Programming in Secondary Schools in Norway – a Wasted Opportunity for Inclusion

Hilde G. Corneliussen
Western Norway Research Institute
Sogndal, Norway
hgc@vestforsk.no

Fay Tveranger
University of Bergen
Bergen, Norway
fay.tveranger@gmail.com

ABSTRACT

This paper discusses a pilot introducing programming as an elective in Norwegian secondary schools. Computing is a male dominated field, in Norway as in other European and Western countries. Despite the male dominance in the field, there were no gender inclusion or diversity measures included in the pilot. The result is an elective heavily dominated by boys and a wasted chance of attracting girls to computing.

CCS CONCEPTS

• **Social and professional topics** → Computing education → K-12 education; Computational thinking; Computing literacy

KEYWORDS

Programming, ICT, children, gender, diversity

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1 INTRODUCTION

Norway is one of the best countries in the world in terms of gender equality, ranked as number three by The Global Gender Gap Report 2016 [65]. The same is not the case when it comes to technology, computing and programming. While 60% of the students entering higher education are women, only slightly more than 20% of the students in technology are women, and even less – between 5 and 10% – aiming for programming (Higher education statistics [Samordna opptak], 2017). During

the 1990s, when we still had a gender gap in terms of access to ICT, we often heard that if only girls can get their hands on technology, they will find it interesting enough to also choose an IT education [31]. There is no gender gap in terms of access to ICT among children and youth in Norway anymore. About 100% of teenagers have access to a home computer and internet, and more than 95% have access to a Smartphone [62], and they are heavy users of digital media platforms [22]. Digital competence has been formally integrated in Norwegian schools through national curriculum since 2006, when the category “digital skills” was introduced as the fifth “basic skill”, alongside oral skills, reading, writing, and numeracy [59]. Growing up with digital technology does, however, not guarantee digital competence. Youth as well as adults in Norway have been found to lag behind the average EU level in ICT skills [49]. While the national curriculum emphasises digital competences as communication, presentation, and use of technology, it puts less emphasise on knowledge about how digital tools work, even less on how to produce or program them. Simultaneously, we find a worldwide trend that has grown over the last decade, of voluntary groups teaching children and youth basic coding or programming skills. Although the interest in teaching children programming is not new [60], this recent movement reflects a concern that advanced digital competence is not taught at school in a society increasingly relying on ICT, together with a growing need to recruit young people to computing [19]. This trend reached Norway at the same time as it spread to many other European countries around 2013 [38]. Since then, local volunteer-driven code clubs have appeared across Norway [54]. This wave of programming involved a political pressure, with parents, enthusiasts, professionals and interest groups for the ICT industry, campaigning for the introduction of programming in elementary school. Or “coding”, used as a synonym to programming, reflected in the names of organisations like Code.org, the Code Club, Girls Who Code, among others. It has been suggested that “coding” is used to make it less dangerous [54], or perhaps just to make it less like work and more like play.

1.1 Why should programming be inclusive?

There are different opinions about implementing coding or programming in school. Negative voices claim for instance that children are not able to understand the abstract principles behind programming [1, 2]. Enthusiastic voices also exist, stating the crucial importance of programming. Or even warning against not learning it, as Rushkoff, suggesting that our choice is to

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Program, or Be Programmed [53]. Others again have emphasized that learning to program amounts to learning the language of the future, seeing it as a key to mastering and controlling technology, and Steve Jobs' often quoted words, "Everyone should learn to program a computer ... because it teaches you how to think" [38]. Programming is frequently mentioned as a vital skill for the 21st Century [25, 54] with champions emphasising the value for the future, like EU Code Week 2014: "Five-years-olds learn coding in schools to prepare for future labour market" (<http://bit.ly/1VSLEAb>). The organisers of the Code Week are not alone in articulating a discourse in which coding is constructed as important for children's participation and future opportunities in society. A recent study of a code club in Norway asked "what is the importance of coding for children?" [19] Having fun and playing with technology was a major motivation for the code club instructors and participating children. However, this study also documented parents', volunteers' and teachers' perceptions of coding as an important competence, together with criticism towards the lack of IT education in school for a generation described by the parents as "completely surrounded by IT [their] every waking moment" [19]. For the code club instructors, this was not only a matter of *not* learning how *technology works* – they compared it to *not learning how society works*. Corneliussen and Prøitz conclude that "what is at stake at the Code Club is 'digital competence' seen as a tool for success, power and empowerment in society".

A key challenge today is this: if coding or programming does indeed represent a vital competence for (future) participation and success in society, providing this competence in an inclusive manner and to all social groups should be considered a vital part of the schools' societal responsibility. Computing education has experienced a falling popularity over the last decades, in particular among girls [15, 18, 29]. The situation does not seem to be improving, either in Norway or in other Western countries. We even see a drop in the number of women in computing studies in the humanities that used to attract more women [30]. In contrast to the Western picture, certain Asian and Eastern European countries have not followed this trend and can boast a higher proportion of women in computer science [8, 50]. This leads us to conclude that there is no obvious, natural or biological reason for women being a minority in computing or for computing being associated with masculinity. Such associations are rather results of social structures and specific cultural constructions that have made it less likely for women to choose computing across most of the Western world [8, 52].

Cultural images and stereotypes have been documented as being vital in creating barriers for girls' and women's engagement in IT [5, 10], also in Norway [18]. Gendered stereotypes of computer science are found to be less prominent among girls in primary school than among older girls, and less effective among girls with some experience with IT education [12]. Studies from USA illustrate that K-12 is where the diversity problem starts. Easier access to introductory courses in computer science has resulted in more women and students from ethnic minorities to take computer science courses (<http://bit.ly/1ZY88ht>). The College Board reported that women

who had the opportunity to try out advanced computing (AP) in high school were 10 times more likely to major in computer science than other women [48]. Several studies show the importance of exposing a diverse group to the field of computing, and to let girls catch an interest in the subject before they adopt stereotypes describing computing as 'boring' or 'unfitting' for themselves [2, 20, 51].

Reasons for including girls in activities leading to coding competence, or simply to interest in IT, should be obvious: they are about 50% of the 5 years old that, according to Code Week, need to learn coding to secure their future opportunities. Others would emphasise that the youth need to learn computer programming, not only to acquire ICT skills, but also for the empowering potential of being able to control technology that has been documented by the voluntary clubs [19, 38]. Although inclusive computing education is important for the individual, there is also another angle, as Hazzan points out: "it is in the interest of the computing world, rather than in the interest of any specific underrepresented group in this community, to enhance diversity in general, and gender diversity in particular" [37]. The challenge that the Norwegian programming pilot is facing is not only to provide children with digital competence, but to do this in an inclusive manner.

2 EMPIRICAL MATERIAL

The main empirical material for this paper is a study following an 8th grade class involved in the programming pilot through the first full year of the pilot. The study includes interviews with children and a teacher, as well as participatory observation over seven months in the programming class by one of the authors [61]. A total of 18 boys and originally four girls participated in the class. One of the girls decided to quit, and the three remaining girls as well as eight boys were recruited for the study. In addition to observations and dialogues in the class, the teacher was interviewed before the first semester and on email at the end of the school year. The pupils were interviewed in groups of two to four, and with as diverse mix as possible in terms of gender and ethnic background. Because the boys were in general more vocal than the girls, two of the girls were also interviewed a second time to give them an opportunity to voice their views. The interview focused on their preconception of, and earlier experience with, programming, their experiences from the programming elective, and their thoughts and ideas on the low proportion of girls in the programming class. The interviews were transcribed and analysed with Grounded Theory techniques [9].

Also informing this paper is a survey among the 144 secondary schools participating in the pilot. The aim of the survey was to identify the gender distribution among pupils in the programming classes. After a total of 53% of the schools have answered the survey, the results are rather unambiguous, suggesting that they provide a representative picture of the situation. Finally, the annual report from the pilot made by the Norwegian Directorate for Education and Training, also provides

information, primarily about how the participating teachers experienced the pilot and the curriculum.

3 THEORETICAL APPROACH

3.1 Social construction

The theoretical approaches informing this study are from feminist research on gender and diversity, as well as from the field of Science, Technology and Society (STS), emphasizing the cultural and discursive character of participation in IT and programming. We start from a post-structural feminist approach that implies a critical perspective on knowledge that is taken-for-granted, and suggests instead to explore social practices, categories, and cultural discourses as socially constructed [43, 55]. This includes gender, which in Butler's words, "is not exactly what one 'is' nor is it precisely what one 'has'" [7]. Rather, gender is shaped by our actions, our performances, and we are "doing gender", West and Zimmerman suggest [64]. Discourses provide frameworks for individual identity, as most of us want to appear as culturally intelligible and recognizable within the majority structures. Although discourses can appear as fixed, they are constantly in flux and moving, affecting and affected by socio-cultural practices [55].

From the STS field we have learnt that "technology is never 'just' technical and society is never 'just' social" [58]. Combining this with Harding's suggestion to see gender in a symbolic, an individual and a structural level [35], we can for instance see how a majority of men in a professional field, like computing, also produces a symbolic association with men [42]. A documented effect on the individual level is that girls are less likely than boys to study computing [24, 52]. Technology fields can even appear as "in-authentic" for women to work with, Faulkner suggests [26], and the performance of a female gender identity can appear as "out of place" in a technological context [57]. Women in male dominated fields might become a "token" [40], that is, visible as women, but invisible as professional experts [26]. On the other hand, the low proportion of girls and women in technology can also become invisible simply because it mirrors the situation in other computing contexts, thus it is perceived as "normal" [19]. These examples illustrate a co-construction of gender and technology [27, 63] that not only affects individual girls and women, but also the formal structures wherein subjects like coding and programming are offered. Illustrating this, Corneliussen has documented that different perceptions of the co-construction of gender and technology also produce different solutions to the challenge of recruiting women to computing education [18]. Thus, analysing how the programming pilot develops the inclusion profile will also provide insight into how the relationship between gender and technology is being shaped in the pilot.

Studying diversity in technology involves more than a question of access to an artefact, but also access to skills, knowledge, symbolic and discursive images [56]. Gender has been formed as a differentiating category in technology across the Western world, to such a degree that Cockburn suggested

that gender and technology constitute each other, providing each other with meaning so that "technology itself cannot be fully understood without reference to gender" [13]. Ensmenger has suggested that the process of making computing a masculine field, starting in the late 1960s, involved a circular emphasise on individuals with a particular "disinterest in people" [23]. The work for inclusion and diversity in computing should not only request an increasing number of women, but of a larger diversity in people, of personalities, interests and features that are being welcomed in computing. After all, computer applications are involved in most aspects of our lives, thus it should be simple to find varied set of examples of uses and users for computer programming.

The theoretical framework with theories and insights from the fields of gender and technology and STS shape our lenses and sharpen our understanding when analysing how the culturally widespread gendering of IT as a masculine field is met in initiatives to introduce programming in secondary school.

4 THE PROGRAMMING PILOT

In February 2016, the Norwegian Directorate for Education and Training announced the three-year pilot for programming in secondary school, that would start already in August the same year. The aim of the pilot was presented as threefold: i) to increase the pupils' competence in and interest for technology, ii) to build experience with programming education in grades 8-10, and to iii) increase competence about programming among teachers. The municipalities, who are responsible for elementary schools in Norway, had to apply to become a participant in the pilot. More than 50 municipalities with nearly 140 schools were selected for the pilot, plus a handful of freestanding schools.

One of the authors followed a programming class in one of these schools through the first year of the pilot, in 2016-2017. The school, situated in a city, offered the programming class only for 8th grade this first year of the pilot. The class met once a week and was attended by 22 pupils; 18 boys and four girls. Data collecting methods consisted partly of participant observation, and partly of in-depth interviews with the teacher and children in groups of 2-4.

4.1 How do the youth perceive programming?

Programming was new at this school and the teacher did not have any prior competence in programming. The school did not have much time for preparing, however, the national pilot provided tailored advices for fresh programming teachers. Like many of his colleagues in other schools, the teacher in our school started with using the block-based programming tool, Scratch, developed by MIT Media Lab.

None of the girls in the programming class had any experience with programming before, however, four of the boys had used Scratch some years earlier when attending an afterschool code club. This reflects findings from higher education, with *some* boys having initial knowledge *before* entering education [44], however, it should not be generalised, as

the majority of the boys in this class had no previous experience with programming.

Scratch is designed as a programming tool to enable youth to work with ICT in a creative way to produce their own interactive stories and games [46], and a central activity in the programming class was to create simple games. One of the boys gives us a picture of his experience of programming as rather varied:

I think you can make it out to be really easy or really hard. It depends on what you are doing. I did a thing like that. [I] sat for two hours making a program. I did not know what I was doing at a certain point because it got too complicated. [...] so, if you are going to make something big, it is a bit limiting. It is good for using logical skills.

He illustrates that programming can be perceived as easy or hard, with small or big projects. The block-based design of Scratch does not appear to limit his feeling of learning to program, as he explains that “everything you do in Scratch, you can do in other [programming] languages as well.” Another boy also emphasized that learning Scratch was useful, saying “it is kind of easy. And you can learn from it”. One of the girls who also found it easy to learn, expressed her surprise about this, saying “I thought it would be more difficult”.

In general, the pupils found programming to be less complicated and more structured than what they initially had expected. Not only among the girls, but also among boys in the pilot class, we saw a change of their conception of programming languages after they had played with and programmed in Scratch: they had started to see it, not only as easy to learn, but also as closer to the human language.

The pupils not only experienced programming as more comprehensible, but they also had a sense that programming can be a crucial skill later in life. Most of them also found it more fun than they had imagined, associating this with their general interest in computers and gaming. They found the programming class fun, because it involved learning to make games with Scratch, illustrated by one of the boys: “I think it is really fascinating how you can make games and programs and stuff. That is a skill that is going to be used a lot in the future, considering that things are becoming more and more digital.”

Computer games have played a role in increasing interest in STEM-fields, such as computer science [39]. It has been suggested that one of the reasons behind this link is that games increase the individual's curiosity towards how things work [21, 39]. Interest in gaming has also often been used to explain why there are more boys than girls choosing computing subjects in school. DiSalvo and Bruckman have, however, suggested that gaming has become so common among youth that it has “lost some of its cultural significance” of being an “introduction into an exclusive community of practice that included computational practices” [21]. All the pupils interviewed said they played computer games, also the girls: “I play The Sims, and I used to play Mine Craft quite a lot before”, one of the girls said. Thus, while a handful of the youth were inspired by their friends or parents, most of the pupils in our study stated that their curiosity for coding originated from their interest in gaming, moving

toward an eagerness to learn about the mechanics. Already in 1927 in his book *Man and the Computer*, Kenedy, one of the creators of BASIC, defended programming, playing games and using the computer for recreational activities as important factors for becoming appreciative of the computer [47]. The girls' statements are in line with the research that points towards gaming as a contributing factor in appreciating and being comfortable with computing [39].

In the programming class, we raised the questions regarding how the pupils view programming: do they view programming as a career path, or as more of a spare time activity? The boys were more interested than the girls in considering game development as a possible occupation in the future. The girls, however, mentioned other directions of interest for computing and programming, such as graphic design and architecture. They illustrated how the programming class had made them change their opinion on computer work, like this girl: “Now I really want to work with something that has to do with computers. I really want to be an architect, and then you have to work on a computer and know things about it.” We found that the girls in this class both had a previous knowledge of computers through game play that resonated with what they experienced in class (producing games), and they expressed interest in computing and pursuing the use of computers for a varied set of tasks. Even though being a programmer was not among the top choices for their future career, the pupils' in the programming class assumed that programming and digital literacy would be important competences strengthening their future career.

4.2 Gender and programming

The high proportion of men involved in computing is contributing to the field's symbolic meaning as masculine. None of the girls in this class gave any indication towards programming or the computer as something that contradicted their identity as girls. The girls admitted both to playing computer games and using the computer frequently for photo manipulation, among other things. In the interviews they did, however, reveal that they came from homes where the computer is central, one telling that her father “works with computers and does some programming and thinks it is exciting, and I have heard that it is important.” One of the other girls pointed out that her “brother is very interested in the computer, and I have learned some things from him, and perhaps become a little inspired.” These examples suggest that the girls had access to role models and, supposedly, a positive perception of computing at home, in line with earlier research that has found family support to be important for choosing careers in science and technology [6].

With only four girls in the group of 22 pupils, the lower popularity of the programming pilot among the girls was apparent also for the youth. But they did not think that boys and girls had different abilities in relation to programming. They did, however, assume that there was a difference between boys and girls in terms of *choice* of learning to program: a difference in interest. The boys, in particular those with some experience in programming, had a more opinionated view on topics of gender

and programming. The girls on their side, seemingly did not have any notable concerns as to why there was an uneven gender distribution in the programming course.

Even though there was consensus around the notion that girls do not necessarily have a similar interest in programming as boys, none of the pupils thought that girls were *worse* at programming than boys or that there were any significant difference in *how* girls and boys program. One of the boys suggested that girls “may not program differently, but perhaps they have other thoughts around what they want to make.” One of the girls suggested it has to do with interests: “I think a lot of girls have other interests, so they choose something that fits them better.”

Through the conversation with the youth, we gained some insight into their awareness of programming as a gendered field, however simultaneously negotiating about it as a more open and inclusive field. In the interview excerpt below, three of the boys discuss *how to get more girls interested in programming*:

Adrian: “Perhaps to program something that is interesting to them? Perhaps, if they just try to program, then perhaps they will like it. Just start with that. Perhaps some just don’t even bother trying it. It looks too complicated.”

Antony: “I don’t know. It is perhaps more of a boy’s thing than a girl’s thing?”

Researcher: “How come?”

Antony: “Perhaps because of gaming and stuff?”

Adrian: “It is for everybody. Because everybody can learn to program. So, if boys and men can program, so can girls.”

Alexander: “I think it is for everybody. I just think that it hasn’t been an option to do it in school for so long, so I think that later, if you inform the pupils of it at a young age, more will enjoy it. I think it simply is a bit coloured by how people look at gaming, too. People think it’s only men there, even though it is not.”

This dialogue suggests that the boys have inherited the discourses of their society, and we see that the pupils have an impression of programming as a gender-specific activity. Most games are still designed and bought by boys and young men [3, 28], leading the pupils here to imbue a gendered view on programming as well as games. However, the dialogue above also suggests that the youth might work as change agents who believe that the gendering of programming *could* have been different if it had been presented in a more inclusive way. Corneliussen and Prøitz’s report on an afterschool code club in rural Norway, points to a similar pattern, where children don’t really think that there are differences in boys’ and girls’ abilities [16]. Thus, even though we hear an echo of cultural stereotypes associating programming with boys more than girls, we can also see their statements as a possibility for creating change.

4.3 The teacher

The teacher had a background in mathematics and philosophy, however, he had no formal education in programming prior to the implementation of the programming course. The national Centre for ICT in Education, working close with the pilot, made

recommendations about the syllabus with suggested tools and approaches. Teachers involved in the programming pilot had access to an introductory programming course developed by the Centre for ICT in Education and they also had the opportunity to attend programming courses during conventions led by the Norwegian Directorate for Education and Training. With an exception of these resources, the teacher in our class had an impression that few of the other teachers involved had formal education in programming. The annual report from the pilot states that 63% of the involved teachers saw their own competence for teaching the programming class to be adequate, however, only 39% had formal competence for teaching programming. Since this is an elective, there are no requirements about formal competence in the subject. The worries of not knowing enough of the subject to teach it in the best way possible, troubled the teacher in our study. At the beginning of the school year, the teacher expressed uneasiness about his ability to master programming and about teaching it to the pupils, saying “I feel that with more basic training in programming, I would have taught the class better”. As with the pupils, also the teacher clearly needed confidence as well as the appropriate resources to make the best of a new and unfamiliar situation.

The teacher chose an approach starting with teaching a basic understanding of programming through Scratch, followed by a small introduction to text-based programming languages such as *Processing* and *Python*. His impression was that approximately two out of three of the pupils felt that they got the hang of block-based programming in Scratch, which they spent most time on in class. About one in four of the pupils became comfortable with simple commands in the text-based programming language *Python*. Approaching possible differences regarding gender and skill level, there were not many, according to the teacher.

The teacher even suggested that the girls were better than the boys in programming: “The girls in my group have a more even skill level than the boys at medium-high levels. [...] they are more focused when working with a problem than the average pupil.” A similar perception of girls, being a minority, but also more focussed in their work than the boys, was found by Corneliussen and Prøitz [19]. Simultaneously, Corneliussen and Prøitz’s found a tendency among adults to generalise about boys and girls, suggesting a need for more research to explore how precise such gendered *perceptions* of boys and girls are compared to how boys and girls themselves behave and perceive the same situation.

The teacher in our study emphasised the importance to plan for assignments where the pupils could create programs with personal relevance: “All the pupils wish to make programs that are relevant for them, so it’s important to design assignments where the girls, too, can make something that are relevant to them.” Even though an important focus in his class has been to teach the basic principles of programming, a way to include the girls has been to give the pupils ways to be creative when making a program: “Exploration of colours and geometrical patterns in processing were particular motivating for the girls in

my group. [...] Perhaps they show a bit more visual creativity than the boys.” Although the teacher does not directly say so, his description of the programming curriculum indicates that he finds that the girls, rather than the boys, need adjustments in the curriculum to make it fit to them.

The teacher had brought the four girls to the convention “Girl Tech Party”. Apart from that, neither the school, nor the municipality, had taken any direct measures to spark an interest for the programming class among the girls. The school did apparently experience it as a challenge to keep the four girls in the class though, as the teacher illustrates: “we try to maintain a large enough group of girls in the course, so that those who are here wish to continue, and we make an extra effort to try to convince the girls who contemplate changing their elective to stay put.”

The low number of girls in this programming class is not unique. In a survey among the pilot schools we found (with a response rate of 53%) a total of 16% girls involved in the programming classes. Three schools did not have any girls at all in the programming classes, and close to 100 classes were also without girls. Reflecting these findings, our contact with the involved parties gave the impression that there were no particular strategies for recruiting more girls into the course and into programming. Considering the overall lack of information in the official issued documents about gender disparity or goals for inclusion, it is not surprising that this has not appeared as important for the schools participating in the pilot.

5 CONCLUSION

Both this study as well as previous studies have shown that girls and women can also enjoy programming, computing and technology [17, 19]. So why did not the school manage to attract as many girls as boys to the programming elective?

Let us briefly recall the facts. IT, computing, and programming, are male dominated fields in Norway. The programming pilot in secondary school was launched as an elective, to be taught by teachers of whom a majority did not have thorough training or professional competence in the field. The pilot was not followed by a strategy for inclusion of minority groups in computing and programming, like girls. Consequently, the result with programming classes heavily dominated by boys, should not be seen as a surprise.

We can only speculate about the reason for the lack of awareness around the challenge of recruiting girls and women to computing. One interpretation could be that the Norwegian *unitary* school system encourages an equal treatment of pupils. However, when difference is the starting point, like it is for girls and boys entering a heavily male dominated field like computing, treating them the same way might involve “hidden gender ordering processes” resulting in inequalities [41]. Another interpretation is that the lack of girls has been equally invisible to the schools that was found in the code club that Corneliussen and Prøitz studied: if the situation of having few girls in computing appears as “normal”, then the situation apparently does not need any interventions [19].

The lack of an inclusion strategy in the pilot represents a sad example of how gendered structures tend to be reinforced when a gender-blind strategy is employed. In the case of the pilot, this was documented by the survey showing 16% girls participating in the programming classes across the country. And this is what we call a wasted opportunity of inclusion: wasted due to a lack of information from the official pilot, as well as a lack of requirements for the participating schools.

We already know that gender inequality most often does not, or only very slowly, adjust itself towards a more equal situation. Gunnes and Hovedhaugen even found that the low proportion of women entering the field of technology in Norway means that we cannot expect approximate gender equality (close to 40% women) to be reached in the field of technology for the next couple of decades [34]. In other words, the situation is gloomy and in need of initiatives to help improve the gender balance in technology – also in Norway, one of the most gender equal countries in the world.

5.1 What could have been done differently?

Many have suggested solutions to the low proportion of girls and women pursuing computing [14, 29, 44]. We will not revisit these here, however we want to point at two ways that the programming pilot could have met the challenge of recruiting girls.

The first is to make awareness of the challenge, and thereby also fight the invisibility, in the shape of an apparent “normality”, of the low proportion of girls. We have met a lack of awareness among educational authorities, school leaders, teachers, and parents. These are groups of adults in important positions, providing young girls with advices, support and self-confidence about their choices, as well as being role models. A vital part of the awareness project should be to challenge taken-for-granted truths, like “girls just aren’t interested in programming/computers” – an articulation we often hear when discussing the topic with relevant adults. Cheryan and colleagues have challenged the assumption of girls’ lack of interest in computing, and found a clear connection between less gender stereotypical stories about computing and an increasing interest among girls and women in choosing the subject [10]. Cheryan and colleagues have also illustrated that one way to create change is to visually change the environment to become more inclusive [11]. Thus, while Grundy’s male colleagues used the image of “yet more potted plants in the entrance” as a way of airing their frustration of not being able to recruit female computer scientists [33], Cheryan et al.’s findings suggest that visual cues, like potted plants, might indeed have positive effects on the goal of recruiting more girls and women.

Second, girls as young as 6 years have been documented to hold cultural stereotypes of computing as a masculine field [45]. The youth in our study are aware of gender stereotypes. But they are also prepared to challenge them – rejecting an inherent gender difference. They are potential change agents, ready to claim boys’ and girls’ equality in programming, with claims like: “if boys and men can program, so can girls”. We might read this as a sign of change, however, it relies on the youth being able to

find open and inclusive arenas where both boys and girls can explore, have fun with and, eventually, also "fall in love with" the computer [16]. Thus, we need to create new images of computing and programming that are more diverse and varied and, consequently, more inclusive than some of the narrow and highly gendered images associated with these fields [32, 36]. Present role models that the girls can associate with, or even create role models at school: let the girls in this year's programming class be next year's role models.

If the Norwegian educational system could turn the trend of girls not opting for technology in general and computing in particular, it would make a massive difference, not only for individuals of presently excluded groups, but also for diversity and thus competitiveness in the industry [39]. Without a dedicated effort to deal with the exclusiveness of technology and IT, we are likely to continue to see low proportions of girls and women in this field. The Nordic Paradox is a label given the seemingly mismatch in the Nordic countries, between the general high level of gender equality and the poor results in recruiting women to technology [4]. In the case of the programming pilot, it isn't really a paradox that there are few girls participating, but rather a highly understandable effect of choices made in structures governing elementary school education.

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