Improving Healthy Skepticism towards Digital Technology in Adolescents through Speculative Design Workshops

YORN THIJSSEN, Eindhoven University of Technology, The Netherlands, y.j.thijssen@student.tue.nl

Children nowadays grow up with and use digital technologies at an early age, even before they start to learn to think critically. In adolescence they therefore lack healthy skepticism towards these digital technologies. This research investigates whether and how speculative design workshops might improve healthy skepticism towards digital technology in adolescents. Over the course of 9 weeks, 7 workshops have been openly developed and given to 18 high school students. The workshops consisted of discussions, theory and activities that stimulated the students towards their goal of creating a speculative design in a specific future scenario. The results included qualitative data from the discussions, the produced outputs from the activities, the created speculative ideas together with presentations and individual evaluations of the workshops through a survey. Even though analysis of these results shows contradictories, it is concluded that speculative design workshops have potential to improve healthy skepticism towards digital technology in adolescents.

CCS CONCEPTS • **Human-centered computing → Empirical studies in HCI**;

Additional Keywords and Phrases: Digital technology; Speculative Design; Education; Design Methods; Workshops

1 INTRODUCTION

Today's society is heavily relying on digital technologies. Parents for instance use digital technology as a tool to keep children busy, when they want some rest [1]. Children start to use digital technologies at a very young age, even daily [2]. At this age, children do not have nor learn the skills to learn to think critically [3]. Children thus adopt and use digital technologies children without critically evaluating them. Children do not really know what internet is, what 'online' means and what risks they can encounter [2]. Moreover, as the COVID-19 pandemic has highlighted and might has even increased the reliability on digital technologies, it also accelerated the adoption of digital technologies [4, 5, 6]. Because most of children and adolescents their life suddenly had to become digital, rapid adoption also occurred amongst these generations. The use and easy adoption of (new) digital technologies without critically thinking about this becomes habituation. Therefore, in adolescents, the stage of life in which critical thinking is developing and acquired, it appears there is a lack of healthy skepticism towards digital technologies. Healthy skepticism is defined in this study as the willingness to think critically [7]. More specifically, healthy skepticism towards digital technology is the willingness to think critically about digital technologies which enables one to make a well-considered, informed, and conscious decision about the use and adoption of (new) digital technologies. The lack of healthy skepticism towards digital technologies in adolescents can have several consequences which are problematic. First, adolescents adopt and use digital technologies without proper knowledge on how these technologies work behind the interface, what it implies using them and without proper awareness of the possible risks that may be involved with using them. This makes them vulnerable for these risks. Having healthy skepticism can enable adolescents to gain this knowledge and make this well-considered, informed, and conscious decision. Moreover, it makes adolescents less vulnerable for risks since they will be more aware of them. Secondly, both companies and people can make use of this lack of healthy skepticism towards digital technologies. Social media companies are for

instance already doing this, deliberately making their apps addictive with the use of algorithms and infinite scrolling [8]. Moreover, it is important that issues with (new) digital technologies will be brought to light before they become public concerns once they are used by, and integrated into, society. Having healthy skepticism has the potential of achieving this. Creating healthy skepticism might be achieved by stimulating critical thinking towards digital technology in adolescence. The aim of this research was to study whether and how speculative design workshops can stimulate critical thinking on digital technologies in adolescents, thereby improving their healthy skepticism. Speculative design has a variety of characteristics that appear to be beneficial to critical thinking and speculation itself does involve critical thinking to some extent. In a series of workshops, a class of 18 high school students worked in groups towards the creation of speculative ideas in a specific future scenario. The workshops included discussions, theory and activities that stimulated the creation of ideas. The opening discussion was also intended to investigate the current healthy skepticism towards digital technologies in these students. This paper continuous with background on critical thinking, adolescents and digital technologies, speculative design, and related work in education. Next, the method and the set-up of the workshops, will be described. Subsequently, a combined results and discussion section will cover and discuss the obtained results and address limitations and future work. The paper ends with a conclusion on the improvement of healthy skepticism amongst adolescents by means of speculative design workshops.

2 BACKGROUND

This section will cover background on topics that are of relevance for this study. First, critical thinking in adolescents is discussed after which their use of and critical thinking towards digital technologies will be covered. Third, speculative design and the choice of this method for this study is discoursed. Lastly related work in education will be discussed.

2.1 Critical thinking

Since critical thinking can be applied to many fields, it is hard to find a set definition. A comprehensive definition of critical thinking is the one described in [10]:

"Critical thinking is the intellectually disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered from, or generated by, observation, experience, reflection, reasoning, or communication, as a guide to belief and action."

This definition includes many aspects which require corresponding skills. These skills are learned from a young age on, but most is learned throughout adolescence. In this stage of life, the thoughts of individual's start taking a more abstract form and egocentric thoughts decrease. In this Formal Operational stage as described by Piaget [1972], adolescents start to think and reason with a wider perspective. This allows them to learn the skills that the aspects of critical thinking as defined in [10]. These skills are required for one to create healthy skepticism: the willingness to think critically as one engages with (new) content, ideas, or perspectives [7]. Critical thinking and having healthy skepticism are thus very closely related. If applied to digital technologies, healthy skepticism would thus mean that one is willing to think critically about (new) digital technologies.

2.2 Adolescents and Digital Technologies

Almost all adolescents use digital technologies. In the U.S. 95% of 13- to 17-year-olds own or have access to a smartphone, 88% to a desktop or laptop and 84% to a gaming console [11]. Amongst the smartphone users, 45% states they are online

almost constantly, probably due to extensive use of social media [11]. In a survey amongst 14- to 22-year-olds it was found that 93% uses social media [12]. Screen time on a screen-based device amongst 13- to 18-year-olds has been found to be 43.6 hours a [13]. The screen-based devices all included digital technologies. Studies on risk awareness in online behavior amongst adolescents show varying results. While one study reports a medium-high awareness, another reports low awareness [14, 15]. In the study reporting a medium to high level of awareness participants could indicate their own awareness on a Likert scale which could not be valued equally amongst participants [14]. In the study that reports low awareness the results are from a questionnaire sent to teachers who amongst other things evaluated risk awareness of their students [15]. With regards to privacy, it was found that adolescents vary in their understanding of privacy practices, and among the ones who do understand how to set their privacy settings, many choose not to do so [16, 17]. In [18] middle school students their perceptions of technology use and digital citizenship practices have been studies according to five key elements: cyberbullying, digital footprint, digital privacy, digital netiquette and digital identity. It was found that the students, aged 10 to 16 years old, lack an understanding of digital citizenship practices. In a similar study educators rated their student's digital citizenship practices instead of students themselves [19]. The educators rated the understanding and practice as not well for most of the five investigated elements of digital citizenship. These studies support the claim that there is a lack of healthy skepticism towards digital technologies. Almost all of these studies mention that education and spreading knowledge and awareness on these topics is important. In a study towards retargeted ads, it was found that debriefing about the practice of retargeted ads, thus raising awareness, elicits skepticism towards this practice [20]. However, raising awareness afterwards might not be the best option with regards to the use and adoption of digital technology, especially when risks are involved. Therefore, this study tries to improve healthy skepticism towards digital technologies in adolescents by means of speculative design workshops. The next paragraph will discuss speculative design and why it has been chosen as method for this study.

2.3 Speculative Design

Speculative design can be described as design that can be used to speculate about how things could be. It flourishes on imagination and can open up new perspectives, create spaces for discussion and debate about alternative ways of life [21]. With regard to technology, it can create possible futures that can act as tool to "understand the present and to discuss the kind of future people want, and, of course, ones people do not want" [21]. Speculative design is closely related to but can also include critical design, which "uses speculative design proposals to challenge narrow assumptions" and is seen as more of an attitude, similar to having healthy skepticism [21]. Speculative design serves two distinct purposes [22]. First it enables to think about the future. Second, it can critique current practice. In [23] this distinction is made through reviewing design exemplars, distinguishing alternative fictions and extrapolative fictions. The latter "questions the status quo from within and use the power of design to highlight underexposed aspects of expected futures" [23]. Speculative design can critically address issues with technology before they will become public concern. By coming up with questions to address the status quo it hast the possibility to stimulate critical thinking and has therefore been chosen as a method for this research. Speculative has been widely used as a method to do research with, for example in [24, 25, 26, 27]. However, mostly speculative design is used as a means to spark debate and by that finding implications. This research studies whether speculative design can also be used to improve healthy skepticism towards digital technologies.

2.4 Related work in Education

Speculative design approaches themselves are widely studied and discussed. It has been used outside educational settings, like the examples in the previous paragraph, but also as participatory or co-design as for instance in [28, 29]. However,

there is little attention to speculative design as method in the classroom. In [30] it is illustrated that speculative design has potential as method for education development, with a focus on new pedagogic potentials for critical digital literacy, which is similar to having healthy skepticism. In [31] speculative design has been used in higher education. However, in this course it was the aim to equip students with skills to " critically adapt their own practices to the changing societal roles of design". This research, however, focusses on how using speculative design in the classroom can improve healthy skepticism, rather than using it for education development or supporting students in developing critical design practices. In 2019 the Minister of Education in the Netherlands received advice for a new curriculum which included that digital literacy needs to be thought in middle and high schools [32]. This new curriculum starts in 2023 but in 2022 the Minister already came with a plan to improve education sooner [33]. Since healthy skepticism is closely related to digital literacy, the result of this study could be of high relevance as possible content of classes in which these basic ICT skills, including digital literacy, can be thought.

3 METHOD

3.1 Workshops

The workshops will be conducted with a group of students from a high school in the Netherlands. Over the course of nine weeks, a total of seven workshops will be given. The workshops will be made available through a class in the students their curriculum, which is given two times a week. Therefore, each workshop will last for roughly 45 minutes. Because the researcher cannot always be present in these nine weeks, the students will be given an intermezzo workshop or will be given instructions to be able to self-organize their work for the 45 minutes of class. At these moments the responsible teacher will be present and facilitate the workshop. This teacher will also help with the development and the facilitation of the workshops. The student's main goal in these workshops is to work in a group towards a speculative idea that suits within a specific future scenario. Next to a final presentation on this idea, the students need to show their idea through for example a lo-fi prototype, video, or sketches. Each group will be free to choose their way to show their idea. The workshops will further include discussions, theory and activities that will stimulate the creation of the ideas. After the workshops the students will individually fill in an evaluation form. The content and development of the workshops will be an open process throughout the time the workshops will be given to match the students their planning and outcomes from activities. The design section will elaborate on the content of the workshops and the specific future scenario by discussing each workshop separately.

3.2 Participants

The students to which these workshops will be given are 11th grade pre-university students in an Information Technologies (IT) class. The class consisted of 18 students aged 16-19 years old, amongst which were 4 girls and 14 boys. These demographics can be seen in table 1 & 2.

Table 1: Genders

Gender	Number of Participants
Female	4
Male	14

Table 2: Ages

Age	Number of Participants
16	8
17	7
18	2
19	1

3.3 Analysis

The results will include qualitative as well as quantitative data from the discussion, outcomes of the activities, the students their final presentation of their speculative idea and individual answers on a survey to evaluate the workshops. The first and last workshop will include a discussion with eight statements on the use of digital technologies. These sessions will be recorded and transcribed. A thematic analysis on retracted quotes will be done to find reoccurring themes in these discussions. Moreover, the number of students (dis)agreeing on each statement will be counted. This will show whether there is a difference of number of students (dis)agreeing on statements as a possible result of the workshops. Several activities will be done that will result in a diverse set of outcomes that can be analyzed. Outcomes of each group will be analyzed to what extend these make use of theory that will be given in the second workshop. Moreover, it will be analyzed to what extend these outcomes go beyond the examples that will be given of possible outcomes of these activities. The speculative idea and the final presentation will be analyzed in similar manner. This will be done by rating the outcomes with low, medium, or high with regards to the theory and examples. The students will evaluate the workshops by means of a digital evaluation survey. The questions in this survey are based upon Kirkpatrick's Four Model of Training Evaluation. Introduced in 1959 and 1960 in a series of four journal articles, it soon became known as the Kirkpatrick model and a well-known and widely used evaluation model in a diverse range of industries and programs [34, 35, 36, 37, 38]. Questions in the survey address three of the four levels of the Kirkpatrick model: reaction, learning and behavior. Results is left out since the students their behavior, improvement on their healthy skepticism, is the possible result of this study.

4 THE WORKSHOPS

This section gives an overview of the workshops, including a description of the activities. The content and development of the workshops has been an open process throughout the time the workshops were given. In total 7 workshops have been given. This excludes an intermezzo and a self-organized workshop.

4.1 Workshop 1: Introduction & Discussion

In the first workshop an introduction to the research was given to the students. After the introduction the students were given time to read what participating in the study involves and gave their voluntary consent in digital format. More important, the first workshop included a physical and open discussion that investigated the students their current healthy skepticism towards digital technology. Students had to walk towards either side of the class in order to agree or disagree with a statement. Eight statements were used that included topics on their use, knowledge, and skepticism towards digital technology (see table 3).

4.2 Intermezzo Workshop

In the next class that followed the first workshop, the researcher could not be present. To get acquainted with the topic of digital technologies, it was decided that a variety of scenes from the documentary The Social Dilemma would be shown [39]. These scenes consist of key elements which the researcher thinks contribute to awareness on social media use. These key elements formed a base of the theory in workshop 2.

4.3 Workshop 2: Theory

The second workshop provided the students with knowledge and awareness on digital technologies and the use of them. First, the key points from the scenes in The Social Dilemma were discussed, followed by a small section on data. Specifically, it was taught what could be implied from data that people share online. It included a small shocking element

in which the researcher implied facts from one of the students in the class based upon data that that student shares online. Next, algorithms were explained and examples of algorithms with a positive and negative effect were given. After that, specific digital technology was explained that makes use of algorithms, namely the smart home. For this, the Internet of Things, Smart Home Technologies (SHTs) as well as learning systems have briefly been explained. Moreover, everyday crises of routine as described in [40] were explained and examples were shown. Explaining the smart home was done because the specific future scenario the students would work in included the future of the smart home. This scenario was clarified at the end of the workshop such that students could start thinking about it before entering the next workshop. More specifically it asked the students to start to think about the following question:

How can the smart home of the future help, nudge or even force you to do better in school?

The smart home has been used as a scenario for several reasons. First, the number of smart homes is rising, and it is expected that many more homes will become smart in the upcoming years [41]. Using this scenario makes the students aware of these new digital technologies. Moreover, instead of creating a speculative design about the abstract 'future', the scenario narrows down the student's scope towards their goal. At the same time, it does not steer the students too much. The home is a diverse place that can house many different digital technologies. Therefore, this scenario still provides a great variety of results amongst the groups.

4.4 Workshop 3: Speculative Design Activities

Workshop 3 included the first activities that would help the students towards their goal of creating a speculative idea. First, an introduction exercise was done that stimulates thinking about the future. The bag exercise asks students to discuss questions on the past and future of items inside their bag in small groups, after which it was discussed with the whole class. The duration of this exercise was 10 minutes. This exercise was inspired by a workshop for the New Futures squad from the faculty of Industrial Design at the University of Technology Eindhoven [Dan Lockton, Personal Communication, February 16, 2022]. The second activity lasted for the remaining 35 minutes of class. This activity involved guided roleplay and is based on the More Than Humans Workshop provided by Lenneke Kuijer for the same New Futures squad mentioned earlier [Lenneke Kuijer, Personal Communication, March 16, 2022, 42]. The activity consisted of 5 steps. First, the students were given a broader description of the future scenario of the smart home which they would have to imagine themselves in. Next, they divided roles in their group as a journalist, an enthusiast, a sceptic person, or the role of a smart product in this future scenario. Each group was given a different product as role to achieve variation in results. After preparing their role, the journalist interviewed the three others. All could improvise on the go. The journalist was given questions that could be used as guidance for the interview. Afterwards, the students had to summarize and visualize their interview by making a newspaper article of the future together with a visualization on a single PowerPoint dia. Secondly, they had to come up with an idea of a future product that would fit within this scenario. The formulation of this idea formed the base for the creation of their speculative idea. Both outcomes were set as homework and had to be presented in the next workshop for 5 minutes. Prior to the activity, the students were given two handouts. One on which the 5 steps were listed and one that contained more information on the roles and the questions for the journalist (see appendix A.1).

4.5 Workshop 4: Presentations Activity Outcomes

A week after the previous workshop each group had to present their news article from the future as well as their idea for a future product in the future scenario. Since each presentation would last for around 5 minutes and the fact there were 5

groups, it was originally planned that for the remaining 20 minutes of the class, the groups could start working on their speculative idea. However, due to technical difficulties with uploading the outcomes this workshop merely consisted of the presentations. At the end the workshop an elaborate explanation on the student's goal was given with examples of how it could be showed in their final presentations. For example, a lo-fi prototype, sketches, a comic strip, a story, or a video.

4.6 Workshop 5: Creating

Since the students did not have time to start creating in the previous workshops, and a 2-week holiday had passed, this workshop started with a short recap of the goal and the ways to show their idea. Next, the students were given plenty of time to work on their idea and the way they want to sow their idea. They were given cardboard in various sizes and colors, colored paper, large sheets of plane white paper and plenty of markers. Since the ideas in the presentations in the previous workshop merely consisted of conventional ideas, it was decided to add an activity at the end of this workshop. This activity was based on the Futures Wheel [43] and asked the students to think about consequences and follow-up consequences of their idea within certain scenarios. The students were given a large handout to perform this exercise (see appendix A.2). Specific scenarios were given to each group to match scenarios with their specific idea.

4.7 Self-organized Workshop

The researcher could not be present in the class that followed the previous workshop. This workshop was facilitated by the responsible teacher of this class and consisted of self-organized work for the full 45 minutes. The students were asked to finalize their idea and the way of showing their idea. Moreover, they had to prepare the final presentation on their speculative idea.

4.8 Workshop 6: Final Presentations

A day after the self-organized workshop the final presentations took place. Each presentation had to last for around 5 minutes. It had to include their way of showing the idea and an explanation of the idea. The students were asked to explain how it works, how it is connected, which data it collects and how it possibly can go wrong in certain situations. After each presentation there was time to ask questions and to provide feedback.

4.9 Workshop 7: Discussion & Evaluation

The final workshop involved the final discussion and the evaluation survey. The discussion involved the same statements as the first discussion to see if change had happened as a result of the workshops. Questions to stimulate the discussion went into what possibly caused this change. After the discussion the students individually filled in a digital evaluation survey. This was added since not all students may speak up in an open discussion with the whole class. The survey was based on the Kirkpatrick four model [34, 35, 36, 37, 38] and included questions on their reaction to the workshops, it questioned what they learned, and it included statements regarding their current digital technology use (see appendix A.3)

5 RESULTS & DISCUSSION

The workshops have led to a wide variety of results. They include the recordings and both quantitative and qualitative data from the discussions, outcomes from the guided roleplay and future wheel activity, the students their eventual ideas and presentations, and finally the results from the evaluation survey. In this section these results will be individually addresses and discussed. At the end of this section, limitations of the study will be addressed, and suggestions for further research are brought forward.

5.1 Discussions

The discussions resulted in recordings of respectively 30 and 36 minutes each. These recordings have been transcribed (see appendix A.4) after which valuable quotes have been retracted and coded. A thematic analysis resulted in a variety of themes. Amongst these themes were for example *digital technology use*, *awareness*, and *knowhow*. As the discussions were based on the same statements, both discussions resulted in the same themes. In the second discussion however, *critical thinking* and *imperturbability* occurred as new themes. In a next step in analysis, the quotes in all themes have been divided in two categories: quotes that show critical thinking and quotes that do not. This showed that a lot of the quotes that did showed critical thinking came from the same participants.

5.1.1 First Discussion

The first discussion was used to investigate the students their healthy skepticism towards digital technologies before the workshops. The students actively participated in this discussion. Sometimes debate would occur amongst students themselves. Students also asked each other questions based on the statements to stimulate each other to think about them. Students moved from side, thus agreeing or disagreeing, after being questioned by another student. They reflected upon their own stance towards that particular statement. A small group of students did mention to be aware of, and to be critical about their use. Bad experiences were for example given as a reason. However, the analysis of this discussion suggests that there is a lack of healthy skepticism in a large group amongst these students. This is supported by the number of students (dis)agreeing with several statements (see table 3). One student for example said as a response to statement 4:

"I thought about cookies, and installing a new application, that you just scroll down and click accept. I always do that."

More students had the same mindset, mentioning not being aware because they just click accept and they are not going to read privacy rules or small prints. One student also indicated that they deliberately choose not to be aware:

"Not wanting to know is pretty important because if you are going to know everything, then it does not really feel safe anymore to use every application, so to speak".

With regards to sharing data, it is interesting to note that the students were asked if they remembered what they share with this research, after which the teacher asked who of the students did not carefully read the consent form. 10 out of 18 students did not carefully read the consent form. These results shows that a majority of these students is not willing to gather information. Therefore, they cannot apply this to actively and skillfully conceptualize, apply, analyze, synthesize, and/or evaluate this as a guide for their belief and actions as described in [9] and thus lack healthy skepticism.

Table 3: Quantitative Results of the Discussions

First Discussion				Final Discussion	
Agree / A	Disagree / B	Number	Statement	Agree / A	Disagree / B
18	0	1	I make use of digital technologies.	18	0
14	4	2	I am aware of or think about my use of digital technologies.	18	0
17	1	3	I make use of digital technologies without knowing how they work.	15	3
9	9	4	A: I always look to what it means for me to make use of digital technologies. B: I never look to what it means for me to make use of digital technologies.	2	16
6	12	5	A: I am always aware of, and don't think about which data I share online. B: I am never aware of, and don't think about which data I share online.	3	15
10	8	6	I am aware of the possible dangers of sharing data online.	11	7
14	4	7	I am skeptical towards the use of (new) digital technologies.	2	16
9	9	8	I am skeptical towards de future in which we are probably going to use more (new) digital technologies.	2	16

5.1.2 Final Discussion

In the final discussion it was expected that students would have improved on their healthy skepticism towards digital technologies, as impact of the workshops and thus show this in (dis)agreeing with the statements. But surprisingly, the number of students that (dis)agreed on the statements showed the opposite. During the discussion the students were less actively involved than in the first. A smaller amount of discussion amongst the students themselves occurred and there were no students who question each other. *Critical thinking* and *imperturbability* were themes that distinguished this discussion from the first. Regarding the latter theme, one student mentioned:

"In the years that I have lived, I have given enough data. Now it is more or less too late to change"

When the teacher asked if this was a form of imperturbability, the student agreed. One student also argued that gained knowledge has led to less critical thinking:

"Yes, I think that that [more knowledge] leads to more incentive to not deal with it."

These results suggest that, because of the workshops, the students became less willing to gather information to be able to think critically about digital technologies. However, there are several factors that could have led to these results. Firstly, the statements were the exact same statements as in the first discussion in which students thus had to choose which side best suits them. These statements did not allow to be in-between and did not go into change that may have occurred. Even though students could have improved in their critical thinking, they could still have chosen for the side that does not show this because that still suits them best. When the students for instance were asked whether they became more skeptical towards digital technologies, instead of the statement which asked if they are skeptical, most students answered yes. Secondly, there was less active involvement which could be the consequence of the discussion taking place at a different time than the first discussion. The final discussion took place early in the morning, whereas the first discussion took place in the early afternoon. Adolescents are least attentive in the early morning [44] which could have led to lesser involvement and thus the result of this discussion.

5.2 Activities, Idea's, and Final Presentations

The outcomes of the activities have been analyzed to what extent they make use of the theory and to what extent they go beyond the examples that were given. This has been done by rating the outcomes with low, medium or high with regards to the theory and examples. Full results can be viewed in table 4. Amongst the 18 students, 5 groups were made for the activities. Therefore 5 times the outcome of each activity was expected.

5.2.1 Guided Roleplay

For the roleplay activity, the outcomes were set as homework for the next workshop. However, these students rely on a digital system for their homework and this homework was not put on this digital system. Therefore, not all groups did create the required outputs. 4 groups handed in a newspaper article and 3 groups created an idea. These 3 groups had a different interpretation of the newspaper article, being it an introduction to their speculative idea. Nevertheless, these 4 articles and 3 ideas have been rated. The newspaper of one group did make high use of theory, but this group did not create an idea. The rest of the groups were rated low to medium use on integration of theory and similar with regards to going beyond given examples.

5.2.2 Future Wheel Activity

Regarding the future wheel activity, only 4 groups performed this activity, of which 2 groups only partly. The results were similar to the guided roleplay. Although there was low to medium use of theory and all groups sticked to the example that was provided, the activity allowed the students to critically address their own idea which is shown in their qualitative outputs. One group even came up with a solution to prevent consequences of one specific scene.

5.2.3 Ideas and Final Presentations

Final presentations took place in workshop 6. 4 groups decided to show their idea with use of sketches and 1 with the use of an animation in PowerPoint. The students came up with the following ideas. Group 1 created a fall detecting camera for elderly that, based on choices made by AI, would send a message to the control center that immediately can send an ambulance. Group 2 created a smart planning system that can help you with planning for school or homework with the use of smart home technologies like a smartwatch. Group 3 created a robot companion with the name Roxy that acts as a voice assistant to help with answering questions for school. Group 4 made a device that connects all device in the home together with several displays in the home to control these devices. The fifth and last group came up with a robot vacuum to which

you can upload your school schedule to such that it only vacuums when you are at school, and you are not disturbed when studying at home.2 groups did not make use of any theory in their presentation, 2 groups did to a medium level and 1 group to a high extend. This group, group 2, also made great use of the future wheel activity in their presentation by addressing limitations of their idea. None of the ideas of the groups were rated to go beyond the examples. Apart from the group which addressed the limitations, all other groups lacked a critical view upon their idea and the impact of the future wheel could not be seen. When critical questions were asked the students looked like they improvised answers on the spot. Even though the future wheel stimulated critical thinking upon the students their idea, and thereby creating information they can use, most groups did not actively use this in their presentation. This does not show critical thinking as described in [9]. Besides the group that did clearly show critical thinking, these results suggests that the activities and creating a speculative idea have not contributed to the student their healthy skepticism towards digital technologies.

Table 4: Analysis of activity outcomes

Group	Newspaper article		Early Speculative Idea		Future Wheel Exercise		Final Idea & Presentation	
	Integration of Theory	Beyond examples	Integration of Theory	Beyond examples	Integration of Theory	Beyond examples	Integration of Theory	Beyond examples
1	High	X	X	X	X	X	Medium	Medium
2	Medium	Low	Medium	Low	Medium	Medium	High	Medium
3	Low	Medium	Low	Medium	Low	Medium	Low	Medium
4	X	X	X	X	Medium	High	Medium	Medium
5	Medium	Medium	Medium	Medium	Medium	Medium	Low	Low

5.3 Evaluation Survey

Besides the final discussion, a survey was used to evaluate the workshops on individual level. The questions were based on 3 levels from the Kirkpatrick four model: reaction, learning and behavior [34, 35, 36, 37, 38].

5.3.1 Reaction

Most students reacted on the workshops being 'okay', 'fine', 'interesting' and/or 'educational' and the average rating of the workshop was a 6.8 out of 10. They based this on amongst other things the gathered knowledge and the content and variation in the workshops. In terms of relevance, the students rated the workshops 7.2. They based this on the topic of the workshop which they find to be very relevant, and because they are digital technology users themselves.

5.3.2 Learnings

Regarding their learnings, the majority mentioned they actually learned to be skeptical and critically think about their digital technology use. Moreover, many students reported to have learned about data collection and possible dangers involved with the use of digital technologies. One student in particular mentioned they learned they "really trust social media and technology, and maybe need to be more skeptical", which shows great self-reflection. Students indicated that

the workshops in general, as well as The Social Dilemma documentary, had contributed to these learnings. Students were also asked to rate their healthy skepticism before and after the workshops. On average, the students went from 5.5 to a 6.4 on a scale from 1-10. 10 out of 18 students indicated The Social Dilemma documentary had contributed to this the most.

5.3.3 Behavior

Finally, regarding their behavior several statements on their digital technology use were given. The students could indicate how much it applied to them on a Likert scale. A third of the students indicated they looked more often what it means for then to use digital technologies in the weeks the workshops were given. A third also indicated to be more aware of their use. Furthermore, the majority (65%) of the students indicated they want to become or remain critical towards the use of (new) digital technologies. For these results they indicated that The Social Dilemma, the workshops in general and the discussion to have contributed the most.

These results contradict with the earlier results from the final discussion, the activities and the student's speculative ideas. They suggest that the students did learn to think critically and that their healthy skepticism has improved. The reason that these are the outcomes of the survey, may be possible because the survey was an individual evaluation. The activities were done in groups, and the discussion involved all students. Since studies found that adolescents become more sensitive to stress [45, 46], especially while speaking in public, it could be the case that students find it difficult to speak up in their group, even more in the open discussion with all students. Moreover, the quotes gathered from the discussion along with the outcomes of the activities have been analyzed and rated to be critical from the facilitators perspective. Even though this perspective on these results shows no improved healthy skepticism, the students themselves can still feel they have improved on this.

5.4 Limitations

The study, especially the workshops, had several limitations. First, it requires the correct skills to be able to transfer information in a correct and understandable manner for this age group. Since it has been the researchers first time as facilitator of workshops, and thus the first time being in front of a high school class, it could be that this has not been achieved throughout the whole workshops. A participant for instance mentioned that the activities and the eventual goal were a bit vague. Nevertheless, experience would solve this limitation. Secondly, the open development and format in which it has been given could have had influence on the results. Due to holidays, absence of the class and workshops that took longer than expected, more workshops had to be given over a longer time period. Moreover, some outcomes of activities were set as homework, but not all groups did make this since it was not placed on the digital system they rely on. In further research on these workshops, the planning and organization should be stricter to see if this would impact the results. Moreover, the format in which the workshops are given should also be addressed. Instead of 45 minutes for a workshop, further research should investigate whether a lesser number of workshops with more time per workshop achieves better results. In that case, students have more time to work on their outcomes in these workshops and no homework has to be set. Thirdly, even though definitions have been used for healthy skepticism and critical thinking, these cannot be measured quantitatively. Therefore, the analysis of the outcomes is to some extend subjective. While the definitions have been used as a guidance, the outcomes have still been analyzed on what the researcher thinks shows critical thinking. Further research should include more researchers, including an expert on critical thinking, to achieve better evaluated results. Since the participants consisted of pre-university students of 11^{th} grade, future studies should also investigate whether similar results are achieved across different educational levels grades.

Overall, the results show contradictories on the improvement of healthy skepticism by means of speculative design workshops. The opening discussion suggests that there is indeed a lack of healthy skepticism towards digital technologies among adolescents. The final discussion suggests that it had declined after the workshops. Furthermore, the analysis of the outcomes of the activities and the students their final idea and presentation showed low to medium critical thinking. However, the individual evaluation survey suggests that as a result of the workshops, healthy skepticism towards digital technologies in these students has improved. For the answer on the research question, there has been put more weight on the result of the individual evaluation survey. Critical thinking might not be shown in the outcomes of the activities or the discussion because it required public speaking. Moreover, in this research healthy skepticism has been defined as the willingness to think critically, which therefore is an attitude which one can assess better themselves than someone else possibly can. Based on these considerations, the limitations of the study and the overall results, speculative design workshops do show to have potential to improve healthy skepticism towards digital technologies in adolescents. Since schools can develop their own content for the new curriculum of 2023 in the Netherlands [32] in which digital literacy is included, speculative design workshops could become a part of the content for this new curriculum. Since digital literacy is closely related to healthy skepticism, the results also show potential that speculative design workshops can be used to teach (critical) digital literacy. However, future studies should first investigate how better results can be achieved, through for instance a different format, and whether speculative design workshops work for different educational levels and ages.

6 CONCLUSION

In this study it has been investigated whether and how speculative design workshops can improve adolescents' healthy skepticism towards digital technologies. In a timespan of nine weeks a total of seven workshops have been given in which high school students worked towards creating a speculative design. The workshops included open discussions, theory and activities that have stimulated the students towards their goal of creating the speculative design. The results of the workshops show contradictories on the improvement of healthy skepticism through speculative design workshops. However, since more weight is put on de students their self-evaluation due to healthy skepticism being an attitude, speculative design workshops show to have potential to improve adolescents' healthy skepticism towards digital technologies. However, before such workshops can be implemented in education, future studies should address the form factor in which the workshops have been given by for instance shortening the complete timespan of the workshops and expanding the duration of a single workshop. This could lead to different results regarding adolescents their healthy skepticism towards digital technologies. Furthermore, future studies should also investigate whether speculative design workshops improve healthy skepticism in students of different educational levels and ages. By improving this healthy skepticism, adolescents will become more aware of the risks involved with using digital technologies. It enables adolescents to make a well-considered, informed, and conscious decision about the use and adoption of (new) digital technologies.

ACKNOWLEDGMENTS

I would like to express my special thanks to my teacher coach, Lenneke Kuijer, who guided me throughout the journey of this research and who gave me plenty of valuable feedback. Furthermore, I would like to express my deepest appreciation to the teacher of the high school class which I have performed this study for. This research would not have been possible without the opportunity to give workshops in this class. Lastly, many thanks should also go to all the students of this class who have participated in this study.

REFERENCES

[1] Netwerk Mediawijsheid. 2022, April. Iene Miene Media - Monitor kinderen 0–6 jaar 2022. Retrieved from: https://netwerkmediawijsheid.nl/wp-content/uploads/2022/03/Iene-Miene-Media-onderzoek-2022.pdf

[2] Joint Research Centre, Institute for the Protection and Security of the Citizen. Stéphane Chaudron. 2015. Young children (0-8) and digital technology: a qualitative exploratory study across seven countries, Publications Office. https://data.europa.eu/doi/10.2788/00749

[3] The Reboot Foundation. 2019. Parents' Guide to Critical Thinking: Introduction. Retrieved May 11, 2022 from https://reboot-foundation.org/en/parent-guide/parent-guide-general-introduction/

[4] Jobie Budd, Benjamin S. Miller, Erin M. Manning, Vasileios Lampos, Mengdie Zhuang, Michael Edelstein, Geraint Rees, Vincent C. Emery, Molly M. Stevens, Neil Keegan, Michael J. Short, Deenan Pillay, Ed Manley, Ingemar J. Cox, David Heymann, Anne M. Johnson & Rachel A. McKendry. 2020. Digital technologies in the public-health response to COVID-19. *Nature Medicine*, 26(8), 1183–1192. https://doi.org/10.1038/s41591-020-1011-4

[5] Linda Hantrais, Paul Allin, Mihalis Kritikos, Melita Sogomonjan, Prathivadi B. Anand, Sonia Livingstone, Mark Williams & Martin Innes. 2021. Covid-19 and the digital revolution, *Contemporary Social Science*, 16:2, 256-270, DOI: 10.1080/21582041.2020.1833234

[6] Deedra Vargo, Lin Zhu, Briana Benwell, Zheng Yan .2020. Digital technology use during COVID-19 pandemic: A rapid review. *Human Behavior and Emerging Technologies*, 3(1), 13–24. https://doi.org/10.1002/hbe2.242

[7] Ian O'Byrne . 2017. Making healthy skepticism happen in teaching and learning. Dr. Ian O'Byrne | Literacy, Technology, and Education. Retrieved May 25, 2022, from https://wiobyrne.com/healthy-skepticism/

[8] Hilary Andersson.2018. Social media apps are "deliberately" addictive to users. BBC News. Retrieved June 15, 2022, from https://www.bbc.com/news/technology-44640959

[9] Michael Scriven and Richard Paul. 1987. Defining Critical Thinking. *8th Annual International Conference on Critical Thinking and Education Reform*. Retrieved from: http://www.criticalthinking.org/pages/defining-critical-thinking/766

[10] Jean Piaget and Bärbel Inhelder. 1972. The psychology of the child. Basic Books.

[11] Monica Anderson and Jingjing Jiang. 2018. Teens, Social Media and Technology 2018. Pew Research Center: Internet, Science & Tech. Retrieved May 25, 2022, from https://www.pewresearch.org/internet/2018/05/31/teens-social-media-technology-2018/

[12] Victoria Rideout, Susannah Fox, and Well Being Trust. 2018. "Digital Health Practices, Social Media Use, and Mental Well-Being Among Teens and Young Adults in the U.S.". Articles, Abstracts, and Reports. 1093.https://digitalcommons.psjhealth.org/publications/1093

[13] The Royal Children's Hospital. 2017. RCH National Child Health Poll. RCH National CHild Health Poll. Retrieved May 25, 2022, from https://www.rchpoll.org.au/polls/screen-time-whats-happening-in-our-homes/

[14] Gila Cohen Zilka. 2017b. Awareness of eSafety and Potential Online Dangers among Children and Teenagers. *Journal of Information Technology Education: Research*, 16, 319–338. https://doi.org/10.28945/3864

[15] Isabella Corradini and Enrico Nardelli. 2018. AWARENESS IN THE ONLINE USE OF DIGITAL TECHNOLOGIES OF ITALIAN STUDENTS. ICERI2018 Proceedings. DOI: https://doi.org/10.21125/iceri.2018.2680

[16] Danah Boyd and Alice Marwick. 2011.. Social privacy in networked publics: teens' attitudes, practices, and strategies. *In: A Decade in Internet Time: Symposium on the Dynamics of the Internet and Society*, Oxford, U.K.:1-29

[17] Mary Madden, Amanda Lenhart, Sandra Cortesi, Urs Gasser, Maeve Duggan, Aaron Smith and Meredith Beaton. 2013. Teens, Social Media, and Privacy. Pew Research Center: Internet, Science & Tech. Retrieved May 27, 2022 from https://www.pewresearch.org/internet/2013/05/21/teens-social-media-and-privacy/

[18] Florence Martin, Brittany Hunt, Chuang Wang, and Elliot Brooks. 2020. Middle School Student Perception of Technology Use and Digital Citizenship Practices. *Computers in the Schools*, 37(3), 196–215. https://doi.org/10.1080/07380569.2020.1795500

[19] Florence Martin, Tuba Gezer, and Chuang Wang. 2019. Educators' Perceptions of Student Digital Citizenship Practices. *Computers in the Schools*, 36(4), 238–254. https://doi.org/10.1080/07380569.2019.1674621

[20] Brahim Zaroualia, Koen Ponnet, Michel Walrave and Karolien Poels. 2017. "Do you like cookies?" Adolescents' skeptical processing of retargeted Facebook-ads and the moderating role of privacy concern and a textual debriefing. *Computers in Human Behavior*, 69, 157–165. https://doi.org/10.1016/j.chb.2016.11.050

[21] Anthony Dunne and & Fiona Raby. 2013. *Speculative Everything: Design, Fiction, and Social Dreaming* (Illustrated ed.). The MIT Press.

[22] James Auger. 2013. Speculative design: crafting the speculation. *Digital Creativity*, 24(1), 11–35. https://doi.org/10.1080/14626268.2013.767276

[23] Lenneke Kuijer.2020. "Democratising and Anticipating Everyday Futures Through Critical Design: A Review of Exemplars". Temes de Disseny, [online]. Num. 36, pp. 150-77, https://doi.org/10.46467/TdD36.2020.150-177 .

[24] James Pierce. 2019. Smart Home Security Cameras and Shifting Lines of Creepiness. *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems.* https://doi.org/10.1145/3290605.3300275

[25] Marie Louise Juul Søndergaard and Lone Koefoed Hansen. 2018. Intimate Futures. *Proceedings of the 2018 Designing Interactive Systems Conference.* https://doi.org/10.1145/3196709.3196766

[26] Larissa Pschetz, Kruakae Pothong and Chris Speed. 2019. Autonomous Distributed Energy Systems. *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems.* https://doi.org/10.1145/3290605.3300617

[27] Majken Kirkegård Rasmussen and Fabian Hemmert. 2019. Envisioning Future Challenges and Possibilities for Shape-Changing Interfaces through Speculative Scenarios. *Proceedings of Mensch Und Computer 2019*. https://doi.org/10.1145/3340764.3344444

[28] Aloha Hufana Ambe, Margot Brereton, Alessandro Soro, Laurie Buys, and Paul Roe. 2019. The adventures of Older Authors: Exploring Futures through Co-Design Fictions. *In Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems (CHI '19).* Association for Computing Machinery, New York, NY, USA, Paper 358, 1–16. DOI:https://doi.org/10.1145/3290605.3300588

[29] Renee Noortman, Britta F. Schulte, Paul Marshall, Saskia Bakker, and Anna L. Cox. 2019. HawkEye - Deploying a Design Fiction Probe. In Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems (CHI '19). Association for Computing Machinery, New York, NY, USA, Paper 422, 1–14. DOI:https://doi.org/10.1145/3290605.3300652

[30] Christian Ehret and Luka Čiklovan. 2020. How speculative designs produce new potentials for education research in digital culture. *Discourse: Studies in the Cultural Politics of Education,* 41(5), 708–722. https://doi.org/10.1080/01596306.2020.1774713

[31] Lenneke Kuijer and Holly Robbins. 2022. Teaching alternative Paradigms through Critical Design. *Interaction Design and Architecture(s)*, 2022(51), 172-201. https://doi.org/10.55612/s-5002-051-008

[32] NOS. 2019. Advies: lesstof voor alle Nederlandse leerlingen moet anders. Retrieved from https://nos.nl/artikel/2305462-advies-lesstof-voor-alle-nederlandse-leerlingen-moet-anders

[33] Ministerie van Onderwijs, Cultuur en Wetenschap.2022. Scholieren verdienen een betere basis. Nieuwsbericht | Rijksoverheid.nl. Retrieved from: https://www.rijksoverheid.nl/regering/bewindspersonen/dennis-wiersma/nieuws/2022/05/12/scholieren-verdienen-een-betere-basis

[34] Donald Kirkpatrick. 1959. Techniques for evaluating training programs.Journal of ASTD,11, 1– 13.

[35] Donald Kirkpatrick. 1976. *Evaluation of training*. In R. L. Craig (Ed.), Training and development handbook: A guide to human resource development. New York: McGraw Hill.

[36] Donald Kirkpatrick. 1994. *Evaluating training programs: the four levels.*.San Francisco: Berrett-Koehler

[37] Kirkpatrick Partners. 2022. The Kirkpatrick Model. Kirkpatrick Partners, LLC. Retrieved May 30, 2022, from https://www.kirkpatrickpartners.com/the-kirkpatrick-model/

[38] Thomas G. Reio Jr., Tonette S. Rocco, Douglas H. Smith, Elegance Chang (2017), A Critique of Kirkpatrick's Evaluation Model. *New Horizons in Adult Education and Human Resource Development*, 29: 35-53. https://doi.org/10.1002/nha3.20178

[39] Jeff Orlowski (Director). 2020. *The Social Dilemma* [Documentary] Exposure Labs.

[40] Emilia Viaene, Lenneke Kuijer and Mathias Funk. 2021. Learning Systems versus Future Everyday Domestic Life: A Designer's Interpretation of Social Practice Imaginaries. *Frontiers in Artificial Intelligence,* 4, [707562]. https://doi.org/10.3389/frai.2021.707562

[41] Statista. 2021, June 15. Number of Smart Homes forecast in the World until 2025. https://www.statista.com/forecasts/887613/number-of-smart-homes-in-the-smart-home-market-in-the-world

[42] Lenneke Kuijer. LET'S REPORT A FUTURE PRACTICE: INTERVIEW ROLEPLAY AS A WAY TO FLESH OUT ALTERNATIVES in Daniel Fischer, Jen Dyer, Jordan King, Marlyne Sahakian and Gill Seyfang (eds), Teaching sustainable consumption: a guide (working title), Routledge. Forthcoming

[43] Jerome Glenn. 2009. The Futures Wheel. *Futures research methodology—version*, *3*.

[44] Suzanne Dikker, Saskia Haegens, Dana Bevilacqua, Ido Davidesco, Lu Wan, Lisa Kaggen, James McClintock, Kim Chaloner, Mingzhou Ding, Tessa West and David Poeppel. 2020. Morning brain: real-world neural evidence that high school class times matter. *Social Cognitive and Affective Neuroscience*, 15(11), 1193–1202. https://doi.org/10.1093/scan/nsaa142

[45] Sindy Resita Sumter, Caroline Bokhorst, Anne Miers, Johannes van Pelt, and Michiel Westenberg. 2010. Age and puberty differences in stress responses during a public speaking task: Do adolescents grow more sensitive to social evaluation? *Psychoneuroendocrinology*, 35(10), 1510–1516. https://doi.org/10.1016/j.psyneuen.2010.05.004

[46] Esther van den Bos,Mark de Rooij,Anne C. Miers,Caroline L. Bokhorst,P. Michiel Westenberg . 2013. Adolescents' Increasing Stress Response to Social Evaluation: Pubertal Effects on Cortisol and Alpha-Amylase During Public Speaking. Child Development, 85(1), 220–236. https://doi.org/10.1111/cdev.12118

A APPENDICES

Appendices start on the next page.

A.1.1 Guided Roleplay handout

De 5 stappen

Vandaag bestaat uit 5 stappen.

1. **Introductie/ inlezen toekomstscenario. [2 min]** Luister naar of lees de beschrijving van het toekomstscenario dat de facilitator van de workshop je geeft en probeer je in te leven in deze toekomst.

2. **Bepaal jouw rol [3 min].** 4 rollen:

- Expert 1: een enthousiasteling van deze toekomst
- Expert 2: een sceptisch persoon van deze toekomst
- Expert 3: een (niet bestaand) product in de smart home in deze toekomst
- Interviewer: een nieuwsgierig, kritische buitenstaander (b.v. journalist) die onbekend is met deze toekomst.

Als er meer dan 4 personen in een groepje zitten, dan is de 5e persoon een extra interviewer, en wisselen jullie met vragen stellen en notities maken.

3. **Bereid je rol voor [3 min]** De experts en interviewers nemen individueel een paar minuten de tijd om hen voor te bereiden voor het interview. Verplaats jezelf in de toekomst en stap in de huid van jouw karakter. Experts komen met een ruw verhaal over deze toekomst. Het is oké, zelf creatief productief, als niet alle verhalen van de experts overeenkomen. Interviewers verdiepen zich in de onderstaande vragen onder stap 4.

4. **Interview Rollenspel [20 min].** De interviewers interviewen de experts over het toekomstscenario door middel van onderstaande vragen als leidraad. Probeer dingen tot op de bodem uit te zoeken door kritische en nieuwsgierige vervolgvragen te stellen. Vraag voor zoveel mogelijk detail (denk eraan om notities te maken) en neem alle experts mee. De experts improviseren ter plekke. Veel plezier!

Interview vragen:

- Bedankt dat jullie deelnemen aan dit interview. Ik begrijp dat jullie een slim huis hebben (of onderdeel zijn van (expert3)). Kun je mij vertellen hoe jullie het slimme huis gebruiken voor school? [Wat is het doel]?
- Hoe/Wat doet het slimme huis dan precies? Wat vind je hier fijn of juist minder fijn aan? Waarom?
- Hoe zijn jullie op het idee gekomen om het slimme huis te gebruiken voor [de experts gekozen doel]/school? Wat vertel je aan mensen die ook geïnteresseerd zijn om hun slimme huis hiervoor te gebruiken?
- Wat heb je van het gebruik van het slimme huis voor dit [experts gekozen] doel geleerd? Doe je bijvoorbeeld dingen voor school anders?
- Hoe heeft het je leven veranderd? En hoe heeft het 't leven van anderen veranderd?
- Hoe kijk je terug op je werk voor school voordat je het slimme huis ging gebruiken voor dit [experts gekozen] doel?
- Hoe verwacht je dat het gebruik van het slimme huis voor school gaat ontwikkelen in de komende jaren?

5. **Visualiseer en samenvatten [15 min].** Creëer op basis van de interviews 2 uitkomsten. Verdeel rollen voor deze stap om het proces te versnellen.
Deze les:

1. Toekomstig nieuwsartikel (Titel, 150 woorden, afbeelding)

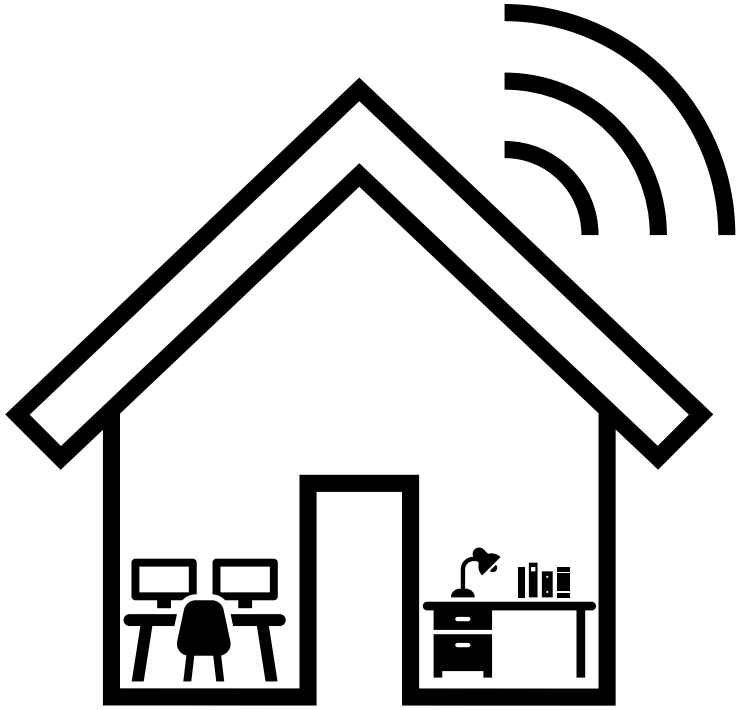
Nu/ Huiswerk voor volgende les/week:

2. Een idee voor een (slim en verbonden met het huis) product dat in dit scenario past.

A.1.2 The Future Scenario handout

HET TOEKOMSTSCENARIO

In de toekomst hebben en wonen we in een slim huis, met verschillende (nog niet bestaande) slimme digitale technologieën die met elkaar zijn verbonden. Het huis heeft de mogelijkheid om toegang te krijgen tot vrijwel alles. Dus het kan ook toegang krijgen tot je (school)agenda, schoolrooster, schoolsysteem (denk aan te maken huiswerk) en je punten. Het huis leert, door middel van algoritmes en AI, van deze data en is dus een leersysteem. Het heeft dus de mogelijkheid, door middel van de slimme apparaten en het leersysteem, ervoor te zorgen dat je beter doet op school, bijvoorbeeld beter je best doen, beter huiswerk maken, op tijd komen, betere punten behalen, etc. Wat het huis doet, en hoe het dit doet, dat is aan jullie om te bepalen!



De rollen:

Expert 1: De enthousiasteling
Jij kruipt in de rol van een enthousiaste gebruiker van het slimme huis, met het oog op het gebruik voor school.

Expert 2: De sceptisch persoon
Jij duikt in de rol van een sceptisch persoon die dus sceptisch is ten aanzien van het gebruik van het slimme huis voor school.

Expert 3: een (niet bestaand) product in het slimme huis.
Deze persoon duikt in de rol van een slim product, en beantwoord vragen vanuit het perspectief van dit product in het huis, met het oog op het gebruik voor school. In elke groep is expert 3 verschillend:

Groep 1: De Voice Assistent
Groep 2: Slimme sensor naar keuze (deur, raam, beweging, temperatuur, CO2, etc.)
Groep 3: Slimme camera('s)
Groep 4: Slim/verbonden entertainment apparaat (Smartphone, TV, Game Console, speaker(s)/geluidsysteem, etc.)
Groep 5: Slimme huishoudelijke apparaten (robotstofzuiger, koelkast, wasmachine, etc.)

Mocht je als expert 3 al een idee hebben van een niet bestaand slim apparaat dat gebruikt kan worden in deze toekomst in het huis én voor school, dan mag je ook deze rol aannemen.

Interviewer:
Jij duikt in de rol van een nieuwsgierige, kritische buitenstaander (b.v. journalist) die onbekend is met deze toekomst. Je zorgt er voor dat alle experts aan bod komen tijdens het interview.

De interviewvragen:

- Bedankt dat jullie deelnemen aan dit interview. Ik begrijp dat jullie een slim huis hebben (of onderdeel zijn van (expert3)). Kun je mij vertellen hoe jullie het slimme huis gebruiken voor school? [Wat is het doel]?
- Hoe/Wat doet het slimme huis dan precies? Wat vind je hier fijn of juist minder fijn aan? Waarom?
- Hoe zijn jullie op het idee gekomen om het slimme huis te gebruiken voor [de experts gekozen doel]/school? Wat vertel je aan mensen die ook geïnteresseerd zijn om hun slimme huis hiervoor te gebruiken?
- Wat heb je van het gebruik van het slimme huis voor dit [experts gekozen] doel geleerd? Doe je bijvoorbeeld dingen voor school anders?
- Hoe heeft het je leven veranderd? En hoe heeft het 't leven van anderen veranderd?
- Hoe kijk je terug op je werk voor school voordat je het slimme huis ging gebruiken voor dit [experts gekozen] doel?
- Hoe verwacht je dat het gebruik van het slimme huis voor school gaat ontwikkelen in de komende jaren?

Notities Groep ___

Yorn Thijssen || s1342320 Industrial Design student at University of Technology Eindhoven

A.2 Future Wheel Activity Handouts

Starting on next page.

Future Wheel activiteit

Groep:

Idee

Gebeurtenis

Ondanks de hulp van het systeem haal ik alleen maar onvoldoendes, want:

Consequentie 1

Consequentie 2

Gebeurtenis

Consequentie 1

Consequentie 2

Gebeurtenis

Het huis heeft een internetstoring

Consequentie 1

Consequentie 2

Activiteit gebaseerd op The Future Wheel door Jerome C. Glenn.

Future Wheel activiteit

Groep:

Idee

Gebeurtenis

De speakers in de slaapkamer / studie ruimte zijn defect.

Consequentie 1

Consequentie 2

Gebeurtenis

Consequentie 1

Consequentie 2

Gebeurtenis

Stiefmoeder/vader waarmeeik geen goede band heb pest mij met gebruik van [idee] door:

Consequentie 1

Consequentie 2

Activiteit gebaseerd op The Future Wheel door Jerome C. Glenn.

Future Wheel activiteit

Groep:

Idee

Gebeurtenis

Het schoolsysteem is gecrasht waardoor het huis geen toegang meer heeft tot deze data.

Consequentie 1

Consequentie 2

Gebeurtenis

Consequentie 1

Consequentie 2

Gebeurtenis

Ik doe alsof ik huiswerk maak en houd hiermee het systeem voor de gek door middel van:

Consequentie 1

Consequentie 2

Activiteit gebaseerd op The Future Wheel door Jerome C. Glenn.

Future Wheel activiteit

Groep:

Idee

Gebeurtenis

Ik ben ziek, en kan dus niet leren of mijn huiswerk maken.

Consequentie 1

Consequentie 2

Gebeurtenis

Consequentie 1

Consequentie 2

Gebeurtenis

Een hacker heeft toegang tot het systeem en de data verkregen en....:

Consequentie 1

Consequentie 2

Activiteit gebaseerd op The Future Wheel door Jerome C. Glenn.

Future Wheel activiteit

Groep:

Idee

Gebeurtenis

We gaan verhuizen, en [idee] verhuist wel/niet mee. (streep een van de 2 door)

Consequentie 1

Consequentie 2

Gebeurtenis

Consequentie 1

Consequentie 2

Gebeurtenis

Ik ga samen huiswerk maken bij een vriend die [idee] (nog) niet heeft.

Consequentie 1

Consequentie 2

Activiteit gebaseerd op The Future Wheel door Jerome C. Glenn.

A.5 Reflection

In my M1.2 I have performed a research project in which I studied whether speculative design workshops can improve healthy skepticism in adolescents. This reflection will dive into my expectations and learning goals at the start of the project, what I have learned over the past 6 months while doing this project and how this influences my future career.

Expectations & Learning Goals

In this research project we put into practice our attitude, knowledge, and skills that we have developed during the course Constructive Design Research. The showroom approach which was taught in this course intrigued me. Moreover, in the M1.1 project we created a critical design, from which the topic (unawareness of data collection by Google), fascinated me. I soon decided that I wanted to do something with speculative or critical design, use the showroom approach and focus on a topic that would include the common truth that society uses digital technologies without knowing what it implies, what data it collects, or what possible dangers are. One learning goal therefore was to gain knowledge on and create a speculative and/or critical design. Moreover, I wanted to get more acquainted with doing research by the showroom approach.

In my vision I state that I it should be clear what technology does, how it works and that this can be achieved by explaining the design, its interactions, and the consequences in an understandable manner. In my professional identity I also state that I like to communicate technology such that one can make a conscious decision on technology adoption. Because of this interest, I am going to do a joint master with the master Science Education and Communication. This will provide me with required knowledge and skills to become a designer with a communicative role. A second learning goal relates to this and came with the opportunity of giving workshops on a High School. While giving the workshops I wanted to become acquainted with teaching: standing in front of a class, finding ways to explain in an understandable manner and, more importantly, I wanted to check whether I made the correct decision about doing a double degree by reflecting upon my own reaction to teaching.

Adaptation

In the early weeks of the project, I struggled with how I could combine the opportunity to give workshops, create speculative or critical design, and the topic. This was due to the fact that I had a too narrow scope of what doing research implies. I had in mind that, since I wanted to do showroom, I was required to create a design, go into debate with people, and collect insights. I simply could not find a way in how I could implement the workshops, while I definitely wanted to do them because of my learning goal. By laying out these puzzle pieces and talking to others about them, but especially during the coach sessions, I learned that doing design research not necessarily meant I had to create a design. It widened my scope, and I was able to put the pieces together to form a puzzle. However, the puzzle, the research I have performed, did not include creating a speculative or critical design anymore, and did not necessarily adhere to the showroom method anymore. Therefore, this learning goal dropped and has therefore not been achieved. But new ones emerged.

The topic of the research, improving healthy skepticism through speculative design workshops, is a unique and unexplored topic which therefore does not have much related work, let alone a theoretical framework. Being a person who is used to and best works with an existing theoretical base, it provided me with a challenge. Because of the interest in the topic, but also because of the insights I could gain on myself while accepting this challenge, I proceeded.

Learnings

The challenge of doing this research without a theoretical base has been very difficult. I was advised to and started with creating this base for myself early on in the project, while also facilitating and creating the workshops. I found myself struggling on creating this base for several weeks, but I really wanted to finish it. The urge to do so and, as consequence of the difficulties, spending too much time on it has resulted in a lot of work towards the end on other requirements. On advice, I learned that in such a situation need to switch tasks instead of working on something for too long with difficulties. I will keep this advice in mind and in future projects I will switch tasks earlier when I find myself having trouble on another.

By facilitating the workshops, standing in front of a class, and being able to share knowledge, I have gained much experience and I learned a lot on personal level. Based on my enthusiasm I can state that I made the correct decision for the joint degree. Regarding becoming acquainted with teaching, I noticed I became more relaxed in front of the class the more workshops I gave. Some students of the class mentioned the workshops and activities were

vague. With regards to explaining in an understandable manner, next time I would show the content of the workshops to a teacher who is familiar with the group and who knows whether it will be clear to them.

Next to these learning goals, I also learned that in doing research, qualitative data might be more important than quantitative. Surely, it depends on the kind of research. But if one for instance rates themselves a 6 on a scale from 1-10 on skepticism, it does not say anything. "Why" this 6 was given is much more important.

To conclude, while doing this research I have not gained all knowledge I expected to gain, but in exchange I gained knowledge which is beneficial for future projects. Moreover, I take the knowledge I gained on myself with regards to teaching with me in the upcoming year in which I am going to do the master Science Education and Communication.