especially the technology programme but also to a lesser extent the programme in economics served as a reliable preparation for entering relatively well-paid and advanced positions in the job market. On the other hand, they also prepared for the majority of courses and study programmes at a university level. In the 1990's, the possibility to obtain a good position with only a upper secondary degree diminished, and, in comparison with the natural science programme and the social science programme, the programmes in technology and economics did not offer the same broad preparation for further studies.

The Natural Science Programme as the Elite Study Programme Par Excellence

For some decades now, the Natural Science programme and its predecessors have occupied a position as *the* élite study programme in Swedish upper secondary education.[3] Recruiting students with the best school results from compulsory education and with the highest social origin (receiving for example ca 40 % of all students from households where one of the parents is a physician or a university teacher), it also sends most students off to higher education. Most official statistics and educational research in Sweden tend to neglect this fact due to the classification categories they operate with, only distinguishing between theoretical and vocational programmes. In order to understand the transformations of the upper secondary study programmes, it is necessary to make finer distinctions between various educational tracks. It then becomes obvious that important changes have occurred during the 1990's, see Table 2. The technology programme and the economics programme, which were the two most important ones for boys in 1988, together attracting 30 % of all boys in upper secondary education (20 % in technology and 10 % in economics) and almost 25 % of the girls (18 % in economics and 6 % in technology), have declined substantially. In 1998 10 % of the boys and 2 % of the girls attended the technology specialisation of the natural science programme, whereas 10 % and 11 % respectively entered the economic specialisation of the social science programme. The decrease in number of students in technology and economics has been accompanied by an increase in the natural science and the social science programmes. The former has increased its proportion of the male pupils from 7,5 % in 1988 to 14 % in 1998 and its proportion of female students from 9 % to 16 %. The corresponding figures for the social science programme are 4,5 % compared to 9 % for boys and, and 12 % compared to 18 % for girls. As indicated above, this transformation is largely explained by the expansion of the educational system and the increased demands on educational diploma on the labour market, devaluating the currency of the vocationally oriented study programmes.

But the fluctuations in the number of students are only part of the story. What is even more revealing is the composition of pupils. During the 1990s, the Natural Science programme has consolidated its position as the élite programme *par excellence*—the proportion of pupils of high social origin and with a particularly good previous school performance has raised even further, see Table 3, Table 4, and Table 5. For example, the proportion of pupils with high marks from compulsory school who choose the natural science programme has increased from 53 % among the boys and 48 % of the girls in 1988 to 60 % for both sexes in 1998. The proportion of high-performing students opting for the technology programme has decreased drastically during the same period, from 36 % to 18 % for the boys, and from 15 % to 5 % for the girls.

It should be emphasized that the élite character of the natural science programme manifests itself not only through indicators such as the ones mentioned here, e.g. a high proportion of students with high social origin, of students with particularly good marks at the end of compulsory education or of students continuing to higher

[3] The International baccalauréat program is another candidate, having an even more selective recruitment. But the program only attracts a small number of pupils and will be left out of following the discussion.

education. An ethnographic comparison[4] between the natural science study programme at one of the traditional *lycées* in the centre of Stockholm and an uprising, contestant study programme in social science with an orientation towards the EU at a less prestigious upper secondary school also situated in the city centre revealed systematic differences between the students. Originating from families possessing a strong cultural capital, one or even both parents being university teachers, physicians or high civil servants, and often living in the culturally renown Southern part of the city centre, *Södermalm*, or in the old town, the natural science students invested much more time into the development of their personality through an interest in classical and modern literature, theatre, avant-garde film, poetry, philosophy, music, chess and travels in both Europe and remote parts of the world. While having exceptionally high marks in compulsory education, students at the challenging EU-oriented study programme in social science generally had a considerably lower social origin and much less understanding for and interest in the particular blend of classical and avant-garde culture that characterized the natural science students. Being less inclined to see their own future as a long-lasting investment in education and personality, they instead tended to emphasize the benefits of education in terms of utility. The differences between the natural science programme and the social science programme with an EU-orientation could be formulated as an opposition or even antagonism between competing definitions of legitimate cultural capital. The dominating definition, represented by the natural science students and characterized by its accent on a combination of classical Swedish culture, including the Swedish language, and avant-garde culture along with an emphasis on personality, was challenged by the definition inherent in the values and cultural practices typical for the students at the EU-oriented study programme with their interest in a more mainstream, commercially strong international and European culture connected to the English language and less dependant on heavy investments in a cultural capital demanding investments of the kind made by the natural science students. In the present context, the ethnographic comparison, albeit a case study, between students at the natural science programme, with its strong component of natural sciences and mathematics, and students in social science with an EU-orientation, alerts us of the dangers of reducing the role of mathematics and natural sciences to their technical content. Most probably, the kind of mastering of mathematical skills and the knowledge of natural sciences demanded at the natural science study programme tend to go along with strong investments in the most legitimate forms of cultural capital not because of an inherent relationship between their content and dominating culture, but because the history of Swedish secondary education has created such a connection.

[4] Donald Broady, Ingrid Heyman, Mikael Palme (1997): "Le capital culturel contesté. Quelques réflexions sur la transformation de l'espace des formations secondaires à Stockholm sur la base d'une étude ethnographique de quatre lycées", in *Formation des élites et culture transnationale. Colloque de Moscou, 27-29 avril 1996*, pp. 175-213. Paris and Uppsala: École des hautes études en sciences sociales and ILU, Uppsala University, 1997.

III. The Space of Upper Secondary Education in Sweden, 1997-2001

Graphic 1 displays the result of a simple correspondence analysis, based upon a contingency table with study programmes (pupils in the second year from 1997 to 2000 taken together) and 32 social groups divided by sex (i.e. sons of physicians, daughters of physicians, sons of engineers, daughters of engineers, etc.). The first axis, the horizontal, divides the upper secondary education in a female part to the left and a male part to the right, where study programmes in humanities, caring and nursing stand in opposition to programmes in technology, construction, industry, and energy. The second axis differentiates groups with substantial amounts of capital, especially educational capital, that is, physicians, university teachers, and lawyers, at the top of the graphic, from the lower social strata, skilled or semi-skilled workers, at the bottom. In between these two poles, we find the middle classes, technicians, merchants and tradesmen, mid-level administrators, etc. This opposition is, to put it bluntly, constituted by the split in the upper secondary school between programmes oriented towards higher education, and programmes that mainly function as vocational training programmes.

The structure is, when we combine the two axes, triangular. At the base, where we find the lower social classes, the differences between the sexes are largest, forming two clearly separated spheres of educational programmes. When we move up in the structure of the graphic, and thus move upwards in the social hierarchy, the difference between the sexes diminishes, and at the most distinguished track, the natural science specialisation of the natural science programme, the sex ratio is balanced. In this respect, the natural science specialisation sets itself clearly apart from the technology specialisation of the natural science programme, which is heavily dominated by male pupils and characterised by a somewhat lower social origin. Furthermore, also the technology programme has a lower social recruitment profile, and the reintroduction of this technology programme indicates a further degradation, positioned more to the right and to the bottom, compared to the position of the technology specialisation of the natural science programme. The modification of the programme structure in 2000 contained two new specialisations within the natural science programme, Mathematics and computer sciences, and Environmental sciences. The former is positioned close to the position of the technology specialisation of the natural science programme, indicating a large proportion of male pupils with middle class background, while the latter is occupying a new position for natural science programmes, clearly setting itself apart on the female half of the space and also having a higher social recruitment than the social science programmes. A conclusion is that the new organisation in year 2000, that is the introduction of the new technology programme and of the two specialisations of the natural science programme, has led to a more differentiated recruitment to upper secondary technology and natural science education. However, the natural science specialisation keeps its position as the dominating track within Swedish secondary education.

IV. Higher Education—Expansion and Degradation

During the 1990's, there has been an extensive expansion of higher education in general and in technology and natural science in particular. From 1989/1990 to 2001/2002, the total number of students increased from 193,000 to 355,000, or with 83 % (see Table 8). In the period between 1993 and 1998, for which we have data on an individual level for all students, the number of students grew from 258,000 to 318,000 (23 %), see Table 9. In the same period, students in technology have increased with 40 %, from 43,400 to 60,700. The corresponding figures for natural science are 31 %, or 28,000 to 36,800.[5] The effort to expand higher education has been linked to an ambition to spread higher education to regions where institutions of higher learning have been absent or underdeveloped. From 1995, all Swedish counties have at least on seat of higher learning, as indicated by Graphic 2, and the expansion of positions has been more rapid at the regional university colleges than at the traditional universities and professional schools (see Table 9). The massive increase of technology education has primarily favoured the regional university colleges, at the expense of the traditional universities and the established professional schools. While three out of four students in technology went to traditional universities in 1993, the ratio has decreased to two out of three in 1998. Related to the geographical diffusion of higher education is the objective to widen the social recruitment to higher education. Groups lacking educational capital are overrepresented in the province, and bringing higher education closer to these groups is aimed at lowering the threshold to higher education.

The expansion of higher education, the supply-side, has to be related to the demand side, i.e. the number of individuals applying to higher education, and on a more specific level, what types of educational programmes and seats of learning. Furthermore, we also have to consider not only the number of students, but also, what kind of students, defined by, for example, their social origin, educational career, sex, age, geographical background, etc. Table 10 gives an idea of the differences between technology and natural science education in 1993 regarding a number of indicator on the students' social origin, educational trajectories, marks, etc. There exists a distinct social difference between the Master of engineering-programmes and the Bachelor of engineering-programmes. Among the former approximate 40 to 55 % of the students originate from senior white-collar homes, while 7-13 % come from working class homes, which can be contrasted with the latter, where students with a higher social origin as well as students with a working class background constitute 20 to 30 % each. Education in natural science is situated in between, i.e. tend to have a lower proportion of students with high social origin than the Master of engineering-programmes but a higher proportion than the Bachelor of engineering-programmes. Programmes that exist both at universities and at university colleges reveal the social status difference between the different types of seats of learning: the programmes at universities have larger proportion of students with higher social origin than their

[5] Only education within the service-sector has increased more, 52 %. Another way to estimate the expansion of technology and natural science is to examine their relative position to other fields of education. Education in technology has increased their share from 16,8 % in 1993 to 19,1 % in 1998, thus an increase by 2,2 %. This is by far the largest growth in relative proportion, education in natural science, which stands for the second largest enlargement, has grown with 0,7 %.

counterparts at the university colleges.[6] The social hierarchy is to a large extent correlated to the variation in credentials. Some interesting exceptions are MS in mechanics and MS in land-surveying, which are characterised by a larger proportion of students of high social origin than students with good credentials. Another important dimension is the educational background of the students, where it is obvious that the natural science programme and the technology programme prepare for different educational trajectories. Certain education programmes and courses in natural science (biology, chemistry, other) have the highest proportion of students with a degree from upper secondary education in natural science (over 50 %), followed by teacher education (45-50 %), while the BS-programmes in engineering have the lowest figures, well below 10 %. The MS-programmes differ from over 50 % at Chemistry and Physics, over Architecture (ca 45 %) and Industrial economy and management (40 %), to Mechanics and Energy (20 %). The proportion of students who have attended the natural science programme at upper secondary school is negatively correlated to the proportion who took technology programmes. For example, among BS-programmes, around 90 % have a background at the technology programmes in the upper secondary school.

The extensive expansion of education in technology has been accompanied by substantial changes in the recruitment; see Table 11 where the changes from 1993 to 1998 are displayed. All the MS-programmes except Electricity and Industrial economy and management have decreasing proportions of students with high social origin. The same is true for almost all education in natural science. The largest change is to be found among the teacher education programmes, which drop as much as 13 percentages. The BS-programmes that have the lowest proportions of students with high social origin in 1993 show less clear tendencies. Some undergo more or less large losses, while BS in computer science even increases their proportion despite a substantial increase in number of students. This recruitment change in social origin is also linked to that of the credentials. Educational programmes that are degraded socially tend to also be degraded when it comes to credentials. Finally, it is clear that the decrease of the importance of the technology track in upper secondary education has effects on the recruitment to higher education. Almost all of the educational programmes studied have a decreasing proportion of students with a background from the technology programme, while the proportion from the natural science programme and as well as the social science programme increase.

[6] On a more detailed level there is a hierarchy between the traditionally universities and the prestigeous institutes of technology, where The Royal Institute of Technology in Stockholm occupies the most dominant position, followed by Chalmers University of Technology, Lunds University, Uppsala University, Linköping University and Luleå Technology University.

V. The Field of Higher Education in Sweden

Let us now examine the structure of the field of higher education in the late 1990s in Sweden. The first analysis is based upon our 33 social groups divided on the basis of sex (separating daughters of university teachers and sons of university teachers, daughters of lawyers and sons of lawyers, etc.; in total 66 categories, see Table 12 for a presentation of our classification of social groups) and almost 1,400 different educational programmes/courses that in autumn 1998 had more than 40 registered students with information on their social origin.[7] The data on educational programmes/courses contain information on institutions of higher education, type of education on a detailed level distinguishing, for example, Master of science (MS) in engineering physics from MS in computer sciences and engineering and MS in electrical engineering, and if it is a programme or a course. We have employed simple correspondence analysis (CA)[8] on a table with 66 columns and close to 1,400 rows. Some supplementary variables are added: programmes in upper secondary education, grades from upper secondary education, scores on the Swedish national aptitude test, the annual income of the parents, and the parents' highest level of education.

A three-dimensional structure

Graphic 3 presents a stylised version of the outcome of a correspondence analysis (CA), where the social groups differentiated by sex[9] and the 1,388 educational programmes are active variables. Also a number of supplementary variables are included in the graphic. The first, most fundamental opposition that the CA points out separates the sexes. To the right we find all the mean points for the men, and to the left all the mean points for the women. Since the supplementary variables are not divided by sex, they are not separated in this dimension, and are positioned in the centre. A few interesting exceptions can nevertheless be noticed. The upper secondary programmes are distributed according to a gender logic. Especially studies in humanities, but also in social science and two year theoretical programmes (containing studies in media and art), have positions to the left, the female part of the field, which is contrasted by studies in science and, particularly, technology, to the right. Low credentials are differentiated in the way that women have more frequently low scores on the national university aptitude test, while the men in general have lower grades from upper secondary school. Regarding the higher education programmes and courses, the main primary opposition separates educational programmes/courses in technology, which are heavily dominated by men, from

[7] Our focus is on the relations between educational programs/courses. We have therefore included all different educational programs/courses any individual is registered at. This means that certain individuals appear more than once in the dataset. The total number of individuals registered on unique educational programs/courses was 318,200 autumn 1998. In order to obtain better data quality, we have omitted all students older than 35 years (there is no information in secondary education or social origin for these students). This leaves us with a dataset with 264,200 students under 35 years and more than 2,500 educational programs/courses. After choosing only educational programs/courses with more than 40 individuals with information on social origin, the number of educational programs/courses is reduced to 1,388, which represent ca 227,700 students.

[8] We have used SPSS for all data management and SPAD for the correspondence analyses.

[9] We have put the social groups that do not contain any specific occupational status (Others, Not employed, Not in the national census) as supplementary variables.

educational programmes/courses in teaching, nursing and social care, where women constitute a distinct majority.

The second dimension in the CA opposes the social groups with considerable amounts of capital from social groups lacking these recourses. The supplementary variables clearly underline this opposition. The highest educational level of the parents is almost perfectly distributed according to a social hierarchy logic. At the bottom of the graphic, low educational levels of the parents are found (primary school 6 years, primary school 9 years, and upper secondary school 2 years, i.e. vocational training education). When moving upwards in the graphic the level of education increases (upper secondary school 3 years, post-secondary education less than 3 years, post-secondary education 3 years and more, and finally, post-graduate school at the top). The economic capital is not dispersed as perfectly as the educational capital. The higher incomes are distinctively situated in the upper part of the field, but the lower and the medium incomes are mixed just below the origo. The interpretation of this is that the educational capital of the parents is much more fundamental to the construction of the field of higher education than the parents' economic capital, which is also apparent when we study the positions of the social groups. The most dominating positions in the social hierarchy dimension are occupied by social groups where the educational capital is built into the definition of the groups, i.e. the professions, Physicians, Lawyers and University teachers. Social groups primarily dependent upon economic capital, Private senior administrators, Engineers, and Executive managers, are positioned distinctively below Physicians, Lawyers and University teachers, and are also clearly distanced by some social groups, which can be classified as Middle class, Journalist and Art producers, who hold more dominant positions. The importance of the educational capital is also underlined by the fact that the students own educational capital, whether indicated by grades from upper secondary school or by scores on the national university aptitude test, is almost perfectly correlated to the social hierarchy dimension. In fact, the credentials of the students are a more distinctive factor for structuring the field of higher education than the social origin. At the most prestigious educational programmes, all students have the highest possible grades or scores, but still, not everyone have a high social origin (students with a social élite background are overrepresented four to five times, and constitute at the maximum ca 60 per cent of the student body). Another aspect of the students' former educational investments is the programmes attended in upper secondary school. These are also structured with regards to the social hierarchy logic. The most distinguished upper secondary programme, International Baccalaureate (IB), is positioned right at the top of the graphic. Beneath, we find the second most renowned and the largest élite programme, the natural science programme, which is off set from all the other programmes preparing for higher studies (the programmes in humanities, social science, economy and technology). At the bottom of the graphic, the vocational training programmes are found.

The social élites (comprising both the cultural and the economic élites) are overrepresented at the traditional universities (Uppsala, Lund, Stockholm and Gothenburg) and professional schools (Stockholm School of Economics, Karolinska institutet,[10] Chalmers University of Technology, Royal Institute of Technology, Swedish University for Agricultural Science, National Academy of Mime and Acting,

[10] Note that the Karolinska institutet normally does not translate its name into English, a signe of pride. It is the only medical university in Sweden, all other faculties of medicine form part of a larger university (Uppsala, Lund, Gothenburg, Linköping and Umeå), and the clearly most prestigious institution within its research field, responsible for the Noble Price in Medicine among other distinctive features.

Royal University College of Fine Arts, Royal University College of Music). At an intermediate level, where students originating from the middle class dominate, the less prestigious and more recently founded universities in Umeå and Linköping are positioned among some of the more dominating among the university colleges, such as Södertörns högskola (University College), located in the southern part of Stockholm, Växjö University College and Örebro University College.[11] At the bottom of the graphic, we find the less prestigious university colleges and the colleges of health science, attended by proportionally more students from modest social backgrounds than other backgrounds. The social hierarchy dimension sets the most profitable educational programmes in terms of professional careers (medicine, MS in architecture, MS in engineering physics, MS in engineering and business administration, MS in economics at Stockholm School of Economics, MS in laws) apart from less profitable ones (BS in social care, BS in nursing and Bachelor of education). The former ones are long programmes, ranging from 4,5 years to 5,5 years in general, are the most competitive, demanding the highest grades and scores at the national university aptitude test, and are conceived as élite educations with long traditions, while the latter ones are shorter programmes, just recently upgraded to three years of studies from generally two years programmes, non-selective, admitting almost all applicants, and holds ambiguous opinions regarding the academy and its tradition.

Moreover, the opposition contains both temporal and spatial dimensions. The élite pole is constituted of traditional universities and professional school with *ancienneté*, often distinguished by being the oldest institution of its kind in Sweden, and of educational institutions that are concentrated to the traditional university towns Uppsala (the oldest university in Scandinavia, founded in 1477) and Lund (the second oldest university in Sweden, dated back to 1666) or to the capital, Stockholm, and the second largest city, Gothenburg. Almost all among the dominating educational institutions are thus located in one of the three major urban regions, the Uppsala-Stockholm-region, the Gothenburg-region, and the Malmö-Lund-region. On the other hand, the institutions of higher education that are located far from the three major urban regions are mainly found at the dominated pole. This is to some extent a consequence of the dispersion of social groups in the geographical space—groups possessing vast amounts of different species of capital are concentrated to the major urban regions, while groups less well to do are over-represented in the less populated areas of Sweden. Even more important is the geographical recruitment. The most prestigious institutions have a national recruitment, while the dominated institutions mainly recruit their students from the surrounding region. In addition, the gap between the élite institutions and the rest increased under the great expansion of the higher education in the 1990s, since the most sought after institutions were in a position where they did not expand as much as the university colleges in the province, leading to a even more tough competition for the positions at, for example, the programmes in medicine, journalism, engineering and business administration, which have resulted in a more socially selected student population than before at these institutions.

The two primarily dimensions together form a two-dimensional space, where the educational programmes and courses are positioned in a triangular shape. The difference between the sexes is most evident at the base, where the students from lower social classes dominate (at some of the educational programmes there is a 90/10

[11] The latter two have together with Karlstad University College obtained the status as university in 1999.

ration between the sexes). For the social élites, the sexes meet at some of the most prestigious educational programmes, especially the medical programme. There are no clear-cut male or female dominated élite programmes, but for the economic programmes, the Stockholm School of Economics distinctively sets itself apart as being the only programme dominated by men with high social origin, with the programmes in International Economy with French as the counterpart for women with the same social origin.

The third dimension, which becomes apparent when we exclude the variable sex in the analysis, is the opposition within the upper class, between groups who are more dependent upon educational and cultural capital than on economic capital for upholding their social positions, and groups with the reverse composition of capitals. In Graphic 4, this polarisation is displayed in the second dimension; the first being the socially hierarchical one. We find in the left lower corner of the graphic students having parents working as Physicians and University teachers, contrasted to the children of Lawyers, Private senior administrators, and Executive managers in the left upper corner. The polarisation is also a split between social groups mainly employed in the public sector (University teachers, Subject teachers, and Physicians), and social groups exclusively or predominantly working in the private sector (Lawyers, Executive managers and Private senior administrators). The supplementary variables support an interpretation of the opposition in economic and cultural terms. We find that high grades from upper secondary school, and high scores on the national university aptitude test, as well as post-graduate studies as the highest educational level for the parents, are drawn towards the cultural pole, while high incomes are more oriented towards the economic pole. The upper secondary school programmes are differentiated according to the same logic, the natural science programme, which is the most demanding programme and the royal road to academic studies, is positioned at the cultural pole, distinctively separated from the economic programme and the technology programme, which both are the most significant background for the economic fraction of the middle class. For the cultural fractions of the middle class, studies in humanities sums up the distinctive previously educational investments, while studies in social science at the upper secondary level do not seem so distinctive at all.

Regarding the educational programmes and courses, the opposition place university medical degree, university degree in dental surgery, veterinary programme, music, theatre, and architecture against international economy: French, engineering and business administration, MS in laws, and economics. In other words, the educational investments are to a large extent reproducing the occupational positions of the social groups. On a more detailed level, it is interesting to notice that the programmes in engineering are differentiated according to the cultural/economic dimension. Architecture, physics, chemistry are closest to the cultural/public pole, while engineering and business administration and materials engineering (and vehicle engineering, engineering, electrical engineering) are positioned in the economic/private pole. Also the cultural educational programmes are to some extent positioned along the same axis. Music tends to be more preferred by the social groups for whom the educational capital is most valued, Physicians, University teachers, and Subject teachers, whereas fine arts are more attractive also to the economic élite.

VI. Appendix A. Preliminary notes on the official discourse on mathematics education in Sweden

We can currently observe a political concern for the recruitment to education programs in the areas of science and technology, as well as for the level of knowledge citizens may have in these areas and especially in mathematics. Similar concerns are to be found in most European nations, but also in for example official documents addressing the development of the European Union.[12] In Sweden there seems to exist a rather uniform official discourse wherein this interest is expressed or manifested. The following is some preliminary notes, as a prelude to further studies on the characteristics, production and circulation of this discourse and especially the one on mathematics.

Firstly we will provide examples of passages in official texts on mathematics education. The purpose is not to give a full account of Swedish governmental strategies in the area of mathematics education[13] but to show that the texts share some fundamental beliefs regarding the role of mathematics. As shall been seen, the texts also have other traits in common. They often use similar rhetorical tools, and they are connected to various governmental policy-related actions, e.g. the funding of activities aimed at responding to the demands expressed in the text. The discourse is thus related to policy formulation and decision-making. Secondly, we will attempt to sketch the context in which these texts have been written, launching some hypotheses on their purpose and relations to both scientific fields and educational and other institutions. Finally a few ideas, inspired by the sociology of Pierre Bourdieu and the ideas of the English sociologist Paul Dowling, will be put forward on how to study both the discursive and the sociological aspect of mathematics education.

Some texts on mathematics education

How is mathematics talked about in official Swedish texts? We will merely provide a few examples, taken from three different kinds of texts: a PM from the Swedish parliament describing the main current governmental activities for promoting interest in the exact sciences; the arguments on mathematics education in the Swedish governmental budget proposals ("budgetpropositionerna") in 1997, 1999, 2003 and 2004, and a report from the National Resource Centre for Mathematics Education (NCM). Our aim is to highlight key topics and shared beliefs in the current discourse of mathematics education.

Swedish government policy documents

In a PM 2003[14] the Swedish parliament responds to questions regarding "the stimulation for choosing and studying exact sciences at secondary level and in higher

[12] The Swedish Government, Goals for Education in EU, http://utbildning.regeringen.se/eugemutbmal/index.htm.

[13] Such an account can be found in The Swedish Parliament (2003), PM on Exact sciences education, ref. 2003:1615.

[14] The Swedish Parliament (2003), PM on Exact sciences education, ref. 2003:1615.

education". The answer to the question "Are students stimulated to choose and follow exact science courses?" is:

> The Swedish Government and authorities as well as a large number of other actors in the so-called SciTech (Science-Technology) field are engaged to keep the SciTech issue up to date. Trade and industry, foundations, associations of inventors as well as private consultants are all examples of this. A large number of different initiatives are taken in order to create a positive attitude towards SciTech and pave the way to recruitment to SciTech studies.
>
> Increased admissions to natural science and technology studies is also one of the sub-goals agreed on by the Ministers of Education in the EU (2002/C 58/01) in order to transform the EU into the world's most competitive and dynamic knowledge-based economy. (ref 1, p. 4)

Let's take another example. In spring 2003 a parliament commission started working with issues related to mathematics education. Explaining the task of this commission, the budget proposal for 2003 describes the "current situation" of maths education in the country as follows:

> Pupils in the Swedish school compare favourably in international studies. In the most recent PISA study, the mathematical results achieved by Swedish students are above the OECD average, whilst interest in mathematics is somewhat lower. This is not sufficient. Results need to be further improved. The ambition of the Government is that results achieved by Swedish pupils should be at the very top in international comparisons.

It goes on explaining the task of the commission:

> The Delegation will draw up an action plan with proposals for measures in order to change attitudes to and increase interest in the subject of mathematics, as well as proposals for developing the teaching of mathematics. The action plan shall cover pre-school, school, adult education, higher education and popular adult education. The Commission shall analyse the current situation in terms of the teaching of mathematics in Sweden and, i.a., assess the need for changing the current syllabi and other steering documents. The action plan shall also aim at increasing interest in further studies in the areas of mathematics, natural sciences and technology. All pupils shall have the opportunity to acquire the knowledge of mathematics needed to participate actively as a private person, member of society, and in working life, and also feel security and familiarity with this knowledge. (p. 6)

Another initiative aiming at stimulating interest in science and technology is the SciTech-project (NOT), run by the National Agency for Education (Skolverket) together with the National Agency for Higher Education (Högskoleverket):

> In the commission, the Government emphasizes the need of society for people educated in the SciTech fields in order to secure the economic growth of the country. But it also emphasizes the importance of a general knowledge mathematics, which will make it possible to exert an influence on development in a democratic society and to take a stand in different political issues. (p. 7)

Swedish government's budget proposals

The government's budget proposals[15] presented to the parliament comprise concise statements of governmental positions in various questions. As regards mathematics education, one recurring theme is references to international tests of pupil's skills such as PISA[16] and TIMMS[17]. Though Swedish pupils have scored rather high compared to pupils in other countries, these tests are frequently referred to in the appeals for reinforcement of the quantity and quality of mathematics education. In the texts supporting the budget proposals the importance of mathematics have been emphasized for many years, but starting in 2000 the arguments receives a new twist:

> Mathematics can be described as a kind of language, a way of communicating. Mathematics creates among other things opportunity to describe and inform about ideas in a short and concise way. Learning of mathematics is most successful when opportunity is given to communicate and practice mathematics in meaningful and relevant situations. Students should be given possibility to search for understanding and solutions to problems. In pre-school, children need support to discover and use mathematics in meaningful situations and to develop understanding of basic mathematical concepts. Lack of pre-knowledge in mathematics is a problem not only in the transition from school to [higher?] education in the sector of natural science in higher education, but also for many students in for example the social science sector. To develop the teaching of mathematics and create a more creative approach, teachers' professional competence needs attention. Different research activities and studies concerning mathematics as a school subject and the teaching of mathematics needs to be initiated. The government intends to take initiative to such actions in the framework of a special mathematics project, to get a foundation for future actions for development. (p. 54)

The budget proposal for 2002 states:

> The need in our society for people educated at university level in the natural sciences, including mathematics and technology, is and has been large. (p. 91)

And the budget proposal for 2003 continues:

> The importance of good knowledge of mathematics is indisputable. Good knowledge of mathematics in a wide sense is necessary at work as well as in private life, and is a prerequisite for making it possible for the individual to participate actively in the democratic process. (p. 69)

And, finally in the proposal for 2004, the same topic reappears:

> An obstacle to get more applicants to education in science and technology is often insufficient knowledge of and interest for mathematics. Good knowledge of mathematics is of great importance for both work, private life and understanding important official information. (p. 48)

These formulations resemble the reports published by the National Centre for Mathematics Education (NCM). See for example one of its first and probably most

---

[15] The Swedish Government (2000,2002,2003,2004), Proposal for budget, http://www.regeringen.se/propositioner/index.htm.

[16] Programme for International Student Assessment. The results from this study were presented in December 2000.

[17] Third International Mathematics and Science Study, conducted in 1995.

influential reports, “Hög tid för matematik” (“High time for mathematics”, NCM, 2001):[18]

> Differences in marks in mathematics have shown to be an important cause of a socially biased recruitment to higher education. Representatives for education, trade and industry, as well as society at large strongly and unanimously express that knowledge of mathematics is important and that good, meaningful knowledge is a prerequisite for self confidence, democracy, economic growth and life long learning. (p. 11)

The texts quoted above comprise elements that have gained in importance during the last years and reached a status of commonly shared beliefs:

- an assumption of the importance of positive attitudes to mathematics.
- the connection between mathematics and general political and human goals such as democracy and self confidence.
- the recognition of mathematics as “basic” knowledge, necessary in the private as well as professional life of everybody, not only for those who use mathematics professionally.

The context of the official discourse on mathematics education

The budget proposals discussed above all refer to an international focus on students’ knowledge in mathematics. This focus is manifested in recurring international tests designed to allow for concise comparisons between countries. In all countries, test results induce different kinds of actions in relation to mathematics education. Despite the fact that Sweden normally does well on these tests, they are used in the argumentation for extended action to promote the development of mathematics education.

During the last decades, Sweden has witnessed a major expansion of secondary and higher education. This expansion has had consequences for mathematics education. Students who are not in the same way as previously prepared for studying mathematics have entered study programs in which mathematics plays a crucial role. This is reflected in a concern from teachers, primarily in higher education, that a growing number of students lack the basic mathematics skills. This kind of difficulties are often referred to in a much discussed general problem, that of the transition from secondary to higher education. It is reasonable to assume that the political discourse on mathematics education described above draws its legitimacy both from the kind of general difficulties related to the transition from secondary to higher education (i.e. not necessarily connected to mathematics skills) and from the growing concern among teachers in mathematics-dependant study programs in higher education about students lacking the necessary competence in mathematics. In doing so, it makes use of and constant reference to the international flow of mathematics testing that, in turn, underpins the legitimacy of the discourse.

The official discourse on mathematics education should also be seen in the light of current trends to strengthen the legitimacy of the teaching profession by providing a scientific foundation, inviting school teachers to conduct research but also offering opportunities for scholars to contribute. In other words, the legitimisation of teaching through science is probably an important factor for explaining the government policy, both in terms of action and rhetoric, to promote the teaching of mathematics in Sweden. Another factor is funding. For example the departments of mathematics at

[18] Johansson, Bengt (2001): *Hög tid för matematik*, NCM.

university level need additional funding, which has contributed to an opening up of the academic field towards cooperation with other disciplines such as education or pedagogy. In Sweden we may observe also observe new alliances between mathematics scientists and schoolteachers, in which the mathematicians helps with academic legitimacy and the teachers contributes with the legitimacy provided by the educational field, the promises of public utility and not the least the capacity to attracting public funding. Of course there are social tensions built into such alliances.

Considerations for future investigations

The examples mentioned suggest that there exists something that we might label an official discourse on mathematics and mathematics education and, further, that there is a specific context for the production and circulation of this discourse. How is it that mathematical skills can be described as a prerequisite for personal self-confidence and for political democracy?

One possible point of departure for an exploration of the official discourse on mathematics education is Paul Dowling's study of texts on "school mathematics"[19]. Dowling has found that both the reader and the reality referred to were constructed in a peculiar way that he calls a "self referential" system. A closer examination of the type of texts that constitute the proposed object of study here might reveal a similar structural relationship to the proposed reader and the world outside school mathematics (e. g. international tests). The number of authors who would be necessary to include in a study of this text corpus is probably, for a country like Sweden, limited.

Another possible point of departure is the sociology of Pierre Bourdieu. The relations between mathematicians, researchers, teachers, unions, organisations and various government bodies might be analysed as a "production field" in Bourdieu's sense. A quick look at the backgrounds of the major contributors to what we have called the official discourse on mathematics education in Sweden show that they come from mathematics, science of education or secondary teaching. They share a common interest in promoting mathematics education, but at the same time compete with each other, both in the hunt for funding and in promoting such views on mathematics education that are compatible with their own possessions of specific symbolic capital. There are certainly specific consecration instances. In other words, many of the mechanisms attributed to fields in the analyses of Bourdieu seem to be at hand. There are several issues that might be approached in studies on such a field of mathematics education. One is the competition between institutions. There is a complex structure of institutions (such as teacher training colleges, departments of mathematics, departments of educational research, administrative bodies etc, teachers' associations etc.) that undergo transformations and redefine their relationships to each other. Academic mathematicians have traditionally benefited less than others from mathematics education (except for the pure academic teaching in mathematics at the universities, the volume of which is small). On the other hand they possess academic and scientific symbolic capital that may be converted into species of capital recognized for example in the context of international testing or even mathematics education at school level.

It has been acknowledged in many evaluations that pupils and students often feel that they have little use of school mathematics in their everyday life. This negative

[19] Dowling, Paul (1998): *The Sociology of Mathematics Education: Mathematical Myths/Pedagogic Texts*, Falmer Press.

attitude towards mathematics is often interpreted as harmful to the individual and to society. The same relation to mathematics no doubt exist also in many other social groups. It might perhaps be described as a kind of "private" discourse that constitutes the complete opposite of the official one. The relation between these two kinds of value sets and discourses seems to be quite complex and deserves further investigations.

VII. Appendix B. Tables and graphs

Table 2. Most Common Study Programmes by Sex, pupils in year two, 1988, 1994, 1998.

Boys					
1988		1994 (n=39 746)		1998 (n=41 377)	
Technology	19,7	Natural science	13,1	Natural science	14,4
Economy	10,0	Technology	11,5	Technology	10,3
Electric engineering	8,5	Social science	10,9	Economy	9,7
Construction	8,1	Economy	10,1	Electricity	8,8
Natural science	7,5	Electricity	9,7	Social science	8,8
Industry	7,3	Vehicle	7,9	Vehicle	7,2
Vehicle engineering	6,2	Business and admin.	5,7	Specially designed prog.	6,4
Social science	4,5	Construction	5,5	Business and admin.	4,4
Business and admin.	4,2	Industry	4,9	Industry	3,9
Social	3,1	Child and recreation	3,2	Hotel/restaurant	3,9
Maintenance engin.	2,6	Hotel/restaurant	3,2	Construction	3,6
Foods	2,3	Arts	2,7	Arts	2,9
Wood engineering	1,3	Natural resources use	2,4	Media	2,9
Humanities	0,9	Media	2,2	Child and recreation	2,4
Girls					
1988		1994 (n=38 654)		1998 (n=40 561)	
Economy	17,7	Social science	20,7	Social science	17,6
Social science	12,3	Natural science	12,6	Natural science	15,8
Business and admin.	9,2	Child and recreation	12,3	Economy	10,8
Natural science	8,7	Economy	9,9	Child and recreation	7,7
Caring	8,4	Health care	7,6	Arts	7,0
Humanities	6,9	Business and admin.	6,4	Hotel/restaurant	5,2
Social	6,2	Arts	6,2	Health care	5,1
Technology	6,0	Humanities	6,1	Business and admin.	4,9
Consumption	5,5	Hotel/restaurant	4,4	Humanities	4,8
Foods	3,4	Media	4,0	Specially designed prog.	4,2
Social service	2,6	Natural resources use	2,3	Media	3,6
Distribution/admin.	2,3	Technology	1,9	Social science, English	3,4
Arts	0,8	Handicraft	1,8	Natural resources use	2,6
Clothing	0,8	Specially designed prog.	0,9	Technology	2,0

Source: Donald Broady, Mats B. Andersson, Mikael Börjesson, Jonas Gustafsson, Elisabeth Hultqvist, Mikael Palme: ”Skolan under 1990-talet. Sociala förutsättningar och utbildningsstrategier”, pp. 5-133 *In* SOU 2000:39, *Välfärd och skola. Antologi från Kommittén Välfärdsbokslut*, Stockholm 2000.

Table 3. Most Common Study Programmes in the Upper Class and Working Class, by Sex, Pupils Year Two, 1994, 1998.

Upper class

1994						**1998**					
Boys	*(n=7 115)*		*Girls*	*(n=6 754)*		*Boys* (n=7 357)			*Girls* (n=7 211)		
Programme	n	%	Programme	n	%	Programme	n	%	Programme	n	%
Natural science	1 937	27,2	Social science	1 844	27,3	Natural science	2 085	28,3	Natural science	2 058	28,5
Technology	1 157	16,3	Natural science	1 611	23,9	Technology	1 015	13,8	Social science	1 489	20,6
Social science	1 107	15,6	Economy	759	11,2	Social science	912	12,4	Economy	848	11,8
Economy	1 002	14,1	Humanities	535	7,9	Economy	826	11,2	Arts	485	6,7
Electricity	345	4,8	Arts	444	6,6	Spec. designed prog.	474	6,4	Humanities	371	5,1
Business/admin.	257	3,6	Child/recreation	344	5,1	Electricity	323	4,4	Spec. desi. prog.	350	4,9
Arts	212	3,0	Media	238	3,5	Arts	252	3,4	Social sci., English	273	3,8
Vehical	153	2,2	Health care	216	3,2	Natural sci., English	226	3,1	Technology	200	2,8
Media	135	1,9	Technology	205	3,0	Hotel/restaurant	181	2,5	Child/recreation	190	2,6
Hotel/restaurant	131	1,8	Business/admin.	173	2,6	Media	177	2,4	Media	162	2,2

Lower working class

1994						**1998**					
Boys	*(n=5 066)*		*Girls*	*(n=4 927)*		*Boys* (n=5 647)			*Girls* (n=5 546)		
Programme	n	%	Programme	n	%	Programme	n	%	Programme	n	%
Vehical	726	14,3	Child/recreation	930	18,9	Vehical	703	12,4	Social science	767	13,8
Electricity	592	11,7	Social science	686	13,9	Electricity	564	10,0	Child/recreation	703	12,7
Industry	481	9,5	Health care	657	13,3	Natural science	442	7,8	Economy	468	8,4
Construction	404	8,0	Business/admin.	501	10,2	Industry	419	7,4	Natural science	463	8,3
Business/admin.	385	7,6	Economy	354	7,2	Economy	405	7,2	Health care	454	8,2
Economy	346	6,8	Hotel/restaurant	312	6,3	Social science	360	6,4	Business and admin.	437	7,9
Social science	341	6,7	Natural science	303	6,1	Technology	344	6,1	Hotel/restaurant	420	7,6
Technology	291	5,7	Arts	265	5,4	Construction	337	6,0	Arts	395	7,1
Natural science	282	5,6	Humanities	195	4,0	Spec. designed prog.	322	5,7	Humanities	234	4,2
Child/ recreation	224	4,4	Media	155	3,1	Business and admin.	313	5,5	Media	218	3,9

Source: Donald Broady, Mats B. Andersson, Mikael Börjesson, Jonas Gustafsson, Elisabeth Hultqvist, Mikael Palme: ”Skolan under 1990-talet. Sociala förutsättningar och utbildningsstrategier”, pp. 5-133 *In* SOU 2000:39, *Välfärd och skola. Antologi från Kommittén Välfärdsbokslut*, Stockholm 2000.

Table 4. Most Common Study Programmes for Pupils with Good Credentials, by Sex, Pupils Year Two, 1988-1998.

1988				1994				1998			
Boys		*Girls*		*Boys* *n=745*		*Girls* *n=1600*		*Boys* n=980		*Girls* n=2 407	
Natural science	53, 0	Natural science	47,6	Natural science	64,0	Natural science	60,9	Natural science	59,6	Natural science	59,4
Technology	36,3	Social science	16,5	Technology	23,2	Social science	16,1	Technology	18,2	Social science	9,5
Economy	4,9	Technology	15,1	Social science	6,5	Humanities	7,4	Natural sci. eng.	6,7	Natural sci. eng.	4,7
Social science	3,5	Economy	11,9	Economy	2,2	Technology	4,7	Spec. des. prog.	5,3	Technology	4,7
Humanities	0,8	Humanities	5,2	Humanities	1,3	Economy	3,8	Social science	4,0	Humanities	4,4
Music	0,7	Music	0,8	Spec. Des. prog.	1,0	Arts	2,9	Economy	1,9	Economy	4,2
				Arts	0,9	IB	1,3	Arts	1,0	Spec. des. prog.	4,0
				IB	0,6	Media	1,2	IB	0,8	Arts	3,3

Source: Donald Broady, Mats B. Andersson, Mikael Börjesson, Jonas Gustafsson, Elisabeth Hultqvist, Mikael Palme: ”Skolan under 1990-talet. Sociala förutsättningar och utbildningsstrategier”, pp. 5-133 *In* SOU 2000:39, *Välfärd och skola. Antologi från Kommittén Välfärdsbokslut*, Stockholm 2000.

Table 5. Choice of Study Programme among Pupils with High Credentials by Social Class Origin, 1998.

	n	Arts	Natural science, English	Natural science	Techno-logy	Social science, English	Economy	Social science	Humanitie s	IB	Specially designed prog.
N.R.	56	**5,4**	**16,1**	53,6	8,9	1,8		1,8	7,1		3,6
Upper class	1 427	2,3	5,0	**65,3**	6,0	2,0	2,6	2,4	8,2	1,6	3,6
Middle class	1 265	3,4	5,4	55,8	10,0	**2,8**	4,7	3,3	8,0	0,9	4,3
Lower middle class	302	2,0	4,0	55,6	11,9	1,7	**5,3**	4,0	5,3	2,0	6,3
Higher working class	112	1,8	6,3	54,5	**13,4**	0,9	2,7	6,3	6,3	0,9	4,5
Lower working class	187	1,6	5,9	50,3	11,2	1,6	2,1	**8,0**	**10,7**	1,6	5,9
Missing	38		5,3	57,9	5,3			2,6	7,9	**10,5**	**10,5**
Total	3 387	2,7	5,3	59,4	8,6	2,2	3,5	3,3	7,9	1,4	4,4

Source: Donald Broady, Mats B. Andersson, Mikael Börjesson, Jonas Gustafsson, Elisabeth Hultqvist, Mikael Palme: ”Skolan under 1990-talet. Sociala förutsättningar och utbildningsstrategier”, pp. 5-133 *In* SOU 2000:39, *Välfärd och skola. Antologi från Kommittén Välfärdsbokslut*, Stockholm 2000.

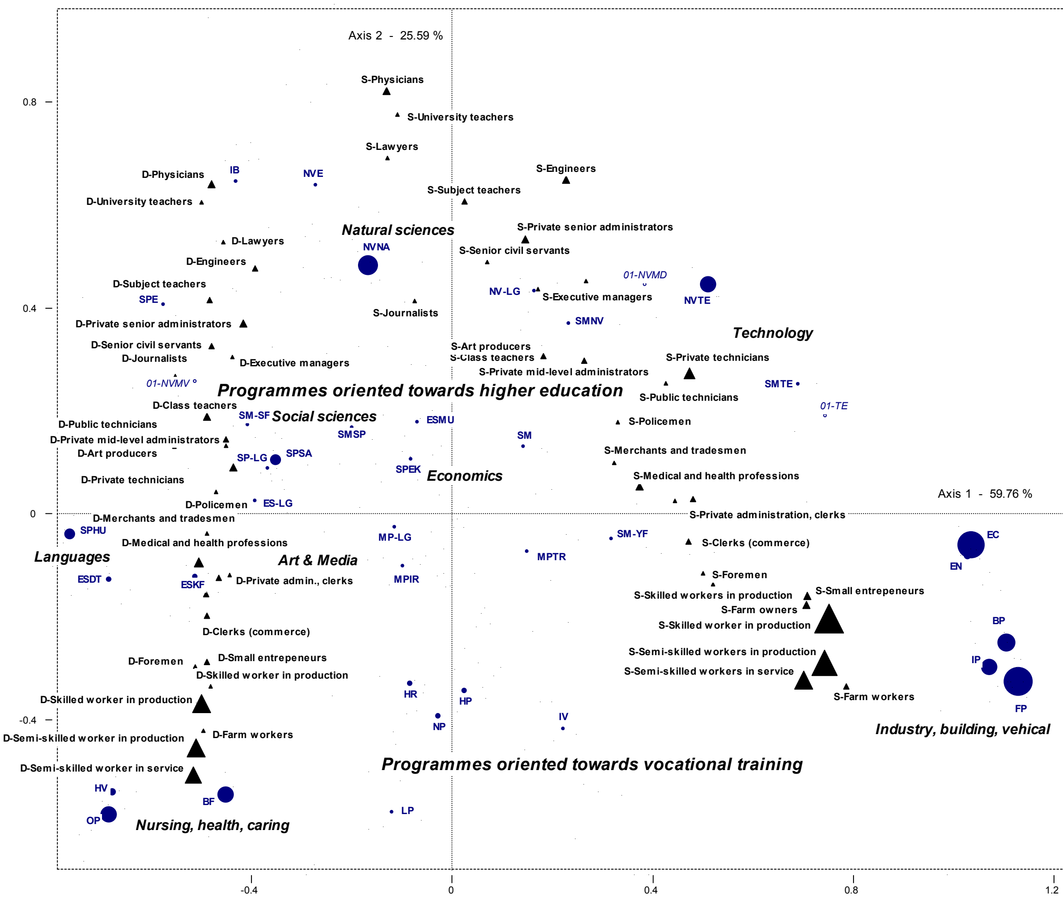
Table 6. Natural Sciences and Technology Study Programmes and Grades from Compulsory School, 1997-2001.

		N	No grades	<2,5	2,5-2,9	3,0-3,4	3,5-3,9	4,0-4,4	4,4-5,0	Not in comp. school	Total
All education	1997	100 014	0,5	12,5	18,7	28,2	22,4	11,8	3,1	2,7	100
All education	1998	96 805	0,6	12,2	17,9	27,4	23,3	12,7	3,8	2,0	100
All education	1999	94 329	0,1	9,8	23,0	28,2	22,4	10,9	3,2	2,4	100
All education	2000	93 839	0,0	10,7	21,7	27,7	22,7	11,3	3,7	2,2	100
All education	2001	96 893	0,0	11,1	19,9	27,1	23,2	12,0	4,4	2,4	100
All education	1997-2001	481 880	0,2	11,3	20,2	27,7	22,8	11,8	3,6	2,3	100
Natural science, local specialisation	1997	1 156	0,1	0,2	2,2	20,1	33,9	31,1	12,0	0,4	100
	1998	1 292	0,5	0,5	1,9	16,9	33,3	34,0	11,9	1,0	100
	1999	1 260	0,0	0,2	3,7	21,2	37,8	27,4	9,0	0,8	100
	2000	1 170	0,0	0,3	2,0	19,7	37,5	30,5	8,7	1,2	100
	2001	482	0,0	0,0	1,9	8,3	30,7	36,7	21,4	1,0	100
Natural science, English	1997	156	1,9	0,0	0,6	0,6	14,7	25,6	42,9	13,5	100
	1998	134	3,0	0,0	3,7	9,0	20,9	25,4	30,6	7,5	100
	1999	235	0,0	0,9	2,6	18,3	26,4	24,3	20,9	6,8	100
	2000	136	0,0	1,5	2,2	4,4	22,1	22,1	32,4	15,4	100
	2001	183	0,0	1,1	0,5	3,8	14,8	33,9	35,5	10,4	100
Natural science, Mathematics and computer science	2001	3 460	0,0	0,7	3,3	19,4	39,9	26,0	9,4	1,4	100
Natural science, Environmental science	2001	599	0,0	0,2	1,0	12,2	34,9	34,7	16,0	1,0	100
Natural science	1997	13 190	0,4	0,2	1,6	12,7	34,5	35,5	13,8	1,3	100
	1998	13 291	0,7	0,2	1,5	11,8	33,3	34,9	16,4	1,3	100
	1999	12 976	0,1	0,3	2,6	16,2	35,8	30,8	12,7	1,7	100
	2000	11 345	0,0	0,4	2,2	14,6	33,5	31,4	16,1	1,8	100
	2001	9 692	0,0	0,6	1,9	11,1	31,8	33,5	19,2	2,0	100
Specially designed programme, natural science	1997	387	0,0	0,8	9,6	34,1	35,1	16,8	3,1	0,5	100
	1998	526	3,4	0,2	2,9	21,1	40,9	26,8	4,0	0,8	100
	1999	945	0,1	0,6	7,4	30,2	36,2	19,4	5,1	1,1	100
	2000	1 603	0,0	1,1	4,9	26,0	39,0	20,8	7,3	0,9	100
	2001	653	0,0	0,0	3,8	15,9	39,1	26,0	13,3	1,8	100
Natural science, technology	1997	6 389	0,2	0,2	3,0	25,4	41,0	24,3	5,1	1,0	100
	1998	5 440	0,1	0,3	3,0	22,8	42,0	25,0	5,9	0,8	100
	1999	5 047	0,0	0,4	4,8	28,3	41,0	19,9	4,5	1,1	100
	2000	4 292	0,0	0,6	4,7	26,4	41,1	21,0	5,4	0,9	100
Technology	2001	4 264	0,0	2,7	15,9	39,4	30,6	9,1	1,5	0,9	100
Technology, specialisation	2001	2 035	0,0	2,1	13,8	38,3	34,0	9,8	1,6	0,5	100
Specially designed programme, technology	2000	1 417	0,0	3,2	15,6	38,4	28,2	10,2	3,1	1,2	100
	2001	676	0,0	8,1	15,8	27,5	28,6	13,5	6,4	0,1	100

Table 7. Natural Sciences and Technology Study Programmes and Socioeconomic Status of Parents, 1997-2001.

			White-collar workers Senior	Inter-mediate grades	Lower grades	Self-employed	Farmers	Blue collar workers	Others	Not in employ ment	NR	Total
All education	1997	100 014	16,7	19,4	11,2	5,2	1,8	33,0	1,6	0,2	10,9	100,0
All education	1998	96 805	16,3	19,2	11,0	5,1	1,9	33,5	1,7	0,2	11,2	100,0
All education	1999	94 329	16,0	18,8	11,1	4,8	1,8	33,9	1,8	0,2	11,6	100,0
All education	2000	93 839	15,3	18,5	10,5	4,7	1,9	34,9	1,8	0,2	12,2	100,0
All education	2001	96 893	14,8	18,0	10,4	4,6	1,7	35,7	1,8	0,3	12,7	100,0
All education	1997-2001	481 880	15,8	18,8	10,8	4,9	1,8	34,2	1,7	0,2	11,7	100,0
Natural science, local specialisation	1997	1 156	27,5	27,7	10,6	4,3	2,2	20,4	0,7	0,2	6,3	100
	1998	1 292	26,4	26,9	10,8	5,1	1,6	20,9	1,2	0,0	7,1	100
	1999	1 260	26,7	24,9	10,8	5,5	1,5	23,0	1,3	0,2	6,2	100
	2000	1 170	25,8	24,6	10,9	4,2	1,6	23,6	1,2	0,1	8,0	100
	2001	482	32,2	22,4	8,1	2,3	1,7	20,3	1,2	0,4	11,4	100
Natural science, English	1997	156	37,2	14,1	6,4	5,8	1,3	7,1	1,3	0,0	26,9	100
	1998	134	30,6	17,2	8,2	6,7	0,7	11,9	2,2	0,7	21,6	100
	1999	235	29,8	17,9	4,7	5,5	0,4	15,7	1,3	0,0	24,7	100
	2000	136	24,3	12,5	3,7	5,1	0,7	16,2	2,2	0,0	35,3	100
	2001	183	25,7	14,8	7,7	3,8	0,5	15,3	3,3	0,0	29,0	100
Natural science, Mathematics and computer science	2001	3 460	25,1	22,6	9,7	3,9	1,6	23,6	1,6	0,2	11,7	100
Natural science, Environmental science	2001	599	27,4	26,9	9,2	4,7	2,2	20,9	1,8	0,0	7,0	100
Natural science	1997	13 190	32,7	23,9	8,9	4,1	1,7	18,1	1,3	0,2	9,0	100
	1998	13 291	32,4	24,2	9,0	3,8	1,6	18,2	1,1	0,2	9,5	100
	1999	12 976	30,1	23,1	9,6	4,0	1,7	19,6	1,5	0,2	10,1	100
	2000	11 345	29,3	23,6	8,3	3,8	2,0	19,8	1,4	0,2	11,6	100
	2001	9 692	30,2	22,5	7,8	3,7	1,6	19,7	1,4	0,2	12,9	100
Specially designed programme, natural science	1997	387	24,5	23,5	11,4	4,4	0,8	26,4	2,8	0,3	5,9	100
	1998	526	22,2	26,4	10,5	4,9	1,9	22,8	1,1	0,4	9,7	100
	1999	945	23,5	26,2	11,2	4,8	1,0	22,4	1,9	0,1	8,9	100
	2000	1 603	24,4	25,6	10,6	4,1	1,5	23,3	1,6	0,1	8,9	100
	2001	653	30,9	22,4	10,4	4,6	0,8	19,8	1,7	0,0	9,5	100
Natural science, technology	1997	6 389	24,5	27,7	10,6	4,1	1,9	21,8	1,4	0,2	7,9	100
	1998	5 440	23,3	27,1	10,7	4,3	2,0	22,8	1,5	0,2	8,1	100
	1999	5 047	22,7	25,9	11,0	4,5	2,2	23,8	1,4	0,3	8,3	100
	2000	4 292	22,8	25,0	9,9	4,5	2,2	24,9	1,3	0,1	9,2	100
Technology	2001	4 264	15,2	22,8	10,9	4,5	2,1	34,7	1,4	0,2	8,2	100
Technology, specialisation	2001	2 035	16,5	23,5	10,7	4,1	1,3	31,9	1,8	0,2	10,0	100
Specially designed programme, technology	2000	1 417	16,6	23,1	11,6	3,5	1,8	32,1	1,6	0,4	9,4	100
	2001	676	14,8	21,7	8,6	4,6	2,2	35,4	1,0	0,3	11,4	100

Graphic 1. The Space of Upper Secondary Education in Sweden, 32 social groups, separated by the sex of the pupils, 1997-2000, educational programmes independent of years active.



Abbreviation	National study programme	Nationally established specializations (as opposed to local specializations)
Orientation towards vocational training		
BF	Child and Recreation	Recreational, Educational and Social Activities
BP	Construction	Construction, Building, Painting, Metalwork
EC	Electrical Engineering	Automation, Electronics, Electrical- and Computer Technology
EN	Energy	Operation and Maintenance, Marine Technology, Heating, Ventilation and Sanitation
ES	Arts	Art and Design, Dance, Music and Theatre
FP	Vehicle Engineering	Aeronautics, Coachwork, Motor Vehicle Mechanics and Engineering, Transport
HP	Business and Administration	Business and Services, Travel and Tourism
HV	Handicrafts	Various trades and crafts
HR	Hotel, Restaurant and Catering	Hotel, Restaurant and Catering Services
IP	Industry	Local specializations, country-wide recruiting
LP	Foods	Local specializations, country-wide recruiting
MP	Media	Media Production, Printing Technology
NP	Natural Resources	Local specializations
OP	Health Care	No national specializations
SM-YF	Specially designed programme	Orientation towards vocational training
Orientation towards higher education		
IB	International Baccalaureate	
NVNA/NVNV	Natural Science	Natural Sciences
NVTE	Natural Science	Technology (In 2000 transformed to National Study Programme: Technology (TE)
NVMD	Natural Science	Mathematics and Computer Sciences (Created in 2000)
NVMV	Natural Science	Environmental Science (Created in 2000)
SM-SF	Specially designed programme	Orientation towards higher education
SPSA/SPSP	Social Science	Social Sciences
SPEK/SPEI	Social Science	Economics
SPKU	Social Science	Liberal Arts (Created in 2000)
SPHU/SPSK	Social Science	Languages
TE	Technology	Local specializations
Other Programmes		
IV/IVLL	Individual Programmes	
SM	Specially designed programme	No spec., therefore not classifiable according to vocational/higher education orientation

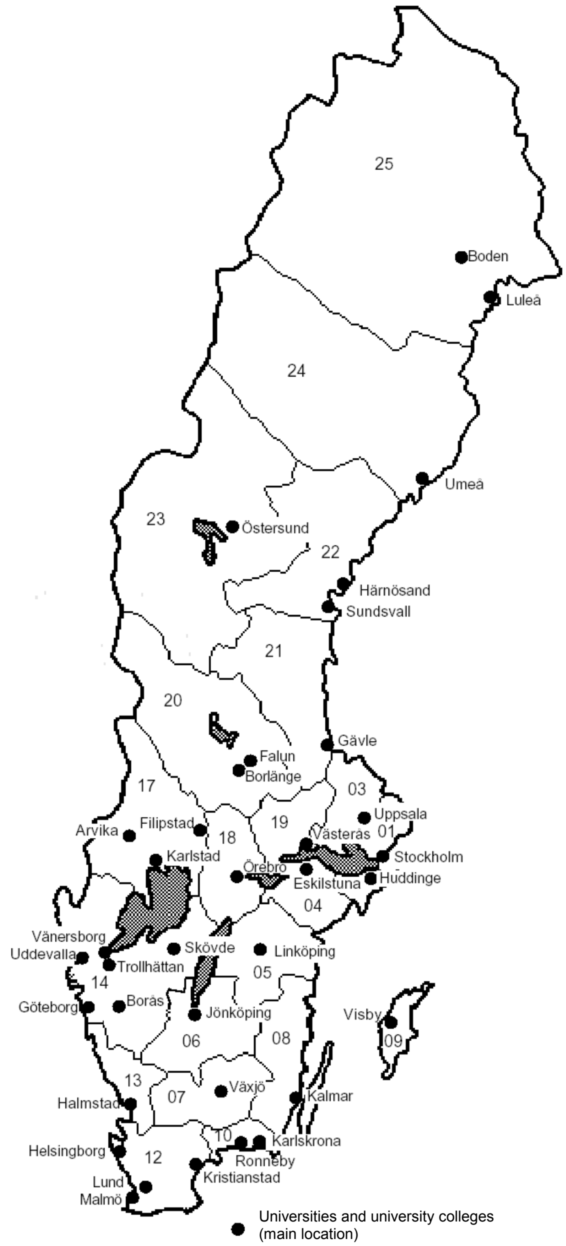
Table 8. Number of Registered Students and New Entrants in Swedish Higher Education, 1989/90-2001/2002.

Year	Registered	New entrants	% new entrants	Index registered	Index new entrants	% change from former year, registered	% change from former year, new entrants
89/90	193 200	47 900	24,8	100,0	100,0		
90/91	203 100	51 100	25,2	105,1	106,7	5,1	6,7
91/92	221 900	55 200	24,9	114,9	115,2	9,3	8,0
92/93	242 500	57 900	23,9	125,5	120,9	9,3	4,9
93/94	256 300	61 600	24,0	132,7	128,6	5,7	6,4
94/95	269 700	62 800	23,3	139,6	131,1	5,2	1,9
95/96	285 800	66 300	23,2	147,9	138,4	6,0	5,6
96/97	301 100	65 800	21,9	155,8	137,4	5,4	-0,8
97/98	305 600	64 500	21,1	158,2	134,7	1,5	-2,0
98/99	310 100	66 700	21,5	160,5	139,2	1,5	3,4
99/00	319 100	70 000	21,9	165,2	146,1	2,9	4,9
00/01	330 000	72 000	21,8	170,8	150,3	3,4	2,9
01/02	354 600	78 400	22,1	183,5	163,7	7,5	8,9

Table 9. Number of Registered Students and New Entrants in Swedish Higher Education, 1993-1998.

		1993		1998		1993-1998		
		N	%	N	%	Diff N	Diff %	Diff percentages
Universities	AL			3	0,0			
	HK	30 834	18,7	30 698	15,9	-136	-0,4	-2,8
	J	1 894	1,1	2 298	1,2	404	21,3	0,0
	M	13 593	8,2	25 092	13,0	11 499	84,6	4,7
	N	20 175	12,2	25 677	13,3	5 502	27,3	1,0
	OK	300	0,2	527	0,3	227	75,7	0,1
	PL	17 998	10,9	17 249	8,9	-749	-4,2	-2,0
	S	47 037	28,5	49 873	25,8	2 836	6,0	-2,7
	ST	1 554	0,9	2 090	1,1	536	34,5	0,1
	T	31 622	19,2	40 039	20,7	8 417	26,6	1,5
	Total	165 007	100,0	193 546	100,0	28 539	17,3	0,0
University Colleges	AL			40				
	HK	7 301	10,3	11 923	10,7	4 622	63,3	0,4
	J	38	0,1	46	0,0	8	21,1	0,0
	M	1 296	1,8	8 898	8,0	7 602	586,6	6,2
	N	7 800	11,0	10 953	9,8	3 153	40,4	-1,2
	OK	454	0,6	500	0,4	46	10,1	-0,2
	PL	18 576	26,3	22 408	20,1	3 832	20,6	-6,1
	S	22 237	31,5	33 648	30,2	11 411	51,3	-1,2
	ST	1 358	1,9	2 351	2,1	993	73,1	0,2
	T	11 628	16,4	20 520	18,4	8 892	76,5	2,0
	Total	70 688	100,0	111 287	100,0	40 599	57,4	0,0
Total	AL			43				
	HK	39 799	15,4	45 217	14,2	5 418	13,6	-1,2
	J	1 950	0,8	2 344	0,7	394	20,2	0,0
	M	34 328	13,3	43 196	13,6	8 868	25,8	0,3
	N	28 084	10,9	36 739	11,5	8 655	30,8	0,7
	OK	790	0,3	1 046	0,3	256	32,4	0,0
	PL	37 087	14,4	40 452	12,7	3 365	9,1	-1,7
	S	69 582	27,0	84 056	26,4	14 474	20,8	-0,6
	ST	2 912	1,1	4 441	1,4	1 529	52,5	0,3
	T	43 371	16,8	60 655	19,1	17 284	39,9	2,2
	Total	257 903	100,0	318 189	100,0	60 286	23,4	0,0

Graphic 2. Seats of Higher Education in Sweden by County, 1998/1999.



Source: SCB, *Universitet och högskolor, Grundutbildning: Nybörjare, registrerade och examina, 1998/99* (Higher Education, Undergraduate education: University entrants, enrolled and graduated students, 1998/99), UF20SM0001, p. 3.

Table 10. The Largest Education in Technology and Natural Science 1993, per Field of Study and Type of Institution, 1993.

	N	At least 20 p	Type of study	Man	Below 24 years	More than 29 years	Abroad	Sweden	Data missing	Parents not in census	Higher civil servants and salaried	Workers	Longer higher education	Only compulsory school or data missing	High income (10 dec.)	Low income (1-2 dec.)	High secondary school credentials	Low secondary school credentials (<	Missing data on secondary school	High points univ. aptitude test (>1,7)	Low points univ. aptitude test (< 0,7)	No national aptitude test	E/SPEK	N/NVNA	S/SPSA	T/NVTE	Gy-stv- Data missing
H-N-data-all	2 011	21,5	K	60,1	69,8	8,3	5,5	93,6	0,9	5,2	27,3	20,1	23,8	20,1	13,8	14,2	1,3	14,0	25,3	2,9	14,1	25,7	39,9	17,6	9,1	19,7	12,0
H-N-data-sys	1 265	46,9	3	68,1	69,2	7,4	8,3	91,3	0,4	6,6	27,1	18,9	26,3	15,3	14,0	14,6	0,5	14,8	23,6	1,8	16,2	22,7	32,5	14,2	10,9	25,7	12,6
H-N-data	697	4,4	K	79,5	71,4	6,9	7,6	91,2	1,1	5,7	25,3	23,7	22,5	18,4	8,8	15,4	2,2	16,9	21,1	2,3	13,4	31,6	13,3	18,5	3,8	54,3	11,3
H-N-mat-stat	711	4,6	K	59,2	78,2	4,1	5,9	92,7	1,4	4,6	26,5	18,1	24,8	18,6	13,8	12,6	0,5	12,6	17,2	2,4	10,7	17,2	45,6	10,0	9,8	27,7	8,9
H-N-mat-öv	311	12,9	K	73,6	76,8	3,9	8,7	91,3	0,0	5,1	21,4	25,4	22,5	13,7	8,9	16,1	0,4	18,5	18,3	1,4	17,9	29,9	4,7	20,2	3,2	64,6	12,3
H-N-mat	1 122	22,6	K	73,7	75,0	7,0	7,5	91,8	0,7	5,3	25,7	22,7	25,1	18,5	12,3	13,0	1,8	18,0	19,9	2,7	17,4	34,8	9,4	20,1	3,2	53,7	13,0
H-PL-1-7-ma	914	96,8	3	26,6	81,5	4,4	1,5	98,5	0,0	0,7	25,8	23,0	28,5	15,2	7,7	9,6	1,0	14,2	14,3	0,5	21,6	27,6	8,0	50,1	4,6	32,8	4,9
H-PL-4-9-ma	358	74,0	4	50,0	77,7	5,0	2,5	97,5	0,0	0,3	30,5	15,1	36,1	14,2	11,0	9,3	1,3	9,6	15,4	2,3	8,5	27,7	5,5	45,2	5,5	39,4	3,8
H-PL-gy-ma	76	97,4	4	57,9	82,9	2,6	5,3	94,7	0,0	2,6	39,2	8,1	40,5	8,1	13,5	12,2	4,7	7,8	15,8	2,9	10,0	7,9	1,5	47,1	2,9	45,6	11,8
H-T-i-bygg	725	88,0	2	77,8	89,4	3,3	5,1	94,5	0,4	2,9	19,0	24,0	17,8	18,5	8,4	12,2	0,3	26,3	12,3	0,0	27,4	30,5	2,0	2,9	0,8	89,2	10,2
H-T-i-data	829	71,7	2	92,2	77,9	5,1	9,9	88,8	1,3	7,5	22,3	25,7	22,1	15,7	8,6	15,7	0,6	26,9	19,8	2,9	15,4	20,0	2,6	16,1	1,3	67,1	15,1
H-T-i-eko	330	82,1	3	74,2	85,2	0,9	3,6	96,4	0,0	0,3	28,6	15,5	25,7	11,6	13,8	11,0	0,7	8,2	7,9	2,1	12,2	13,3	3,8	13,2	1,3	77,0	3,8
H-T-i-en-eltek	760	86,6	2	93,6	86,8	3,9	6,1	93,8	0,1	3,0	21,4	22,5	21,5	15,7	9,3	14,5	1,3	27,3	11,8	1,6	23,1	32,1	0,4	2,7	0,3	84,2	8,9
H-T-ing-ma	986	83,4	2	88,4	81,1	5,2	5,7	94,3	0,0	3,8	23,8	24,7	23,4	15,2	10,1	13,6	0,5	28,9	14,6	1,1	22,2	35,6	1,9	5,4	1,2	80,2	7,9
U-N-bio	2 351	57,0	4	41,3	64,1	8,1	5,7	92,7	1,6	4,8	41,6	12,4	48,7	8,8	19,1	14,4	12,5	2,9	28,7	12,6	3,3	37,7	2,7	64,4	5,6	18,2	10,9
U-N-data-all	798	63,7	K	65,0	59,5	10,5	6,5	93,0	0,5	5,9	31,0	17,4	30,8	15,0	13,6	16,5	1,7	11,0	33,0	3,8	10,6	28,2	36,0	16,0	11,5	24,6	12,2
U-N-data-sys	1 874	86,5	3	67,9	61,3	10,0	11,0	87,9	1,1	9,7	36,2	16,0	36,2	12,6	18,9	15,3	1,5	7,4	34,4	4,7	9,2	23,3	32,1	19,2	12,8	24,3	19,7
U-N-data	1 543	17,5	K	88,3	57,7	10,0	8,7	89,4	1,8	8,0	38,1	16,1	39,1	12,4	14,1	17,7	4,9	8,6	31,8	10,9	6,1	50,0	2,6	34,5	1,2	55,7	13,6
U-N-fysik	1 597	26,9	K	77,5	62,9	8,0	8,1	87,5	4,4	10,0	37,1	14,7	41,3	11,5	14,1	15,0	8,3	8,3	31,2	11,4	7,5	45,6	2,4	42,0	1,7	48,5	14,4
U-N-geo	1 805	48,2	K	53,7	65,9	8,5	4,7	94,1	1,3	5,1	37,1	13,9	43,0	11,1	16,3	13,5	3,5	12,0	28,5	6,5	10,7	33,1	7,0	42,5	11,3	28,0	11,1
U-N-kemi	1 581	58,8	4	46,4	71,3	5,7	8,9	89,1	2,0	7,3	38,8	15,5	44,2	11,9	18,3	14,1	6,1	3,9	22,6	7,0	6,3	34,7	1,4	54,5	3,7	34,8	11,5
U-N-mat-stat	1 427	49,9	K	68,0	62,3	7,5	7,1	91,6	1,3	6,0	40,3	12,4	40,2	11,9	19,6	13,6	3,1	12,7	28,4	6,2	10,2	27,2	29,7	23,6	13,4	24,9	10,3
U-N-mat-öv	1 676	68,1	4	65,5	75,0	5,9	9,7	89,2	1,1	6,9	39,9	14,0	45,7	10,0	16,6	14,1	8,4	3,5	21,6	9,7	8,4	29,5	1,5	52,8	3,4	36,1	14,7
U-N-mat	3 050	12,7	K	76,8	71,2	6,2	7,7	91,3	1,0	5,9	37,3	15,1	42,7	11,8	16,6	15,1	10,3	8,3	22,4	9,8	8,5	32,6	2,3	37,3	1,5	53,4	12,0
U-PL-1-7-ma	1 165	87,3	3	20,1	77,2	6,1	2,1	97,7	0,2	1,7	28,7	20,0	33,3	12,8	11,7	12,2	0,7	8,6	15,2	1,2	16,2	30,0	6,5	52,0	6,6	31,2	3,6
U-PL-4-9-ma	1 305	91,4	4	46,1	74,1	3,6	2,1	97,8	0,2	1,3	32,4	18,1	38,0	13,5	11,4	11,4	1,5	9,3	16,2	1,5	8,2	30,5	2,7	48,1	4,4	39,0	4,4
U-PL-gy-ma	301	72,4	4	55,8	67,8	8,3	2,0	98,0	0,0	1,0	36,2	13,4	43,5	10,2	13,2	14,6	10,7	3,0	22,6	11,1	3,4	31,2	1,8	52,4	2,9	37,5	9,5
U-T-ci-bygg	1 813	72,4	4	70,8	68,8	3,8	5,2	94,3	0,4	4,1	39,6	11,7	45,9	9,3	21,5	11,6	11,4	1,5	17,5	10,8	4,4	39,2	1,5	28,6	1,5	64,6	6,8
U-T-ci-eko	1 546	84,9	4	76,5	67,7	2,1	3,4	95,9	0,7	1,7	46,3	8,6	52,3	5,9	28,4	8,2	39,5	0,7	19,3	24,5	1,4	42,8	1,6	41,2	1,2	52,3	6,3
U-T-ci-el	2 780	71,3	4	93,1	68,1	4,4	8,6	90,7	0,7	6,0	39,0	13,6	41,5	10,1	18,2	13,5	13,5	1,4	19,9	18,4	4,1	42,0	0,4	30,7	0,3	65,6	10,0
U-T-ci-en	3 936	79,0	4	90,0	65,8	4,3	8,4	90,9	0,7	6,4	40,9	12,4	45,5	10,6	21,1	11,5	17,2	1,2	20,0	12,4	5,9	44,0	0,2	21,5	0,4	74,0	10,1
U-T-ci-kemi	1 878	74,0	4	51,9	78,6	2,3	7,1	92,5	0,3	4,6	48,3	11,1	54,3	7,7	27,0	9,0	24,8	1,2	14,7	14,2	4,8	38,5	0,9	56,7	0,8	39,3	8,6
U-T-ci-lant	551	65,3	4	50,3	69,1	6,0	3,4	96,2	0,4	3,3	47,5	8,8	49,5	8,2	24,9	11,6	5,3	1,6	21,4	9,2	4,8	28,7	3,3	42,6	8,6	38,1	7,6
U-T-ci-ma	4 310	78,8	4	83,8	65,7	4,0	5,9	93,8	0,3	3,8	43,5	11,6	45,9	9,6	24,2	10,9	5,4	1,8	17,7	5,7	5,6	43,0	1,2	21,6	0,8	73,4	7,2
U-T-ci-sam-ark	840	77,7	4	51,1	42,7	13,7	8,3	90,4	1,3	9,8	54,0	6,9	67,0	5,2	25,3	11,8	51,1	1,8	53,2	35,7	2,7	46,7	2,5	41,2	20,1	25,5	22,3
U-T-ci-sam	261	59,0	4	43,7	75,5	3,1	1,5	98,1	0,4	2,3	36,1	13,3	40,6	6,7	19,3	9,4	14,1	3,2	15,7	9,9	6,2	37,9	2,9	43,0	6,6	42,6	7,0
U-T-ci-tf	2 299	75,7	4	86,0	75,2	3,2	6,7	93,0	0,3	3,7	48,7	10,1	56,3	7,9	24,9	11,1	39,4	0,9	18,6	31,4	2,7	43,4	0,3	52,6	0,7	43,2	8,5
U-T-i-bygg	962	76,4	2	75,6	89,5	2,2	4,8	95,0	0,2	1,6	30,6	16,9	29,0	12,6	16,2	9,8	1,6	12,5	8,2	2,5	23,8	30,0	0,5	4,2	0,4	91,7	4,5
U-T-i-data	184	70,7	2	92,4	81,0	2,7	2,7	97,3	0,0	1,6	24,9	26,0	23,3	13,9	8,3	8,3	0,0	13,8	13,6	1,3	10,5	17,4	1,1	13,2	0,6	72,4	5,7
U-T-i-en-eltek	1 339	78,8	2	90,1	87,8	3,3	7,8	91,7	0,5	3,2	26,6	17,5	26,8	12,5	14,0	13,5	0,1	14,6	11,7	0,2	17,1	32,6	0,7	1,8	0,8	91,2	8,2
U-T-i-kemi	360	94,4	2	44,7	92,5	2,5	8,9	91,1	0,0	2,2	31,5	20,7	34,5	13,4	12,9	11,5	0,9	18,3	9,2	0,4	23,3	21,4	1,5	15,8	1,5	80,3	7,5
U-T-ing-ma	993	84,4	2	88,5	87,1	3,5	5,7	94,3	0,0	2,4	30,0	17,2	29,2	11,9	16,7	11,5	0,2	15,6	11,6	0,3	19,4	34,4	1,9	0,9	0,6	87,8	9,2

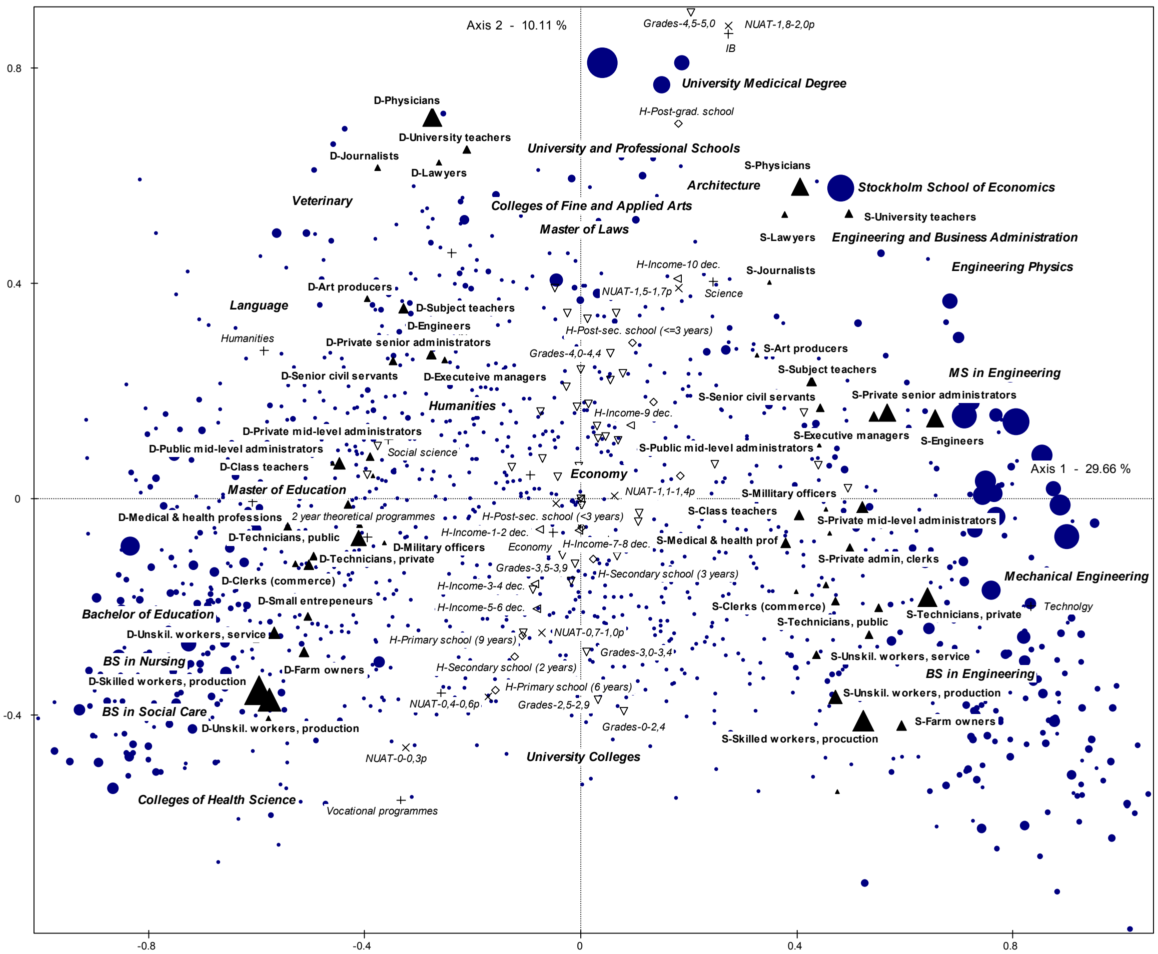
Table 11. The Largest Education in Technology and Natural Science 1993, per Field of Study and Type of Institution, Change 1993-1998.

	N	At least 20 p	Type of study	Man	Below 24 years	More than 29 years	Abroad	Sweden	Data missing	Parents not in census	Higher civil servants and salaried	Workers	Longer higher education	Only compulsory school or data	High income (10 dec.)	Low income (1-2 dec.)	High secondary school	Low secondary school	Missing data on secondary school	High points univ. aptitude test (>1,7)	Low points univ. aptitude test (< 0,7)	No national aptitude test	E/SPEK	N/NVNA	S/SPSA	T/NVTE	Gy-stv- Data missing
H-N-data-all	-44,6	-5,5	K	-5,9	-22,6	11,3	0,8	-1,1	0,3	-1,4	-0,6	4,3	1,8	-4,9	-3,8	0,4	0,8	4,6	-5,2	1,5	4,0	-4,9	-8,0	-6,1	12,0	-4,8	1,9
H-N-data-sys	88,9	13,8	3,0	-3,4	-13,4	5,5	-2,2	2,1	0,1	-2,8	-2,7	6,3	-2,3	1,4	-3,8	0,3	1,3	-0,4	-4,9	1,7	-2,0	-5,7	-7,4	-2,9	7,9	-9,6	3,5
H-N-data	102,7	3,1	3,0	-11,5	-20,1	14,3	0,9	-2,4	1,5	1,0	-1,2	1,3	1,5	-0,2	0,7	-0,2	-0,6	2,4	5,3	2,2	4,4	-6,3	5,0	-3,7	10,6	-25,6	9,1
H-N-mat-stat	-22,2	11,1	K	-0,6	-18,9	5,0	1,0	-3,0	2,0	2,8	-1,9	6,3	3,0	-3,2	-2,2	1,0	1,5	8,8	0,0	-0,6	12,7	1,6	-4,2	2,6	6,8	-13,3	5,9
H-N-mat-öv	73,6	13,2	4,0	-30,9	-17,4	11,1	-2,0	-1,9	3,9	2,6	-0,3	1,3	0,1	3,9	-0,8	-0,7	0,6	-1,8	3,9	-0,4	1,1	-6,0	5,8	9,3	10,4	-44,8	6,2
H-N-mat	-10,2	-2,6	K	-4,3	-15,2	5,8	2,2	-2,2	0,0	1,9	-2,6	1,4	1,2	-5,9	-2,0	0,0	1,3	4,7	-3,2	1,0	6,3	-9,0	-1,5	4,5	2,6	-8,4	0,4
H-PL-1-7-ma	95,5	-9,5	3,0	-8,6	-15,5	3,8	0,8	-0,8	0,1	-0,2	-4,9	2,1	-3,8	1,7	0,9	0,2	-0,7	3,4	-4,8	0,3	21,2	-13,6	11,1	-21,5	20,5	-20,7	3,0
H-PL-4-9-ma	274,3	7,8	4,0	-10,2	-22,4	13,8	1,2	-1,2	0,0	0,5	-8,6	12,0	-11,1	1,9	-3,4	3,7	-1,0	11,5	3,3	-1,8	15,9	-11,8	5,7	-3,9	6,4	-14,0	11,2
H-PL-gy-ma	369,7	-18,7	5,0	-9,4	-18,2	10,5	2,9	-3,4	0,6	3,0	-12,8	15,6	-13,0	8,7	-2,7	0,4	-0,6	5,6	2,7	0,3	9,9	12,0	8,1	-0,4	6,7	-23,7	3,6
H-T-i-bygg	-10,1	-33,2	3,0	-3,4	-21,7	9,3	3,5	-3,1	-0,4	1,9	0,8	-0,3	0,1	-2,7	0,7	1,7	0,2	3,7	1,2	0,8	8,6	-5,5	5,5	11,1	4,5	-31,3	1,9
H-T-i-data	186,5	-20,7	3,0	-10,1	-13,5	11,8	-0,4	1,5	-1,2	-2,6	-1,6	1,0	-0,1	1,0	-1,0	-0,8	0,4	-7,9	-1,6	-1,2	1,6	-0,2	5,7	3,1	3,5	-21,7	1,0
H-T-i-eko	142,4	-47,1	3,0	-12,0	-16,2	12,0	2,9	-3,1	0,3	2,1	-4,2	7,3	-3,6	2,9	-2,5	-0,6	-0,5	14,4	5,9	-1,6	12,0	3,0	17,1	5,9	8,6	-40,5	7,7
H-T-i-en-eltek	108,8	-25,8	3,0	-7,3	-18,3	9,1	5,3	-5,2	-0,1	4,3	-4,4	5,7	-1,0	1,2	-1,2	-1,0	-0,6	-4,4	4,7	-0,3	6,1	-2,9	5,3	9,5	3,1	-34,8	6,1
H-T-ing-ma	145,1	-26,8	3,0	-10,2	-8,6	6,1	1,5	-1,5	0,0	0,1	-2,5	2,2	-0,8	1,0	0,7	-2,2	0,5	-6,8	-1,3	-0,2	5,3	-13,5	6,7	7,5	5,0	-24,1	4,1
U-N-bio	37,3	-4,0	K	-4,5	-2,6	3,4	-0,2	-3,5	3,6	3,4	-4,3	4,4	-5,8	0,9	-2,9	-2,4	0,4	2,5	-8,3	0,3	3,3	-20,9	2,0	-4,4	5,7	-6,3	6,9
U-N-data-all	-50,6	-15,7	K	-7,7	-21,2	4,7	2,6	-2,6	0,0	0,5	6,1	-2,0	9,2	-2,9	3,7	-4,7	10,9	0,6	-13,7	18,4	-0,8	-8,1	-11,9	3,2	6,8	-8,3	3,5
U-N-data-sys	46,6	-17,8	4,0	-7,4	-15,1	9,6	-1,6	0,7	0,8	-2,1	-3,6	1,4	0,8	-0,5	-0,1	-1,1	7,6	3,0	-6,6	13,6	0,1	-1,8	-10,5	-4,2	11,1	-7,9	3,7
U-N-data	34,4	-0,7	K	-6,2	0,2	2,3	2,0	-6,1	4,1	4,0	-3,1	2,5	2,2	-2,2	2,9	-4,4	3,5	0,3	-10,9	3,7	1,5	-25,4	3,3	6,7	2,4	-15,9	3,7
U-N-fysik	15,9	-7,9	K	-3,1	-0,7	2,0	2,9	-3,0	0,2	0,6	-2,6	3,7	-0,4	0,0	1,6	-0,5	4,8	3,5	-12,3	2,1	3,5	-21,7	2,6	2,6	4,2	-16,4	1,3
U-N-geo	9,0	-3,6	K	-7,6	-11,1	2,5	-0,2	-0,4	0,6	-1,3	-2,5	2,7	-4,2	-2,1	-1,1	-2,0	0,5	-0,2	-11,7	-0,1	0,4	-18,4	0,3	1,4	4,0	-9,3	2,6
U-N-kemi	23,8	-2,4	K	-4,9	-6,5	5,0	1,1	-3,7	2,6	3,1	-5,2	2,8	-4,2	-0,8	-2,1	-1,7	1,9	2,8	-2,7	-0,6	5,1	-15,1	2,7	1,0	5,6	-13,2	6,0
U-N-mat-stat	26,3	-7,6	K	-6,5	-5,0	3,0	2,7	-3,4	0,6	1,6	-5,3	3,5	-2,3	-0,9	0,1	-0,9	4,8	-0,3	-12,1	1,0	7,0	-8,0	-2,6	0,3	6,7	-5,6	3,3
U-N-mat-öv	90,4	-42,4	K	-14,4	-7,6	4,1	-1,4	1,7	-0,4	-1,6	-8,3	7,8	-7,6	0,7	-2,3	-2,3	-0,3	6,1	-6,0	-1,5	5,6	-12,2	6,4	-13,4	11,2	-16,9	-1,7
U-N-mat	-40,0	8,6	K	-1,7	-5,4	3,6	2,9	-5,6	2,7	4,0	-2,2	2,2	0,5	-0,5	1,3	-3,1	2,3	4,7	-3,1	4,2	3,2	-10,1	5,3	5,3	3,0	-17,0	4,9
U-PL-1-7-ma	1,0	-7,3	4,0	-3,3	-7,4	-0,1	0,8	-1,2	0,3	-0,5	-1,7	3,4	-1,8	-0,2	0,2	-5,6	0,5	5,1	-7,0	-0,7	19,6	-16,9	10,6	-20,8	18,5	-16,2	3,8
U-PL-4-9-ma	-1,8	-11,6	4,0	-2,3	-18,8	10,7	1,6	-1,6	0,0	0,2	-6,2	6,5	-6,0	-1,2	-0,2	-0,7	-0,7	5,8	-1,8	0,8	11,9	-18,2	6,0	-7,5	7,1	-10,9	7,6
U-PL-gy-ma	115,3	9,7	4,0	-5,8	-3,3	1,7	5,9	-6,3	0,5	4,7	-5,6	11,5	-8,8	0,7	-0,1	-4,7	-5,9	7,6	-9,6	-7,4	10,5	-14,7	5,0	0,4	3,9	-12,1	1,7
U-T-ci-bygg	5,9	-19,6	4,0	-3,4	1,5	1,1	0,4	-0,5	0,1	-1,0	-3,0	2,9	-3,3	-0,5	-1,3	-3,4	-2,5	3,5	-8,9	-3,3	6,9	-23,3	0,4	6,0	2,5	-9,7	1,1
U-T-ci-eko	17,6	-17,0	4,0	-5,3	11,6	2,4	0,5	-0,2	-0,3	0,1	2,9	0,8	3,4	-1,6	7,1	-1,3	0,5	1,0	-10,6	-1,7	2,2	-29,8	3,3	9,3	2,3	-14,0	1,8
U-T-ci-el	26,8	-18,2	4,0	-7,4	9,9	1,2	-1,1	1,5	-0,4	-1,4	0,4	0,6	4,4	-2,7	2,7	-4,7	6,0	1,3	-9,2	3,6	0,2	-23,3	2,3	8,1	1,9	-16,8	-0,3
U-T-ci-en	-7,0	-20,1	4,0	-3,0	10,4	1,1	0,9	-0,6	-0,3	-0,6	-2,1	2,3	0,5	-2,6	0,2	-2,0	-4,8	1,1	-10,5	-2,8	0,3	-22,6	1,8	8,8	0,9	-14,9	-1,5
U-T-ci-kemi	55,4	-22,5	4,0	-3,4	4,0	0,9	-0,7	0,7	0,0	-1,2	-4,2	1,6	-2,5	-1,0	-2,1	-1,4	5,9	1,0	-7,3	2,5	0,9	-25,2	1,6	6,4	3,0	-12,6	-2,0
U-T-ci-lant	13,4	19,0	4,0	-2,9	4,1	-2,1	-0,2	0,3	0,0	-2,5	-8,4	1,8	-0,9	-0,8	0,5	-3,4	-1,1	2,2	-16,9	-6,6	4,9	-20,8	1,3	6,7	-0,9	-3,1	-3,8
U-T-ci-ma	-6,1	-28,6	4,0	-2,7	7,0	1,4	-0,7	0,8	-0,1	-1,0	-4,3	2,1	-1,7	-1,8	-0,3	-3,4	-1,0	3,1	-9,9	-1,5	4,6	-26,6	1,9	4,8	2,2	-11,5	-0,2
U-T-ci-sam-ark	0,8	-11,2	4,0	-2,5	10,5	-2,2	-1,6	2,6	-1,0	-4,7	-6,1	1,8	-6,1	0,8	1,7	-1,4	-19,7	3,5	-34,4	-5,7	2,6	-27,8	1,8	-0,7	4,6	-5,4	-8,3
U-T-ci-sam	27,6	-52,4	4,0	-1,6	0,5	3,2	0,6	-3,2	2,6	1,9	-5,7	6,7	-7,3	1,1	-4,5	-1,3	-5,6	4,0	-4,0	-2,0	9,6	-25,3	3,5	3,1	1,1	-8,2	3,2
U-T-ci-tf	15,7	-34,5	4,0	-4,9	5,5	0,5	0,2	-0,1	-0,1	-0,5	-4,1	1,2	-1,0	-1,7	0,9	-1,9	-1,4	1,6	-10,0	-6,2	0,6	-24,8	1,5	4,3	1,2	-7,9	-0,7
U-T-i-bygg	-17,8	-14,3	3,0	0,5	-24,0	10,8	6,7	-6,6	-0,1	4,5	-7,1	5,7	-4,4	0,8	-5,3	2,0	3,2	11,9	6,7	2,6	6,6	-6,1	3,5	14,3	2,9	-30,7	8,9
U-T-i-data	666,3	-10,4	3,0	-12,1	-20,1	15,2	5,2	-5,3	0,1	4,0	0,9	-3,6	6,0	-0,4	3,6	5,9	1,6	-4,0	7,0	5,8	0,2	0,8	5,6	12,3	4,8	-28,8	11,8
U-T-i-en-eltek	29,6	-18,4	3,0	-4,0	-21,6	10,8	6,4	-6,0	-0,4	4,8	-2,5	3,3	0,8	0,3	0,3	1,3	0,2	-1,2	5,6	1,0	1,7	-10,2	4,3	14,5	3,8	-38,6	7,6
U-T-i-kemi	81,4	-43,6	3,0	-2,8	-24,7	11,1	5,0	-5,2	0,2	5,9	-5,9	-0,4	-2,7	-0,8	-0,2	4,7	0,4	-7,9	8,9	1,5	-2,4	-3,9	8,2	26,0	9,5	-55,1	7,5
U-T-ing-ma	54,8	-25,3	3,0	-4,9	-15,6	7,5	2,8	-3,0	0,1	2,3	-2,4	2,7	1,8	-0,9	-1,5	-0,6	0,5	1,9	2,3	1,0	3,5	-11,9	4,1	13,7	3,3	-30,7	2,9

Table 12. Classification of Social Groups, 33 Groups Level, and Socio-economic groups.

Social class	Occupational Category	N	Senior salaried employees	Intermediate-level non-manual employees	Lower-level non-manual employees	Self-employed entrepreneurs	Farmers	Skilled workers	Unskilled and semi-skilled workers	Others	Total
1. Upper class	1. Engineers	2 708	100,0								100,0
	2. Physicians	1 762	99,6			0,4					100,0
	3. University teachers	683	96,3	0,6		3,1					100,0
	4. Subject teachers	2 542	96,7	2,0		1,3					100,0
	5. Lawyers	346	99,7			0,3					100,0
	6. Senior civil servants	2 179	100,0								100,0
	7. Private senior administrators	4 062	100,0								100,0
	8. Military officers	2 173	100,0								100,0
	9. Executive managers	250	99,2			0,8					100,0
2. Middle class	10. Art producers	954	25,4	21,0	30,0	16,1		7,5			100,0
	11. Journalists	510	35,3	59,0	1,0	4,7					100,0
	12. Public technicians	1 760		86,1	13,2			0,4	0,2		100,0
	13. Private technicians	8 309		87,5	7,9	2,4		1,8	0,3		100,0
	14. Public mid-level administrators	1 038		100,0							100,0
	15. Private mid-level administrators	4 122		92,5		7,5					100,0
	16. Class teachers	4 224	8,4	84,7	4,4	1,8		0,0	0,7		100,0
	17. Medical and health professions	6 734	8,1	38,6	7,1	2,0		44,0	0,1		100,0
3. Lower middle class	18. Public administration, clerks	2 799			98,6				1,4		100,0
	19. Private administration, clerks	4 049			99,6				0,4		100,0
	20. Clerks (commerce)	3 621			59,3			1,2	39,4		100,0
	21. Farm owners	2 459		3,5	4,6	8,1	83,7				100,0
	22. Small entrepreneurs	3 073				100,0					100,0
	23. Merchants and tradesmen	1 547				100,0					100,0
	24. Policemen	1 446		52,5	36,4				11,1		100,0
4. Skilled workers	25. Foremen	1 441			100,0						100,0
(Upper working class)	26. Skilled workers in production	9 930						100,0			100,0
	27. Skilled workers in service	618						100,0			100,0
5. Unskilled workers	28. Farm workers	746						16,2	83,8		100,0
(Lower working class)	29. Semi-skilled workers in production	8 535							100,0		100,0
	30. Semi-skilled workers in service	5 848							100,0		100,0
	31. Others	1 526								100,0	100,0
6 o 7. Missing	32. Missing (Internal)	3 698								100,0	100,0
	33. Missing (External)	14 969								100,0	100,0
Total		110 661	16,2	19,2	11,6	5,2	1,9	12,6	15,1	18,2	100,0

Graphic 3. The Field of Higher Education in Sweden, the autumn 1998, 33 Social Groups Divided by Sex and 1,388 Educational Programmes/Courses.



Active variables:

▼ Social groups (here divided by the students' sex).

● Educational programmes/courses by institution of higher learning.

The size of the triangles and circles is proportional to the contribution value.

Supplementary variables:

◁ Total annual income of the parents.

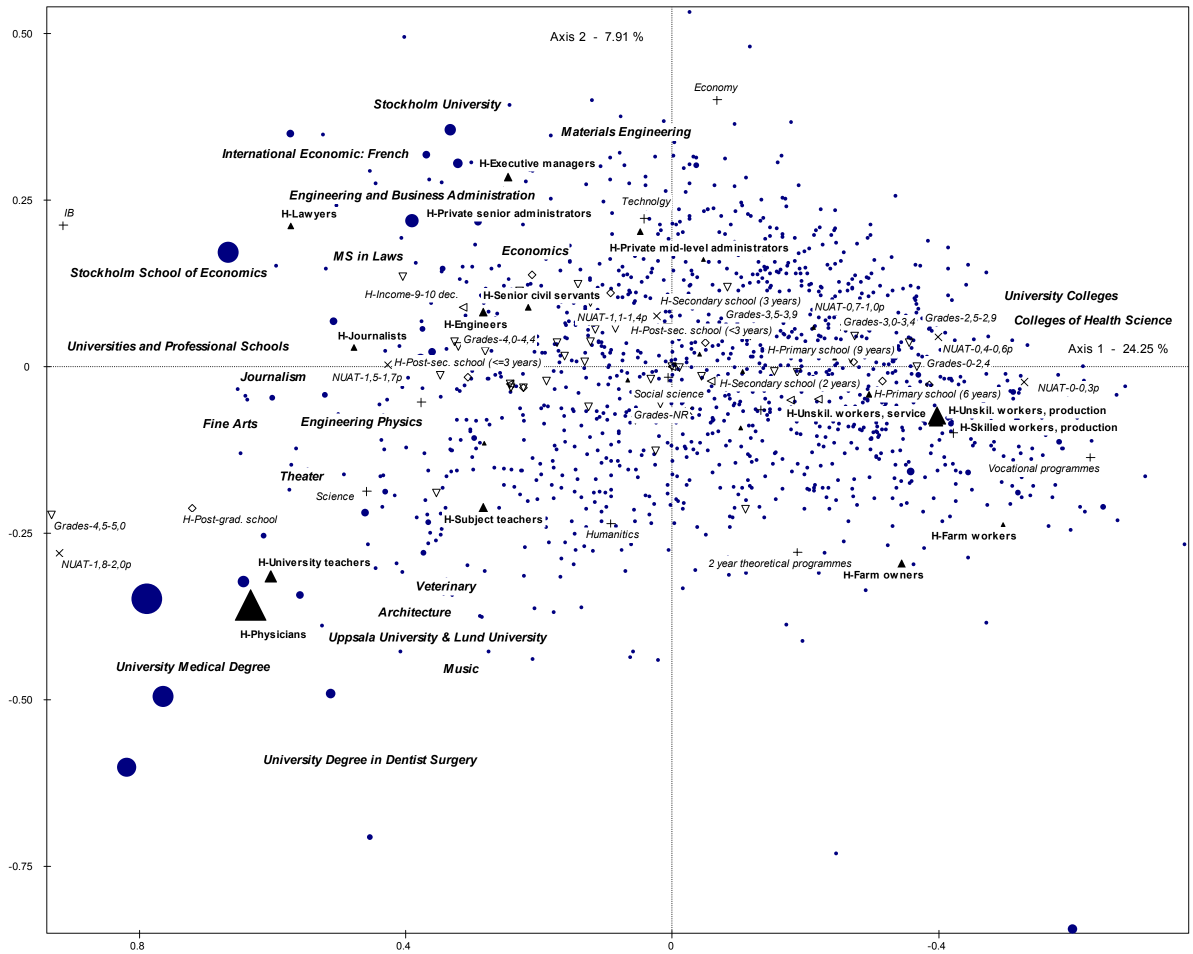
◊ Highest level of education for parents.

┼ Upper secondary education.

X Scores at the national university aptitude test.

, Grades from upper secondary school.

Graphic 4. The Field of Higher Education in Sweden, the autumn 1998, 33 Social Groups and 1,388 Educational Programmes/Courses.



Active variables:

▼ Social groups.

● Educational programmes/courses by institution of higher learning.

The size of the triangles and circles is proportional to the contribution value.

Supplementary variables:

◁ Total annual income of the parents.

◊ Highest level of education for parents.

┼ Upper secondary education.

X Scores at the national university aptitude test.

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