



# When the Google Generation Meets Academia: Digital Skills of Tomorrow's Students

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## Abstract

*What digital skills do tomorrow's higher education students have? Can we talk about a paradigm shift in skills, knowledge, and learning strategies? This paper is based on extensive data from a national survey on digital practices in primary and secondary education. These students are born and raised in the digital era with smartphones, social media, and online games. However, findings indicate that the twelfth graders seem to be quite traditional when faced with their own learning strategies, as many prefer pen and paper over keyboard and screen. The seventh graders have to a larger extent been trained in using digital learning tools and seem to prefer digital approaches over lectures with pen and papers. There is a notable positive development of digital maturity among students in the last six years. The proportion of twelfth graders that spend their time on non-academic activities on computers in class has halved. Also, reported disturbance from computers in class has decreased for all students. Twelfth graders report extensive use of computers during most of their classes, but they have less use of creative tools than their younger counterparts, e.g., movie editors, animation apps, and computer programming. The twelfth graders will meet academia in 2020, while the seventh graders follow five years later. Different blended learning approaches could motivate and engage tomorrow's students. Lecturing and handwriting seem to be more applicable for the forthcoming students, but more interactive solutions could be needed to engage the ones that enroll higher education in five to eight years from now.*

Keywords: *ICT in education, digital skills, digital natives, blended learning, learning strategies*

## 1. Introduction

It has long been discussed how students are affected by computers and tablets in school. All the time children and young people spend on digital media in their spare time are for some an argument that the school should be a counterweight to the digital [1]. Or conversely, a good digital practice in school is necessary for students to become good digital citizens and acquire the skills and competencies needed in society and working life [2]. Regardless of the different opinions about the school's role, it is obvious that learning by using digital technology has recently become more relevant than ever before, as countries around the world practice digital homeschooling due to the corona pandemic. The purpose of this paper is to address the typical characteristics of Norwegian students' digital practices in lower education. It is based on data from the national survey Monitor 2019 - which was conducted among students in four different grades in K-12 education. In this paper, I will use data from two grades: seventh grade and twelfth grade, to compare students from primary and upper secondary school.

### 1.1 The Norwegian school system

The primary and secondary education and training consist of grades 1-13 for general studies, or grades 1-12 plus to more years as an apprentice when choosing vocational training. Kids start 1st grade in the year of their sixth birthday. Most commonly, the schools are divided into three levels: primary school 1-7 (barneskole), lower secondary school 8-10 (ungdomsskole), and upper secondary school 11-13 (videregående). There are approximately 630,000 students in primary and lower secondary school, and 187,000 students in upper secondary school [3].

## 2. Theoretical background

In this chapter, I will briefly describe some of the terminology used in this paper. We have many names for the things we love, but a discussion of different conceptions will be sparse due to the paper's premises.



## 2.1 Google generation

There are several terms to describe the generation that is born and raised in today's digital world. Prensky uses 'digital natives' for the young generation, while those born before the internet are 'digital immigrants' [4]. He claims that digital natives "*are all 'native speakers' of the digital language of computers, video games, and the Internet*" [4 p.6]. Rowlands et al. use 'Google generation' about those born after the personal computer became ubiquitous, and those who frequently use the internet as a source of information [5]. At the same time, they point to the fact that 'googling' is something we all do, which makes it somewhat an inaccurate description. Therefore, I want to add an additional element in describing our emerging generation. That is, the way most children and young people have become accustomed to work online. The youngest students are less familiar with concepts like HDD and 'Save As', as they are no longer relevant for a generation that uses cloud-based solutions. Both Google, Microsoft, and Apple have launched cloud-based solution for the education sector. As an example, half of the top ten largest municipalities in Norway have fully or partly implemented G Suite for Education and chromebooks for their primary and lower secondary schools. Overall, more than 100,000 students nationwide work cloud-based in Google's solutions [6]. This, in addition to the way many tend to search for information, i.e., 'to google' makes Google generation a descriptive term for young students today.

## 2.2 Digital skills

In Norwegian curricula, the term 'basic digital skills' is used to describe what students in 1-13<sup>th</sup> grade should be able to perform as a minimum when it comes to digital skills for learning purposes. Digital skills are among the five basic skills of the Norwegian school system, together with reading, writing, numeracy, and oral skills. In the national framework for basic skills, digital skills are described as "*being able to use digital tools, media, and resources efficiently and responsibly, to solve practical tasks, find and process information, design digital products and communicate content. Digital skills also include developing digital judgement by acquiring knowledge and good strategies for the use of the Internet*" [7] p.12]. There is no official framework for digital skills or other basic skills for higher education.

## 2.3 Blended learning

There are many different definitions and interpretations of the term 'blended learning' (BL), but a widespread perception is that BL consists of a combination of face-to-face interaction and the use of online learning tools [8,9,10]. Important issues to address are what is being blended (content) and how (context) [8]. BL can also happen within the classroom; it does not have to be a specific mix of online classes with physical ones. In this paper, BL is used as a concept for understanding the blended practices and learning strategies that young students have – where both textbooks and tablets are part of their learning environment.

## 3. Method

This paper is based on data from Monitor 2019, a national survey conducted in fourth grade, seventh grade, ninth grade, and twelfth grade general studies (studieforberende). The data collection was carried out by the author and two colleagues at SINTEF Digital during May 2019. Students were asked to take a position on different types of questions. We used different types of Likert scales, ratings, and yes/no questions. Monitor has been conducted seven times before, last in 2016. Some of the questions in Monitor 2019 coincide with previous years' surveys in order to find trends. Schools in 212 municipalities received an invitation to participate, and schools from 84 municipalities participated in the survey. 155 out of 869 invited schools participated in the survey, with a total of 3,440 responding students, of which 48.3 percent are boys and 51.5 percent girls. Table 1 shows the distribution of the respondents per grade. In this paper, I only use data from seventh grade and twelfth grade.

Table 1: Number of respondents per grade

| 4th grade | 7th grade | 9th grade | 12th grade | Total |
|-----------|-----------|-----------|------------|-------|
| 1015      | 1064      | 630       | 730        | 3440  |



### 3.1 Response rate and representativeness

The response rate is an indicator for saying something about the reliability and validity of a survey. The ideal is to calculate the response rate based on the number of invited pupils, but this is unknown in this survey. The invited schools received an invitation letter asking for a response from one class per grade in the target group. The number of students in the given group is unknown. Based on the participation of the total number of invited schools, 155 out of 869, the response rate is low. However, despite a low response rate, the survey is representative in the sense that it has participation from 84 municipalities divided across all regions. Geographical distribution, participation from large and small municipalities, and large and small schools contribute to the representativeness of the collected data. In survey research, response representativeness might be more important than the response rate [11]. Low response rates are somewhat expected when inviting broadly in large populations [11]. The survey is voluntary for the students and has also not been compulsory to carry out for participating schools.

In larger surveys, one should not always look blind at response rates. The margin of error might be another way to calculate discrepancies between the sample and the population. In Monitor 2019, the sample of students is 3,440. See Table 1 for respondents per grade. According to statistics from national authorities, the gross population in the two respondent groups used in this paper is 64,000 (seventh grade) and 35,000 (twelfth grade general studies) [3]. With a confidence interval of 95 percent, the margin of error is between +/- 3.0-3.6% for each of the different respondent groups. The data material is considered sufficient to provide a representative picture of the digital state in Norwegian schools due to the use of stratified sampling [12].

## 4. Findings

The key findings will be presented in somewhat simplified profiles of two student groups – those that will enroll higher education in 2020 and the ones that follow five or more years later.

### 4.1 Students in upper secondary school (The twelfth graders)

The twelfth graders (18 years) in the survey are now in 13th grade and will enroll in university or college during fall 2020. All students in upper secondary school have their own computer, either by bringing their own device or by making use of a school leasing system. As many as 74 percent use traditional PC's (Windows), while 26 percent use Mac. Typically, they use their computer on a daily basis in class, but not always in all subjects. Skills and practices are quite similar to the assumed general practice in university and college. That is, to take notes during lectures, make presentations, use of writing tools, spreadsheets and so on. They have less use of creative tools than their younger counterparts, like movie editors, animation apps, or computer programming [12]. However, the twelfth grader differs in some digital activities, such as collaborative writing: Almost six out of ten twelfth graders say they often do collaborative digital writing with their classmates, compared to one of four seventh graders. Furthermore, 56 percent agree that computer-based tasks make it easier to collaborate with other students; only 10 percent disagree.

There is a mentionable positive development of digital maturity among twelfth graders in the last six years. The proportion of students spending time on non-academic activities on computers in class has halved, from 46 percent in 2013 to 23 percent in 2019. Also, reported disturbance of computers in class has decreased from 47 percent in 2013 to 12 percent in 2019 [12].

The twelfth grader is born and raised in the digital era and quite familiar with social media, smartphones, and online games and activities. However, he or she seems to be more traditional when faced with his or her learning strategies. The students were asked to consider the following statement: "I learn better by reading the paper textbook than a digital one (reading on a screen)" 50 percent of the twelfth graders agreed, 18 percent disagreed, and 32 percent were neutral.

When faced with the statement, "I learn better by writing by hand than typing on a computer," 43 percent of the twelfth graders agreed, 27 percent disagreed, and 30 percent were neutral. So even though they frequently use digital tools, a small majority seems to believe that handwriting and reading textbooks are better for their learning.

### 4.2 Students in primary schools (The seventh graders)

This chapter presents some of the key findings among the seventh graders. The average coverage rate of personal computers is 1:2. Twice as many seventh graders report spending more than four hours per week on computers in class than six years ago [12]. The seventh graders use different devices than the twelfth graders: 39 percent use chromebooks, 46 percent use PC's (Windows), while



14 percent use iPads or similar tablets. The high proportion of chromebook users is partly because many large municipalities in Norway have chosen G Suite for Education. In the fifty largest municipalities, approximately one out of four devices available for students in grades 1-10 are chromebooks [6].

The younger students use their computers in class to write texts, make presentations, and search for information on the internet. 18 percent of students in seventh grade use computers for simple programming activities, compared to 12.6 percent in twelfth grade. Some primary schools have focused on introducing simple coding throughout the annual Hour of Code, as well as introducing students to micro:bit and simple block programming. Here we will probably see an increase in the years to come as algorithmic thinking and programming are being introduced in several subjects and grades in the new curriculum from fall 2020 [13]

The survey listed twelve different computer-based activities, from writing to information search and basic programming skills. The seventh graders have the largest proportion of students which have been trained in these skills, with six out of twelve skills (proportion of students in parentheses): writing texts (94 percent), making presentations (91 percent), information search (74 percent), movie editing (34 percent), programming (26 percent) and animation apps (24 percent). In comparison, the twelfth graders have a higher proportion trained in three out of twelve skills, i.e., spreadsheets, online dictionaries, and information literacy.

When faced with the statement "I learn better by writing by hand than typing on a computer," 22 percent of the seventh graders agreed, 30 percent were neutral while 48 percent disagreed. Also, 23 percent of the seventh graders agree that they learn better by reading the paper textbook than a digital one, 36 were neutral, while 41 percent disagree. This shows that a larger proportion of the seventh graders seem to prefer digital learning strategies than the twelfth graders.

There is also a mentionable positive development among the seventh graders when it comes to digital distractions and non-academic use of computers in class. Just above 3 percent of the students agree that they are distracted by computers, compared with 13 percent in 2013. 5 percent spend too much time on non-academic things on their computers, compared with 20 percent in 2016 and 15 percent in 2013 [12]. Time spent using computers in class and access to computers have both a significant increase during the last six years [12].

## 5. Discussion

Can we talk about a paradigm shift in learned skills, knowledge, culture, and learning strategies?

Findings from Monitor 2019 suggests that students are more familiar with computers and digital learning tools in class than what was the case a few years ago. Also, there are less reported distractions and non-academic use of computers during lectures. As for the seventh graders, there was an increase in non-academic use of computers in class between 2013 and 2016. Fortunately, the negative trend did not continue until 2019, even though access to computers and the time spent using them increased significantly during the same period [12]. Both indicate a growing digital maturity among students that will meet academia in a few years from now.

A higher proportion of the youngest students claim to use practical and creative digital tools in class. However, the twelfth graders report of more frequent use of methods such as collaborative writing. At the same time, they have somewhat more 'traditional' preferences regarding learning strategies. The younger students' preferences towards digital learning strategies might be affected by the fact that they generally have less access to computers during class and therefore might be more motivated when they are allowed to use them. On the other hand, research on one-to-one technology in K-12 education shows that students having their own computers are quite motivated in the first few years before the motivation gradually decreases [14].

Overall, the findings in this study suggest that the students have different BL practices. Digital tools are widely used as substitution and augmentation [15]. For example, writing texts on the computer (substitution), using websites related to the textbook (augmentation), and searching for subject-related information on the internet (augmentation). Searching for and finding the right information is considered a basic digital skill in the framework for basic skills [7], but it does not necessarily have to be an easy exercise. In fact, it may be an exercise itself that students should practice critical thinking related to information search and assessment of sources. In the curricula in major subjects, i.e., Norwegian, English, Social sciences, Science and Physical education, source assessment and various forms of digital judgment are highlighted as important [16]. Information literacy is also an essential skill in academia. One should not assume that the Google generation masters this better than previous generations [5]. On the contrary, this can become an even more in-demand expertise at a time when online research databases and publications are rife, both with and without open access,



and where one must constantly assess the credibility of sources. The task of higher education institutions might be to recognize and build on the digital skills of the Google generation so that they develop a more complete digital literacy. Different BL approaches could motivate and engage tomorrow's students. Lecturing and handwriting seem to be more applicable for the forthcoming students, but more interactive solutions could be needed to engage the ones that enroll higher education in five to eight years from now.

## 6. Conclusion

The digital development in education is taking place more as a silent evolution than a radical paradigm shift. Nevertheless, this study shows that there are differences between student cohorts in the years to come, where digital technology affects students' work methods and attitudes towards learning. Digital technology has come to stay and can both redesign and redefine the way teaching is done. What academia needs to ask itself is how and whether one can benefit from the work methods, skills, knowledge, and attitudes that the younger generation brings with them - or should one simply continue teaching as one has done for the last hundred years?

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## References

- [1] May, C. "Students are Better Off without a Laptop in Classroom". Scientific American, July 11., 2017. Retrieved from: <https://www.scientificamerican.com/article/students-are-better-off-without-a-laptop-in-the-classroom/>
- [2] O'Dwyer, G. "Norway's government to upgrade digital in school curriculum", ComputerWeekly.com, January 20.,2020. Retrieved from: <https://www.computerweekly.com/news/252476995/Norways-government-to-upgrade-digital-in-school-curriculum>
- [3] The Norwegian Directorate for Education and Training. Statistical database. Available at: <https://www.udir.no/tall-og-forskning/statistikk/>
- [4] Prensky, M. "Digital Natives, Digital Immigrants: Part 1", On the Horizon, 9 (5), 2001, p. 1 – 6
- [5] Rowlands, I., Nicholas, D., Williams, P., Huntington, P., Fieldhouse, M., Gunter, B. & Tenopir, C. "The Google Generation: The Information Behaviour of the Researcher of the Future", Aslib Proceedings: New Information Perspectives 60, 2008, p. 290–310.
- [6] FIKS. Preliminary Overview of the Digital Devices in Schools in the Fifty Largest Municipalities, University of Oslo, May 2020. Retrieved from: <https://www.uv.uio.no/forskning/satsinger/fiks/kunnskapsbase/digitalisering-i-skolen/>
- [7] Norwegian Directorate for Education and Training. "Framework for Basic Skills", 2012. Available at: [https://www.udir.no/contentassets/fd2d6bfbf2364e1c98b73e030119bd38/framework\\_for\\_basic\\_skills.pdf](https://www.udir.no/contentassets/fd2d6bfbf2364e1c98b73e030119bd38/framework_for_basic_skills.pdf)
- [8] Graham, C. R. "Emerging Practice and Research in Blended Learning". In M. G. Moore (Ed.), Handbook of distance education, 3rd ed., New York, NY: Routledge, 2013, p. 333–350.
- [9] Bonk, C. J. & Graham, C. R. "Handbook of Blended Learning: Global Perspectives, Local Designs". San Francisco, CA: Pfeiffer Publishing, 2005.
- [10] Kerres, M., & De Witt, C. "A Didactical Framework for the Design of Blended Learning arrangements". Learning, Media and Technology, (28)2, 2003, p. 101-113.
- [11] Cook C, Heath F, Thompson R. L. "A Meta-analysis of Response Rates in Web- or Internet-based Surveys". Educational and Psychological Measurement: Sage Publications, 60(6), 2000, p. 821–836.
- [12] Fjørtoft, S. O., Thun, S., & Buvik, M. P. "Monitor 2019 - En Deskriptiv Kartlegging av Digital Tilstand i Norske Skoler og Barnehager", Trondheim, SINTEF Digital, 2019. (In English: "Monitor 2019 - A Descriptive Mapping of the Digital State in Norwegian Schools and Kindergartens").
- [13] Norwegian Directorate for Education and Training. "Algoritmisk tenkning" Retrieved from: <https://www.udir.no/kvalitet-og-kompetanse/profesjonsfaglig-digital-kompetanse/algoritmisk-tenkning/>
- [14] Harper, B. & Milman, N. B. "One-to-One Technology in K–12 Classrooms: A Review of the Literature From 2004 Through 2014", Journal of Research on Technology in Education. 48 (2), 2016, p.129-142.
- [15] Puentedura, R. R." Transformation, Technology, and Education", 2006. Retrieved from: <http://hippasus.com/resources/tte/>
- [16] Norwegian Directorate for Education and Training. "Læreplaner" (Curricula). Available at: <https://www.udir.no/laring-og-trivsel/lareplanverket/>