Computing Education in Sweden: Unequal Participation in a Changing Field

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Abstract

This position paper explores unequal participation in computing education within Sweden, offering a comprehensive analysis across multiple educational levels and institutional contexts. Drawing on national data and case studies, the paper examines participation trends in high school study programmes, higher education fields, and at Uppsala University, one of Sweden's leading institutions. The discussion addresses ambiguities in the definitions of "computing," "ICT," and "digital competency" and how this impacts the development of computing education in Sweden and beyond. We identify key factors shaping participation, including gender disparities, family background, and programme-specific barriers, and situate these findings within the broader evolution of the field. While this work is in its early stages, it aims to provide valuable insights for educators, policymakers, and researchers to address inequalities and foster inclusive computing education in a rapidly changing digital landscape.

CCS Concepts

• **Social and professional topics** → **Computing education**.

Keywords

Computing education; broadening participation; field theory

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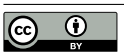
1 Introduction

Digitalisation in Sweden, and the education needed to support that, has been an ongoing discussion in light of becoming "the best in the world in exploiting the opportunities of digitalisation" [17]. In 2014, a report published by the digitalisation committee highlighted the importance of strengthening digital competencies within the national curricula [5]. One specific recommendation was to integrate programming as a cross-disciplinary component within existing subjects. In 2015, the Swedish National Agency for Education (*Skolverket*) was tasked with updating the national school curriculum to strengthen digital competency among young people and to introduce programming from a young age [7]. These discussions stemmed from societal trends in which digital competency was seen as a prerequisite for being an active part of a democratic society [28], as well as differences in digital habits and competencies based on gender, ethnicity, demographics, and socioeconomic background [6]. The Swedish government thus viewed the digital divide as an inequality issue, one which had to be addressed through a new IT strategy:

> Digital competence is basically a matter of democracy. In school, we learn to understand the world in order to change it. All children and students need to understand how digitalisation affects the world and our lives, how programming controls both the flow of information we reach and the tools we use, as well as gaining knowledge about how technology works to be able to apply it ourselves [26, translation].

As mentioned by Tamborg [26], there were other factors at play here. Programming was already an aspect of one of the study programmes in high school (*gymnasiet*), as a reaction to a strong pressure from the IT industry [29]. This pressure emerged from a 2012 report highlighting the shortage of computing professionals and recommended programming as part of the curriculum [9]. Other reports were critical of the level of technology use in schools, as well as teachers' technical competencies [23]. In addition, the European Schoolnet [22] found Sweden to be behind in terms of implementing programming in schools. Since 2018, a revised national curriculum for primary education has been in effect in Sweden which describes digital competence as follows: a) to understand the impact of digitalisation on human society; b) to be able to use and comprehend digital tools and media; c) to adopt a critical and responsible attitude to change; d) to be able to solve problems and implement theoretical solutions in practice [16]. The implementation of this curriculum was not to view digital competency as a separate subject, but rather to integrate it into existing school subjects such as mathematics and technology.

Yet, it remains unclear how effective these policies have been for widening participation in the field of computing. Since the policy took effect in 2018, first-year university students will have completed some parts of this education, providing real opportunities to study the transition to higher computing education using register-based data. The goals of this position paper are thus twofold. The first is to situate these revised curriculum changes within larger participation trends in the Swedish computing education field. With this context in mind, a research project is proposed



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which utilises register-based data to better understand the transition from high school to computing higher education, and the socioeconomic factors which influence that transition. Ultimately, the goal is to broaden participation in computing, by developing an understanding of who participates in the field, and how this is affected by educational trajectories and socioeconomic context.

1.1 Computing, Information Technology or Digital Competency?

A point of contention between policy makers and researchers alike is the use of terminology with regards to the description of the computing field, both from a national and international perspective. This is further complicated in the context of Sweden, where digital competency is not considered a standalone subject in primary schools, but is rather integrated into existing school subjects. At the high school level, most computing-related courses are offered in the Natural Science and Technology study programmes, including courses such as Programming and Artificial Intelligence. In higher education, the Swedish government is guided by the SUN classification, which groups higher education programmes in computing as Information- and Communication Technology (ICT). A term coined and popularised in the 1980s, ICT focuses on anything from telecommunications, such as telephone lines and wireless signals, to computers and their software [15]. The ICT umbrella term has been criticised for being outdated and for having negative associations, leading to some countries to adopt the term computing instead, referring to the use of or operation of a computer. England, for example, is widely acknowledged as playing a leading (if not initiating) role in the global resurgence of policy interest in coding in schools, not least as the first country in the world to formalise computing and programming in its curriculum for schools in 2013 [29]. Applying this terminology of computing to the Swedish educational system, the field of computing education can be understood as the digital competency curriculum in primary school, the computing courses offered at the high school level, and the higher education programmes which traditionally fall under ICT.

2 Field Theory

As this position paper sets out to understand the computing education field in the Swedish context, it is important to highlight ongoing discussions within field theory and how it relates to participation of students. According to Bourdieu, a field is a structured social space where power dynamics and competition for resources shape participation [2]. Bourdieu likened the idea of a social field to that of a football field, where the field is occupied by players, who then follow rules and position themselves strategically within the confounds of the field. The game that is played is competitive, with agents using strategies to maintain or improve their positioning. In education settings, the field involves the structures, principles, and values of the classroom, for example, the expected ways of behaving, norms of interactions, and discourses [10]. A prerequisite for playing the game is one's *capital* – legitimate, valuable and exchangeable resources that individuals use to generate social advantage [3]. Forms of capital include economic, social, and cultural capital, all of which have been found to relate to educational participation in various ways. Economic capital, for example, affords private education or tutoring, but also digital technology needed for computing. Social capital is about who you know, and the influence these people have on an individuals' life trajectory. Cultural capital can be understood as educational qualifications, dispositions, knowledge, and skills. From a social reproduction perspective, it is important to study fields and capital as they maintain educational inequality [11]. That is, through participation of a select demographic who know how to play the game, others are unable to participate or may feel that the field is not for them. Within computing education, a dominant class has been identified, consisting of students who possess knowledge and skills related to computing, as well as positive views and dispositions towards the discipline that aligns with their future goals [10, 12]. These students and teachers also share a common language and discourse related to computing, and a specific style of communication and interaction with their peers of the same position and with their teachers. Field theory therefore offers a powerful lens for analysing the structured inequalities within society. What follows below is an analysis of the computing education field in Sweden at each educational level, aiming to understand how computing education is both envisioned and implemented, and the unequal participation of students at each level.

3 Participation in the Swedish computing education field

Since 2018, each student at the primary school level (age 7 – 15) is required to participate in the digital competency curriculum [28]. However, it should be noted that these curriculum revisions took effect before the required teaching training, with many teachers indicating uncertainty about their ability to teach the curriculum [13]. In addition, as has been pointed out by Yang Hansen & Gustafsson [30], school choice and residential segregation in Sweden lead to differences in educational provision, with privileged students being able to participate in higher quality schooling. That is to say, while everyone is supposed to participate in the digital competency curriculum, the experience of this education is varied, and so are the learning outcomes among the students.

3.1 High school participation by study programme

Around the age of 16, students advance to the high school level of education, where they choose their study programmes. The Swedish high school system can roughly be grouped in two categories of education provision, namely vocational education (*yrkesprogram*) and university preparatory education (*högskoleförberedande program*). Generally speaking, high school students transition to higher education through the university preparatory education, however, they may also complete courses in adult education (*komvux*) first, or complete a base year (*basår*) at university. In order to understand the transition from high school to higher education in computing, it is important to consider the high school study programmes which offer a wider variety of courses in computer science and mathematics, as this can be a requirement for computing programmes

Table 1: Applicants to high school study programmes with at least one parent who completed higher education (HE), 2024 [24]

	Total	% Parents' HE
High school	131 423	
Vocational education	**49 716**	**29.0**
University prepatory education	**81 707**	**56.0**
Economy	24 913	54.5
Aesthetic	6 972	55.4
Humanistic	543	67.8
Natural Science	**15 686**	**66.5**
Social Science	23 269	50.9
Technology	**9 339**	**55.5**
International Baccalaureate	985	52.8

Table 2: Applicants to high school by study programme and gender, 2024 [24]

	Total	% Female applicants
High school	131 423	48.5
Vocational education	**49 716**	**42.5**
University preparatory education	**81 707**	**52.2**
Economy	24 913	**44.9**
Aesthetics	6 972	66.7
Humanities	543	82.5
Natural Science	**15 686**	**55.2**
Social Science	23 269	**66.8**
Technology	**9 339**	**17.6**
International Baccalaureate	985	**54.1**

in higher education. For example, students applying for the Bachelor's degree in Computer Science at Uppsala University need to have completed the Mathematics 4 course, which is by default only offered by Natural Science or Technology study programmes. What follows below are some general statistics on students enrolling in these study programmes, and factors influencing participation.

As can be seen in Table 1, The Natural Science and Technology study programmes observed 15,686 and 9,339 applications in 2024, falling behind the largest study programmes of Social Science (23,269) and Economy (24,913). Of these applicants, 65.5% of Natural Science and 55.5% of Technology students had at least one parent who completed higher education. This is similar to other high school study programmes, where the average is at 56% as compared to vocational education where the average is 29%. Thus, a point of departure for understanding participation in university preparatory education is to consider the higher education background of the family, although it should be noted that this affects high school participation in general, rather than specific study programmes. From a gender perspective, the differences between study programmes are more noticeable: the Technology programme is characterised by a strong overrepresentation of men, with only 17.6% female applicants in 2024, while the Natural Science programme sees a slight overrepresentation of women (55.2%). However, worth mentioning is that the Natural Science programme also prepares students for subjects such as biology and chemistry, which have traditionally been characterised by having more female students in higher education [27]. The highest percentage of women applicants can be found in the Aesthetics (66.7%) and Humanities study programmes (82.5%).

The numbers provided here give a general overview of high school participation in Sweden, yet it is unclear how many of these students transition to computing higher education. While the study programmes of Natural Science and Technology generally prepare students for a higher education in computing, there are different paths to study a computing-related programme at university, for example through adult education or completing a base year at university. It is also acknowledged that the study programmes of Natural Science and Technology students prepare students to study a wide variety of subjects at university, not only limited to computing, making it difficult to infer meaningful insights into the transition to computing higher education based on data from these study programmes alone.

3.2 Higher education participation by field of study

The higher education system in Sweden follows the Bologna process and can be divided into postgraduate education at the doctoral level and undergraduate education at the Bachelor's and Master's level. Without prior higher education, students can apply for the Higher Education Diploma (*Högskoleexamen*, 120 ECT), the Degree of Bachelor (*Kandidatexamen*, 180 ECT), and the Professional Degree (*Yrkesexamina*, 3-5 years). While both the Higher Education Diploma and Degree of Bachelor are offered through a variety of programmes in computing, the Professional Degree is unique as it prepares students for a certain profession. For aspiring computing professionals, this means that they usually complete a Civil Engineering degree (*Civilingenjörsexamen*) with a focus on Information Technology or other computing-related field. In Sweden, computing-related degrees, such as computer science and information technology, fall under the broader umbrella term of ICT, according to the SUN classification [20].

As can be seen in Figure 1, admissions to the field of Natural science, maths, and ICT fall significantly behind other fields. While an uptake in admissions can be observed between 1998 and 2024, general admissions to higher education has also increased during this period. Within the field of Natural science, maths and ICT, most students are admitted to ICT higher education, as visualised in Figure 2. Over the years, the number of admissions has increased significantly (+261%), from 2606 admissions in 1998 to 6809 admissions in 2024. While a gender imbalance among the students can be observed, this seems to be improving, with the lowest percentage of women admissions observed between 2004-2006 (18%), up to 39% in 2024. This data includes both admissions for the engineering programmes and non-engineering programmes.

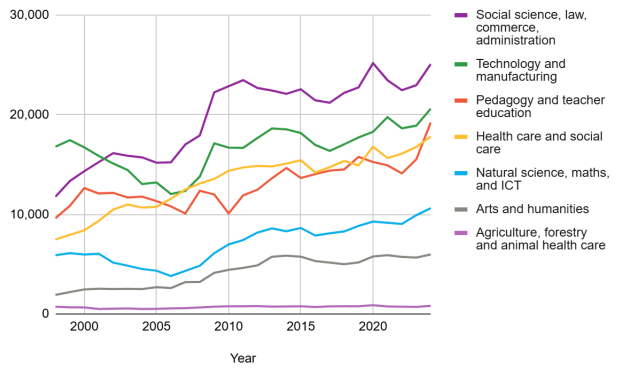

Figure 1: Admissions to higher education by field, 1998-2024 [21]

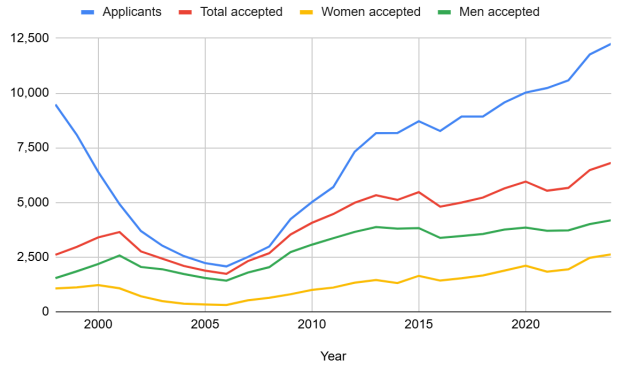

Figure 2: Admissions to ICT higher education by gender, 1998-2024 [21]

Focusing on engineering programmes only, men outnumber women significantly (including in computing-related subjects), with only 25% women admitted to the Degree of Bachelor of Science in Engineering in 2022 [27]. However, the gender gap deviates significantly from one specialisation to the next. At the Master's level, among the five largest fields it was only in chemical technology and biotechnology that women outnumbered men. The percentage of women was lowest in electronics, computer engineering and automation, in which 21 percent of admitted students were women in the autumn semester of 2022 and 79 percent men.

3.3 Institution-specific participation: Uppsala University

At the institutional level, a large social bias in recruitment for computing programmes at Uppsala University can be observed, as can be seen in Table 3. The five-year Civil Engineering degree in Information Technology recruits students who are more likely to come from academic families and have obtained excellent grades in high school, while showing a strong underrepresentation of women. Even fewer women participate in the Bachelor degree of Computer Science, yet the high school grades are closer to the national average. Students in this programme are still more likely to have one or more parents who completed higher education as compared to the national average. Although admission rates by socioeconomic background vary from one institution to the next, the data from Uppsala University reflect a more general trend: participation in computing higher education is imbalanced and does not represent the general population.

3.4 Factors influencing educational participation

In Sweden, it has been well documented how socioeconomic and demographic variables influence participation both at the high school and higher education level [27]. As mentioned, the level of parents' education plays an important role in the individual's pursuit of higher education: 81% of people who have at least one parent who completed higher education go on to pursue higher education themselves. While women are more likely to transition to higher education, this varies across study programmes and type of degree. Men are more likely to be presented in Engineering degrees, with the effect being stronger for fields such as computer science and information technology. The Swedish Higher Education Authority [27] also notes that higher education institutions experience difficulty recruiting students from a wider variety of backgrounds: those people with good high school grades and a university preparatory education are already transitioning to higher education, irrespective of social background. At the same time, young people coming from non-academic homes are more likely to choose vocational education. In addition, Statistics Sweden [19] notes a large difference in education level between those living in large cities or municipalities close to large cities, as compared to those living in more rural areas.

Table 3: Enrolment data in computing programmes at Uppsala University, 2020-2022 [8]

Programme	High school grades 17.5+	Parent completed HE	Full Swedish background	Women
Civil Engineering - Information Technology	84.3	72.5	4.1	-58.7
MSc. Computer Science	54.5	62.0	-41.0	-55.5
BSc. Computer Science	-2.2	44.6	-3.2	-73.2

Note: The percentage over- or under-representation indicates how many percent higher or lower the percentage is compared to the average among people born in 1988–2003 who at some point studied at university level.

4 Reproduction or Transformation? Implications of Curriculum Revisions

Over the last few decades, inequality in Sweden has widened [18], with educational institutions and study programmes playing a significant role in exacerbating socioeconomic differences. Studies show how parents' opportunities to choose between different types of schools contribute to a school segregation in addition to the existing housing segregation in preschool [1], primary school [30] and high school [25]. The influence of family extends beyond school choice to study programme in high school and university, referring to what some call the family spillover effect [4]. This implies that having a family member who went to university and studied a particular subject increases the likelihood of an individual pursuing higher education studies, with an added effect for the subject choice. This becomes particularly important for fields like computing, which has traditionally been characterised by low levels of participation and diversity among its student population [14]. In this sense, computing education can be said to exacerbate existing inequalities in society through the participation of a select demographic.

Yet, it should be noted that the computing education field varies by country, and so does the student participation and diversity thereof. An added layer of complexity has been the lack of agreement on the scope of the computing field, ranging from outdated terms such as ICT to terms increasing rapidly in popularity like Artificial Intelligence. While some countries, like the United Kingdom, managed to develop a stand-alone computing subject in high school, other countries, like Sweden, choose to integrate the course content within other subjects. This position paper thus underscores the importance of clarifying definitions and expectations around "computing," "ICT," and "digital competency," as these conceptualisations influence educational policies and student participation. In light of this, the findings presented here show how computing education in Sweden is envisioned through the lens of digital competency at the primary school level, and how computing education provision is varied at both the high school and higher education level. Further to this, enrolment data at each level reveal an unequal participation in computing education, influenced by variables such as gender and parents' educational level.

The Swedish government's push for mandatory computing education aims to democratise access to digital skills and to prepare for a future workforce. However, within the framework of Bourdieu's theory, it remains crucial to ask whether these efforts genuinely disrupt existing inequalities or inadvertently reinforce them. For example, while the revised curriculum promotes digital competency, its impact may be limited if disparities in cultural and economic capital persist.

5 Future work

The Swedish government has made it clear that digitalisation is the path to the future and that people from all walks of life should be represented, for example through a mandatory computing education starting in primary school [28]. Yet, it remains unclear how effective these curriculum revisions have been for widening participation in the field of computing. Since the curriculum revision was initiated in 2018, there are now real opportunities to study the transition to higher computing education using register-based data. This position paper forms the background to a larger study on the transition from high school to computing higher education and how this is mediated through high school study programmes and socioeconomic context. Departing from a population study of all higher education applicants between 2014–2024 in Sweden, the project focuses on three analytical levels - individual, family, and high school. The project's aim is accomplished by analysing register-based data of higher education applicants and identifying the relationship between high school study programme and individual's social and economic contexts, and the association these contexts have with transitioning to computing higher education. Anticipated results will inform stakeholders on how participation in computing higher education varies across educational institutions, and how it is connected in terms of supply – institution composition, achievement and competition – and demand – young people with varied educational trajectories and life opportunities. These insights aim to inform educators, policymakers, and stakeholders on strategies to create a more equitable and representative computing education landscape in Sweden and beyond.

6 Conclusion

This position paper highlights critical disparities in participation within Sweden's computing education field, emphasising the complex interplay of institutional and socioeconomic factors. By examining trends across high school study programmes, higher education fields, and specific institutional contexts like Uppsala University, we provide a nuanced understanding of the barriers and opportunities shaping access to computing education. Additionally, persistent gender imbalances and socioeconomic inequalities require targeted interventions to foster inclusive participation in this rapidly evolving field. Looking forward, the Swedish government's emphasis on digitalisation and the recent revisions to the national curriculum present a unique opportunity to evaluate the long-term impacts of these changes. Future research, including our planned population study of higher education applicants between 2014–2024, will delve into the transition from high school to computing higher education, examining how study programmes and socioeconomic contexts mediate this process.

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