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Digital Technology and design processes: Report on a FabLab@School survey among Danish youth

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Report

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Digital Technology and design processes:

Report on a FabLab@School survey among Danish youth

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Report on the FabLab@school.dk survey

This report contains findings from a survey on Danish adolescents aged 11-15 years conducted in the fall of 2014 among 1236 students. It is a part of the FabLab@School.dk research program, which investigates the use of digital fabrication technologies in Danish schools.

We would like to thank all the participating schools as well as the collaborating municipalities of Aarhus, Silkeborg, Vejle and Favrskov. We would further like to thank Rikke Toft Nørgaard for contributing to the survey.

We would also like to thank Morten Rasmus Puck, Morten Petterson, André Torre and Peter Allerup for their support with statistical planning and analysis.

1 The FabLab@School.dk survey

FabLab@School.dk is a Danish research project at the Department of Aesthetics and Communications at Aarhus University supported with a grant from The Danish Industry Foundation. It is part of the global FabLab@School initiative, founded by Dr. Paulo Blikstein at the Transformative Learning Technologies Lab at Stanford University. The Danish research project focuses on Fablabs as a hybrid learning laboratory, which combines digital fabrication, design thinking, collaborative idea generation and creating in solutions to complex societal challenges. Based on this definition of FabLab@School, an emphasis is put on the entire creative process from early ideation, sketching and mockup creation to the initial presentation of a prototype.

The survey reported here has been conducted in collaboration with Stanford University, and parts of the survey are run in various countries around the world in order to establish foundations for comparison on a global scale. Aarhus University is cooperating with Aarhus, Vejle and Silkeborg municipalities in the FabLab@School.dk project.

The survey is in part based on questions used by TLTL at Stanford University. These questions have been translated into Danish language and some have been modified to better fit the Danish context. The questions reported here are translations of the Danish questions. Some of the instruments used, are tentative measures, which are guiding our further investigations, but which are not yet established as valid measures of the concerned traits. This report is mainly descriptive in its approach to the collected data, and it serves the purpose of presenting these data in a way, that lends itself to further exploration. Apart from the survey reported here, the research project consists of ethnograhic observations and interviews with teachers and students and on design interventions in and with the collaborating schools.

1.1 Content and limitations of this report

This report describes the frequency of answers on questions, and the report further tentatively explores composite measures, correlations and underlying factors.

The findings in this report are divided into themes, which are explored from different perspectives with different types of questions. In chapter two of this report, participating schools are compared with the population of schools in general and in chapter 3, the group of respondents is analyzed. Chapter 4 concerns the students' abilities to use, master and understand digital technologies, while chapter 5 is an analysis of what the students claim to learn about IT in schools. Chapter 6 is a comparison of the students self-perceived creativity compared to their experiences with working with ideas and relating to complex societal challenges. Chapter 7 is the conclusion, which is followed by a

list of references and an appendix containing the original questionnaire, translations into English of all the questions, charts showing the number of responses for every quantitative question asked on the report, and details with regards to statistical tests, which have been run on the data.

1.2 Research question

The main research question guiding the Danish FabLab@School research project, is:

How can design thinking and digital fabrication in Danish public schools contribute to adolescents' abilities to understand and create with digital technologies?

1.3 The Danish FabLab@School project

This survey is (as stated above) part of an ongoing research project on digital fabrication in education. In 2014 the educational landscape in Denmark changed due to a new reform of standards in the Danish public school (primary and lower secondary). Part of the initiative was to introduce a stronger focus on competencies related to "21 century skills"(Ananiadou and Claro 2009). On this basis, The Danish FabLab@School project was initiated by the Child-Computer Interaction group at Aarhus University together with Aarhus, Vejle and Silkeborg to study how digital fabrication could promote 21st century skills in educational contexts. The aim of the FabLab@School project is to develop a sustained digital fabrication in education initiative within the existing framework of the Danish school system among children aged 11-15 (Smith et al. fc.).

Among 21st century skills, which were considered relevant to the above-mentioned combination of digital fabrication, design thinking, collaborative idea generation and creating in solutions to complex societal challenges, were:

- Abilities to use, master and understand digital technologies
- Abilities to actively engage in heterogeneous communities of practice
- Abilities to think and act innovatively (with technology) on societal challenges

It is a central hypothesis of the research project that adolescents aged 11-15 years through hands-on education with digital fabrication technologies can improve these abilities significantly compared to existing offers in the Danish school system.

1.4 Research design

As stated, our hypothesis is investigated through observations, interviews, interventions as well as the survey reported here. The survey is a baseline study of children's use, knowledge of and skills with regards to digtal technology, design and attitudes towards hacking, open data and privacy issues. The baseline survey will be followed up by an endline survey after three years, at the end of

the project (2016) to assess improvements among the target group. The research design resembles a quasi-experimental design where a test group and a control group are followed in order to look for differences in their development. In our case however, it is not possible to follow the same students throughout the project period. In order to be able to use the same schools in the endline survey however, we included two target groups in the survey: One group consisting of students from schools that are formally part of the FabLab@school.dk project (FabLab schools). The other group consists of students from schools not within the project (non-FabLab schools). When the endline survey is run at the end of the three-year project, we will test different classes within the same schools. Since we will be surveying the same age group next time, we will not be able to use the same students, many of whom will have graduated lower secondary school by the time of the next survey. On schools, which are part of the project, we will specifically ask for students, which have been a part of the FabLab@school.dk project activities in order to compare these to students from the non-FabLab schools.

1.5 The questionnaire

The survey was conducted as an online questionnaire with 227 questions under the following six themes:

1. Personal information
2. School and leisure
3. Media and technology in everyday use
4. Technology in school
5. Design and creativity
6. Hacking and repair of technology

Table 1 gives an overview on how the six themes were used for investigating the initial three areas of interest above. The personal background of the students was investigated through questions relating to their background, leisure time and interests in and outside of school. The abilities to use, master and understand digital technologies was gauged through 127 questions regarding media and technology in everyday use, use of technology and learning about technology in school and repair of technology in the "hacking and repair of technology" part of the questionnaire. Finally, abilities to actively engage in heterogeneous communities of practice and to think and act innovatively (with technology) on societal challenges were measured through questions regarding design and creativity, and through attitudes towards hacking etc. in the "hacking and repair of technology part of the questionnaire.

Areas of interest	Themes	Number of questions
Personal background and interests	• Personal information • School and leisure	34
Abilities to use, master and understand digital technologies	• Media and technology in everyday use • Technology in school • Hacking and repair of technology	127
Abilities to actively engage in heterogeneous communities of practice Abilities to think and act innovatively (with technology) on societal challenges	• Design and creativity • Hacking and repair of technology	66
3 areas of interest	**6 main themes**	**227 questions**

Table 1: The relationship between areas of interest, themes and the number of questions.

1.5.1 Types of questions

In the survey, four types of questions were used to investigate the different themes. Likert-type scale questions with a scale from 1 (strongly disagree) to 6 (strongly agree) were used to gain insight into the students' views and perspectives on technology and issues related to various kinds of stakeholders and activities within a concrete design process. In order to gauge self-perceived abilities within the areas of interest, another Likert-type scale was used with values ranging from 1 (I know nothing about it) to 6 (I could teach others about it). Time used on leisure activities and different types of IT-use was measured through multiple-choice questions with different ranges. Finally, open-ended questions and tasks were used in order to evaluate students' abilities and mindsets with regards to the aforementioned areas of interest. The latter method involves a coding of the responses with regards to different categories of answers. These types of questions afford opportunities for comparing self-perceived abilities with scores or categories on a specific type of performance. For example the students where asked to rate their own creative skills in terms of coming up with new ideas, having a good imagination, etc. Such questions were used to prompt a range of responses about the students' self-views, which could be compared to other types of responses where the students were asked for ways to solve a concrete societal challenge.

It is important to note, that in many questions, we asked the students to evaluate themselves. This method is prone to different types of biases. For one, students are often uncertain of their own level of competence, and especially male students tend to score their own IT skills higher than their female counterparts (Bundsgaard et al 2014). Another problem is the so-called demand characteristics: Students' answers are often influenced by their wish to find the "right" answer, that is, to answer what they think, the researchers or teachers want to hear. Students will often experience a survey as a test, and make attempts to do well in the given task.

As stated, we have used Likert-type scales with six possible values. When using Likert-type scales, it is common to recommend using an uneven number of response possibilities. The reason for this, is that respondents whose views are genuinely in the middle of the scale are otherwise forced to answer to one of the sides and are thus misrepresented in the data (Marsden and Wright 2010). On the other hand by taking away the middle category, even those respondents who are prone to satisficing (by choosing the option in the middle) in order to finish quickly will at least have an extra incentive to reflect on if they are on one side of the middle or the other.

1.5.2 Ordering of questionnaire themes

The six themes in the survey were ordered in the abovementioned sequence of:

1. Personal information
2. School and leisure
3. Media and technology in everyday use
4. Technology in school
5. Design and creativity
6. Hacking and repair of technology

As can be seen, the survey started with questions of background and demographic characteristics. It is common to recommend having this type of questions at the end of a questionnaire (Marsden and Wright 2010). This is recommended, because respondents may feel intimidated or otherwise put off by questions about their background. We chose to begin with background questions for two reasons: Firstly, we did not know if all students would finalize the questionnaire (and the data would be useless without correct background information). Secondly, for motivational reasons we communicated to the students that we had an interest in their genuine experiences and responses, and thus that the questionnaire was indeed not a test.

Each section of questions were grouped by content in order to facilitate respondents' cognitive processing (Marsden and Wright 2010). The ordering of questions and themes had two main aims: 1. To create a sense of a common thread running throughout the questionnaire, and thus to make the questions make sense to the respondents, 2. To make the students respond with their own uses and views on technology and design before revealing too much about our

understandings. The last aim was important in order to minimize demand characteristics, which could potentially lead students to try to give us what they thought might be the correct answer

1.5.3 Translations and wording of questions

Large parts of the survey were translated from survey questions used in the FabLab@School project at Stanford University. While some questions were directly translatable, others posed problems in terms of interpretation in a Danish context. For example, concepts such as creativity and imagination can be interpreted differently in the two different contexts. The wording of the questionnaire was carefully selected with a goal of reducing the complexity of the language and having as little text as possible. This was done in order to speed up the reading process. At the same time, our aim was to be as precise and easy to understand as possible in order to secure valid data and minimize fatigue and satisficing resulting from this fatigue.

The questions and the questionnaire were tested on small groups of adolescents within the age group on four occasions. During the testing, students were asked to read the questions aloud, in order to reveal which words and wordings were difficult to understand. Furthermore, in 2 cases the students were asked to discuss their answers in pairs, in order to reveal how the students interpreted the questions. After completing the survey, the students where interviewed about their experiences of answering the questionnaire.

2 Survey administration and data treatment

The survey was carried out among 11-15 year old students in 39 schools (upper primary and lower secondary) in 4 municipalities in Eastern Jutland, Denmark (Vejle, Silkeborg, Aarhus and Favrskov). A team of six researchers from Aarhus University administered the survey to the schools in the period of August 25th – September 12th 2014.

In the classrooms, the survey was administered by two researchers (although in a few instances towards the end of the administration period only one researcher was present). The researchers introduced the research project and survey to the students and were present in the classroom during the entire test in order to help with questions and technical problems. Studies suggest, that researchers assistance increases reliability because fatigue-effects are slower to set in (Marsden and Wright 2010). To increase reliability, the introduction was done based on a document including the most important points to communicate to all involved students. The response time varied from approximately 30 minutes and up to one hour. The teachers and the students were generally very flexible with the students' time, which allowed for most students to complete the questionnaire (see below).

The survey was administered as an online survey through SurveyXact. During the introduction, the students were asked to enter the webpage www.fremtid.eu, on which there was a "pop-in" link to the survey. In most cases, this worked reliably, but we did experience technical problems in the schools with Internet connections and servers. The survey was accessed on computers, tablets and phones, and therefore letting the students use their own phones/devices on the mobile network solved some technical issues. Tricking school computers to enter other networks than the faulty one, which they had been locked to, solved other issues. Because of technical problems, some students, who had started answering the survey before the problems arose, had to start over again. A few classes even had to reschedule the survey to a different day.

2.1 Recruitment of schools

As stated earlier, both FabLab and non-FabLab schools were to participate in the survey. With help from the municipalities, we identified 21 schools, which were already or which would in future be part of the FabLab@School project. The research team had already established contact with many of these schools, as they had been objects of our initial observations and interviews. Thus, these schools were very accommodating in terms of assigning participants to the survey.

We asked the municipalities to help us find corresponding groups of schools, which were not part of the FabLab@School.dk project, and for which did not have any plans of becoming part of the project. Ideally we wanted these schools

to match the first group in terms of average socioeconomic status of the students, school size, average grades of the students, etc. In most cases, the suggested schools from this group accepted the invitation to be part of the survey, whereas in the one municipality, only 2 out of 10 suggested schools were willing to participate. In the end some schools in this municipality were chosen mainly on a basis of their willingness to participate. In total, the survey was carried out on 18 schools, which were not part of the FabLab@School.dk project.

As is clear, our aim was not to create a random sampling amongst the schools. In order to later be able to estimate the generalizability of the results, it was made sure however, that the group of schools was as diverse as possible. Thus the group included rural and urban, low-achieve and high-achieve, low- and high socioeconomic status schools in order to be able to screen for effects from school type. Since we did not have the possibility of creating a representative sample of schools, we do not claim to be able to conclude on Danish adolescents as such. Thus, all claims made in this report, are made with regards to our sample of respondents only.

2.2 Data collection

On most schools we tested one class or group (on a few schools, we tested 2-3 classes). We wanted to get responses from as many different schools as possible in order to make sure, that we a wide range of background factors, such as e.g. socio-economic status, were represented.

Contact to the schools was made through a letter to the principals asking them for 45 minutes with a grade 6, 7 or 8 class of their choice. With most of the schools, it was necessary to call several times in order to make an arrangement. In the beginning, most principals chose to go with grade 7, and when this became apparent, we did our best to get 6^{th} and 8^{th} graders on board.

It was important for our data analysis, that we would get at least 200 respondents in each group consisting of a specific grade of students. In the analysis of the data, we do not distinguish between schools within the FabLab@School project and schools outside the project, which means, that we needed at least 600 respondents. In the endline survey, however, the plan is to compare project schools to non-project schools, and thus a sample of 1200 respondents is needed. In order to match the total number of respondents in the endline survey, the aim was for 1200 respondents in the baseline survey as well. After removing the responses, which did not fit the criteria for being part of the data, we had 1156 responses (see Data treatment below).

2.3 Data treatment

The data was downloaded from SurveyXact as a Microsoft Excel® file. In order to facilitate easy data calls from SAS and R, which were both used, the variable names were changed to s1-s227. In the original data file, there were 1433

entries. Responses which did not fit the criteria mentioned below, were deleted, and the final number of responses in the dataset ended up being 1156.

2.3.1 Blanks

When a person creates a questionnaire without filling in anything at all, it is counted as a blank. 112 Blanks were deleted from the dataset, which means, that there were 1321 responses to the survey.

2.3.2 Duplicate entries

Due to technical problems, several students needed to start over on the survey – thus creating duplicate entries. In each case, the entry with the most answers was kept in the data set, and the others were deleted. There were 163 records of multiple entries. Of these, 5 persons had three entries, and 74 had duplicates. A total of 84 entries were deleted from the 163, which left 1237.

2.3.3 Age range

In this survey, we are researching 11-15 year olds, and therefore any entries out of this range were deleted. 6 entries had put something un-age related in the age field, and they were deleted (1231 left), whereas 10 entries had stated an age above 15 and were deleted as well (1221 left).

2.3.4 Completion

It was decided to keep all responses that were either completed or were only missing the last task of answering what was inside a key fob. This decision was made, because the task was not of central importance with regards to the research question and the hypothesis' in question here. Of the remaining 1221, 65 had not answered the last question before the key fob task (s199). Since respondents were prompted to answer all questions, it was not possible to be missing this item, if the subsequent items were answered. It was also not possible to have answered this item without answering the items before it (except for open ended items). Thus, if there was an answer to item s199, there would also be answers on the items before it. If item s199 was not answered, neither would the subsequent items be. For this reason, the responses, which were blank with regards to item s199, were deleted (and the rest were kept), which meant that the total number of respondents ended up being 1156.

3 Participating schools and respondents

The 1156 respondents come from 39 primary schools in the municipalities of Vejle, Silkeborg, Aarhus and Favrskov. The sample includes a wide range of schools, though all except one are public schools.[1] The schools are positioned in both rural and urban locations in or around the towns of Aarhus (approx. pop: 260,000), Vejle (approx. pop: 53,000) and Silkeborg (approx. pop: 43,000). These schools recruit from a wide range of socioeconomic groups. However, the difference between socioeconomic groups in Denmark is low compared to most other countries, which is e.g. demonstrated by Denmark having one of the lowest Gini coefficients in the world.[2]

As a simple comparison of our sample of schools to the population of Danish public schools in general, the average score for grade 9 students from these schools on the national examinations in the years 2011/2014 has been calculated (see Table 2). Three numbers are publicly available from each school: The average score, the expected average score (based on socioeconomic status of the students), and the difference between the first two, indicating the performance of the school. The table below shows both the averages of these numbers based on the schools in our sample and the weighted average, in which the average is calculated based on the number of respondents from each school.

39 schools	1156 resp.		
Average	Weighted Average	Expected Average	Weighted Exp. Average
6.95	6.98	6.84	6.87

Table 2: Average marks of participating schools and their expected average marks. Both un-weighted and weighted average scores are shown.

The national average on grade 9 exams in these same three years among all school types is 6.6.[3] As can be seen, the schools we visited, were on average placed higher than this mean, both when considering actual scores and when looking at expected scores, which can be seen as a measure of average

[1] Only public schools are a part of the FabLab@School.dk project, but N. Kochs skole was included in the survey. Public schools is the most common school type in Denmark. As of October 1st, 2014, 78% of all pupils of grade 0-10 in Denmark attended public schools. According to the Statistics Denmark: http://dst.dk/da/Statistik/emner/fuldtidsuddannelser/grundskole.aspx (retrieved April 14., 2015)

[2] http://data.worldbank.org/indicator/SI.POV.GINI (retrieved May 6th, 2015)

[3] The average score of all students in Denmark is evaluated in different ways. First of all, it can be split into different school types such as public schools, private schools etc. With one exception (N. Kochs skole with 17 respondents) our sample consisted solely of public schools. Removing N. Kochs skole gives the averages 6.93, 6.97, 6.81 and 6.85 respectively. This does not change the conclusion, that our sample is above the national average with regards to expected average scores and realized average scores.

socioeconomic status of pupils in the given schools. The same goes for the weighted averages.

FabLab-average	Respondents	Weighted	Non-FabLab average	Respondents	Weighted
7.06	595	7.01	6.81	527	6.95

Table 3: Comparison of the average exam scores between FabLab schools and non-FabLab schools

Comparing the average score between the FabLab and the non-FabLab groups, the schools designated as potential FabLab schools on average have higher average grades than the other schools. This difference is however not statistically significant[4] and thus we cannot conclude that the two groups differ with regards to average score on examinations in the 9th grade.

In conclusion, our sample schools in general have higher grades and socioeconomic status than the Danish average, and this difference is statistically significant.

3.1 Age and grade of the respondents

The age of the 1156 respondents ranged from 11-15 years old, with the majority between 12 and 14, as can be seen in Figure 1:

[4] See appendix I. The t-test was done on un-weighted scores for which the difference between the two groups is largest.

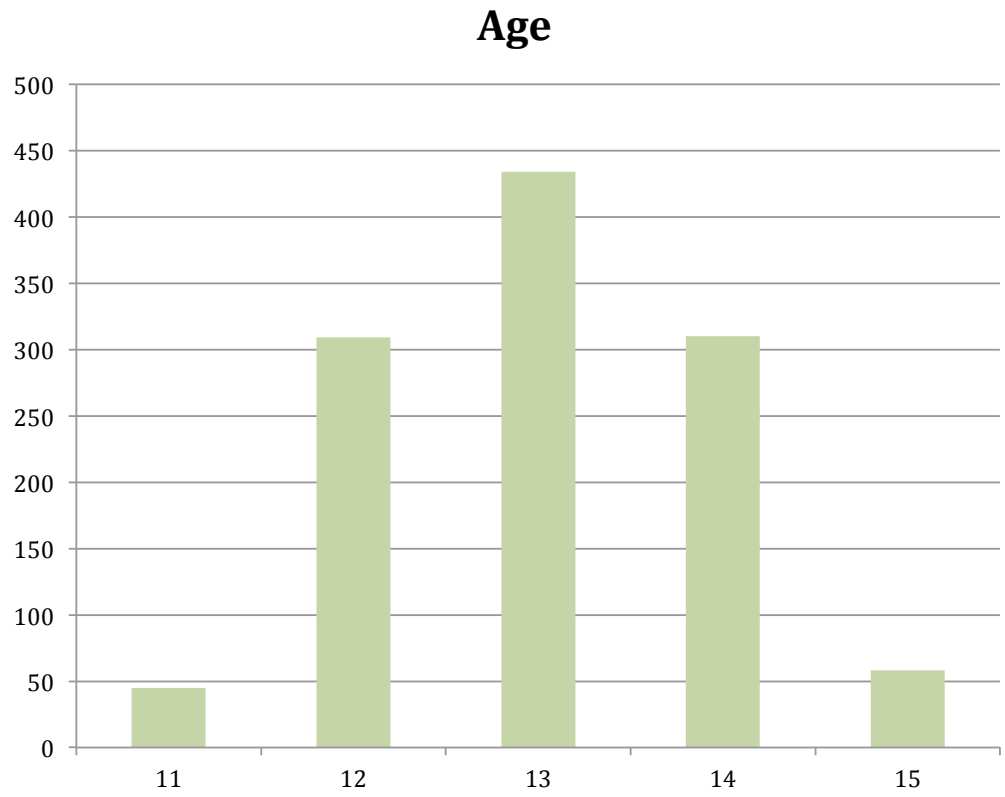

Figure 1: Respondents. Listed by age.

These students all attended grade 6, 7, 8 or 9, with the majority in grades 6 through 8 as seen in Figure 2.

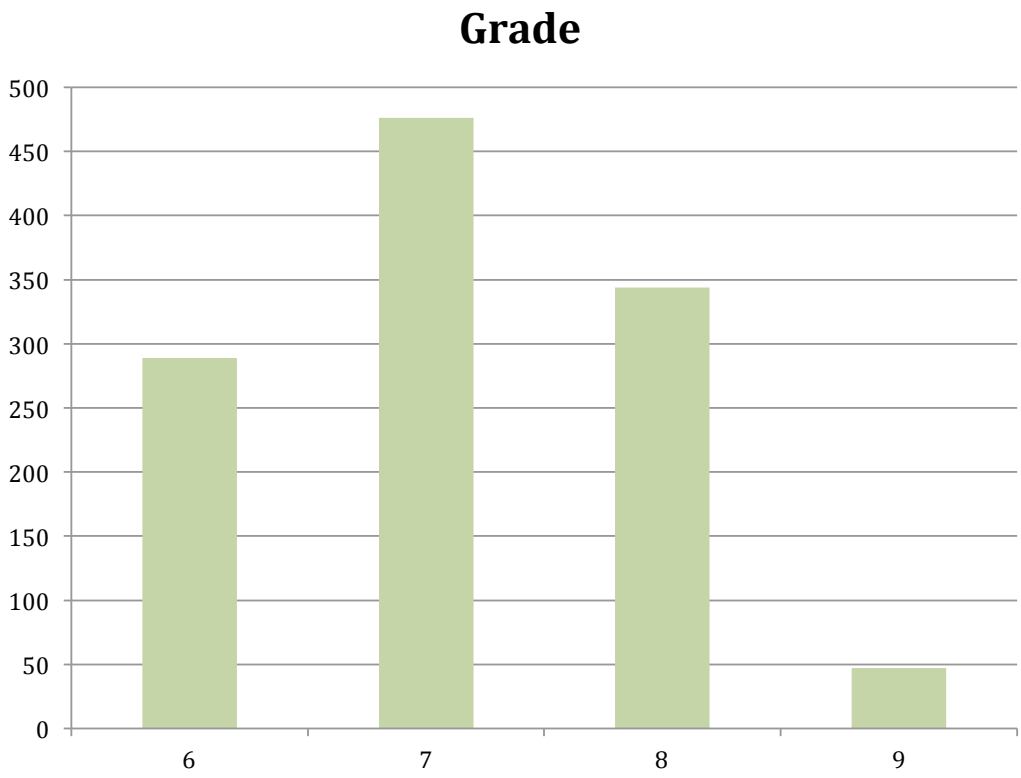

Figure 2: Respondents. Listed by grade.

3.1.1 FabLab and non-FabLab schools

The distribution of designated FabLab and non-FabLab schools with regards to the age of the students shows the difficulties we had in securing an even spreading out of the different groups of students:

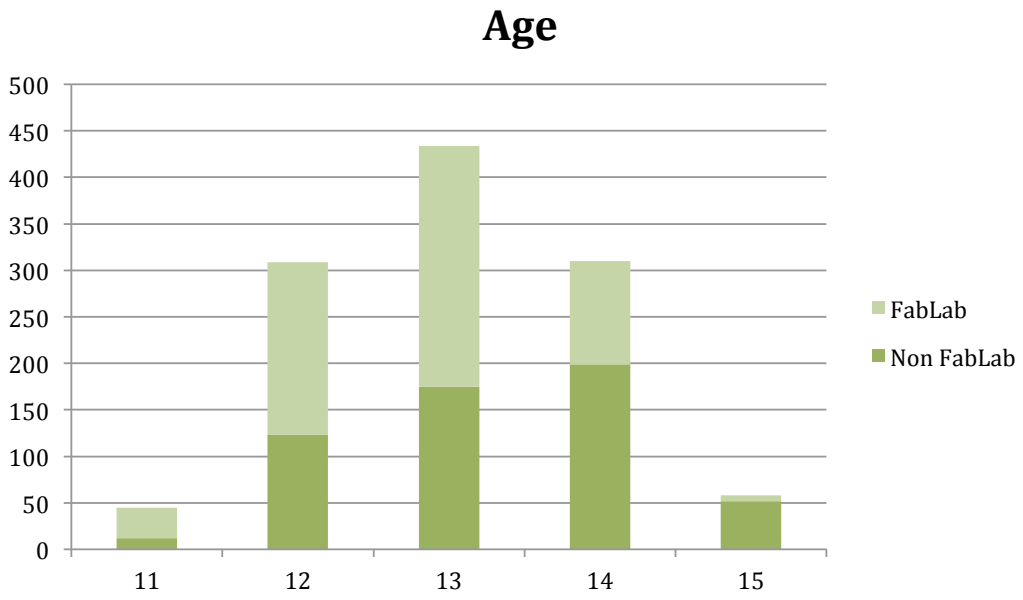

Figure 3: Respondents in the sample. Divided by FabLab-participation of school. Listed by age.

It is clear from Figure 3 (and Figure 4) that the students in the sample are not spread out evenly with regards to age and grade attended. Ideally, we wanted the 6 groups of grade 6, 7 and 8 in both FabLab and reference group to be of equal size, but this turned out to be difficult in practice as many schools selected grade 7 for the survey. At many of the FabLab schools, FabLab-activities had been planned for 7th grade, and thus these schools often chose to let 7th grade participate in the survey.

The survey was done in the early phases of the FabLab@School.dk project, and thus the participation in the project on some schools was unclear: Were they going to be a part of the FabLab@School project or not? Other schools had already created designated FabLab-facilities and were using these with select classes. In the schools, which were already using FabLabs, the schools were specifically asked to assign classes, which had not yet been a part of FabLab@School activities to the survey.[5] Thus, the schools' selection of classes means, that there should be no difference between the two groups respondents (FabLab and non-FabLab) with regards to FabLab background. Unless otherwise noted we have chosen to treat the FabLab and non-FabLab groups as one throughout this report (though they will be treated separately in the endline survey). This in turn leads to adequate numbers of respondents in each of the groups of 6th, 7th and 8th graders when testing for the effect of grade.

[5] As mentioned earlier, we wished to be able to investigate effects of participation in the FabLab@School project in an endline survey after three years.

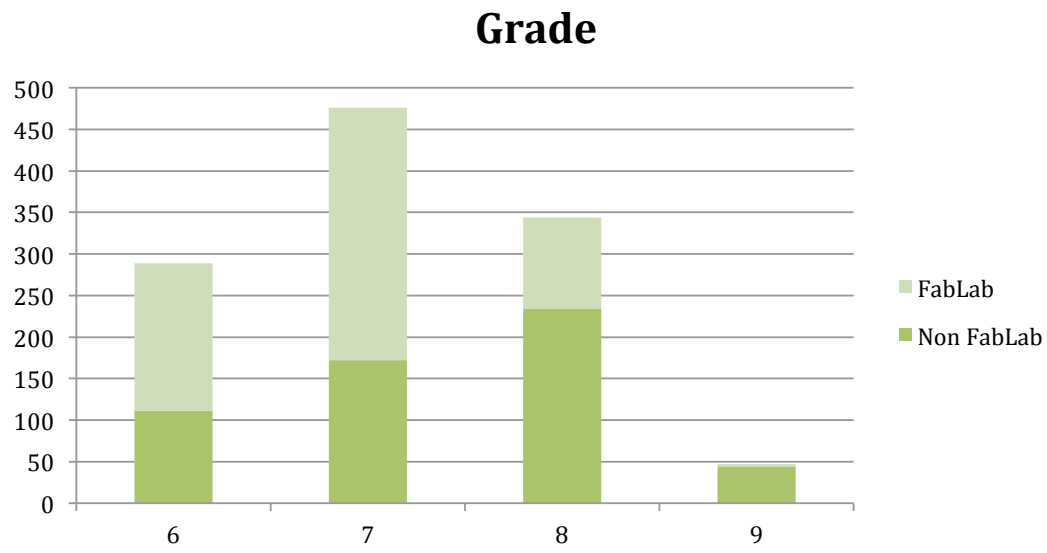

Figure 4: Respondents in our sample. Listed by grade.

4 Use and knowledge of digital technology

A central part of the survey was to investigate students' *abilities to use, master and understand digital technologies*. In order to investigate these abilities, this chapter concerns findings with regards to use of digital technologies outside of school and students' self-perceived knowledge of digital technologies. The following chapter focuses on which digital technologies students reported to have learned in school, and which technologies, the students reported to have learned outside of school.

In the current chapter, our main finding is, that while the students spend a lot of time with digital technologies, they mainly use these for consuming digital media and content rather than producing these.

4.1.1 Leisure time

In order to better understand our respondents, we asked them, what they spent their spare time on. The respondents were asked to report time spent on given activities during the past week. To ensure, that the students were able to respond rapidly we had given the students as little as four possible answers to choose from. As fig. 5 below indicates 69% of the students reported, that they had used a phone, TV or computer at least five hours during the last week. 57% of the respondents reported having been with friends at least five hours per week, while the students also spent a great deal of time on sports (39% spent at least 5 hours during the last week). Fewer students reported, that they spent more than 5 hours per week in nature (15%), performing household chores (12%), and studying (8%). Very few students reported to have spent at least 5 hours per week on working at a job that pays an income (7%), creating things (4%), singing or playing in a band (6%), home improvement (4%), and volunteering (2%).

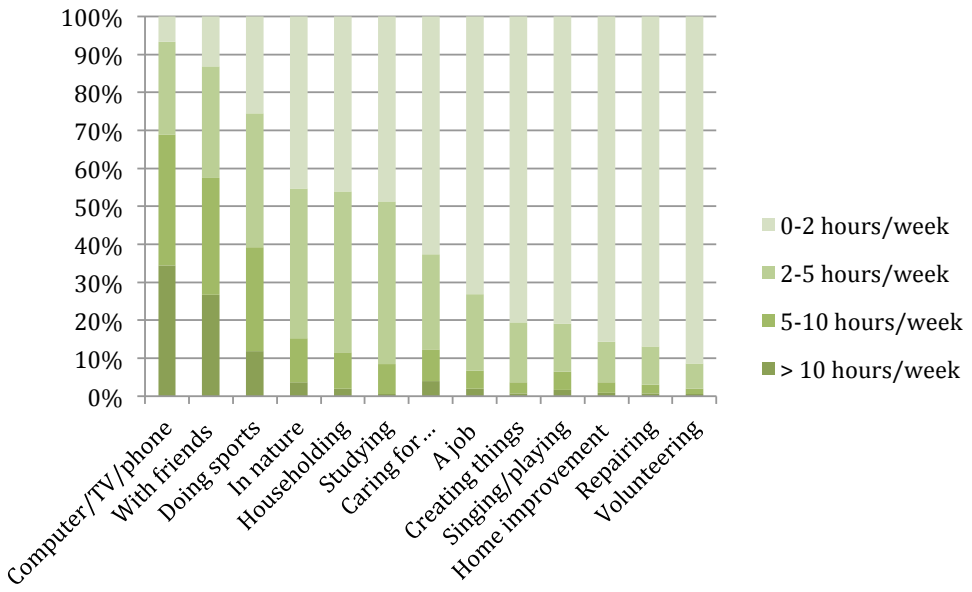

Figure 5: "During the last week, how many hours did you spend...?" The chart is ordered with regards to the 0-2 hours/week category.

4.1.2 Use of digital technologies

As mentioned in the last section (4.1.1), the students in our sample reported that they spent more of their leisure time (during the last week) on computers and phones than on any other of the given choices. The following questions probe further into which activities with digital technologies, the students reported to be engaged in most frequently.

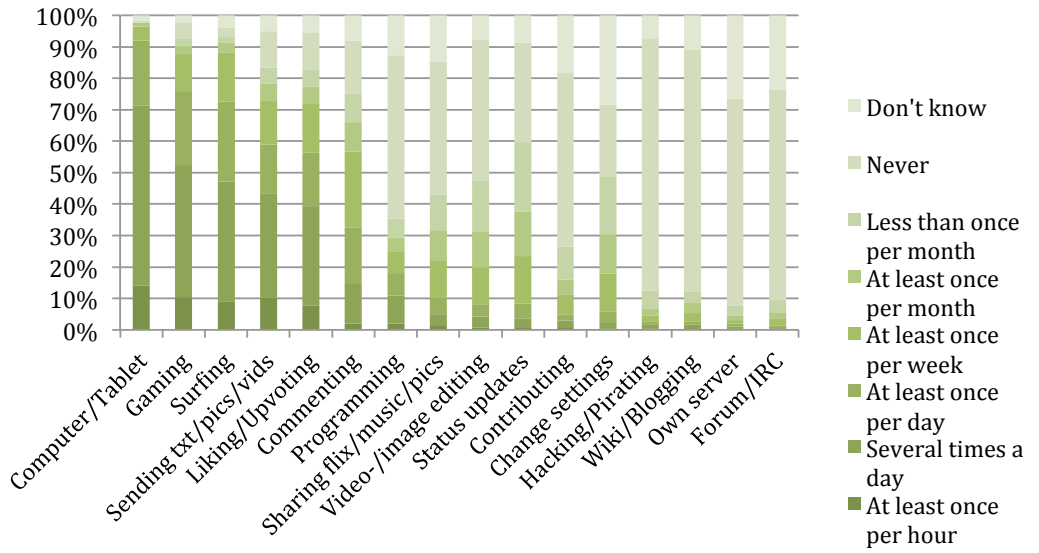

Figure 6: It use outside of school. Ordered by the sum of "at least once per day" and "Several times per day"

In Figure 7 and Figure 8, the six categories from Figure 6 have been collapsed into three possible answers, which were “several times a day”, “at least once per week” and “less than once per week or don’t know”. This provides a more interpretable visualization of the data. To create more readable charts, the original chart has been split into two charts: Figure 7 contains the activities, which more than 50% of the respondents reported to do at least once per week, while Figure 8 shows remaining activities.

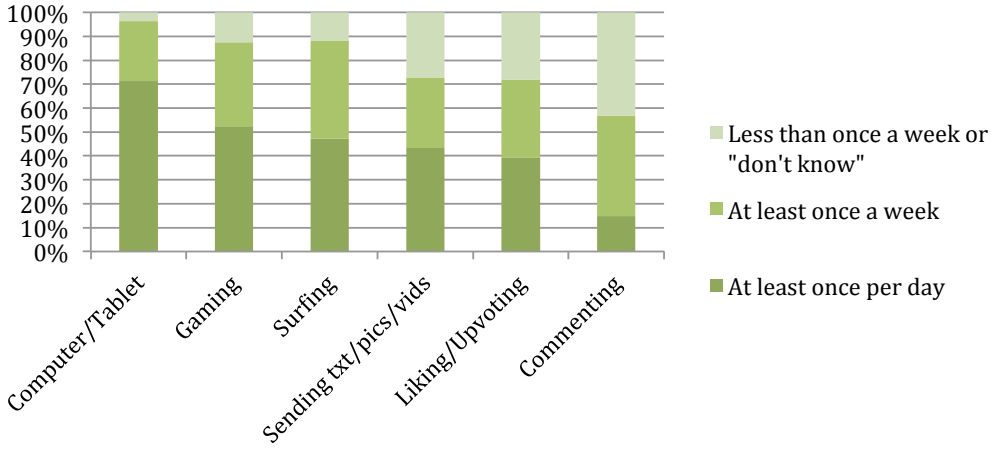

Figure 7: Time spent on computers/tablets, and on activities with digital technologies. Ordered by "at least once per day".

As can be seen in Figure 7, 71% of the students reported, that they used computers or tablets at least once per day. The data further show, that many of the students use computers, tablets and phones at least once per day for gaming (52%), surfing on the internet (47%), chatting (43%), liking/upvoting what others have posted (39%) and commenting on the updates and posts of others (15%). These activities all involve consumption of media and content as opposed to e.g. producing digital content.

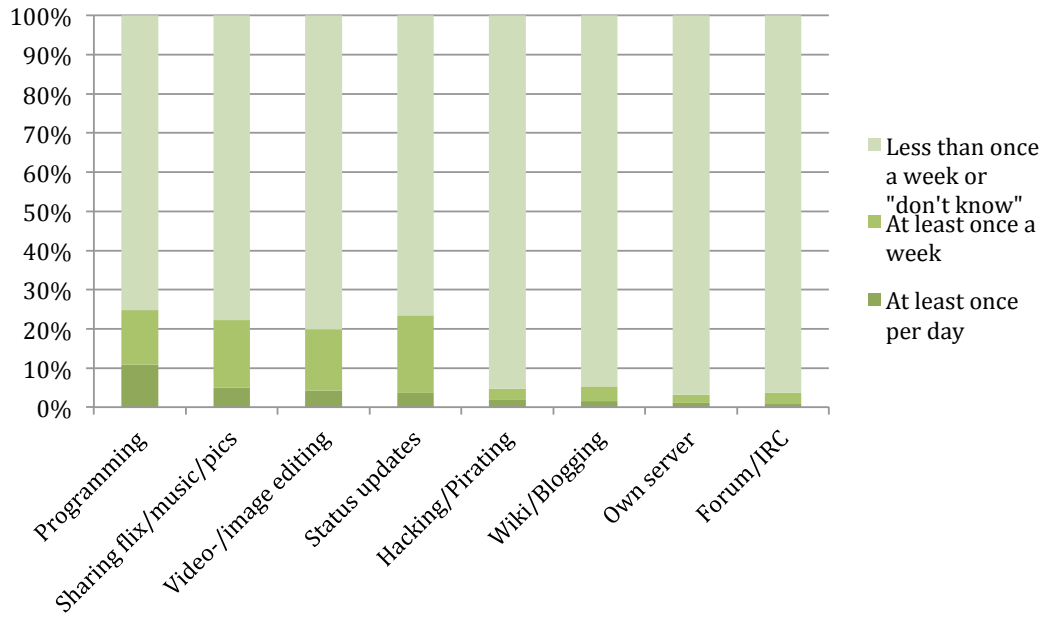

Figure 8: Time spent on computers/tablets, and on activities with digital technologies. Ordered by "at least once per day"

As Figure 8 shows, no more than 25% of the students reported to engage in any one of the included activities at least once per week. 25% of the students claimed to be programming at least once per week, but we have not had the chance to probe, what the respondents mean by programming.

Around 20% of the students reported to be engaged in sharing video, music and images on the Internet, using video-/image editing software (20%), writing status updates (23%), contributing to e.g. a Minecraft server or a blog (11%), or changing settings (18%) *at least once per week*.

Hacking and pirating was something, which very few students (5%) claimed to be involved in more often than once per week. Writing on wikis or blogs (5%) is also something, which most students do more seldom than once per. week. The same applies to setting up and running a server (3%) and communicating on forums or using IRCs (4%).

To conclude, it seems from the data, that rather than producing and sharing, the students spend a lot of time consuming digital media and content.

4.2 Self-perceived knowledge of IT

In the survey, we investigated the technological and digital literacy of the students through different instruments. One such instrument was a list of technologies towards which the students were asked to evaluate themselves on a scale from 1 to 6 (1 being "I know nothing about it" and 6 being "I could teach others about it"). The list of technologies included 22 types, and therefore it has been split into two charts. Figure 9 consists of purely digital technologies, whereas Figure 10 consists mainly of FabLab-technologies. The scale has been collapsed into three categories in order to better facilitate interpretation.

4.2.1 Computers, tablets and phones

The data shows that the most of the students in our sample reported, that they had some knowledge or good knowledge about using smartphones (93%), tablets (90%) and computers (92%). In other words approximately 90% of the students claim to be knowledgeable to some degree, when it comes to phones, tablets and computers. As shown in Figure 5, 69% of the students reported, that they use computers, TVs and phones at least 5 hours pr. week outside of school and 34% that they use computers, TVs and phones at least 10 hours pr. week outside of school. As shown Figure 7, more than 70% of the students reported, that they use computers or tablets every day. In conclusion, the students spent a lot of time on computers, tablets or phones, and they feel quite confident using these technologies.

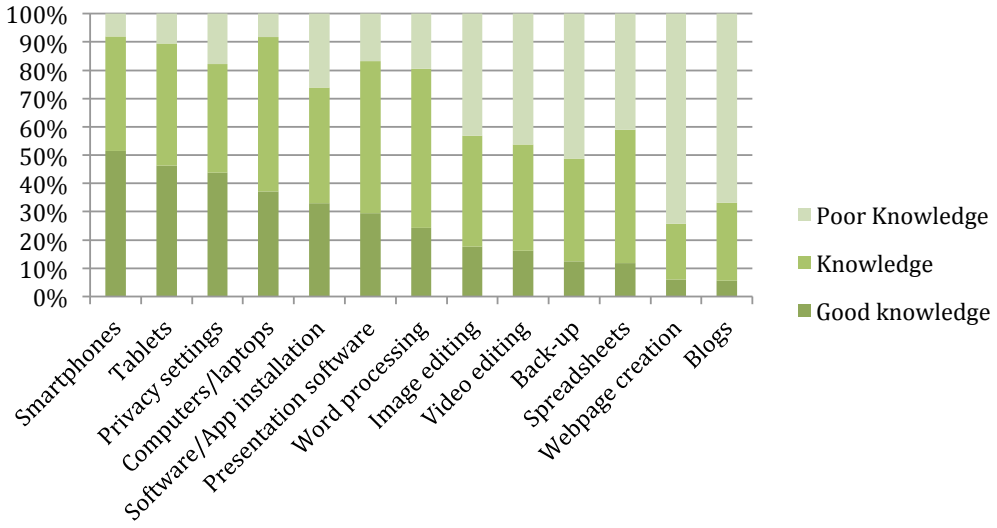

Figure 9: Self-perceived knowledge of technologies. Scale collapsed from 6 to 3 categories (1+2, 3+4, 5+6). Ordered by "Good knowledge" (5+6).

4.2.2 Privacy settings and installation of apps

The data shows that the students are relatively confident in changing privacy settings (83% claim some or good knowledge) and installing apps/software (75% report to have some or good knowledge). Both of these can be said to be important skills in an age of social media. As seen in Figure 7 most of the respondents reported that they play games (88%), surf the internet (88%), use social media for communicating (73%), liking/upvoting (72%) and commenting (57%) at least once per week. All of these are activities for which installing apps and changing settings is important.

4.2.3 Presentation-, spreadsheet and word processing software

Most respondents claimed to have some or good knowledge of presentation (84%) and word processing (81%) software. On the other hand, only 60% claimed the same with regards to spreadsheet software. These abilities will be treated under the name of *Office Literacy* later in this text.

4.2.4 Image- and video editing

When it comes to tools for creating other kinds of digital content than texts and presentations, the data show, that the students are not as confident in their knowledge: Less than 20% of the students claimed good knowledge and more than 40% claimed poor knowledge of image and video editing. As shown in Figure 6, 80% (of the students) responded that they use image- and video editing tools less than once per week (53% never use or don't know). Thus the respondents claimed to use image- and video editing software less than tools for consuming online media and content.

4.2.5 Back-ups, webpages, wikis and blogs

49% of the respondents claimed to have some or good knowledge of doing back-ups, while creating webpages (26%) and blogs (33%) also score low with regards to self-reported knowledge (some or good knowledge). In line with this, contributing to wikis and blogs is also something, which only 5% of the students claimed to do weekly (see Figure 8). A possible reason for this is, that perhaps the technology has shifted away from webpages, wikis and blogs (towards easily accessible social media platforms such as Instragram™, Tumblr™ or Facebook™. There is no longer a need for setting up a homepage or even what used to be called a blog.

4.2.6 Summing up

The data in this section suggests that, the students we surveyed were heavy users of computers, tablets and phones. They felt confident using these technologies. However, the respondents reported, that they mainly use computers, tablets and phones for consuming digital media and content by e.g. playing games, surfing the net, chatting, liking, and commenting posts and updates from others. Rather than producing content, the students reported to be consuming media and content. In line with this, many of the students in our survey reported, that they had relatively poor knowledge of tools for producing images, videos and webpages and thus move beyond consumption of digital content. The students

reported to have some or good knowledge about using tools such as word processing and presentation software. We have not inquired into for what purposes they used these office programs and how advanced functions, the students were able to use.

4.3 Fabrication technologies

In the questions about self-perceived technological and digital literacy, the students were asked to evaluate themselves on a range of technologies associated with FabLabs and digital fabrication. They were asked to do this using the scale of 1 ("I know nothing about it") to 6 ("I could teach others about it"). Again, the categories have been collapsed for better visualization of the data.

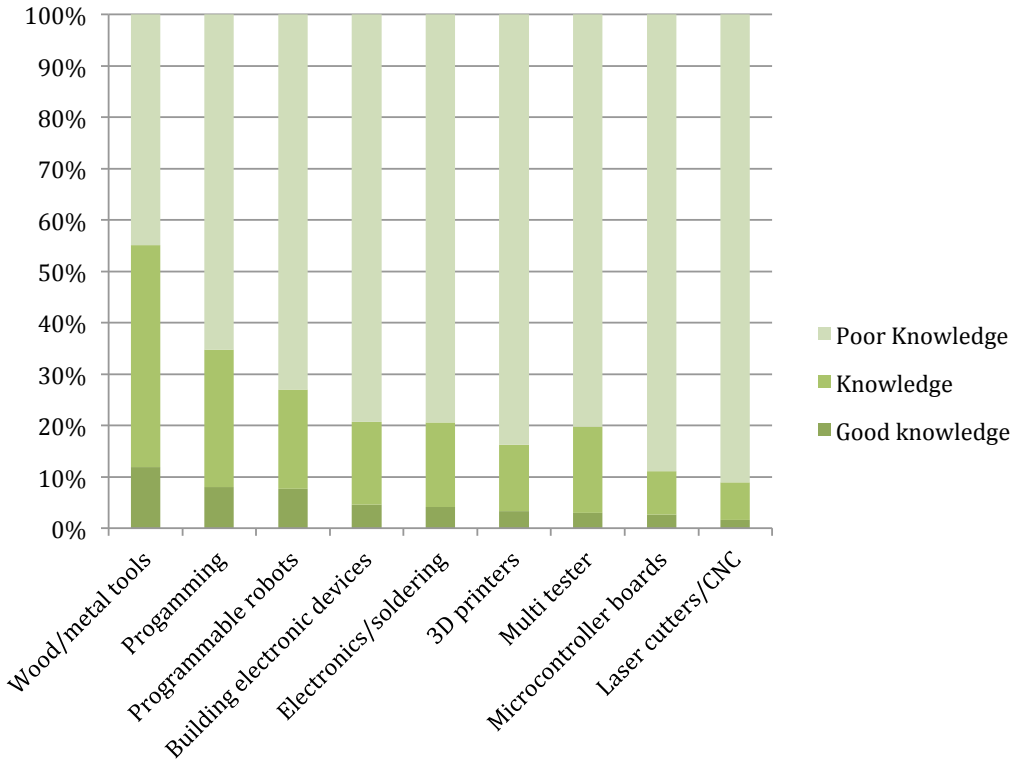

Figure 10: Self-perceived knowledge of technologies. Scale collapsed from 6 to 3 categories (1+2, 3+4, 5+6). Ordered by "Good knowledge" (5+6).

Very few students claimed to have good knowledge of any of these technologies. Tools for woodworking and metalwork stand out however as the most familiar (56% claim some or good knowledge). Except for wood/metal tools and multi-tester, the technologies in Figure 10 are all digital fabrication technologies. More students claim to have some or good knowledge about programming (35%) and programmable robots (27%) than building electronic devices from scratch (21%), electronics and soldering (21%), multi-testers (20%), 3D printers (16%), microcontroller boards (11%), and laser cutters (9%). As the

category of programming is not self-explanatory it would be interesting to investigate, what the students mean by programming, how they do it, and what they use programming for.

Overall, it is clear, that few students reported to have knowledge of digital fabrication tools. This was to be expected, since digital fabrication technologies are not widely available, and since the respondents (as requested) had not yet taken part in FabLab@School activities.

4.4 Conclusion

This chapter concerns students' knowledge and use of digital media and technologies.

To conclude, it seems from the data, that rather than producing, the students spend a lot of time consuming digital media and content on computers, tablets and phones - e.g. by playing games, surfing the net, chatting, liking, and commenting posts and updates from others. Most students reported to have some or even good knowledge of using computers, tablets and phones for consumption purposes. On the other hand, many of the students in our survey reported, that they had relatively poor knowledge of tools for producing images, videos and webpages and thus move beyond consumption of digital content. The students reported to have some or good knowledge about using tools such as word processing and presentation software. We have not inquired into for what purposes they used these office programs and how advanced functions, the students were able to use.

In the recent International Computer and Information Literacy Study (ICILS) report it is concluded, that Danish adolescents are heavy users of IT but that their use is not very advanced (Bundsgaard et al. 2014). The ICILS based the conclusions on tests of advanced functions within software programs, as opposed to the present survey, which focuses more on use of different types of technologies, including social media and digital fabrication. The ICILS report is thus able to conclude, that the functions, which Danish adolescents are able to use within known types of programs, is not very advanced. In the present report, we are however able to conclude, that the students in our sample are in general not very familiar with technologies for producing digital content, and that very few of them are familiar with digital fabrication technologies.

When spending time with computers, TVs and phones is the most popular leisure activity, it is tempting to talk about the students in our sample as digital natives: Adolescents who were born in a digital world and to whom all things digital are easy and comes naturally (Prensky 2001). As seen in both this report and in the ICIL study, the school system cannot take this for granted.

5 IT in schools

The previous chapter concerns students' use and knowledge of digital media and technologies. This chapter on the other hand, concerns questions investigating which knowledge of digital technologies the students had acquired inside and outside of school. The students were asked, whether they had gained knowledge of the given technologies either "primarily in school", "primarily at home" or whether they had not yet learnt to use the technology in question ("I haven't learned it"). Our main concern was to identify which technologies are primarily being obtained as part of the Danish school system. Figure 11 below displays the results from the first section of questions, whereas the last part will be treated later in the chapter.

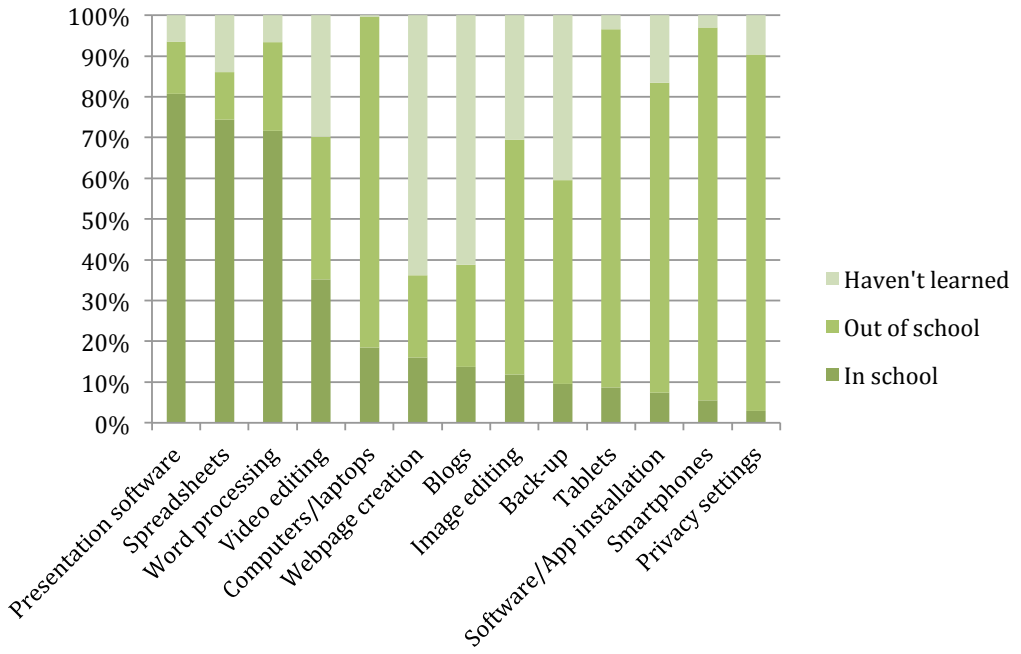

Figure 11: Where have the students primarily learned their digital skills? Ordered by "in school"

As Figure 11 shows, most students report, that they have learned to use presentation software (81%), spreadsheets (74%) and word processing software (72%) in school. While 35% of the respondents claim to have learned video editing in school, for the remaining technologies, this is true for less than 20% of respondents. Thus, few respondents claim to have learned webpage creation (16%), blogging (14%), image editing (12%), backing up (10%), installing apps (7%), and changing privacy settings (3%) in school. In line with this, few students report that they have learned how to use computers/laptops (18%), tablets (9%), and smartphones (5%) in school. Thus the vast majority of the participating students claimed, that they had learned how to use computers at home (81%), but there is a group of 18% of the respondents, who seemed to have learned this

primarily in school. This group of students could potentially be a very important group to focus on when teaching the use of computers in schools.

5.1.1 Office literacy

As reported in the last paragraph, Figure 11 shows that a large majority of students report having learned to use presentation software, spreadsheets and word processing software in schools. Since these three types of software make up the core of any office-package of software, we have chosen to call the ability to use these programs *Office Literacy*. To investigate this finding further, we have run a factor analysis[6] on the data of self-reported knowledge with regards digital technologies (see section 4.2). A factor analysis is a statistical method, which searches for common factors underlying answers on several questions. Especially one factor stands out, when this analysis is run. Three variables all draw heavily on this factor, and that is presentation-, spreadsheet- and word processing software. Another way to put this is, that if one respondent has e.g. a high score on one of the items, that respondent is likely to also have a high score on the other items drawing on the same factor. The analysis shows, that there seems to be an underlying factor, which is explanatory with regards to self-perceived abilities with regards to presentation-, spreadsheet- and word processing software.[7]

In conclusion, students report having learned office software in schools, and knowledge of different types of office software draw on the same underlying factor. The data suggest that schools have an important impact on the digital literacy of the students in our sample.

In order to investigate the Office Literacy further, we have developed an index variable, which consists of the students' self-perceived knowledge with regards to word processing-, spreadsheet- and presentation software averaged and rounded off to nearest whole number. This gives the following chart:

[6] Principal Components on a polychoric correlation matrix with an orthogonal rotation. The group stands out with nfactors=3 as well as 4.
[7] The Danish findings do not match findings from identical questions used by the TLTL group at Stanford University in California, which makes them even more interesting.

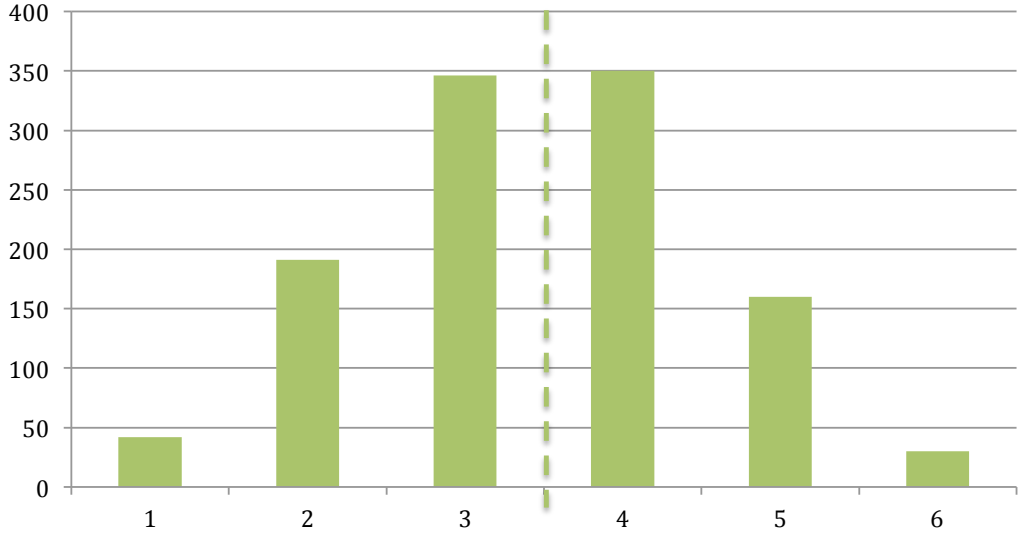

Figure 12: Average of students' responses on self-perceived knowledge about office software on a scale of 1 ("I know nothing about it) to 6 ("I could teach others about it).

The mean value of the scale is 3,5, and as can be seen, this coincides with the mean value of the Office Literacy score of the students.

As seen in Figure 12, the middle categories of the index variable are very populated. This indicates that office programs are familiar to most students, while at the same time it is something, that fewer students claim to be able to teach others about than e.g. phones, computers and tablets (see Figure 9). This could suggest, that teaching Office Literacy in schools has the aim of getting as many students as possible to reach a certain level of literacy in the office programs and thus not on teaching the more advanced skills, which only few of the students are ready for.

5.1.2 Image and video editing

The data shows that fewer students claim to have learned image- (12%) and video (35%) editing skills. This suggests, that these skills are not in the same way the focus of the schools. With regards to both types of software, there is a group of about 30% claiming not to know how to use them (see Figure 11). In Figure 9, which concerns self-perceived knowledge of given technologies, more than 40% of the respondents claim poor knowledge of these two skills. The scope of this report is not to claim, that video- and image editing are important skills (for content creation in a time of social media), but it is clear from the data, that if they are indeed deemed important, there seems to be an opportunity for schools to make an impact with regards to image- and video editing software.

5.2 Digital fabrication in schools

Figure 11 above displayed the first part of results regarding whether or not the students reported to have learned use of given technologies in- or outside of school. The last part of these results is displayed below in Figure 13. As before, the possible three answers included: "primarily in school", "primarily at home", and "I haven't learned it". The questions in this section focus specifically on fabrication technologies but include items from metal-/woodwork and a multi-tester as these technologies are often used in connection with digital fabrication.

Of the technologies mentioned in Figure 13, most students report to have learned wood- and metalworking in school (52%). Woodworking is taught as a subject in Danish schools, and metalwork is often offered as an elective course. In this perspective, it is not surprising, that more than half of the students think, they have primarily learned wood- and metalwork in school. 25% of the students report, that they have learned using the multi-tester in school. Since the some of the students have been introduced to the multi-tester in the subject Nature&Technology[8] (grade 1-6) and everyone should be introduced to it in the subject Physics&Chemistry[9] (grade 7-9), it is surprising, that 65% of the students in our sample do not think they have learned to use it.

According to the respondents, 22% of them have learned to use programmable robots (such as LEGO™ Mindstorms) in school. Less than 15% of the students report to have learned to use the remaining digital fabrication technologies and skills in school. These are building electronic devices from scratch (14%), electronics and soldering (14%), microcontroller boards (e.g. Arduino) (10%), 3D printers (8%), Programming (8%) and Laser cutters and CNC routers (5%). Students in our sample have not had much exposure to digital fabrication technologies in school, since we had specifically asked for school classes, which had not been part of the FabLab@School project yet for our survey.

[8] Natur/Teknik
[9] Fysik/Kemi

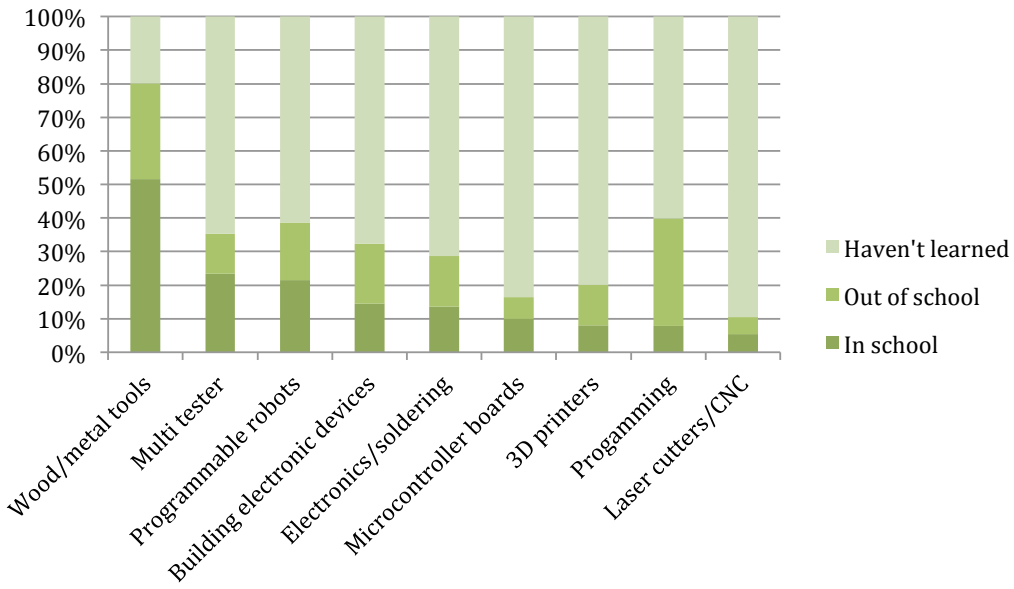

Figure 13: Where have the students primarily acquired their fabrication skills? Ordered by "in school"

5.3 Conclusion

In conclusion, it seems that most students are taught to use office programs in school, and that they acquire some form of Office Literacy. It also seems, that there is not the same amount of focus on teaching how to use image/video editing software, and that very few students have worked with digital fabrication technologies in school (below 15% except programmable robots, which 22% claimed to have learned to use in school). A large group of students report, that they have not learned how to use image-/video editing software (31% and 30% respectively) and digital fabrication technologies (60%-90%).

Overall it seems plausible, that the schools have focused on Office Literacy, and that this focus had the effect of reaching some level of literacy with regards to presentation software, spreadsheets and word processing. Further, it seems very plausible, that a focus on image-/video editing software and digital fabrication technologies would have the effect of raising the amount of students, who learn to use these technologies in school, raise the average level of knowledge about these technologies and thus expand the range of digital literacies among Danish students.

6 Design processes

The Organization for Economic Co-operation and Development (OECD) has through a series of reports on the topic referenced and defined a set of 21st century skills (Ananiadou and Claro 2009). The abilities to actively engage in heterogeneous communities of practice and to think and act innovatively on societal challenges are parts of what these 21st century skills. These same skills are also argued to be an important part of design thinking in academic literature (Cross 2011). Such skills are difficult to expose or measure in the timespan and limitations of a survey format. However, we have made attempts to probe into these aspects through a range of questions.

Firstly, we asked the students how they perceive their own abilities to work in groups, as well as their own creative, imaginative and idea generating abilities. (on a scale of 1 to 6). Further, the students were asked about their experiences with creating ideas for products or inventions and acting on these ideas.

After probing the self-views and experiences, the students were asked an open-ended question on a societal challenge. To follow up, the students were asked to rate different types of stakeholders, such as personnel, relatives, and police, in relation to their potential importance for solving the problem. They were further asked to rate the importance of different parts of the problem-solving (design-) process, such as planning, testing, involving stakeholders and building cardboard models.

The questions on design process thus combine measures of self-perceptions, experiences, approaches to real-world problems and valuations of process parts and stakeholders.

6.1 Creativity, imagination and collaboration

The students' were asked to self-assess their creative, imaginative and collaborative abilities by rating to which degree, they agreed with a range of statements. This was done on a scale of 1 (strongly disagree) to 6 (strongly agree). The students were furthermore asked, if they thought of creativity as fixed human capacity, whether they were interested in the creative (crafts) subjects in school, and whether inventing things were important to them. The data (see Figure 14) showed that most of the students rate themselves high in terms of their creative (73%), imaginative (80%) and collaborative (84%) abilities, and they find creative subjects interesting (74%), but inventing stuff is not important to most of them (42%). Apparently this is not a part of being a "creative person" according to many of the students.

For the sake of writing this report, the survey questions have been translated into English.. It is important to note that concepts such as imagination, creativity, ideas etc. are difficult to translate directly into Danish and can take on different

meanings depending on the context in which they are used. For example, in the minds of the respondents, the Danish word for imagination (fantasi) might have more to do with imagining "weird stuff" than with imagining solutions to real-world challenges. The data is shown in Figure 14, but since the questions are abbreviated for the sake of formatting the chart, the full (translated) wordings of questions are included in Table 4.

1.	**I am good at coming up with new ideas together with peers**
2.	**I am good at collaborating in heterogeneous groups**
3.	**I have a good imagination**
4.	**I am good at generating new ideas**
5.	**Creative subjects are interesting**
6.	**I have lots of good ideas**
7.	**I am a creative person**
8.	**Some people are born creative, while others will never learn**
9.	**I am good at building on the ideas of others**
10.	**Inventing things is important to me**

Table 4: Translated questions from the multiple-choice creativity instrument

In Figure 14, the six categories of strongly disagree to strongly agree have been collapsed into two categories of either disagree or agree.

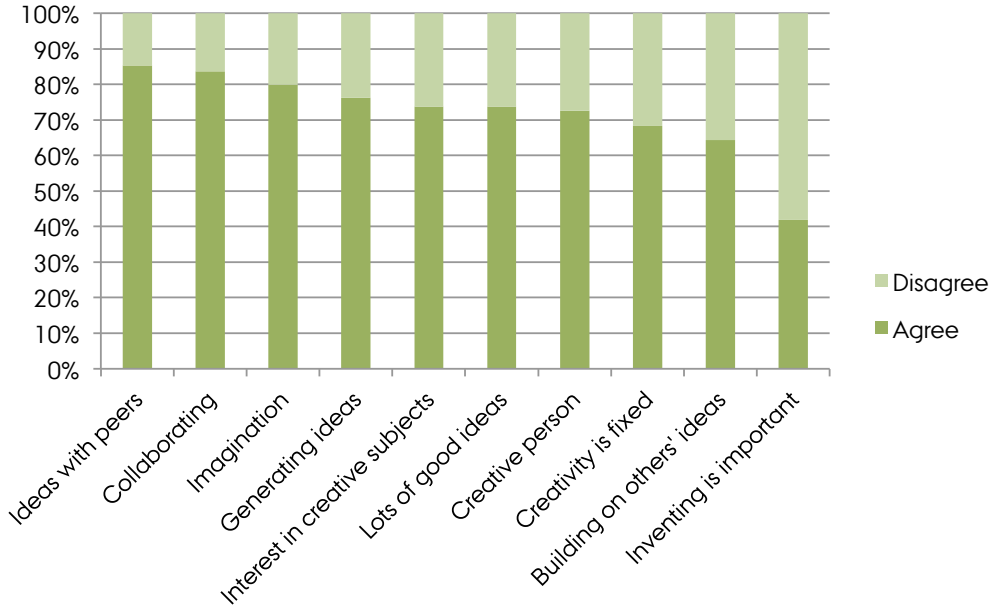

Figure 14: Attitudes and self-evaluation with regards to creativity, imagination, cooperation and creative subjects. Values collapsed from 6 to 2 categories. Ordered by "Agree".

Overall the data show a high self-rating in terms of the questions asked, with all except for the last one, at positive scores above 60%. More than 70% of the students report that they view themselves to be creative persons (73%), that they are good at generating new ideas (76%), have a good imagination (80%), and are skillful in terms of engaging in heterogeneous collaboration (84%). This was a surprising result to us, especially since the responses did not match our observations of students in this age group. There can be several reasons for this surprising result: Perhaps the students had unrealistic self-perceptions, perhaps they had other interpretations of the involved concepts and perhaps the answers are in part due to demand characteristics. As explained in section1.5.1 (Types of questions), demand characteristics cause students to answer what they believe the researchers want to hear. Another interesting result was that only 42% of the students considered inventing as important to them. Perhaps this has to do with the wording of the question. To invent (Danish: Opfinde) in the Danish context is equivalent to creating truly novel products. One could argue, that a question about whether or not producing or creating own products was important to the students could have aligned closer with their answers on the creativity items. Ultimately, the data indicate that according to the students, being creative, imaginative and generating new ideas is not necessarily linked to inventing things.

6.2 Realizing ideas for products or inventions

Following the questions concerning their own creative and imaginative abilities, the students were asked if they had ever had an idea for a product or an invention. If they responded positively to this question they were asked to describe the idea in an open question. As shown in Figure 15, 47% of the students responded positively that they had had an idea for a product or an invention

The students who responded positively to having had an idea for a product or an invention, were asked to describe this. The answers ranged from a bedside cup holder to new types of motherboards for computers, while others did not remember or did not wish to share their ideas for fear of us/others patenting or stealing them. Of the students, who answered that they had had an idea for a product or invention, only 26% had created their product, while 74% had not (see Figure 16 below).

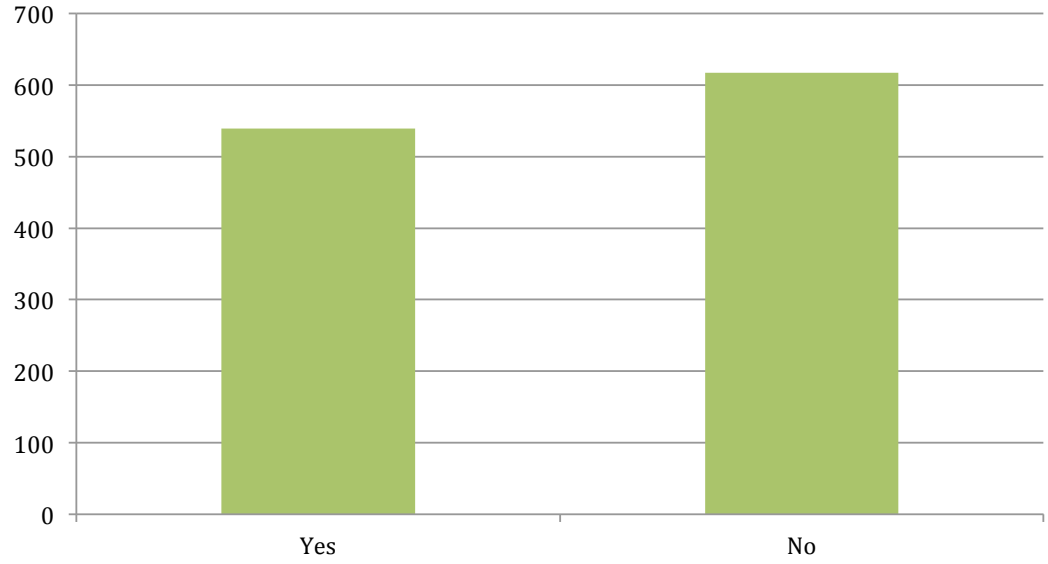

Figure 15: Have you ever had an idea for a product or an invention?

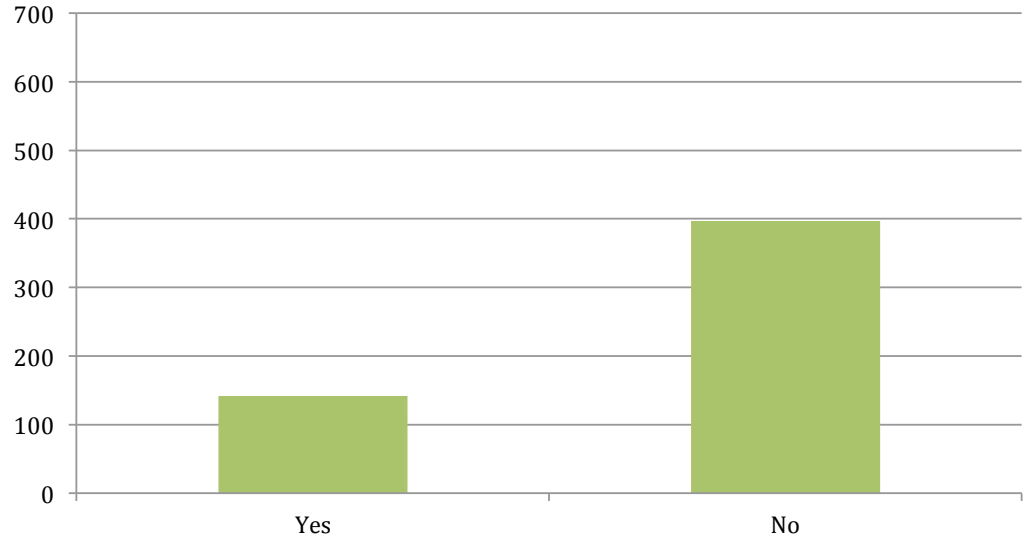

Figure 16: Did you create or build this product or invention?

When looking at the total number of responding students only 12% had built or created their idea or product. 34% of the students had an idea that they did not create or build while 53% claimed never to have had an idea for a product or an invention. This can be taken as an indication that most students are not used to thinking about objects in their everyday lives, which they can improve, and that

very few are used to actually acting on ideas for improving their everyday lives. Another way of putting this is that the students in general approach the world as consumers rather than approaching it as something to which one can imagine preferred futures and create intentional change. That is, the students do not approach the world with a designerly mindset (Nelson and Stolterman 2012).

While this seems very plausible and fits well with our observations (Smith and Iversen Forthcoming), such a conclusion would require further investigation into how the students perceive the question: What is a product or an invention in their interpretation? What does it mean to create a product or invention?

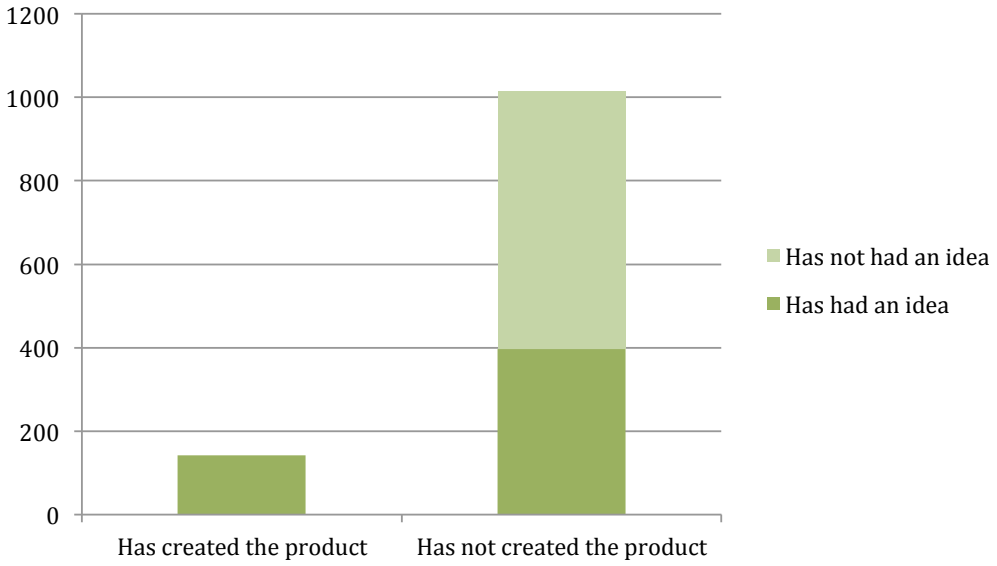

Figure 17: Have you had an idea and created the product or invention?

In conclusion the students generally perceive of themselves as good at imagining, generating ideas, being creative and collaborating in heterogeneous groups. They do not however seem to link these skills to inventing or producing things – neither in an abstract ("inventing is important to me") or a practical ("I have created the product or invention") sense.

Since one objective of the Danish FabLab@School research project is to investigate students' "abilities to think and act innovatively on societal challenges", the link between thinking and acting innovatively is of great interest. While we as researchers may define innovative thinking as linked to generating ideas, having a good imagination and being creative, we cannot conclude, that (an instrument consisting of) students answers on items relating to their self-perceived abilities within these areas is necessarily a measure of the students'

abilities for innovative thinking. At the same time, it could be argued, that acting innovatively is not necessarily the same as inventing or creating a product. It is however, interesting to investigate the possible discrepancies between innovative thinking and acting and between definitions in the literature and views among the students. Further studies are planned in order to investigate these discrepancies.

6.3 The dementia task

As stated in the introduction, the Danish FabLab@School survey consists of different types of questions. More specifically the questions range from closed items asking about opinions or self-perceived abilities through multiple-choice tasks and to open-ended problems. One such problem is a task of preventing demented elderly from getting lost (and sometimes dying before they are found), from their nursing homes. This is an example of a design problem or a so-called *wicked problem* (Buchanan 1992). It is a characteristic of wicked problems, that they are indeterminate. That is, they do not have one true solution. Thus per definition, suggesting a solution to a wicked problem requires judgment. According to pragmatist design literature (e.g. (Löwgren and Stolterman 2004)) this judgment is exercised on a basis of knowledge generated in an iterative process – for example through externalizations (i.e. sketches, mockups and prototypes, etc.). Thus according to *Design Thinking* (Cross 2011), a designer would approach the wicked problem in an investigative (design) process. However, processual thinking and complex problem solving is not necessarily part of the current Danish school reality.

We had the hypothesis, that the students lacked the necessary tools with which to approach the dementia task. That is, they would be inclined to suggesting solutions and inventing ideas rather than approaching the problem as a complex challenge in need of further investigation. Our aim was to investigate what the students, despite their lack of insight into such processes, would respond or consider as alternative ways of approaching the challenge.

The dementia case was a real-world problem discussed in the Danish media at the time of the survey.[10] The wording of the open-ended question translates from Danish to the following:

> "In the beginning of the year 2014, 9 grandparents disappeared from their nursing home because of their loss of memory (dementia). The problem for the nursing home is to create security for the elderly without taking away their freedom.
>
> If you were asked to solve this problem, what would you do?"[11]

[10] The number of elderly refers to a Danish context (population approx. 5.7 million)
[11] Translated from Danish

Posing a good question, which could probe the current state/understanding of *design*, *process* and *inquiry* among the students in a valid way was difficult. We are aware that the framing of the question asked, could have easily prompted the respondents to come up with a solution rather than a process. Nevertheless, the results of the answers are interesting for various reasons, discussed below. Further, it is our assumption that responses to similar questions, between the baseline survey and the endline survey, will reveal a shift in the number of students who have been exposed to design processes in FabLab@School activities. The assumption is, that it will be more frequent for the latter to suggest processual and investigative approaches to complex challenges.

After having answered the open-ended question, the students were asked to rank suggested stakeholders and activities within their process of solving the problem. This task is discussed in the paragraphs 6.3.2 and 6.3.3 below.

6.3.1 Coding the responses

In order to score the responses to the open-ended question, the answers were coded in a grounded theory approach (Strauss and Corbin 1990). Rather than making a coding system based on an initial hypothesis, the responses were grouped based on the given answers. Each time a new type of answer appeared, a new code was created. When the amount of codes stabilized after approximately 220 respondents, a total of18 codes had been made. The 18 codes were then collapsed and categorized into three categories:

1. Creating a situation in which the demented do not try to leave or get lost
2. Preventing the demented from leaving the nursing home
3. Keeping track of and finding the demented, once they have left the nursing home

Within each of these categories, a taxonomy of 4 levels was created, resulting in a total of 12 codes. The highest level (level four) within each category was reserved for the responses, which, within the category in question, proposed to start an investigation into the problem. The preliminary version of the coding system looked like this:

A. Creating a situation in which the demented do not leave/get lost

1. Convince the elderly not to leave/ let the elderly stay in their own home/ cure the dementia
2. Make sure the demented have a good time (get a lot of visits/ participate in activities/ create better surroundings/ have more caretakers/ have more freedom)
3. Make the demented feel more at home (e.g. by making their rooms/ apartments resemble their previous private homes)
4. Investigate what makes the demented leave and get lost

B. Preventing the demented from leaving the nursing home

1. Put a fence around the nursing home/lock the doors/surveil the elderly/guard the doors
2. Place a chip on (or inside) the demented elder and a sensor at the door, or using other

kinds of technology with the purpose of preventing the demented from passing or leaving with no concrete suggestions of placement or function
3. Place a chip on (or inside) the demented or using other kinds of technology with the purpose of preventing them from leaving the home. Including reflections on where to place it or how it should function
4. Investigate, how the demented could be prevented from leaving and what this would affect their lives

C. Tracking and finding the demented, once they have left

1. Look for the demented/ call the police to have them look for the demented
2. Place a tracking device on/in the demented without reflecting upon how to place it or how it should function, or put up signs, which show the direction home, in the neighborhood
3. Put a tracking device on/in the demented including reflections about how to place it and how it should function
4. Investigate, why the demented get lost, how to best find them and how this possible solution would affect their lives

Table 5: The initial 12 codes in the coding system

The coding system captured differences in approaches, ideas and solutions to the problem, and indicated how many students opted to set up an inquiry or design process in response to the challenge. The coding system, however, still presented some challenges. Often, it was difficult to distinguish between some of several codes within a category (e.g. whether a suggestion for placing a gps on the elderly was reflected with regards to usage (C3) or not (C2)). In order to avoid this ambiguity, the codes B2 and B3 was collapsed into one as was C2 and C3. A further problem, which manifested itself during the coding, was an uncertainty whether simply locking the doors with keys (B1) was at a different taxonomical level than preventing the demented from leaving by using chips, sensor or codes at the (locked) doors (B2+B3). Seen from the perspective of the elderly the result remained the same, as they would not have the possibility of leaving the premises. Therefore, B1, B2 and B3 ended up in one collapsed variable.

Responses, which suggested that staff from the nursing home should take the demented for walks outside the home, posed challenges of ambiguity. These responses could stem from both an emphatic and an instrumental approach to the elderly. This type of suggestion could have the purpose of improving the happiness of the demented and thus (according to the responses), make them less likely to leave. On the other hand, the same response could be made with the purpose of surveilling the elderly. In this way, responses including escorts or walks could be seen as both a limitation of their freedom (B1+B2+B3: Prevent the demented elderly from leaving/escaping) and an increase in their freedom (A2: improve the life of the demented elderly). The responses in the end were coded based on an interpretation of the intention of the respondent.

In the end, a new collapsed coding system was made with the following codes:

Resulting codes for answers to the task of saving demented elderly

1. I don't know and other similar responses
2. Cure the elderly or persuade them not to leave
3. Prevent the demented elderly from leaving/escaping
4. Find the demented elderly once they have left
5. Improve the life of the demented elderly
6. Track the demented elderly (GPS)
7. Investigate the problem further (processual approach)

Based on the collapsed codes, the number of responses in each category created the following representation (Figure 18):

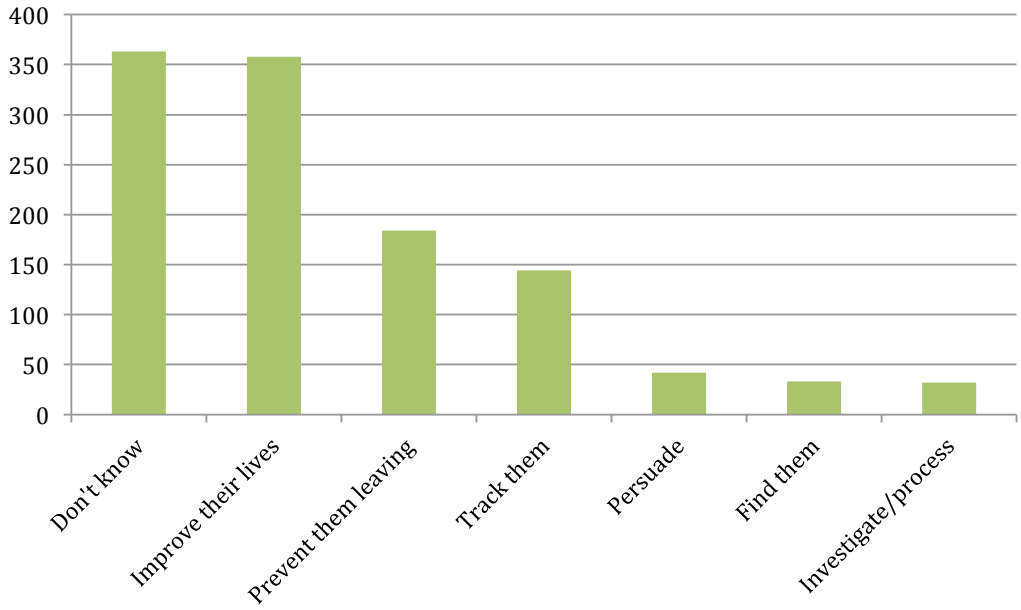

Figure 18: Distribution of answers in final version of the coding of the open-ended dementia problem. Ordered by frequency.

As seen in Figure 18, the two most popular categories were "I don't know" (31%), and "improve the life of the demented elderly" (27%), including more than 700 responses in total. This is followed by 184 responses (16%), proposing that the elderly should be prevented from leaving the nursing home (by means of locks, bodyguards, RFID chips, fences, etc.). A total of 144 respondents (12%) suggested some form of tracking – often including GPS-technology. The following two categories show a lack of insight into the problem area. If one could simply persuade the elderly to stay, which 42 respondents (4%) proposed or find the easily elderly, which 33 respondents (3%) suggested, this would not be a societal challenge in the first place.

Thus 31% of the respondents thought they should come up with a solution to the complex problem of demented elderly leaving their nursery home, but they where not able to suggest such a solution. On the other hand, 66% of the respondents suggested solutions with varying degrees of insight and appropriateness. Only 32 respondents (3%) responded, that they would initiate some kind of inquiry or process. Thus, the data suggests a general lack of focus on teaching the students processual approaches and to ways of addressing complex and societal challenges. But this will require further research.

Figure 19 is another representation of the same data.

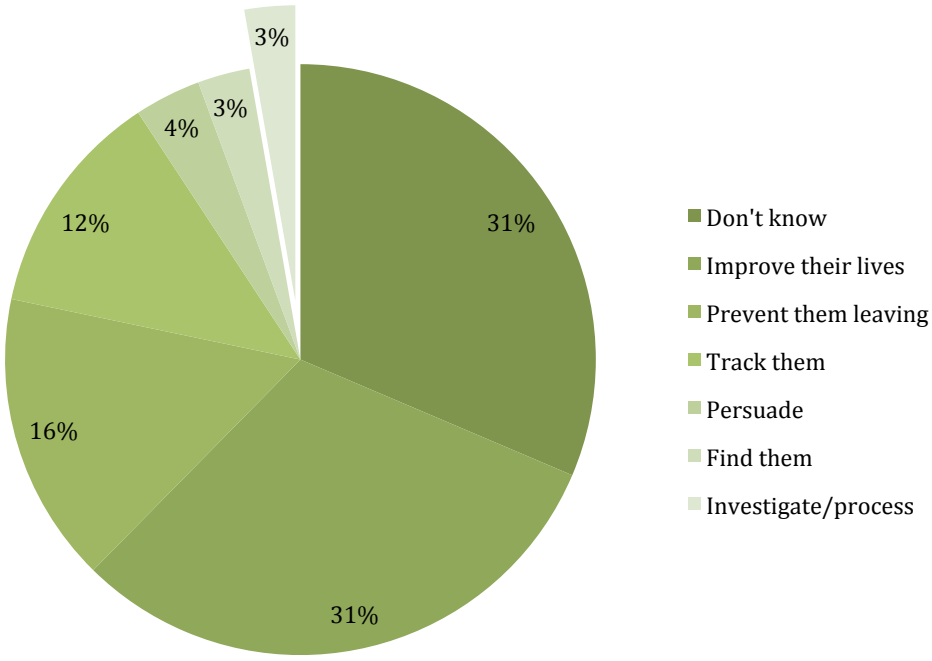

Figure 19: Pie chart of the distribution of responses on the open-ended dementia challenge.

Overall, the data shows an example of how the students addressed a concrete societal challenge, and the tendency to provide final ideas or solutions rather than processes of inquiry, which could lead to a solution. There can be many reasons for this, one clearly resulting from the wording of the question. This is nevertheless a very interesting finding, which calls for further investigation.

6.3.2 Importance of stakeholders

After answering how to solve the dementia problem, the students were asked to rate the importance of specific (possible) stakeholders on a scale of 1 (not important at all) to 6 (very important). This instrument was meant to give insights into students' abilities to identify important stakeholders, as part of solving the

challenge. The elders, their relatives, the nursing staff, as well as an industrial designer, the police, NASA, and others were included as possible stakeholders. This was done in order to gauge the extent to which the students, given possible relevant answers, could see the benefit of involving different stakeholders into the process. We wanted to investigate if some students would choose to solve the problem on their own without involving anyone (relying on their own ideas), or whether they were aware of the benefits of involving multiple stakeholders.

A chart with the 6 values collapsed into three categories[12] (see Figure 20 below), illustrates which stakeholders the students considered to be the most important.

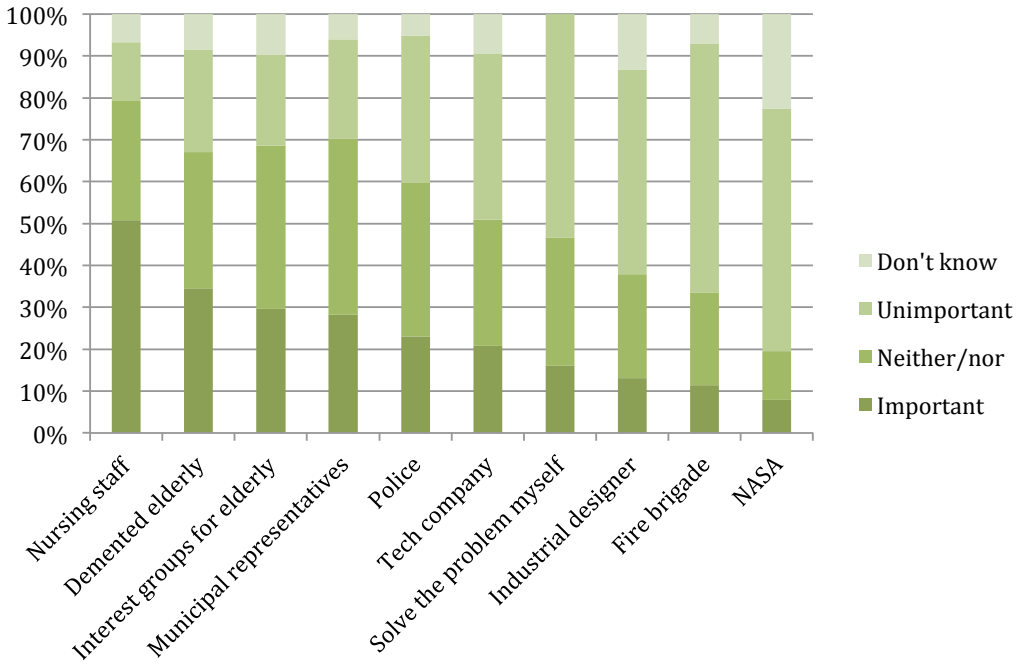

Figure 20: Who would be important for you to collaborate with? Scale collapsed from 6 to 3 categories. Ordered by "important".

The four groups of stakeholders, which most respondents considered to be important, were nursing staff (51%), the demented themselves (35%), interest groups for the elderly (30%) and municipal representatives (28%). These are also stakeholders, who are already involved in the problem. Thus they are important for understanding the problem ecology. Furthermore, to the notion of solving the problem without involving any stakeholders, 54% of the students answered 1 or 2 on the 6-point scale, indicating that they did not see this as an attractive

[12] We have chosen to call these categories Unimportant (values 1+2), neither/nor (values 3+4) and important (values 5+6) respectively.

approach.[13] This leads to us to conclude, that when prompted, many students were able to identify the most important stakeholders for understanding the problem, and that most students saw the value of including (some) stakeholders.

As stated, most students valued stakeholders, who had knowledge of the problem ecology. On the other hand only relatively few respondents considered it important to involve a tech company (21%) or an industrial designer (13%). This valuation of their importance appears to be low in relation to their potential role in solving the challenge, but it corresponds well with the fact that 16% of the students point to technological solutions in the above open-ended task.

A sizable part of the respondents did not even see the value of involving the nursing staff (14%), the demented (24%), their interest groups (22%) or the municipal representatives (24%) and 16% preferred to just solve the problem without involving others. Thus, there was a group of students, who, even when prompted, did not see the value in involving stakeholders at all.

When confronted with a complex real-world challenge, the students tend to offer possible solutions without considering potential stakeholders, but when asked specifically about the importance of involving specific stakeholders, most students seemed able to identify, who were most relevant for them to involve.

6.3.3 The process

We wanted to test further, the students' understanding of inquiring, creative and exploratory (design) processes. We were aware that these skills were not taught (as such) in the Danish schools, but wished to establish a baseline against which we would later be able to measure the impact of working with design processes in FabLab@School activities. Therefore, the students were asked to a series of suggestions for the activities in the process they would set up to solve the dementia problem. Again they were asked to score the items on a scale of 1 (not important at all) to 6 (very important).

In Figure 21 and Figure 22 below, the values of responses to these items are collapsed into three possibilities,[14] and the data is split into two charts. The activities, which were rated as important for the process more often than unimportant, are shown in Figure 21. The remaining activities are shown in Figure 22. The activities that most students identified as important for the process, were making all the stakeholders agree on a solution (57%), setting up a meeting with staff and relatives (54%), and visiting nursing home to explore the problem (54%). Only secondarily the students pointed to creating a thorough plan (43%) and

[13] As described the scale ranges from unimportant to important, whereas the wording of this specific item would be better suited for a scale from disagree to agree. This could potentially lead to confusion, but since no students have answered, "I don't know", this does not seem to be the case.

[14] We have chosen to call these categories unimportant (values 1+2), neither/nor (values 3+4) and important (values 5+6) respectively.

testing a possible solution with the elderly (46%), while using disagreements in a fruitful way to reach the best solution was rated (32%).

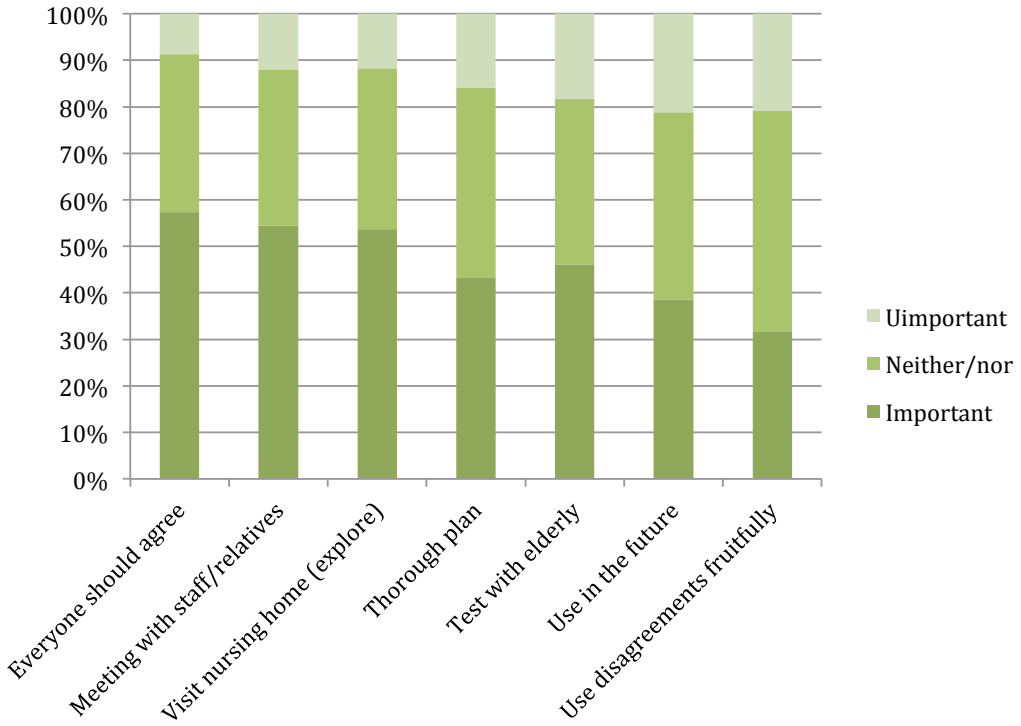

Figure 21: What parts of the process would be most important to you? Scale collapsed from 6 to 3 categories. Ordered by average score.

Figure 22 shows the suggested activities, which a larger group of students found 'unimportant' than 'important'. It is clear from the responses that the students viewed model building as very unimportant: The students rated the three suggestions that entailed building a cardboard model (6%), testing a cardboard model in a nursing home (10%) and repeating this test with a new model (11%) as having little relevance or importance. In line with this, sketching on paper was important to only 21% of the students, just above patenting ones idea (19%), or waiting for a good idea to emerge (17%). When considering that sketching and using mock-ups and paper prototypes are essential parts of creative and professional (design) practices, this is an interesting result that suggests that the students are not familiar with such creative processes.

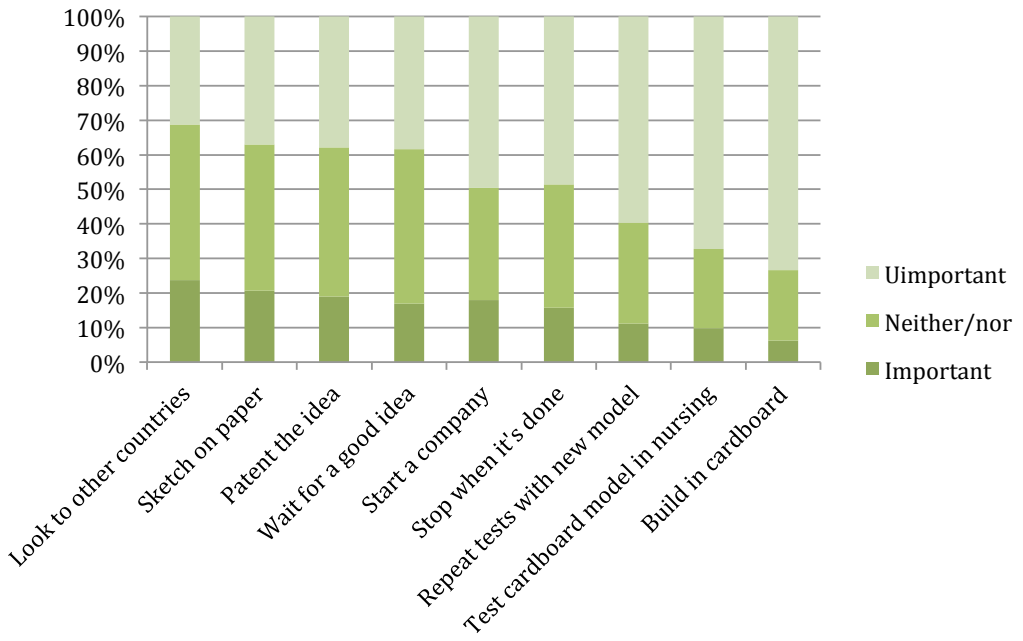

Figure 22: What parts of the process would be most important to you? Scale collapsed from 6 to 2 categories. Ordered by average score.

6.4 Summary

In order to gain insight into the students' knowledge of design processes we asked a range of questions combining measures of self-perceptions, experiences, approaches to real-world problems and valuations of process parts and stakeholders.

Most students rated themselves high in terms of their creative (73%), imaginative (80%) and collaborative (84%) abilities. The data further indicates that according to the students, being creative, imaginative and generating new ideas is not necessarily linked to inventing things, as the students did not see inventing as important to them.

Only 12% of the students reported, that they had had an idea for a product and invention, and that they had realized this idea.

When asked an open-ended question of solving a complex societal issue (the dementia problem), 31% of the respondents did not know what to answer, and only 3% of the students proposed to investigate the problem further.

The Danish students, which were asked to rate different stakeholders and potential activities of an inquiry and/or creative process, were good at identifying relevant stakeholders and they addressed some relevant activities involved in a typical design process. The students did not, however, show an understanding of the value of externalizing ideas, through activities such as sketching and building

mock-ups, for gaining insights and knowledge to inform the production of a possible solution.

Probing into design process skills and design thinking knowledge is difficult in a survey like the one, which this report is based on. Each of the approaches reported in this chapter point to the need for further investigation. However, by approaching the subject of students' knowledge and skills with regards to design processes from different angles, a fuller understanding is possible. What has emerged from the evaluation of the data, is that there is a possible connection between not valuing externalizations, trying to come up with final solutions instead of starting investigations into the problem space and not having produced ones idea(s) - suggesting that the students, however creative they perceive themselves to be, on average are lacking skills for acting on ideas and for dealing with complex problem solving.

7 Summary and Conclusion

This is the report on the baseline survey for the FabLab@school.dk research project. 1156 students aged 11-15 years, answered 227 questions in total. The questions were about their use and knowledge of digital technologies, both in and outside of school, about design and creativity, and about their perspectives on hacking, open data and privacy issues. The sample of students in this survey was not randomly selected, and thus we cannot claim representativity. This means that claims are made for the sample only. Below is a summary of the most important findings for this sample of students from the participating four municipalities.

Students are consumers (rather than producers) of digital media and technology
From the data, we have concluded, that rather than producing, the students spend a lot of time consuming digital media and content on computers, tablets and phones. They do this by playing games, surfing the net, chatting, liking, and commenting posts and updates from others. Most students reported to have some or even good knowledge of using computers, tablets and phones for consumption purposes. On the other hand, many of the students in our survey reported, that they had relatively poor knowledge of tools for producing images, videos and webpages and thus move beyond consumption of digital content.

When spending time with computers, TVs and phones is the most popular leisure activity, it is tempting to talk about the students in our sample as digital natives: Adolescents who were born in a digital world and to whom all things digital are as easy as they are natural to them. As seen in both this report and in the ICIL study, the school system cannot take this for granted.

Few students have knowledge of digital fabrication
Few students in our sample reported to have knowledge of digital fabrication tools such as 3D printers, laser cutters and microcontroller boards such as Arduino and Makey Makey. This was to be expected, since digital fabrication technologies are not widely available, and since the respondents (as requested) had not yet taken part in FabLab@School activities.

Schools focus on teaching "Office Literacy"
According to most of the students in our sample, they are taught to use office programs in school, and they acquire some form of Office Literacy. It also seems, that there is not the same amount of focus on teaching how to use image/video editing software, and that very few students have worked with digital fabrication technologies in school. A large group of students report, that they have not learned how to use image-/video editing software and digital fabrication technologies. Thus a focus on image-/video editing software or digital fabrication technologies could possibly expand the range of digital literacies among Danish students.

Most students do not act on their creative ideas
Most students in our sample rated themselves high in terms of their creative (73%), imaginative (80%) and collaborative (84%) abilities. The data further indicates that according to the students, being creative, imaginative and generating new ideas is not necessarily linked to inventing things, as the students did not see inventing as important to them. Only 12% of the students reported, that they had had an idea for a product and invention, and that they had realized this idea.

Students lack knowledge of design processes
The Danish students in our sample do not seem to have knowledge and experience with design processes as a way to engage in complex problem solving. When asked an open-ended question of solving a complex societal issue (the dementia problem), 31% of the respondents did not know what to answer, and only 3% of the students proposed to investigate the problem further.

The Danish students, which were asked to rate different stakeholders and potential activities of an inquiry and/or creative process, were good at identifying relevant stakeholders and they addressed some relevant activities involved in a typical design process. The students did not, however, show an understanding of the value of externalizing ideas, through activities such as sketching and building mock-ups, for gaining insights and knowledge to inform the production of a possible solution.

There is a possible connection between not valuing externalizations, trying to come up with final solutions instead of starting investigations into the problem space and not having produced ones idea(s) - suggesting that the students, however creative they perceive themselves to be, on average are lacking skills for acting on ideas and for dealing with complex problem solving.

8 Literature

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Appendix I: Comparing the sample with the population

In order to compare our sample of schools with the population of Danish schools in general, a t-test on the average exam scores was run.

Schools – calculation of variance and standard error

Firstly two schools were deleted from the school data, since they did not have 9th grade and thus have no relevant data. The category "missing" consisting of 4 students who had not put a relevant school name in the field asking them to do so was also removed.

The standard error on the scores for the schools in our sample has been calculated using R with the following code:

```
library(ggplot2)
setwd('/.../data')
csv.data <- read.csv2("skoledata.csv")
mean_se(skoledata$Karaktergennemsnit, mult=1)
```

Which gives a mean of 6.95 and a standard error of 0.123. The average score of Danish schools in the same period, was 6.6.

In order to see, whether our sample is significantly different from the population, a two-sided t-test was used:

$$t = \frac{\mu_{sample} - \mu_{population}}{Standard\ error}$$

Table 6: Test of significant difference between sample and population with regards to average score of the schools

μ_{sample}	6.95
$\mu_{population}$	6.6
Standard error	0.123
T-test value: H_0: $\mu_{sample} = \mu_{population}$	2,85

With a 95% confidence interval and 36 degrees of freedom, the t-value should lie within the -2.04 to 2.04 interval for the H_0 hypothesis to be true. Thus the H_0 hypothesis is rejected, which means, that the difference between the average scores of our sample and the population of Danish schools, is significant ($p<0.05$).

Comparing project schools with non-project schools

In order to compare the two groups of schools, a Welch two-sample t-test was run using R Studio.

The Code:

```
FABLAB=skoledata[skoledata$FABLAB.=="1",]
NONFAB=skoledata[skoledata$FABLAB.=="0",]
sd(FABLAB$Karaktergennemsnit)
sd(NONFAB$Karaktergennemsnit)
t.test(FABLAB$Karaktergennemsnit, NONFAB$Karaktergennemsnit)
```

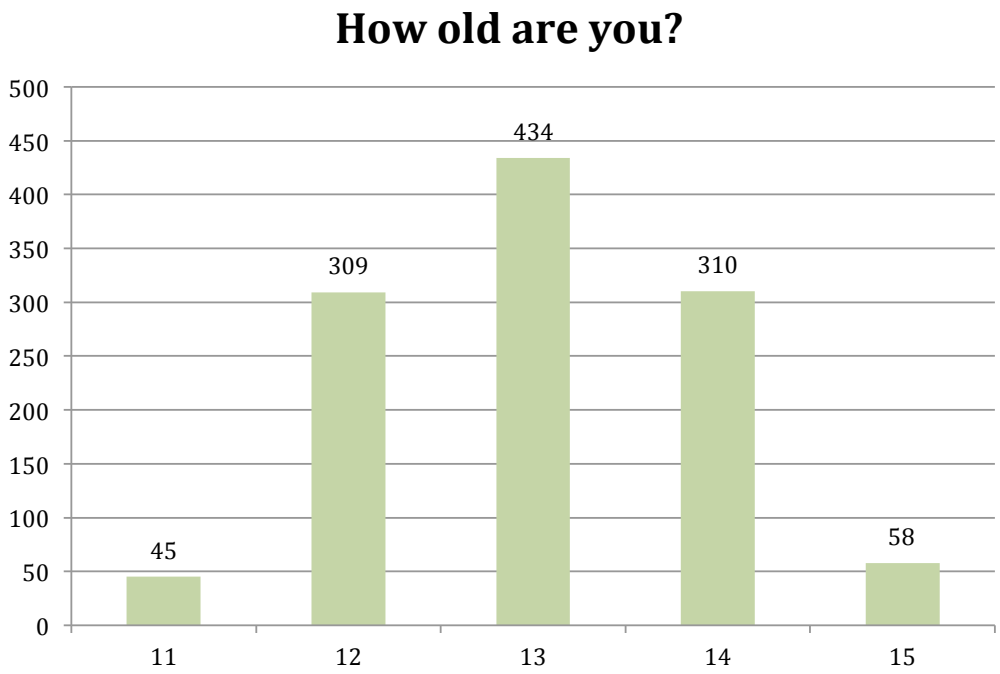
Gave

```
> FABLAB=skoledata[skoledata$FABLAB.=="1",]
> NONFAB=skoledata[skoledata$FABLAB.=="0",]
> sd(FABLAB$Karaktergennemsnit)
[1] 0.8370015
> sd(NONFAB$Karaktergennemsnit)
[1] 0.6060459
> t.test(FABLAB$Karaktergennemsnit, NONFAB$Karaktergennemsnit)

        Welch Two Sample t-test

data:  FABLAB$Karaktergennemsnit and NONFAB$Karaktergennemsnit
t = 1.0572, df = 34.937, p-value = 0.2977
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 -0.2309039  0.7326897
sample estimates:
mean of x mean of y
 7.057143  6.806250
```

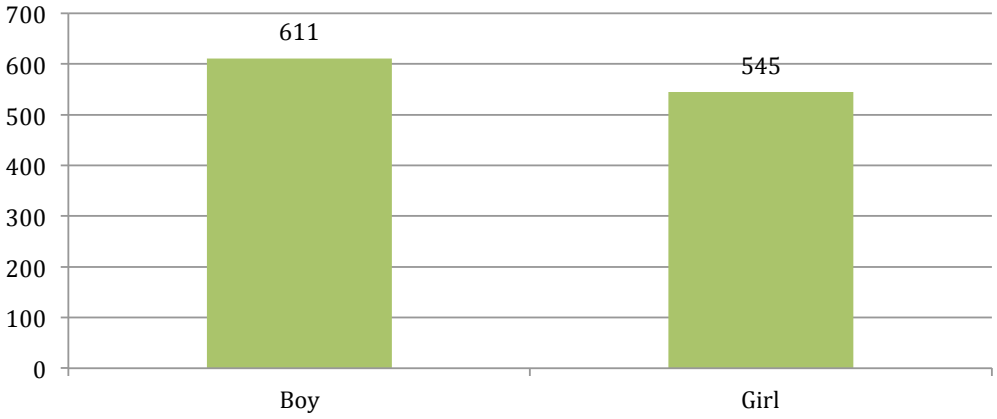
Thus on average, participating schools from the FABLAB group had a higher average score (M = 7.06, SE = 0.84), than participating schools from the NON-FABLAB group (M = 6.81, SE = 0.61). This difference was however, not significant t(34.9) = 1.06, p = 0.30.

Appendix II: Answers to quantitative questions in the questionnaire

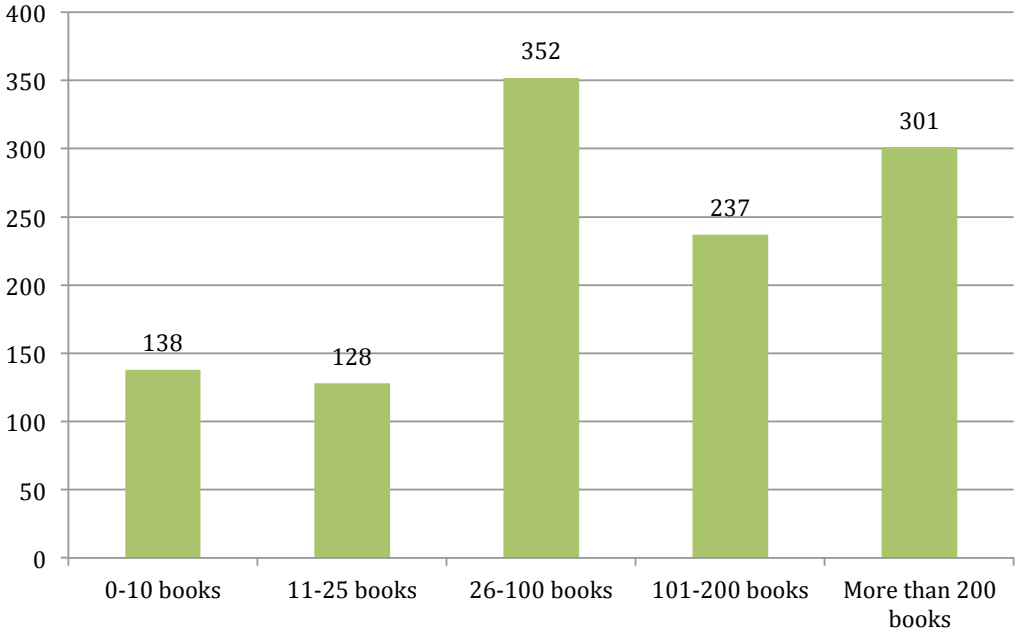
In the following pages, tables and charts with results from quantitative questions on the survey are displayed. Texts are translated from the Danish questionnaire, which means, that even in the case, where these question originate from Stanfords work, the wording might be different. All tables have a corresponding chart below them. In the charts, text have been shortened due to readability.



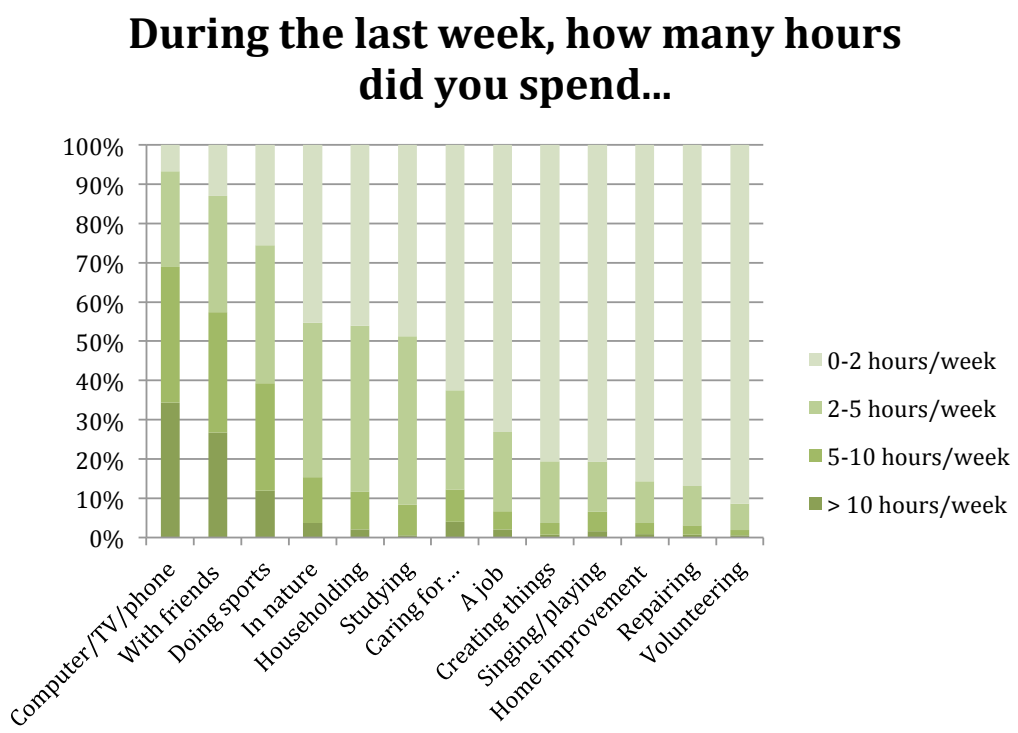
What is your gender?



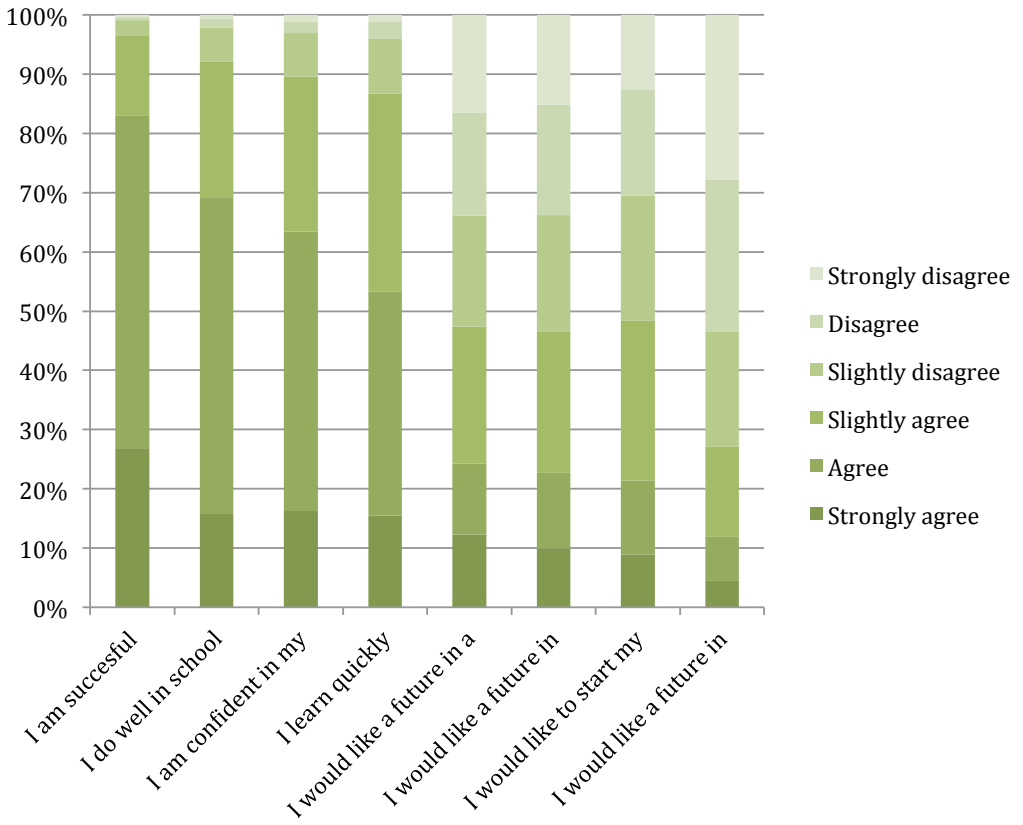
How many books are in your home?



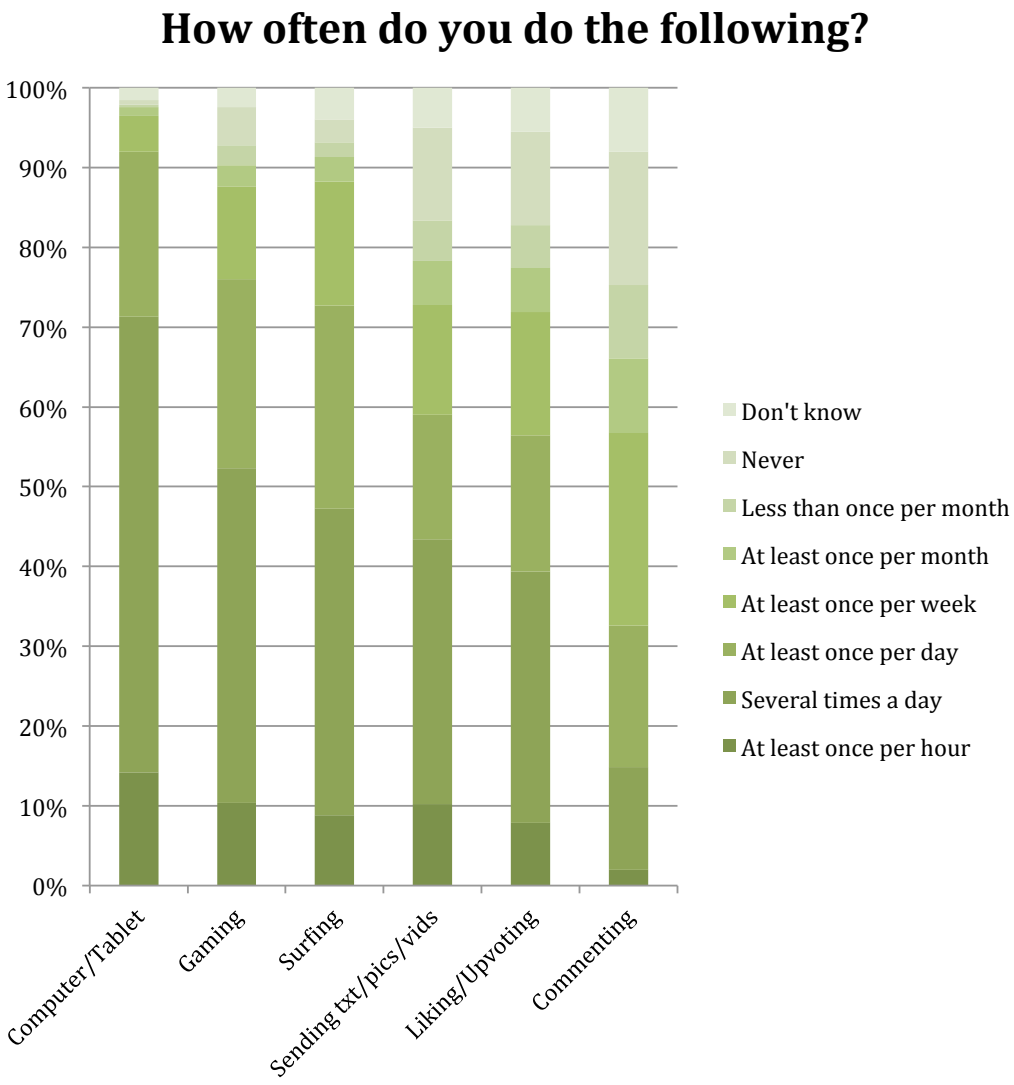
During the last week, how many hours did you spend...?	> 10 h/week	5-10 h/week	2-5 h/week	0-2 h/week
On computer, TV, phone etc.	398	399	282	77
Being with friends	309	355	341	151
Participating in any kind of sports	138	316	407	295
In nature	42	135	455	524
Performing household chores	23	111	490	532
Studying	6	91	496	563
Caring for siblings, pets etc.	46	96	291	723
Working at a job that pays an income	23	55	233	845
Creating things from e.g. wood, paint or textiles	8	34	182	932
Singing or playing an instrument or in a band	19	56	147	934
Working on home improvement or construction projects	10	33	122	991
Repairing furniture, bicycle or electronic devices in your home	9	27	116	1004
Volunteering in your community	6	16	78	1056

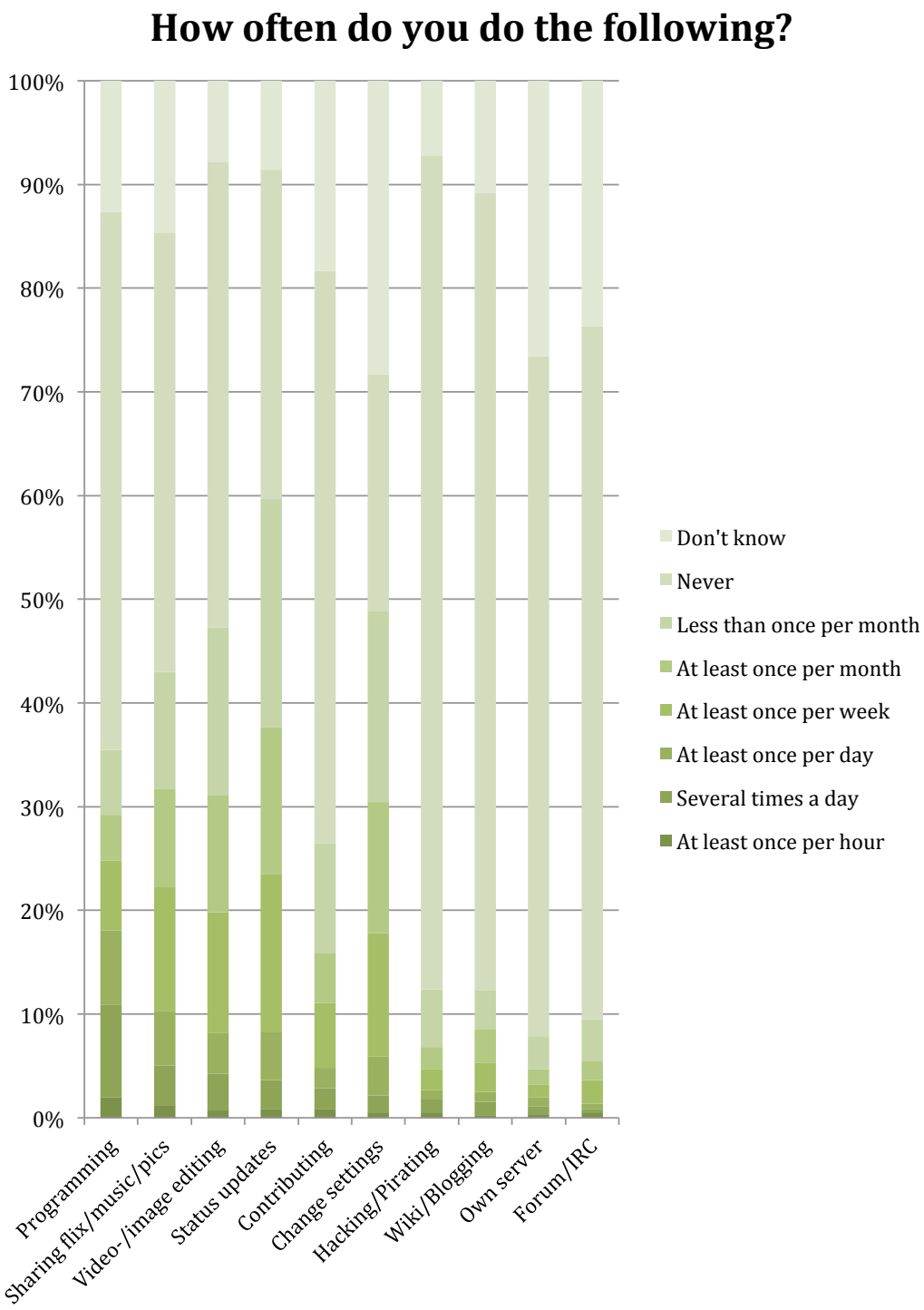


To what extent do you agree?	Strongly disagree	Disagree	Slightly disagree	Slightly agree	Agree	Strongly agree
I am succesful	4	6	31	154	639	307
I do well in school	7	18	66	262	610	178
I am confident in my academic abilities	13	21	85	301	537	184
I learn new concepts quickly	12	34	106	381	433	175
I want a future within a creative profession	186	199	213	266	137	140
I want a future within technology and design	172	213	225	274	146	111
I want to start my own business	142	204	242	310	143	100
I want a future in engineering or science	318	292	221	172	88	50

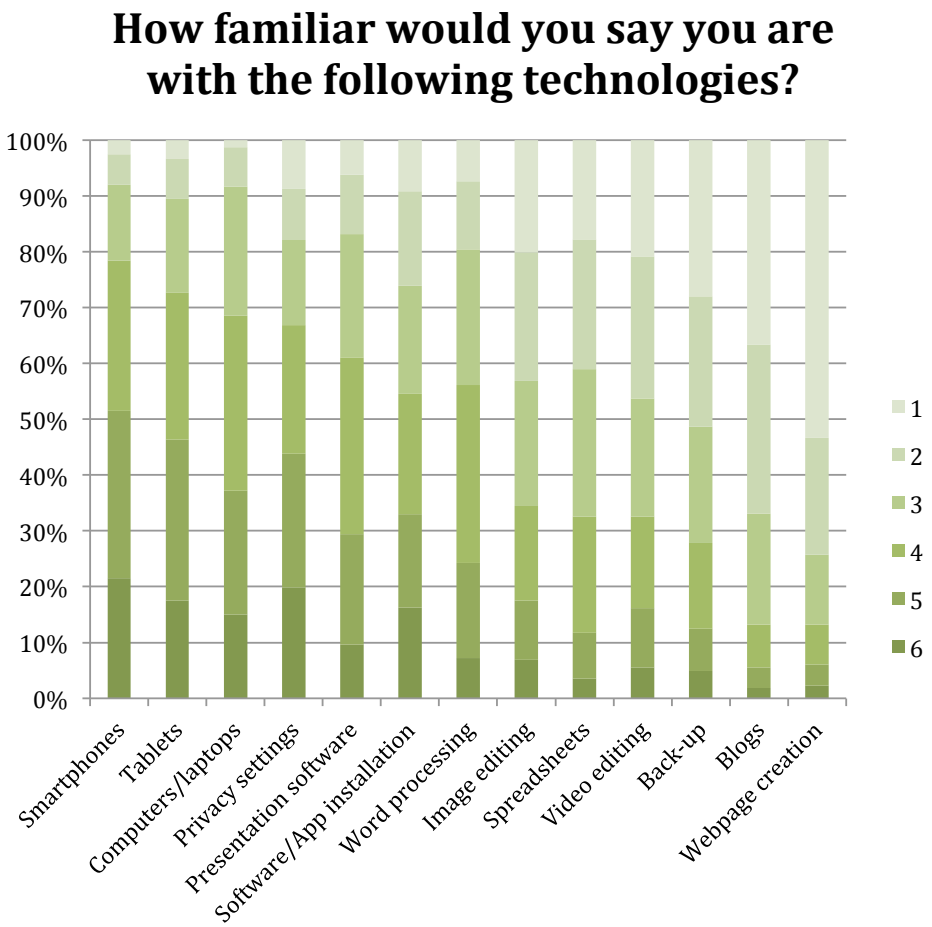


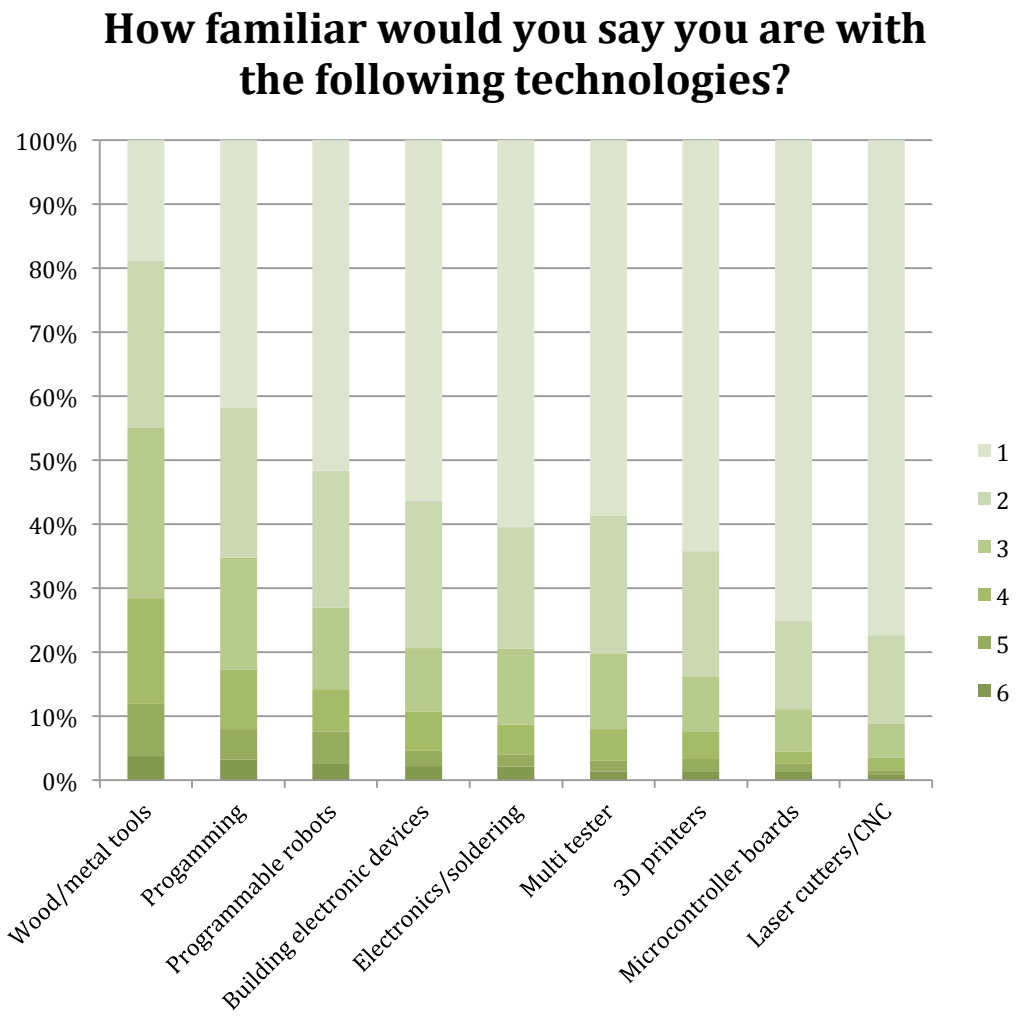
How often do you do the following?	At least once per hour	Several times a day	At least once per day	At least once per week	At least once per month	Less than once per month	Never	Don't know
Use computer or tablet at home	164	660	239	52	13	3	7	18
Play computer-, mobile- or videogames	120	485	274	134	31	29	55	28
Surf or watch videos on the internet	102	444	294	180	36	21	33	46
Communicate with images, videos or text (e.g. Facebook, Instagram, Snapchat)	118	384	180	159	64	59	134	58
Deal out likes or upvotes on Facebook, Instagram, Reddit, etc.	91	364	197	179	64	62	135	64
Commenting on the posts and updates of others	23	149	205	279	108	106	193	93
Program webpages, games, apps, etc.	23	103	83	78	51	72	600	146
Share files such as movies, music and images (e.g. Youtube, Soundcloud, Pinterest)	14	44	61	138	110	130	489	170
Work with video or images (e.g. In Photoshop)	8	41	46	134	130	188	519	90
Write status updates	10	32	54	175	164	255	367	99
Contribute to a fashion blog, a Minecraft server, film projects etc.	10	23	23	72	56	122	638	212
Change app settings (e.g. Security or layout)	5	20	43	138	146	213	264	327
Participate in hacking, remixing, pirating, etc.	5	16	10	23	25	64	930	83
Write on wikis, blogs, own webpage, etc.	2	16	11	32	38	43	889	125
Share files on your own server (e.g. FTP) or P2P network (e.g. Bittorrent)	4	9	10	14	17	36	759	307
Participate on forums, IRCs or mailing lists	5	5	6	26	21	47	772	274


How often do you do the following?
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Computer/Tablet
Gaming
Surfing
Sending txt/pics/vids
Liking/Upvoting
Commenting
Don't know
Never
Less than once per month
At least once per month
At least once per week
At least once per day
Several times a day
At least once per hour


How often do you do the following?
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Programming
Sharing flix/music/pics
Video-/image editing
Status updates
Contributing
Change settings
Hacking/Pirating
Wiki/Blogging
Own server
Forum/IRC
Don't know
Never
Less than once per month
At least once per month
At least once per week
At least once per day
Several times a day
At least once per hour

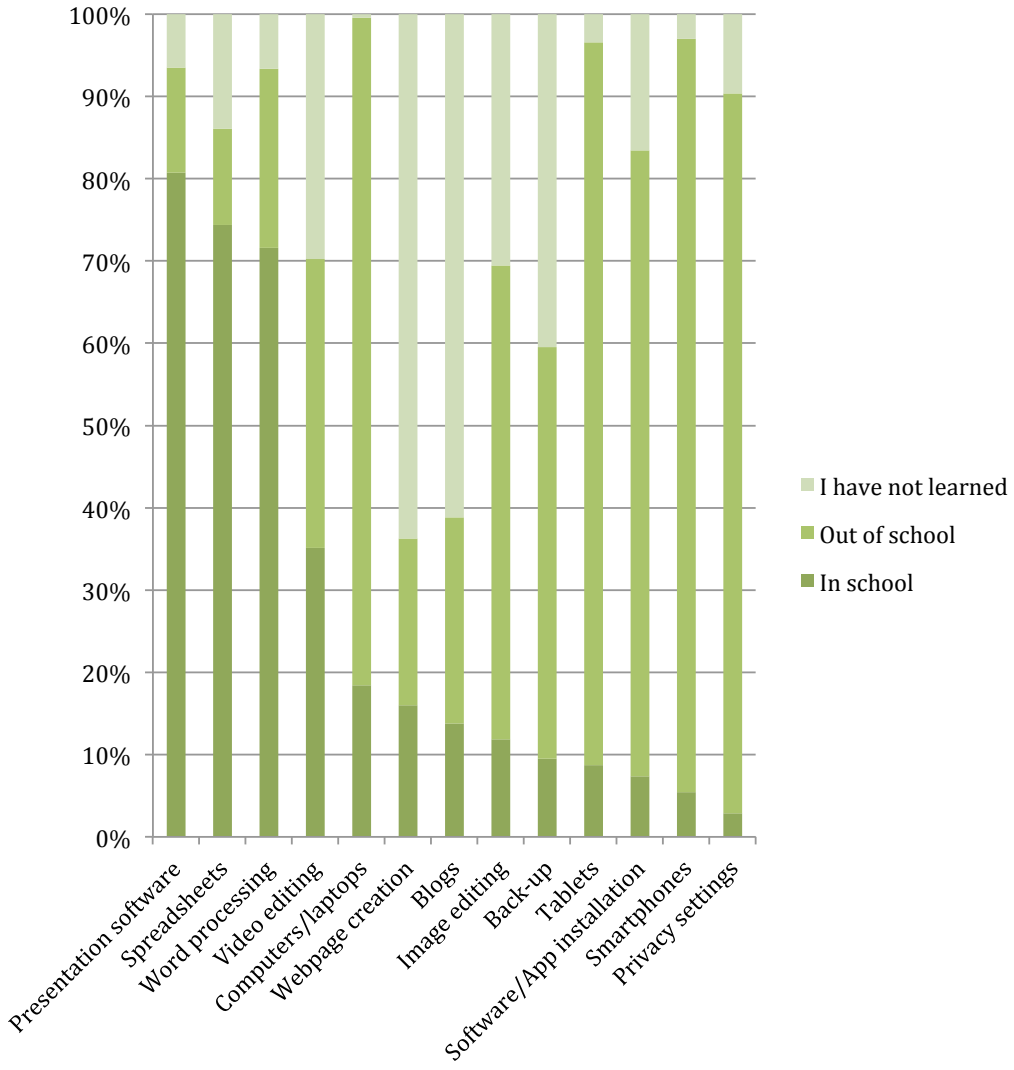
How familiar would you say you are with the following technologies? Please rate yourself on a scale from 1 to 6, where 1 is "I know nothing about it" and 6 is "I could teach other people about it"						
	1	2	3	4	5	6
Smartphones	29	64	156	311	347	249
Tablets	39	83	194	304	333	203
Computers/laptops	14	82	267	363	257	173
Changing privacy settings on e.g. Facebook, Gmail, Instagram	101	106	176	266	278	229
Presentation software (e.g. Powerpoint, Prezi)	72	122	256	366	229	111
Software or App installation	106	195	224	250	193	188
Word processing (e.g. Word, Google Docs)	85	141	281	368	198	83
Image editing	232	266	260	195	123	80
Spreadsheets (e.g. Excel, Google Sheets)	206	268	306	240	95	41
Production or editing digital movies/videos	241	294	244	190	123	64
Back-up of documents, contacts, mails, etc.	324	269	241	178	87	57
Blogs	423	350	230	89	42	22
Webpage creation	616	243	144	83	44	26
Working with wood/metal tools	217	302	308	191	95	43
Programming (e.g. Coding of apps)	483	271	203	107	55	37
Building programmable robots (e.g. Lego Mindstorms)	597	247	148	76	57	31
Building electronic devices or simple machines from scratch	651	266	115	71	28	25
Electronics and soldering (e.g. LEDs and resistors)	699	219	137	54	23	24
Multi tester (Volt- or Ohmmeter)	678	250	136	57	19	16
3D printers	742	226	101	49	23	15
Microcontroller boards (e.g. MakeyMakey and Arduino)	869	159	76	22	15	15
Laser cutters and CNC routers	894	159	63	22	9	9

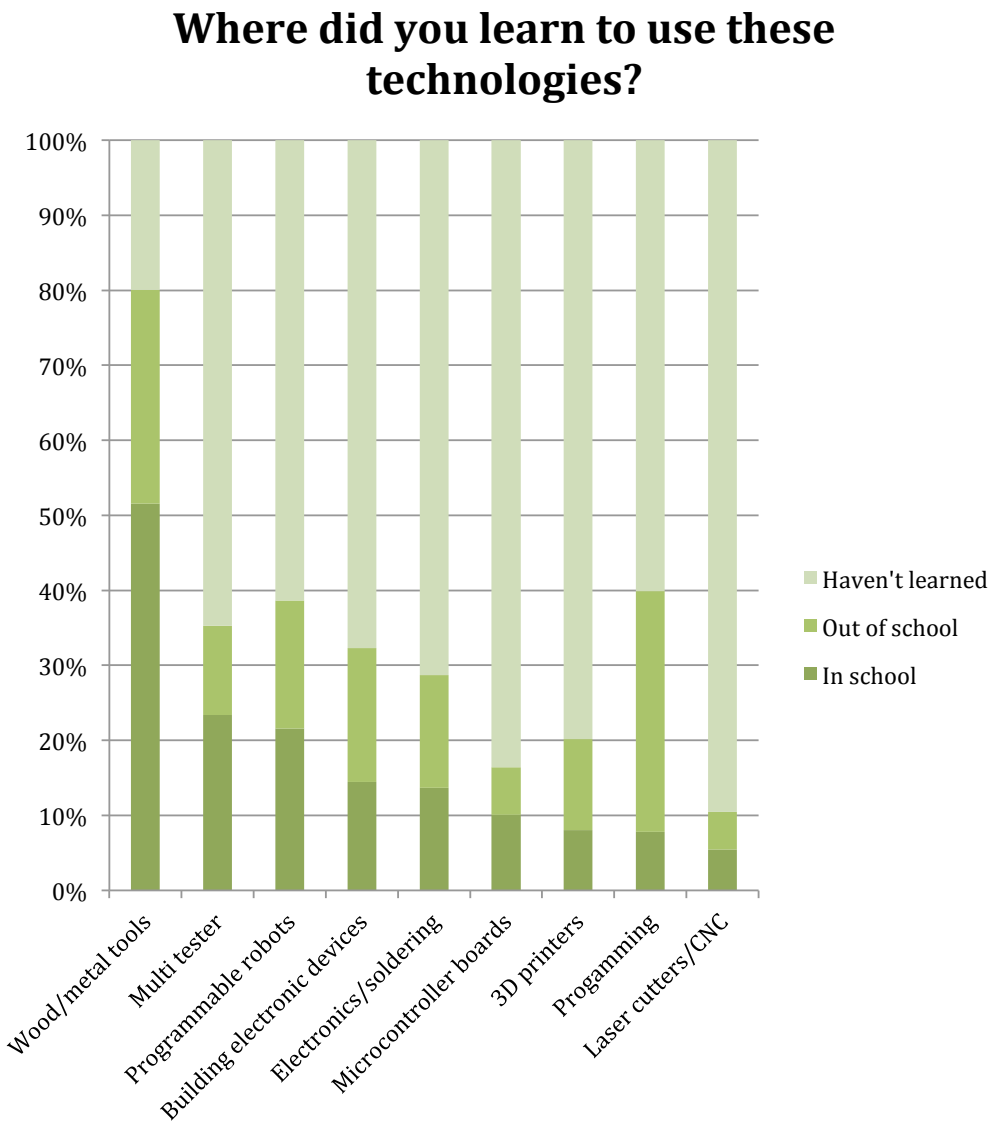

How familiar would you say you are with the following technologies?
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Smartphones
Tablets
Computers/laptops
Privacy settings
Presentation software
Software/App installation
Word processing
Image editing
Spreadsheets
Video editing
Back-up
Blogs
Webpage creation
1
2
3
4
5
6


How familiar would you say you are with the following technologies?
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Wood/metal tools
Progamming
Programmable robots
Building electronic devices
Electronics/soldering
Multi tester
3D printers
Microcontroller boards
Laser cutters/CNC
1
2
3
4
5
6

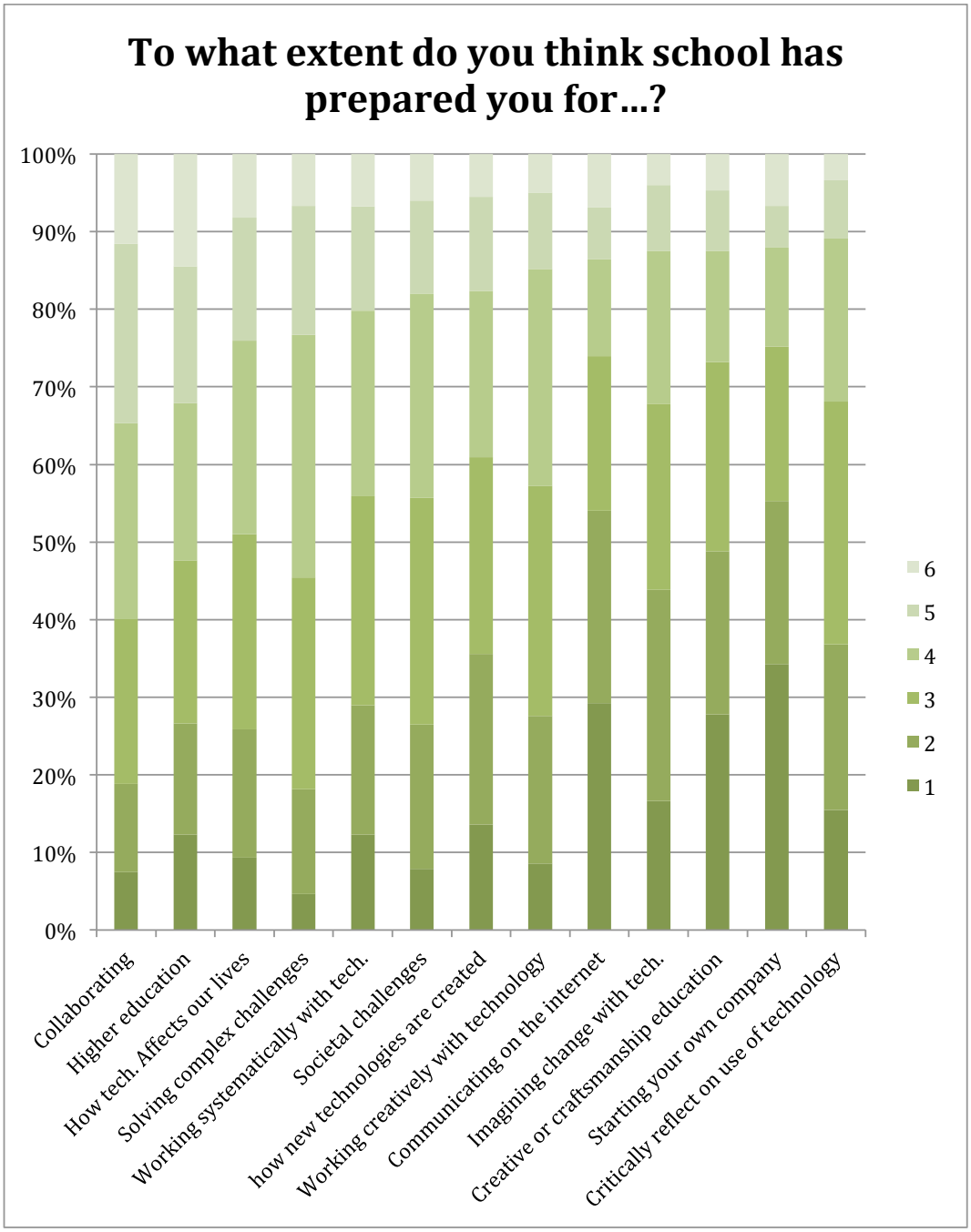
Where did you learn to use these technologies?			
	In school	Outside of school	I have not learned to use it
Presentation software (e.g. Powerpoint, Prezi)	933	148	75
Spreadsheets (e.g. Excel, Google Sheets)	860	135	161
Word processing (e.g. Word, Google Docs)	828	251	77
Production or editing digital movies/videos	406	406	344
Computers/laptops	213	938	5
Webpage creation	185	234	737
Blogs	159	290	707
Image editing	137	666	353
Back-up of documents, contacts, mails, etc.	110	578	468
Tablets	101	1015	40
Software or App installation	85	880	191
Smartphones	63	1058	35
Changing privacy settings on e.g. Facebook, Gmail, Instagram	33	1012	111
Working with wood/metal tools	596	329	231
Multi tester (Volt- or Ohmmeter)	270	138	748
Building programmable robots (e.g. Lego Mindstorms)	249	198	709
Building electronic devices or simple machines from scratch	167	206	783
Electronics and soldering (e.g. LEDs and resistors)	158	174	824
Microcontroller boards (e.g. MakeyMakey and Arduino)	116	74	966
3D printers	93	140	923
Programming (e.g. Coding of apps)	90	371	695
Laser cutters and CNC routers	63	58	1035

Where did you learn to use these technologies?

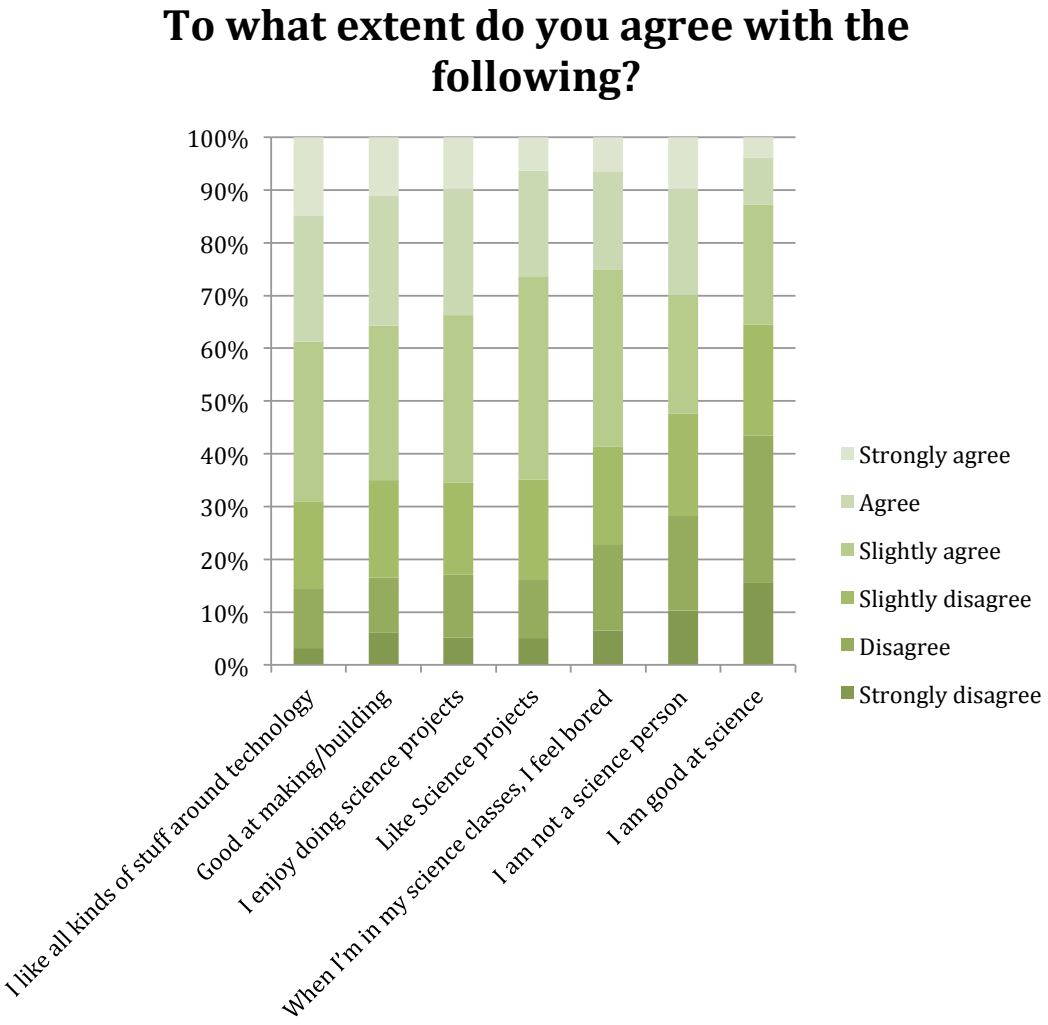



Where did you learn to use these technologies?
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Wood/metal tools
Multi tester
Programmable robots
Building electronic devices
Electronics/soldering
Microcontroller boards
3D printers
Progamming
Laser cutters/CNC
Haven't learned
Out of school
In school

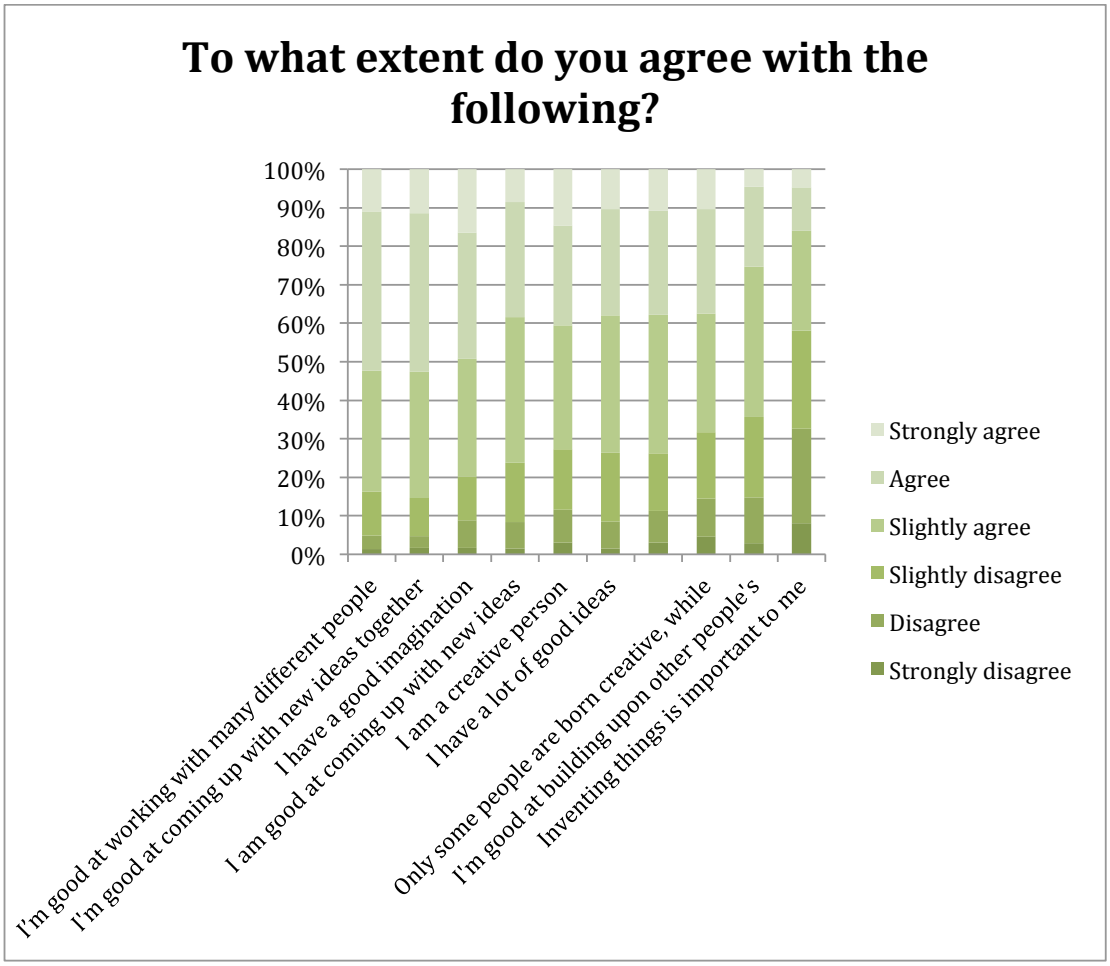
To what extent do you think school has prepared you for...?	1 (Not at all)	2	3	4	5	6 (To a large extent)
Collaborating in heterogeneous groups	86	132	245	292	267	134
Getting a degree in higher education	142	166	243	234	204	167
Learning how technology affects our lives	108	191	291	288	183	95
Learning to solve difficult or complex challenges	54	156	315	362	192	77
Using technology to work systematically with tasks (in e.g. Physics/Chemistry, Science/Technology)	142	193	311	277	155	78
Learning to relate to societal challenges	91	215	338	304	139	69
Learning how novel ideas, things and technologies are created	157	254	293	248	140	64
Working creatively with technology	99	220	342	324	114	57
Communicating with different people on the internet	338	287	230	144	77	80
Imagining how you change things, e.g. with technology	192	315	277	228	98	46
Getting a creative or craftsmanship education	321	243	282	166	90	54
Starting your own company	396	243	230	148	62	77
Critically reflect on own and others' use of technology	179	247	361	243	87	39


To what extent do you think school has prepared you for…?
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
6
5
4
3
2
1
Collaborating
Higher education
How tech. Affects our lives
Solving complex challenges
Working systematically with tech.
Societal challenges
how new technologies are created
Working creatively with technology
Communicating on the internet
Imagining change with tech.
Creative or craftsmanship education
Starting your own company
Critically reflect on use of technology

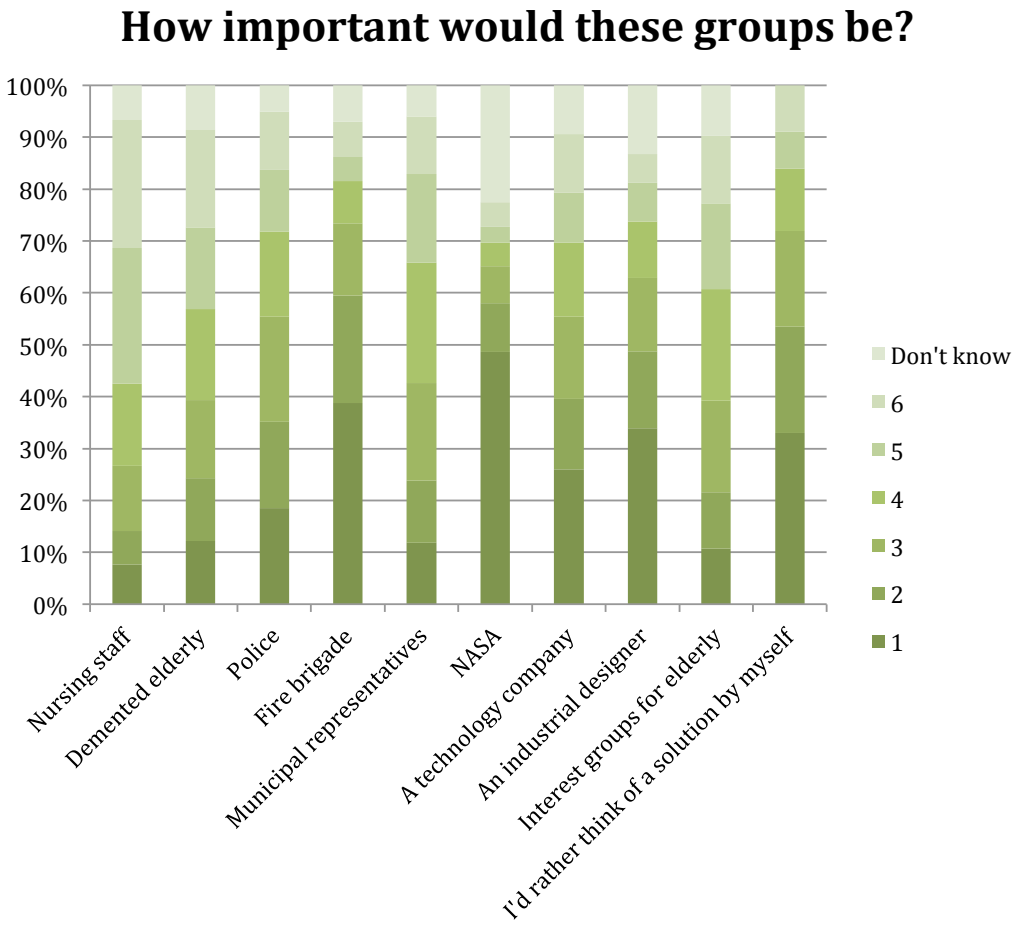
To what extent do you agree with the following?	Strongly disagree	Dis-agree	Slightly disagree	Slightly agree	Agree	Strongly agree
I like all kinds of stuff around technology	37	131	189	351	276	172
Good at making/building	70	121	214	338	284	129
I enjoy doing science projects	60	138	201	367	276	114
Like Science projects	59	127	220	444	233	73
When I'm in my science classes, I feel bored	75	189	214	387	216	75
I am not a science person	119	207	224	260	232	114
I am good at science	179	323	244	262	103	45



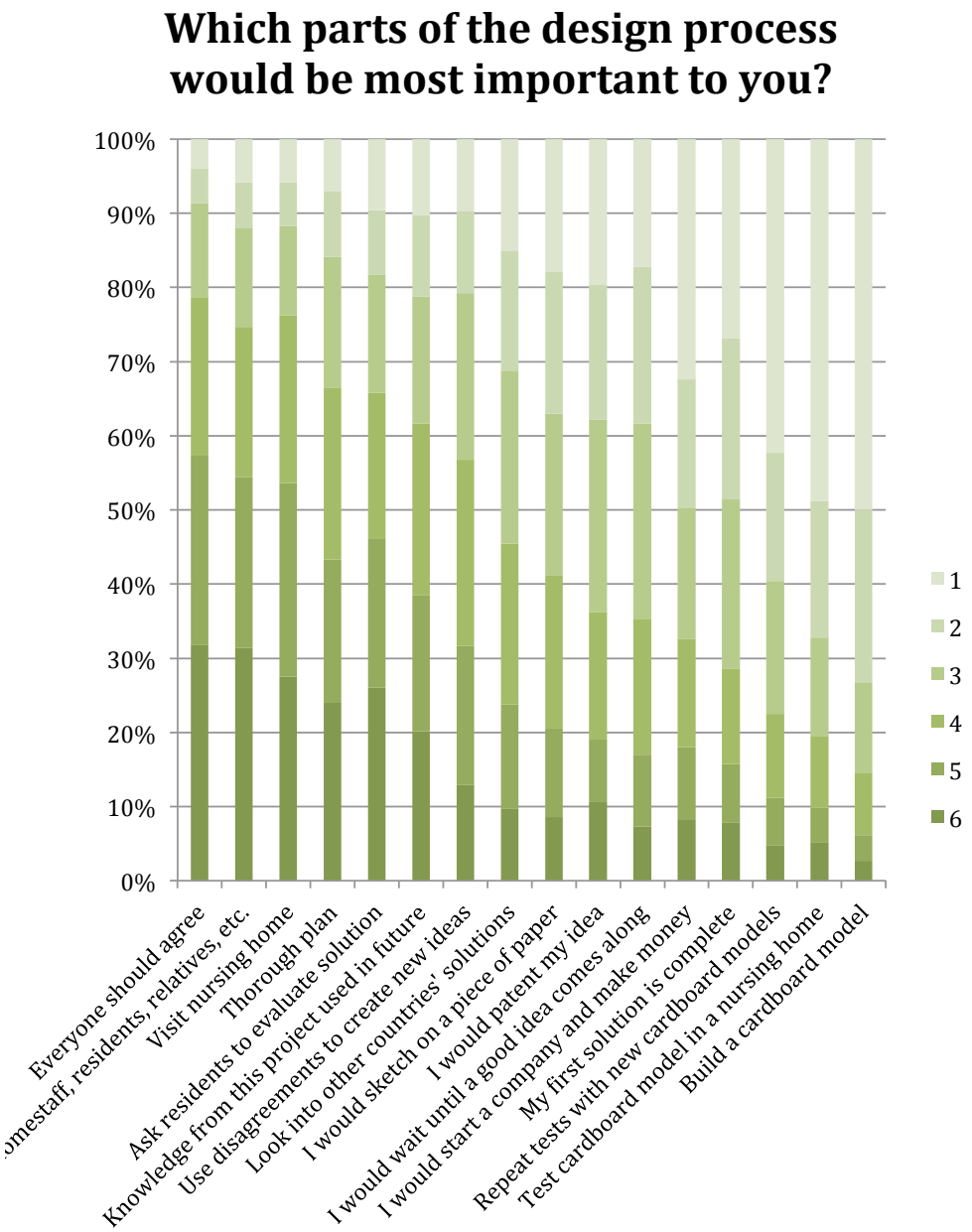
To what extent do you agree with the following?	Strongly disagree	Disagree	Slightly disagree	Slightly agree	Agree	Strongly agree
I'm good at working with many different people in the groups	16	41	132	362	478	127
I'm good at coming up with new ideas together with my peers	19	36	114	379	475	133
I have a good imagination	20	82	131	353	380	190
I am good at coming up with new ideas	17	79	178	438	346	98
I am a creative person	36	98	182	371	299	170
I have a lot of good ideas	18	80	206	414	319	119
I am interested in the things we do in the creative crafts and arts	35	96	172	416	312	125
Only some people are born creative, while others never learn it	52	115	200	355	314	120
I'm good at building upon other people's thoughts and ideas	33	137	242	451	240	53
Inventing things is important to me	93	284	295	299	131	54


To what extent do you agree with the following?
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
I'm good at working with many different people
I'm good at coming up with new ideas together
I have a good imagination
I am good at coming up with new ideas
I am a creative person
I have a lot of good ideas
Only some people are born creative, while
I'm good at building upon other people's
Inventing things is important to me
Strongly agree
Agree
Slightly agree
Slightly disagree
Disagree
Strongly disagree

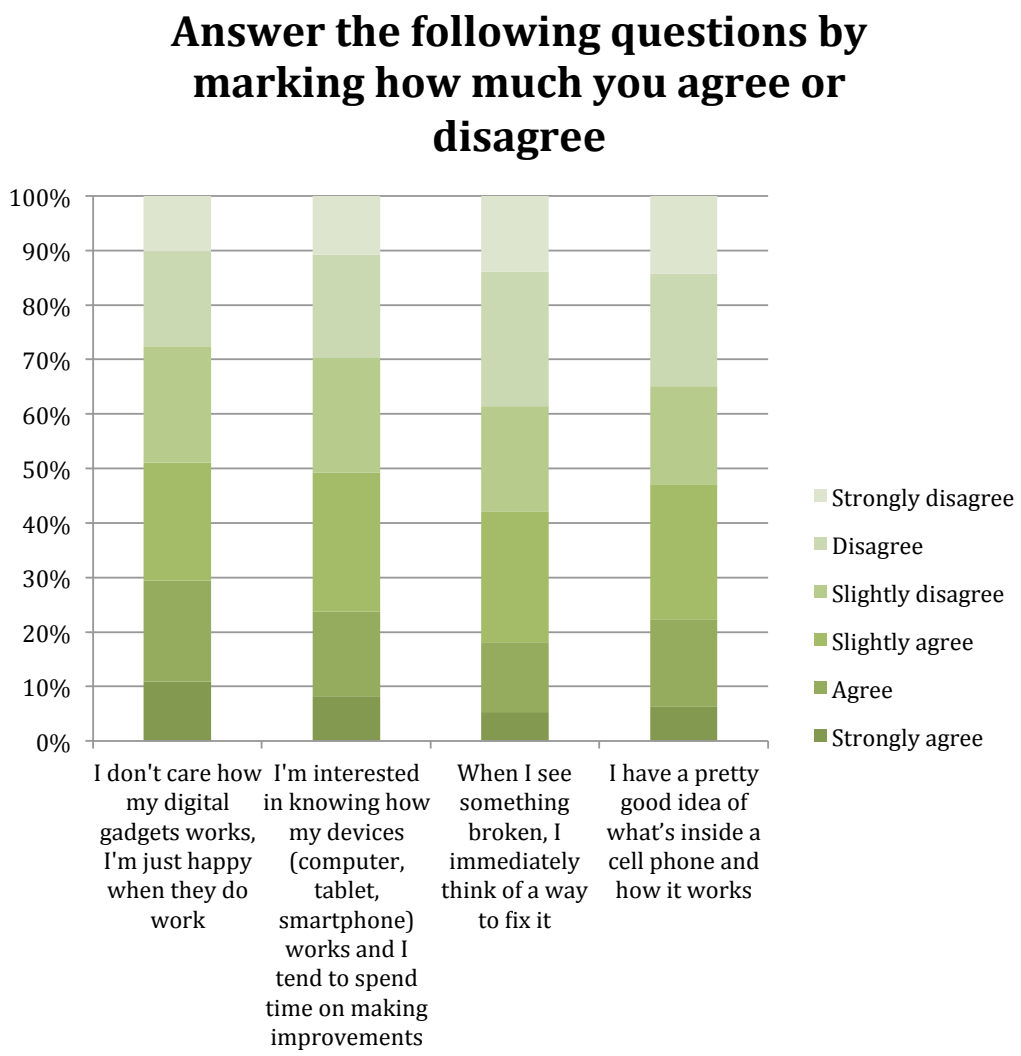
If you were to find a solution in collaboration with others, how important would these people or groups be on a scale of 1-6 (1 = not important, 6 = very important)?							
	1	2	3	4	5	6	Don't know
Nursing staff	88	75	145	184	301	286	77
Demented elderly	141	140	174	203	182	217	99
Police	214	192	235	189	138	129	59
Fire brigade	448	239	161	95	54	78	81
Municipal representatives	137	138	218	268	198	128	69
NASA	562	108	83	52	36	55	260
A technology company	300	158	183	165	110	131	109
An industrial designer	392	172	163	125	87	64	153
Interest groups for elderly	124	126	204	248	191	151	112
I'd rather think of a solution by myself	381	237	214	138	82	104	0



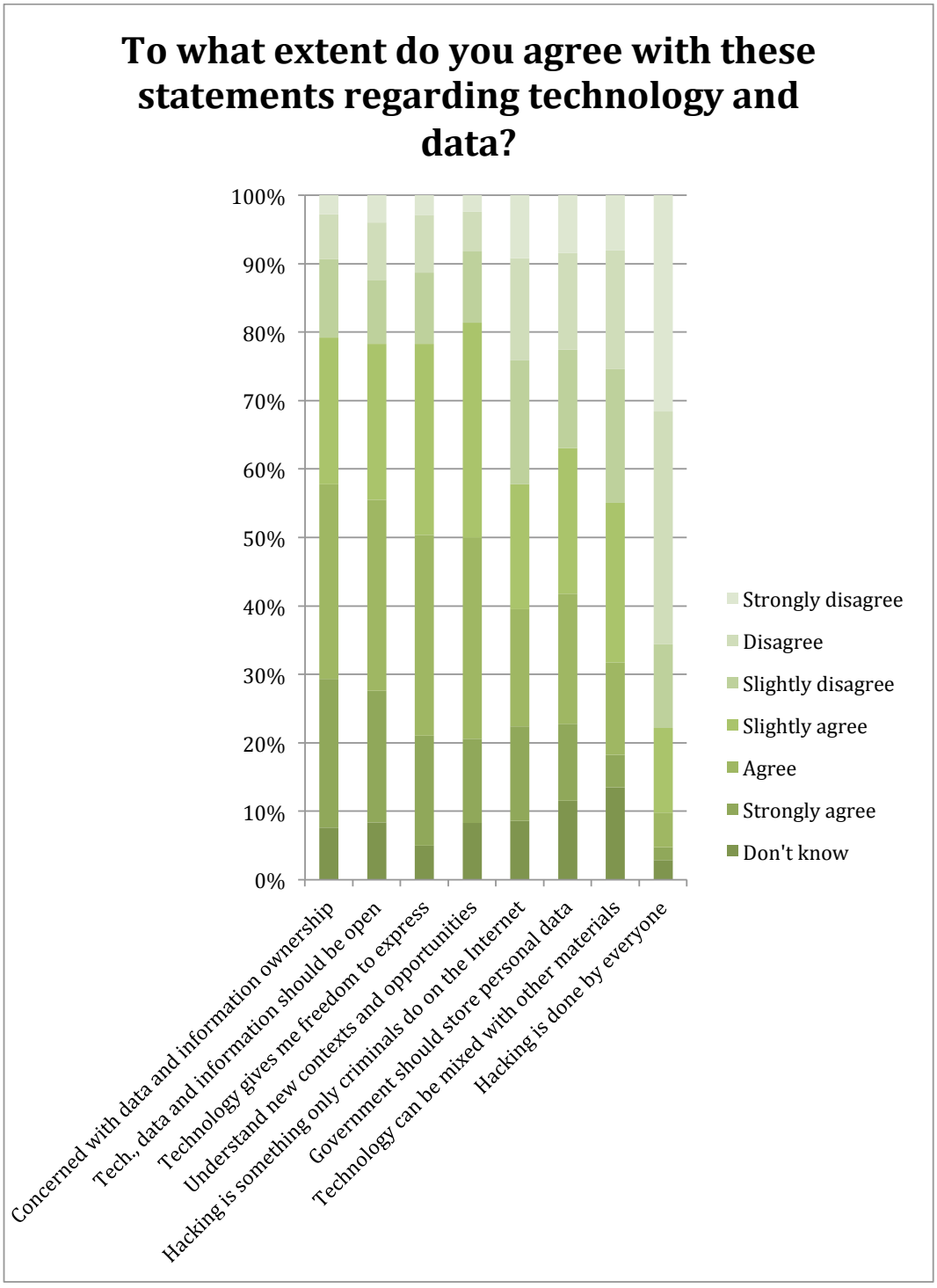
How would you come up with the right solution? Which parts of the design process would be most important to you? (1 = not important at all, 6 = important).						
	1	**2**	**3**	**4**	**5**	**6**
I would make sure that everyone agrees on the final solution	45	55	146	247	296	367
I would have a meeting with nursing homestaff, its residents, relatives and others interesting partners to discuss my solution	67	72	154	234	266	363
I would visit a nursing home to further explore the issue	67	68	139	262	302	318
I would do a thorough plan for the entire project	82	102	203	268	224	277
I would ask residents in the nursing home what they think of my solution	111	100	184	228	232	301
I would consider how the knowledge gained from this project can be used in future projects	118	127	198	268	212	233
I would use disagreements between individuals and groups to create new ideas and solutions	113	127	260	290	217	149
I would figure out how people tackle the problem in other countries	174	187	270	250	163	112
I would outline possible solutions on a piece of paper	207	221	253	237	139	99
I would patent my idea	226	211	300	199	96	124
I would wait until a good idea comes along	199	244	306	211	111	85
I would start a company to market my solution and make money	374	200	205	169	113	95
As soon as my first solution is complete, I would stop working on the problem	310	252	263	149	91	91
I would repeat my tests with a new sketch or cardboard model several times over	489	200	207	131	74	55
I would test my cardboard model in a nursing home	564	213	154	111	55	59
I would build my idea in cardboard	578	270	141	96	40	31


Which parts of the design process would be most important to you?
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1
2
3
4
5
6
Everyone should agree
omestaff, residents, relatives, etc.
Visit nursing home
Thorough plan
Ask residents to evaluate solution
Knowledge from this project used in future
Use disagreements to create new ideas
Look into other countries' solutions
I would sketch on a piece of paper
I would patent my idea
I would wait until a good idea comes along
I would start a company and make money
My first solution is complete
Repeat tests with new cardboard models
Test cardboard model in a nursing home
Build a cardboard model

Answer the following questions by marking how much you agree or disagree	Strongly dis-agree	Dis-agree	Slightly dis-agree	Slightly agree	Agree	Strongly agree
I don't care how my digital gadgets works, I'm just happy when they do work	117	202	246	251	214	126
I'm interested in knowing how my devices (computer, tablet, smartphone) works and I tend to spend time on making improvements	124	220	242	296	179	95
When I see something broken, I immediately think of a way to fix it	161	285	224	276	149	61
I have a pretty good idea of what's inside a cell phone and how it works	164	239	208	287	186	72



To what extent do you agree with these statements regarding technology and data?	Strongly dis-agree	Dis-agree	Slightly dis-agree	Slightly agree	Agree	Strongly agree	Don't know
I'm concerned with data and information ownership on my data such as pictures, video and music etc..	32	76	133	247	329	251	88
Technology, digital data and information should be open and accessible for all	46	97	108	263	323	222	97
Technology gives me the freedom to express my interests and goals	34	97	120	323	339	185	58
Technology allows me to understand new contexts and opportunities	28	67	120	364	339	142	96
Hacking of technology, data and information is something only criminals do on the Internet	106	173	209	211	198	160	99
The government should collect, store and protect personal data and information	98	163	166	246	220	130	133
I use technology and data on the same footing as wood, paper and soft fabrics	93	201	226	269	156	55	156
Hacking is done by everyone	365	393	142	143	58	22	33


To what extent do you agree with these statements regarding technology and data?
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Concerned with data and information ownership
Tech., data and information should be open
Technology gives me freedom to express
Understand new contexts and opportunities
Hacking is something only criminals do on the Internet
Government should store personal data
Technology can be mixed with other materials
Hacking is done by everyone
Strongly disagree
Disagree
Slightly disagree
Slightly agree
Agree
Strongly agree
Don't know

What kind of parts do you think are inside of this key-fob?

For each part, write 1 for "Yes" or 0 for "No", AND write a number from 1 to 10 to show how sure you are. (1 = you're not sure at all, 10 = you're really sure)

	Yes	No	Level of confidence
Motor	101	1047	7,6
Temperature sensor	139	1009	6,7
Gear	80	1068	7,4
Batteries	941	207	7,3
LEDs	545	603	5,2
Microcontroller	801	347	5,5
Light bulb	300	848	6,1
Screws	763	385	6,4
Light sensor	359	789	5,6
Antenna	439	709	6,3
Laser	275	873	6,2
Mechanical switches	692	456	7,2
Transistor	370	778	4,5
Microphone	54	1094	7,3

Appendix III: The questionnaire

In the following pages is a print out of the original questionnaire. It is included in the original wordings (in Danish)

Teknologi i skole og fritid

Velkommen til Aarhus Universitets spørgeskema om dig og dit forhold til teknologi i skole og fritid.

Personlig information

Vi vil først gerne vide noget om dig og din skole

Hvad er dit UNI-login (brugernavn)? _____

Hvor gammel er du? _____

Hvad hedder din skole? _____

Hvilket køn er du?

- ❑ Dreng
- ❑ Pige

Hvilket klassetrin går du på?

- ❑ 6.
- ❑ 7.
- ❑ 8.
- ❑ 9.
- ❑ 10.

Hvor mange bøger er der ca. i dit hjem?

(du skal ikke tælle blade, aviser eller dine skolebøger med)

- ❑ 0-25 bøger
- ❑ 10-25 bøger
- ❑ 25-100 bøger
- ❑ 100-200 bøger
- ❑ Over 200 bøger

Skole og fritid

I løbet af den sidste uge, hvor mange timer brugte du på...

	0-2 timer pr. uge	2-5 timer pr. uge	5-10 timer pr. uge	Over 10 timer pr. uge
Lektier derhjemme	❑	❑	❑	❑
Passe dine søskende, familiens kæledyr osv.	❑	❑	❑	❑
Hjælpe til i hjemmet (rengøring, madlavning osv.)	❑	❑	❑	❑

Arbejde på gør-det-selv byggeprojekter	❑	❑	❑	❑
Reparation af f.eks. møbler, cykler eller elektriske apparater i dit hjem	❑	❑	❑	❑
At arbejde kreativt med f.eks. træ, maling eller stof.	❑	❑	❑	❑
Fritidsjob (med løn)	❑	❑	❑	❑
Være på computer, TV, mobil osv.	❑	❑	❑	❑
Sportsaktiviteter	❑	❑	❑	❑
At synge, spille et instrument eller i band	❑	❑	❑	❑
At være sammen med dine venner (fysisk/online)	❑	❑	❑	❑
Frivilligt arbejde (f.eks. foreningsarbejde)	❑	❑	❑	❑
At være i naturen	❑	❑	❑	❑

Her spørger vi dig om dit forhold til skolen og din fremtid.
Hvor enig er du?

	Meget uenig	Uenig	Lidt uenig	Lidt enig	Enig	Meget enig
Jeg klarer generelt mig godt i livet	❑	❑	❑	❑	❑	❑
Jeg stoler på mine egne faglige evner	❑	❑	❑	❑	❑	❑
Jeg klarer mig godt i skolen	❑	❑	❑	❑	❑	❑
Jeg lærer hurtigt nye ting	❑	❑	❑	❑	❑	❑
Jeg vil have en fremtid indenfor et kreativt fag (f.eks. håndværk, film eller musik)	❑	❑	❑	❑	❑	❑
Jeg vil have en fremtid indenfor teknologi og design	❑	❑	❑	❑	❑	❑
Jeg vil have en fremtid som ingeniør eller indenfor naturvidenskab	❑	❑	❑	❑	❑	❑
Jeg vil starte min egen virksomhed	❑	❑	❑	❑	❑	❑

Teknologi i hverdagen

Her spørger vi om din brug af teknologi og deltagelse i online fællesskaber.
Hvor ofte gør du følgende?

	Hvor ofte?							
	Min. hver time	Flere gange om dagen	Min. en gang om dagen	Min. en gang om ugen	Min. en gang om måneden	Højst en gang om måneden	Aldrig	Ved ikke
Bruger computer eller tablet derhjemme	❑	❑	❑	❑	❑	❑	❑	❑
Spiller computer-, mobil- eller videospil	❑	❑	❑	❑	❑	❑	❑	❑
Surfer eller ser video på Internettet	❑	❑	❑	❑	❑	❑	❑	❑
Uddeler f.eks. likes eller upvotes på Facebook, Instragram, Reddit, osv.	❑	❑	❑	❑	❑	❑	❑	❑
Kommenterer andres posts og opdateringer	❑	❑	❑	❑	❑	❑	❑	❑
Skriver statusopdateringer	❑	❑	❑	❑	❑	❑	❑	❑
Kommunikerer med billeder, video og tekst (f.eks. Facebook, Instagram, Snapchat)	❑	❑	❑	❑	❑	❑	❑	❑
Deler filer som film, musik og billeder (f.eks. YouTube, Soundcloud, Pinterest)	❑	❑	❑	❑	❑	❑	❑	❑
Ændre app indstillinger (f.eks. sikkerhed eller layout)	❑	❑	❑	❑	❑	❑	❑	❑
Skriver på Wikis, blogs, egen hjemmeside, osv.	❑	❑	❑	❑	❑	❑	❑	❑
Arbejder med video eller billeder (f.eks. i Photoshop)	❑	❑	❑	❑	❑	❑	❑	❑
Deltager på forum, IRC kanaler eller mailing lister	❑	❑	❑	❑	❑	❑	❑	❑

Deltager i hacking, tilpasning, piratkopiering, osv.	❑		❑		❑		❑		❑		❑		❑		❑		❑		❑		❑		❑
Programmerer hjemmesider, spil, apps, osv.	❑		❑		❑		❑		❑		❑		❑		❑		❑		❑		❑		❑
Deler filer på egen server (f.eks. FTP) eller P2P netværk (f.eks. Bittorrent)	❑		❑		❑		❑		❑		❑		❑		❑		❑		❑		❑		❑
Bidrager til en modeblog, en Minecraft server, filmprojekter, osv.	❑		❑		❑		❑		❑		❑		❑		❑		❑		❑		❑		❑

Teknologi i skolen

Hvad du ved om teknologi og hvordan du bruger den i skolen?
Skriv kort om din bedste oplevelse med teknologi i skolen. Skriv hvad og hvorfor det var spændende.

Hvor godt kender du disse teknologier?
Bedøm dig selv på en skala fra 1 til 6, hvor 1 er "*Det ved jeg ikke noget om*" og 6 er "*Jeg kunne undervise andre om det*."

	1		2		3		4		5		6
Computer / bærbar	❑		❑		❑		❑		❑		❑
Smartphones	❑		❑		❑		❑		❑		❑
Tablets eller iPads	❑		❑		❑		❑		❑		❑
Blogs	❑		❑		❑		❑		❑		❑
Tekstbehandling (f.eks. Word, Google Docs)	❑		❑		❑		❑		❑		❑
Regneark (f.eks. Excel, Google Spreadsheets)	❑		❑		❑		❑		❑		❑
Præsentationsprogrammer (f.eks. Powerpoint, Prezi)	❑		❑		❑		❑		❑		❑
Produktion eller redigering af digitale film/videoer	❑		❑		❑		❑		❑		❑
Lave en hjemmeside	❑		❑		❑		❑		❑		❑
Redigering af digitale billeder	❑		❑		❑		❑		❑		❑
Installation af software eller apps	❑		❑		❑		❑		❑		❑
Back-up af dokumenter, kontakter, mails, osv.	❑		❑		❑		❑		❑		❑
Ændring af privatindstillinger på f.eks. Facebook, Gmail, Instagram	❑		❑		❑		❑		❑		❑

...forsat fra sidste side

Hvor godt kender du disse teknologier?

	1	2	3	4	5	6
Programmering (f.eks. kodning af apps)	☐	☐	☐	☐	☐	☐
Bygge elektroniske dimser eller simple maskiner fra bunden	☐	☐	☐	☐	☐	☐
Bygge programmérbare robotter (f.eks. Lego Mindstorms)	☐	☐	☐	☐	☐	☐
Arbejde med træ- og metalværktøj	☐	☐	☐	☐	☐	☐
Lasercutters eller CNC fræsere	☐	☐	☐	☐	☐	☐
3D-printere	☐	☐	☐	☐	☐	☐
Elektronik og lodning (f.eks. dioder og modstande)	☐	☐	☐	☐	☐	☐
Microcontroller boards (f.eks. MakeyMakey og Arduino)	☐	☐	☐	☐	☐	☐
Multimeter (f.eks. volt eller ohm måler)	☐	☐	☐	☐	☐	☐

Hvor har du lært at bruge disse teknologier?

	Primært i skolen	Primært hjemme	Har ikke lært det
Computer / bærbar	☐	☐	☐
Smartphones	☐	☐	☐
Tablets eller iPads	☐	☐	☐
Blogs	☐	☐	☐
Tekstbehandling (f.eks. Word, Google Docs)	☐	☐	☐
Regneark (f.eks. Excel, Google Spreadsheets)	☐	☐	☐
Præsentationsprogrammer (f.eks. Powerpoint, Prezi)	☐	☐	☐
Produktion eller redigering af digitale film/videoer	☐	☐	☐
Lave en hjemmeside	☐	☐	☐
Redigering af digitale billeder	☐	☐	☐
Installation af software eller apps	☐	☐	☐
Back-up af dokumenter, kontakter, mails osv.	☐	☐	☐
Ændring af private indstillinger på f.eks. Facebook, Gmail, Instagram	☐	☐	☐

Hvor har du lært at bruge disse teknologier?

	Primært i skolen	Primært hjemme	Har ikke lært det
Programmering (f.eks. kodning af apps)	☐	☐	☐
Bygge elektroniske dimser eller simple maskiner fra bunden	☐	☐	☐
Bygge programmérbare robotter (f.eks. Lego Mindstorms)	☐	☐	☐
Arbejde med træ- og metalværktøj	☐	☐	☐
Lasercutters eller CNC fræsere	☐	☐	☐
3D-printere	☐	☐	☐
Elektronik og lodning (f.eks. dioder og modstande)	☐	☐	☐
Microcontroller boards (f.eks. MakeyMakey og Arduino)	☐	☐	☐
Multimeter (f.eks. volt eller ohm måler)	☐	☐	☐

Har du nogensinde arbejdet med digital fabrikationsteknologi på din skole f.eks. i et FabLab eller

værksted?

Digital fabrikationsteknologi er f.eks. MakeyMakey, loddekoble eller 3D printer

- ☐ Ja
- ☐ Nej
- ☐ Ved ikke

Beskriv kort, hvad du har lavet, hvilken teknologi brugte du og til hvad?

1. projekt

2. projekt

Hvordan var det at arbejde med digital fabrikation i skolen/FabLab?

	Meget uenig	Uenig	Hverken enig/uenig	Enig	Meget enig
Jeg kedede mig	☐	☐	☐	☐	☐
Jeg kan godt lide at være i værkstedet/FabLab	☐	☐	☐	☐	☐
Undervisningen er interessant	☐	☐	☐	☐	☐
Undervisningen er spild af min tid	☐	☐	☐	☐	☐
Jeg vil gerne bruge teknologierne til mine egne projekter udenfor skolen	☐	☐	☐	☐	☐
Det, vi lærer i værkstedet/FabLab, kan jeg bruge i fremtiden	☐	☐	☐	☐	☐
Jeg elsker at arbejde på digital fabrikations projekter	☐	☐	☐	☐	☐
Jeg lærer meget i værkstedet/FabLab	☐	☐	☐	☐	☐
Jeg tænker på det, vi har lært, når jeg er derhjemme	☐	☐	☐	☐	☐

Har du nogensinde modtaget undervisning i elektronik, robot-teknologi eller programmering uden for skolen - f.eks. på en workshop eller sommerlejr?

- ☐ Ja
- ☐ Nej
- ☐ Ved ikke

Skriv navnet på begivenheden, og hvor lang tid den varede (f.eks. 5 dage):

Beskriv kort hvad du lavede til begivenheden

I hvor høj grad synes du at *skolen* har hjulpet dig til ...

Bedøm på en skala fra 1 til 6, hvor 1 er "*Slet ikke*" og 6 er *"I høj grad*".

	1	2	3	4	5	6
At arbejde kreativt med teknologi	❑	❑	❑	❑	❑	❑
At lære at løse svære eller komplekse udfordringer	❑	❑	❑	❑	❑	❑
At lære at forholde dig til samfundsmæssige problemer	❑	❑	❑	❑	❑	❑
At forestille dig, hvordan du kan forandre ting, f.eks. med teknologi	❑	❑	❑	❑	❑	❑
At samarbejde med mennesker med forskellig baggrund og evner	❑	❑	❑	❑	❑	❑
At lære hvordan teknologi påvirker den måde, vi lever på	❑	❑	❑	❑	❑	❑
At lære hvordan nye ideer, ting og teknologier bliver skabt	❑	❑	❑	❑	❑	❑

...forsat fra sidste side

I hvor høj grad synes du at *skolen* har hjulpet dig til ...

	1	2	3	4	5	6
At forholde dig kritisk til din egen og andres brug af teknologi	❑	❑	❑	❑	❑	❑
At kommunikere med forskellige mennesker over Internettet	❑	❑	❑	❑	❑	❑
At bruge teknologi til at arbejde systematisk med opgaver (i f.eks. fysik/kemi, natur/teknik)	❑	❑	❑	❑	❑	❑
At ville have en videregående uddannelse	❑	❑	❑	❑	❑	❑
At ville have en kreativ eller håndværksmæssig uddannelse	❑	❑	❑	❑	❑	❑
At ville starte din egen virksomhed	❑	❑	❑	❑	❑	❑

Design og kreativitet

De næste spørgsmål handler om at få nye idéer, arbejde kreativt og skabe nye ting med teknologi.

Hvor enig eller uenig er du i følgende...

	Meget uenig	Uenig	Lidt uenig	Lidt enig	Enig	Meget enig
Jeg kan lide alt, der har med teknologi at gøre	❑	❑	❑	❑	❑	❑
Jeg er god til at lave eller bygge ting	❑	❑	❑	❑	❑	❑
Det jeg lærer i natur/teknik eller fysik/kemi interesser mig	❑	❑	❑	❑	❑	❑
Jeg kan godt lide at arbejde på natur/teknik eller fysik/kemi projekter	❑	❑	❑	❑	❑	❑
Jeg keder mig, når vi har natur/teknik eller fysik/kemi	❑	❑	❑	❑	❑	❑
Jeg er ikke en naturfags-person	❑	❑	❑	❑	❑	❑

Jeg er god til natur/teknik eller fysik/kemi	❑	❑	❑	❑	❑	❑

Hvor enig eller uenig er du i...

	Meget uenig	Uenig	Lidt uenig	Lidt enig	Enig	Meget enig
Jeg er god til at finde på nye idéer	❑	❑	❑	❑	❑	❑
Jeg har en god fantasi	❑	❑	❑	❑	❑	❑
Jeg har en masse gode idéer	❑	❑	❑	❑	❑	❑
Jeg er en kreativ person	❑	❑	❑	❑	❑	❑
Nogle personer er født kreative, mens andre aldrig lærer det	❑	❑	❑	❑	❑	❑
Det jeg lærer i de kreative fag interesser mig	❑	❑	❑	❑	❑	❑
At opfinde ting er vigtigt for mig	❑	❑	❑	❑	❑	❑
Jeg er god til at bygge videre på andres tanker og ideer	❑	❑	❑	❑	❑	❑
Jeg er god til at samarbejde med forskellige mennesker i grupper	❑	❑	❑	❑	❑	❑
Jeg er god til at finde på ideer sammen med andre på min alder	❑	❑	❑	❑	❑	❑

Har du nogensinde haft en idé til et nyt produkt eller opfindelse?

❑ Ja

❑ Nej

Beskriv kort din idé

Har du skabt eller bygget din idé eller opfindelse?

❑ Ja

❑ Nej

Hvorfor ikke?

Hvordan og med hvem?

Designopgave: Plejehjemmets udfordring

I begyndelsen af 2014 forsvandt 9 bedsteforældre fra deres plejehjem pga. hukommelsestab (demens). Plejehjemmets problem er at skabe tryghed for de ældrene uden at tage deres frihed fra dem.

Hvis du blev bedt om at løse dette problem, hvad ville du så gøre?

Hvilke stikord ville du søge med på Internettet, for at få idéer til at løse problemet?

Hvem ville være vigtige for dig at samarbejde med, om at finde en løsning?

Vælg et tal fra 1 til 6 (1 = slet ikke vigtigt , 6 = virkeligt vigtigt)

	1	2	3	4	5	6	Ved ikke
Plejehjemspersonale	❑	❑	❑	❑	❑	❑	❑
Andre ældre med demens	❑	❑	❑	❑	❑	❑	❑
Politiet	❑	❑	❑	❑	❑	❑	❑
Brandvæsenet	❑	❑	❑	❑	❑	❑	❑
Folk fra kommunen	❑	❑	❑	❑	❑	❑	❑
NASA	❑	❑	❑	❑	❑	❑	❑
Et teknologi firma	❑	❑	❑	❑	❑	❑	❑
En industriel designer	❑	❑	❑	❑	❑	❑	❑
Interessegrupper for ældre (f.eks. Ældresagen)	❑	❑	❑	❑	❑	❑	❑
Jeg vil hellere tænke på en løsning selv	❑	❑	❑	❑	❑	❑	
Andet. Skriv det i tekstboksen.							

Hvordan ville du finde den rigtige løsning på problemet med de demente ældre, som bliver væk?
Hvilke dele af processen ville være vigtigst for dig?

Vælg et tal fra 1 til 6 (1 = slet ikke vigtigt, 6 = virkeligt vigtigt)

	1	2	3	4	5	6
Jeg ville lave en grundig plan for hele projektet	❑	❑	❑	❑	❑	❑
Jeg ville vente til at en god idé dukkede op	❑	❑	❑	❑	❑	❑
Jeg vil besøge et plejehjem for at udforske problemet nærmere	❑	❑	❑	❑	❑	❑
Jeg ville finde ud af, hvad de gør i andre lande	❑	❑	❑	❑	❑	❑
Jeg vil skitsere mulige løsninger på et stykke papir	❑	❑	❑	❑	❑	❑
Jeg ville bygge min idé i pap	❑	❑	❑	❑	❑	❑
Jeg vil teste min pap-model på et plejehjem	❑	❑	❑	❑	❑	❑
Jeg vil gentage mine tests med en ny skitse eller pap-model flere gange	❑	❑	❑	❑	❑	❑

Jeg vil afprøve min løsning sammen med ældre plejehjemsbeboerne ☐ ☐ ☐ ☐ ☐ ☐

...forsat fra sidste side

Vælg et tal fra 1 til 6 (1 = slet ikke vigtigt, 6 = virkeligt vigtigt)

	1	2	3	4	5	6
Jeg vil afholde et møde med plejehjemspersonale, pårørende, for at diskutere min løsning	☐	☐	☐	☐	☐	☐
Jeg vil sørge for, at alle er enige om løsningen	☐	☐	☐	☐	☐	☐
Jeg vil bruge uenigheder mellem personer/grupper til at udvikle nye idéer	☐	☐	☐	☐	☐	☐
Jeg vil tage patent på min idé	☐	☐	☐	☐	☐	☐
Jeg vil starte et firma til at markedsføre min løsning og tjene penge	☐	☐	☐	☐	☐	☐
Så snart min løsning er færdig, stopper jeg helt med at arbejde på problemet	☐	☐	☐	☐	☐	☐
Jeg vil bruge min viden fra dette projekt, i fremtidige projekter	☐	☐	☐	☐	☐	☐

Andet du ville gøre? Beskriv dem her.

Hacking, data og teknologi

Her handler det om dit forhold til hacking og reparation af teknologi i din hverdag. Hvor enig eller uenig er du...

	Meget uenig	Uenig	Lidt uenig	Lidt enig	Enig	Meget enig
Når jeg ser en ødelagt ting, tænker jeg straks på en måde at reparere	☐	☐	☐	☐	☐	☐
Jeg er ligeglad med hvordan mine digitale dimser fungerer, bare de virker	☐	☐	☐	☐	☐	☐
Jeg har en god idé om, hvad der er inde i en mobiltelefon, og hvordan den virker	☐	☐	☐	☐	☐	☐
Jeg er interesseret i at vide, hvordan mine digitale dimser fungerer, og jeg forbedre dem ofte	☐	☐	☐	☐	☐	☐

Hvad gør du, hvis noget ikke virker på f.eks. din computer eller mobil?
Markér tre muligheder.

- ☐ Ringer til en ven
- ☐ Læser i en manual
- ☐ Spørger en af mine forældre
- ☐ Ringer til support
- ☐ Søger på problemet på Internettet
- ☐ Søger efter hjælp på specifikke hjemmesider
- ☐ Starter en diskussion på en f.eks. et forum
- ☐ Roder med forskellige indstillinger, kommandoer osv., som jeg kender
- ☐ Ved det ikke
- ☐ Andet. Skriv venligst her: _____

Har du nogensinde skilt din telefon eller andre digitale dimser ad?

- ☐ Ja
- ☐ Nej
- ☐ Ved ikke

Hvorfor åbnede du den? Var det f.eks. for at fikse/forbedre noget?

Hvorfor ikke?

- ☐ Hvorfor skulle jeg?
- ☐ Det kan jeg ikke finde ud af
- ☐ Så ville jeg bryde garantien
- ☐ Ved ikke
- ☐ Andet. Skriv det venligst her: _____

Hvor enig er du i disse udsagn om teknologi og data?

	Meget uenig	Uenig	Lidt uenig	Lidt enig	Enig	Meget enig	Ved ikke
Teknologi, data og information bør være åbne og tilgængelige for alle	☐	☐	☐	☐	☐	☐	☐
Staten skal gemme alles personlige data og information	☐	☐	☐	☐	☐	☐	☐
Jeg går op i hvem der ejer mine data og informationer, f.eks. billeder og musik	☐	☐	☐	☐	☐	☐	☐
Hacking er kun noget kriminelle gør på internettet	☐	☐	☐	☐	☐	☐	☐

...forsat fra sidste side

Hvor enig er du i disse udsagn om teknologi og data?

	Meget uenig	Uenig	Lidt uenig	Lidt enig	Enig	Meget enig	Ved ikke
Hacking er noget alle gør	☐	☐	☐	☐	☐	☐	☐
Teknologi giver mig frihed til at udfolde mine interesser	☐	☐	☐	☐	☐	☐	☐
Jeg kan se hvordan teknologi kan kombineres med andre materialer (f.eks. stof, træ eller papir)	☐	☐	☐	☐	☐	☐	☐
Teknologi giver mig mulighed for at forstå nye sammenhænge og muligheder	☐	☐	☐	☐	☐	☐	☐

Opgave: Hvilke dele er der i bilnøglen?


Fjernbetjening til billås (centrallås)

Vælg ja eller nej, vælg derefter et tal fra 1 til 10 ud fra hvor sikker du er på dit svar (1 = ved ikke/usikker, 10 = virkeligt sikker).

	I bilnøglen?		Hvor sikker er du?									
			1	2	3	4	5	6	7	8	9	10
Motor	ja ❑	nej ❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
Temperaturføler	ja ❑	nej ❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
Gear	ja ❑	nej ❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
Batteri	ja ❑	nej ❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
Lysdiode	ja ❑	nej ❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
Microcontroller	ja ❑	nej ❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
Lyspære	ja ❑	nej ❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
Skrue	ja ❑	nej ❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
Lyssensor	ja ❑	nej ❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
Antenne	ja ❑	nej ❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
Laser	ja ❑	nej ❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
Kontakt knap (on/off)	ja ❑	nej ❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
Transistor	ja ❑	nej ❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
Mikrofon	ja ❑	nej ❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑

Tusind tak for din hjælp med at besvare vores spørgeskema.

Hvis du har andet at fortælle om dit forhold til teknologi, eller ideer til hvordan fremtidens skole kan bruge teknologi i undervisningen, så skriv dem gerne her:

Mange hilsner
Ole, Rachel, Kasper og Mikkel
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