Social Media Battle

User Vs Company

DSPM210 Master 2.1 Preparation FMP Project

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Prologue

This document is a design report describing the creation of Social Media Battle, a design project by Yorn Thijssen in the final year of the master Industrial Design prior to the start of the Final Master Project (FMP).

In this project, my aim was to create a design for education about algorithms in social media, a similar topic as in a previous attempt of the preparation FMP project. The motivation for this aim and topic stems from my professional identity and vision, and both the desire to combine, and my experience in my current two studies: Industrial Design and Science Education.

By adopting and learning from a Learning Experience Design approach I sought to tackle the lack of digital literacy in younger students, focusing specifically on the lack of algorithmic literacy regarding algorithms in social media in students aged 12 to 16 years old.

Summary

Social media platforms are deeply ingrained in the lives of young people today, with algorithms playing a crucial role in shaping their online experiences. These algorithms, particularly on platforms like TikTok, create a personalized feed in which users can end up in filter bubbles, isolating them from diverse perspectives and information. Given the extensive use of social media among younger generations, and studies showing that students aged 12 to 16 lack awareness, knowledge and skills needed to critically evaluate how social media algorithms impact them and society, it is essential for them to develop this so-called algorithmic literacy.

By taking a learning experience design approach, an educational game to enhance algorithmic literacy among students aged 12 to 16 years old was created: Social Media Battle: User v/s Company. This game aims to help these students understand the pervasive role of algorithms in social media. The game encourages critical evaluation and equips them with the knowledge and skills needed to understand and influence these algorithms, enabling more conscious and responsible social media use. This report describes the design process towards the creation of Social Media Battle.

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1. Introduction

Algorithms are deeply integrated into our daily lives (Dwivedi et al., 2021). One of the domains in which algorithms are integrated is in our social media, in the form of recommendation systems (Fayyaz et al., 2020). These algorithms gather and incorporate user data, such as demographic data, preferences and behavior, to find the user's interests and provide each user with personalized content accordingly.

Despite this personalization can improve user experience, these algorithmic operations are potentially harmful for both individuals and society by creating so called filter bubbles. The personalized recommended content in such bubbles might contain harmful content or can close one off to new ideas, subjects, and important information, reinforcing existing beliefs and biases (Pariser, 2011b). Not only do these algorithms shape our online experiences, but they also shape our everyday experience of the real world (Wilson, 2016).

Younger generations tend to engage with social media the most, with over one third of Gen Z (12 to 27 years old) indicating they spend more than two hours on social media each day (Coe et al., 2023). Specifically, 84% of 12- to 16-year-olds indicate to use social media (almost) daily (Rombouts, Van Dorsselaer, Scheffers-van Schayck, Tuithof, Kleinjan, & Monshouwer, 2020). These children are therefore bombarded with a stream of information, images, and videos tailored to each one of them.

While it is often expected that children become skilled in the use of digital technologies because they encounter and start using digital technology from an early age on, research has shown that using algorithmically curated systems does not automatically lead to awareness upon and understanding of how these algorithms work (Powers, 2017). It has been found that the 12-to 16-year-olds actually lack the awareness, knowledge and skills needed to critically evaluate how social media algorithms can impact them and society or how they can influence these algorithms. (de Groot, de Haan & van Dijken, 2023).

Given these findings and the extensive use of social media among young people, it is essential for them to develop this so-called algorithmic literacy (Dogruel et al., 2021: 4). Enhancing algorithmic literacy in this age group is crucial to help them navigate and understand their digital environments and their effects. It has led to the following design question:

How might I enhance algorithmic literacy in high school students aged 12 to-16-year-old through educational design?

1.1 Approach

During this project a Learning Experience Design (LXD) approach was taken to address the design question. LXD is a term and design principle coined by Dutch LX Design pioneer Niels Floor in 2007 (Learning Experience Design, 2023). It is a principle that bridges the gap between the fields of design and learning. By using the perspective, methods, skills and tools of a designer, the principle offers a new view upon shaping the way we learn. It will be further detailled in the next chapter.

1.2 Reading Guide

This report continues with background and related work upon LXD, algorithmic literacy, algorithms in social media and their effect. Chapter 3 will describe how LXD is applied in, and further describes the design process, followed by the final design in chapter 4. Both the process and final design will be discussed in chapter 5, including limitations and future work. Lastly, the project will be concluded in the final chapter. In addition to the report the proposal for the Final Master Project is presented.

2. Background & Related Work

This chapter provides background information on the chosen design principle, as well as on algorithmic literacy and algorithms in social media. Besides, related work on algorithmic literacy in education will be given.

2.1 Learning Experience Design

LXD is an emerging field that bridges the gap between design and education and is located at the crossroads of several other fields. There is yet no common or shared understanding of how LXD should be defined and which fields it actually crosses over (Tawfik et al., 2021). Within the academic realm however, the use of terms and concepts associated with LXD is increasing (Schmidt & Huang, 2021). It is therefore also called for a better understanding of what LXD exactly is and attempts have been made (Jahnke et al., 2022; Schmidt & Huang, 2021). In this project LXD has been applied with the approach and definition coined by Niels Floor:

"Learning experience design is the process of creating learning experiences that enable the learner to achieve the desired learning outcome in a human centered and goal-oriented way" (2023a).

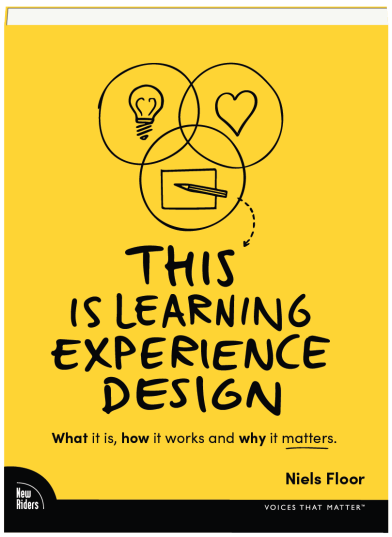


Figure 1: Learning Experience Design book (Floor, 2023a)

Key design principles used in his perspective on LXD come from interaction design, (user) experience design, graphic design and game design, which are combined with elements of learning such as education, instructional design, cognitive psychology and educational sciences (Learning Experience Design, 2023). One of the aspects that distinguishes LXD from other principles is that it focusses on the overall experience of a learner. In context of a training or a course, experience goes beyond the content, instruction, exercises and tools being used, which may be part of the experience but are not the experience itself. An experience consists of the situation, time and impression. A learning experience is simply any experience one learns from. It is a 'holistic experience that is intentionally designed and carefully crafted to help the learner achieve a meaningful learning outcome that is (mostly) predefined' (Learning Experience Design, 2023).

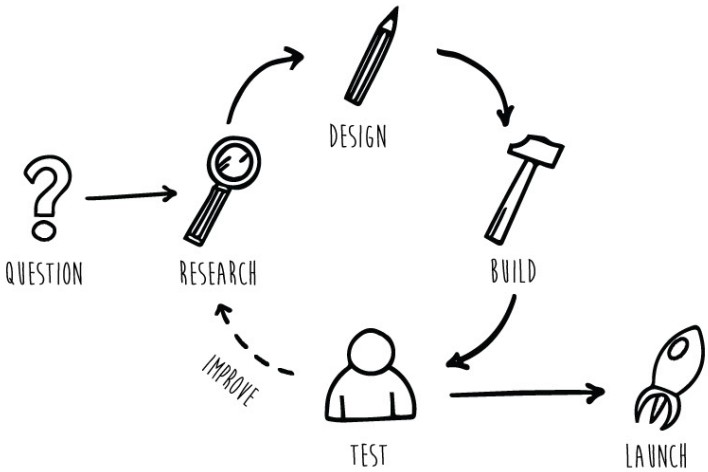


Figure 2: LXD process (Learning Experience Design, 2024)

The learning experience design process is a process with six basic steps, of which the four middle steps are iterative (figure 2). In the design phase, similarities can be found with the second diamond of the double diamond model (Design Council, n.d.). First you diverge by generating loads of ideas (develop) after which you converge by picking the best ideas (deliver).

Overall, LXD represents a combination of design and learning, aiming to create educational experiences that are not only instructive but also deeply engaging and learner centered.

2.2 Algorithms in social media

Algorithms have played a significant role in the rise of and are an inseparable part from social media platforms. They create a personal feed, a stream of content people can scroll through, for each user by selecting what content is considered most relevant to each user (Gillespie, 2014). The goal of this personal feed is to keep users engaged and keep users on their platform. One of the strongest algorithms that creates a personal feed is the one used by TikTok. It analyzes user interactions, such as likes, shared videos, and watch time, to offer an endless stream of content that perfectly matches users their interests (TikTok, 2020). This algorithm is so powerful that 90-95% of the content that is seen on the personal feed comes from the recommendation system (The Wall Street Journal, 2021).

However, the impact of these algorithms goes beyond just retaining user attention. They have also led to the creation of so-called 'filter bubbles, a term coined by Eli Pariser in 2011:

"your own personal, unique universe of information that you live in online. And what's in your filter bubble depends on who you are, and it depends on what you do. But the thing is that you don't decide what gets in. And more importantly, you don't actually see what gets edited out." (Pariser, 2011)

He warned that filter bubbles are potentially harmful for both individuals and society. It closes us off to new ideas, subjects, and important information, reinforcing existing beliefs and biases (Pariser, 2011b). They rarely expose users to opposing opinions or new ideas, potentially contributing to a skewed worldview or exacerbating polarization within society. Although studies show mixed empirical evidence on these effects of filter bubbles, the presence of filter bubbles in recommendation systems is apparent (Kramer et al., 2014; Haroon et al., 2022; Ross Arguedas, A., et al., 2022; Areeb et al., 2023).

In line with the strong algorithm of TikTok, a investigation by The Wall Street Journal's found content on a For You page can consist for 93% on depression and sadness related content (The Wall Street Journal, 2021).

Because of its exploding popularity, other social media platforms have copied and adopted their own version of TikTok's recommended For You Page, leading to the potential implication for users to be in multiple filter bubbles across various social media platforms (Murray, 2023). It is important for users to be aware of (these effects of) algorithms in social media, understand how they work and to be able to deal with these algorithms. In other words, to be algorithmic literate.

2.3 Algorithmic Literacy

Algorithmic literacy is a relatively new term. Several studies define algorithmic literacy in various ways (Oeldorf-Hirsch & Neubaum, 2023). In this project the definition formulated by Dogruel et al. has been adopted, which is

*'being **aware** of the use of algorithms in online applications, platforms, and services, **knowing** how algorithms work, being able to **critically evaluate** algorithmic decision-making as well as having the **skills** to cope with or even influence algorithmic operations' (2021).*

Studies that measured algorithmic literacy often involved focus groups and interviews (Powers, 2017; Swart, 2021; Malcorps et al., 2023). Other studies created scales that assess individuals' awareness and understanding of algorithms or use self-report measurements (Dogruel et al., 2021; Zarouali et al., 2021). The common result of these studies is that generally people lack algorithmic literacy. In particular, a study found that 12-to 16-year-olds in the Netherlands actually lack the awareness, knowledge and skills needed to critically evaluate how social media algorithms can impact them and society, and in turn how they can influence these algorithms (de Groot, de Haan & van Dijken, 2023).

2.4 Algorithmic Literacy in Education

In the Netherlands, algorithmic literacy is not (yet) a distinct domain within the educational curriculum. It is not even a well-known term. If one googles the Dutch term (algoritmische geletterdheid), the results show plenty of sites diving into digital literacy in education, which is the overarching domain upon literacy on digital technology. Algorithms and social media are part of this domain, but minor learning material specifically focusses on algorithmic literacy, or on algorithms in social media (De Baas Op Internet, n.d,; The Filter Bubble App, n.d.; TikTok - the Hmm, 2023). Existing material mostly focusses on media literacy, addressing topics such as privacy and fake news (Leermaterialen, n.d.; De InternetHelden, n.d.). However, with the apparent role of algorithms in our daily life, there is a worldwide growing plead for the need of (education on) algorithmic literacy (Knack, 2021; Rusanen, 2021; Morris, 2022; Anderson & Rainie, 2024). Incorporating algorithmic literacy into education can bridge current knowledge gaps and empower individuals to influence and interact with algorithms more effectively.

3. Design Process

This chapter describes the design process towards the creation of Social Media Battle in the context of the Learning Experience Design process. Four of the six steps (research, design, develop and test) are iterative. This iterative cycle has been done twice. No activities have been taken within the final step (launch) and will not be adressed.

3.1 Question

The process starts with formulating a design question or problem. A design brief, including research questions, assumptions, planning, resources, and risks, was created (Appendix A). The design question for this project was formulated as:

How might I enhance algorithmic literacy in high school students aged 12 to-16-year-old through educational design?

Additional sub questions to aid the creation of a design were:

- What is the current state of algorithmic literacy amongst students aged 12 to 16 years old?
- Are there specific aspects of algorithmic literacy that students have difficulty with?
- In what way is algorithmic literacy currently stimulated in education and what learning material does exist?
- How can design enhance algorithmic literacy?
    - Which innovative technologies or methods, and their interactions have potential to enrich learning algorithmic literacy?

Assumptions were formulated, and research methods were conceptualized for each question.

First, based on previous research and experience, it was expected that students aged 12 to 16 lack algorithmic literacy, especially in understanding social media algorithms and critically addressing these processes. Research using algorithmic literacy scales has addressed these questions.

Secondly, it was presumed that little existing learning material focuses on algorithmic literacy in education. Background research has addressed this question (see Chapter 2).

Thirdly, emerging technologies and methods were selected for the design, and a SWOT analysis was conducted on their use in education.

3.2 Iteration 0

3.2.1 Step 2: Research

Research in the context of LXD prioritizes understanding the learner and the learning outcome.

The Learner

An empathy map specifically for learners (figure 3) was used and created from a 1st person perspective, and in two sessions with teachers. Full description of this session and their results can be found in Appendix B. In this empathy map two questions need to be answered for each step in the four-step process of experiential learning: *Be, See, Know* and *Do* (Floor, 2023b).

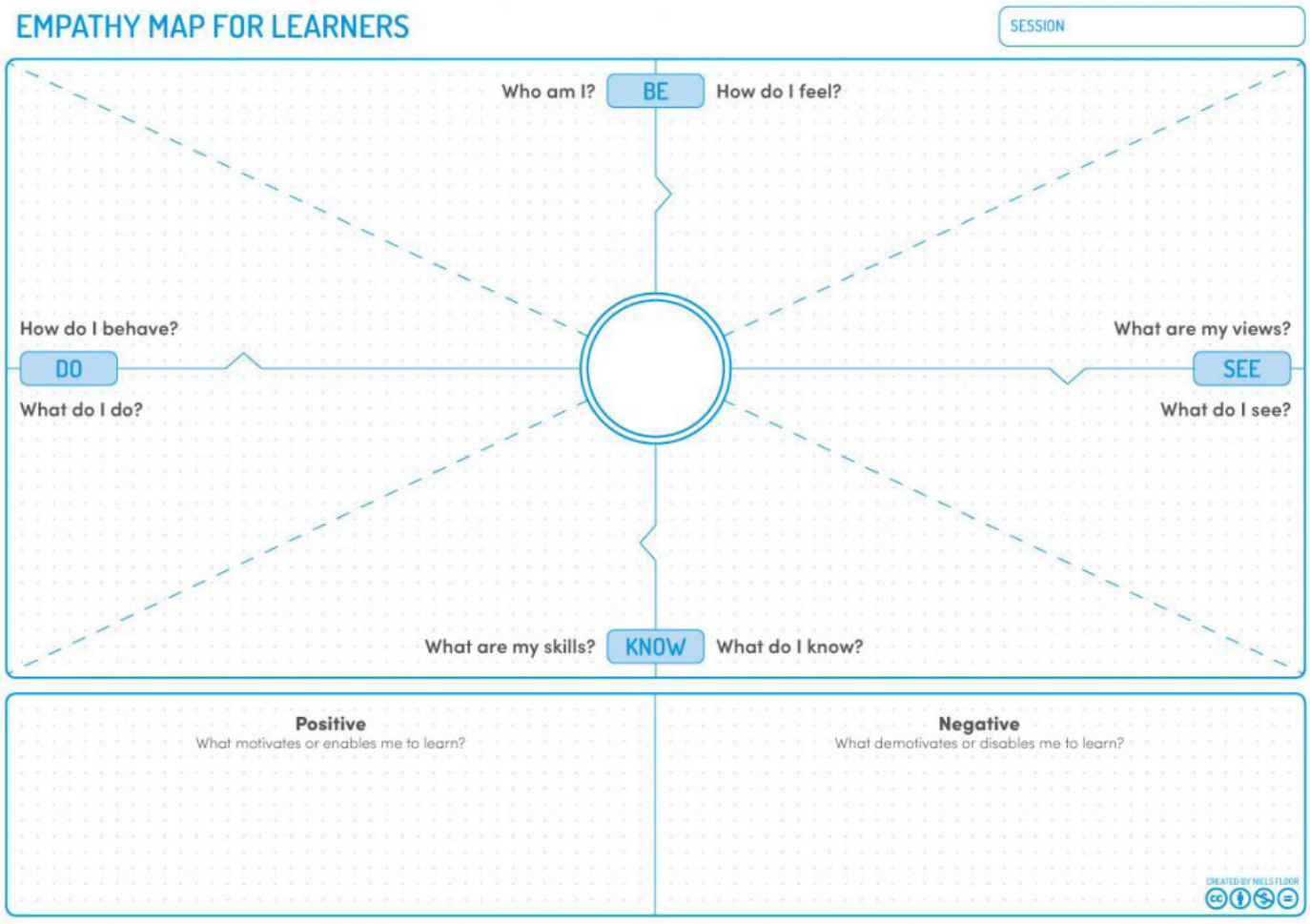


Figure 3: Emapthy map for learners (Floor, 2023b).

Key insights from the creation of these empathy maps within this four-step process are:

Be:
Students use social media and other platforms that use algorithms, have no emotion regarding algorithmic literacy and are little to not aware of algorithmic processes in social media.

See:
Students experience algorithms in daily life. They are aware that other's see different content on social media but do not critically think about this.

Know:
While students are aware of personalization based on interests, they do not know how this works. They have practical skills in influencing algorithms on social media.

Do:
Students make unconsciously use of algorithms and enjoy the content they get. While some are interested in learning algorithmic literacy, others probably do not care.

Other key insights that were gathered from the empathy maps come from listing both positive and negative aspects that motivates students to learn algorithmic literacy:

Positive:
Knowing what algorithms are and how they work enables students to positively use this knowledge in daily life. It motivates them to learn algorithmic literacy when it is taught in their experience, or when using methods such as group work, gamification and competition.

Negative:
Aspects that demotivate students are when learning is forced, using direct instruction, it being too complex, or homework.

Creating the empathy map has aided in understanding the learner and aspects that motivates them to learn algorithmic literacy. Insights have been used in the creation of the Learning Experience Canvas and underscore later made design decisions.

SWOT analysis Emerging Technologies for Eduaction

A Strengths, Weaknesses, Opportunities and Threats analysis was done on emerging technologies or methods for education to answer one of the subquestions. Questions for each compnent of the analysis were formulated and answered for each emergent technology. The full analysis can be found in appendix C.

The analysis and empathy maps combined resulted in the choice for two emergent technologies/methods to apply in the design: Generative AI and Gamification. Generative AI due to its high popularity, fast-paced developments and possibility to create diverse and student tailored content. Gamification because of its possibilities to allow group work and include competition, positive motivating aspects mentioned in the empathy map.

3.2.2 Step 3: Design

The design phase itself consists of four phases: *Ideation: Divergence, Ideation: Convergence, Conceptualization: draft design* and *Detailed Design*.

Before ideation however, the Learning Experience Canvas tool was used (figure 4). The LX canvas is a tool that helps structure the design, gives a clear overview, allows better choices, is easy to use and is versatile (Floor, 2023a). It is designed into two phases. In the exploration phase one focusses on personal aspects of the learner, situational aspects of the learning experience and the strategy. The strategy guides the process, is formulated based on the personal and situational aspects and bridges the exploration and design phase. In the design phase the exploration is used to describe the activities in, and process of the whole learning experience. It is a dynamic tool to come back to and change during the process. The fully created LX canvas for this project can be found in appendix D.

Using the LX canvas has allowed to formulate a learning outcome, learning objectives, narrow down the design question, and a strategy through which design choices were made. The most important decision being to prioritize two of the four aspects of algorithmic literacy: '*knowing how algorithms work*' and '*being able to critically evaluate algorithmic decision-making*'. The choice was made that through knowing how algorithms work, awareness of their presence and skills to deal with or even influence them in social media would be touched upon as well.

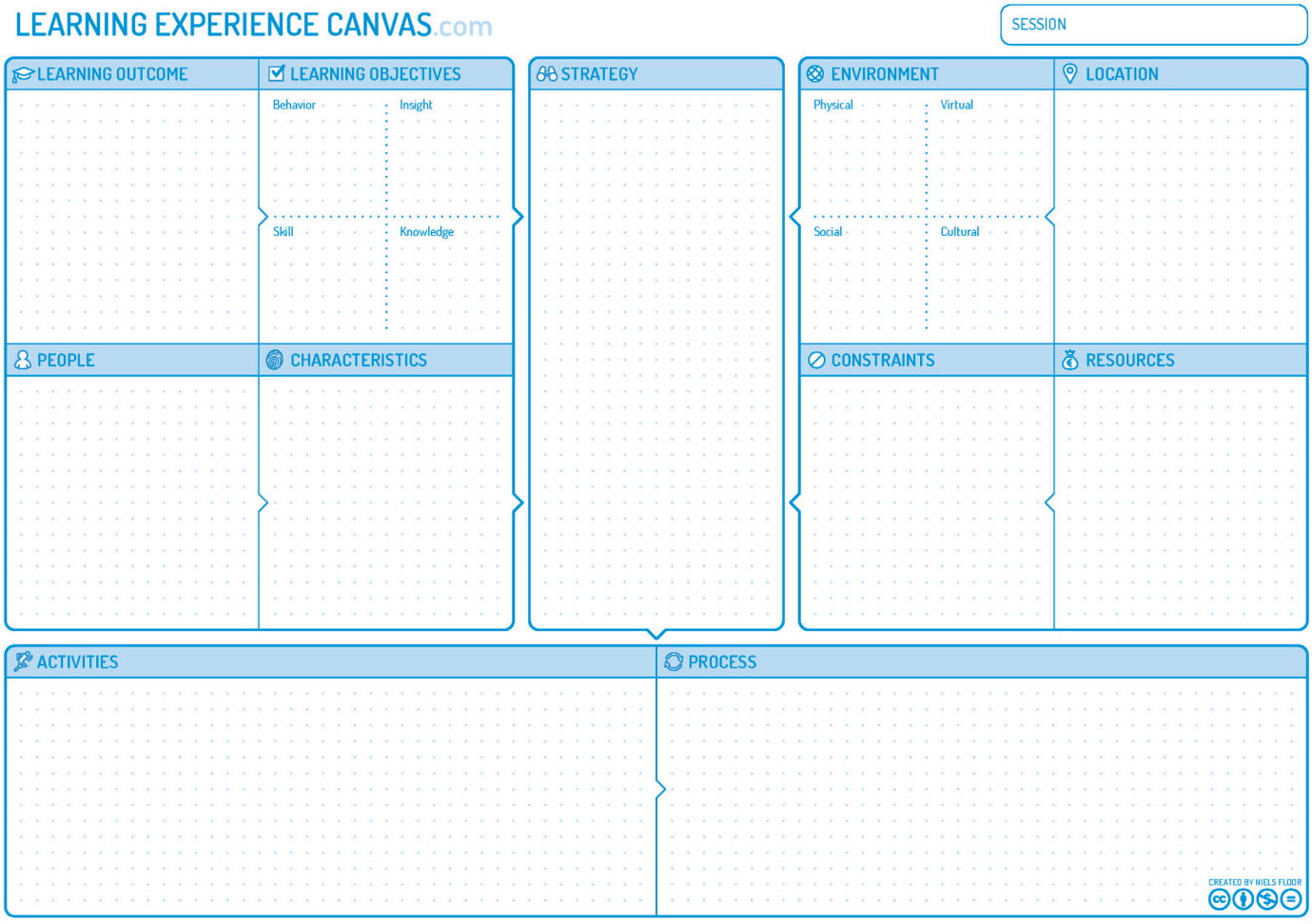


Figure 4: Learning Experience Canvas (Floor, 2023a)

First Design Ideas

Multiple design ideas were generated in the design phase (divergence) and the best ideas were chosen (convergence) (Appendix E). A combination of these ideas led to the first design: Escape the Bubble (conceptualization & detailed design) (Appendix F).

"Escape the Bubble" was a game where students answered questions about algorithms in social media to reach the endpoint on the game board. The game featured a story about a person unhappy with their social media filter bubble, seeking to pop it. Players took turns answering questions correctly to move forward on their data path towards the bubble's edge. Incorrect answers kept players in the same spot. Players competed as "digital thumbtacks" to reach the endpoint first and metaphorically pop the bubble. The game included easy and hard questions. With correct answers to hard questions players earned data tokens, which could be used for hints generated by generative AI.

3.2.3 Step 4: Develop

In the development phase the idea is brought to life by creating a rapid prototype of the game. It included the game board, player indicators and question cards. (figure 5) GenAI was used by prompting ChatGPT to provide hints for questions.

Questions.

A total of 50 questions were generated for this game and consisted of various types of easy and hard questions. An analysis was conducted to determine which learning objectives they target, and what themes the questions address (figure 6, table 1). This showed priority was indeed given to knowledge upon algorithms and the critical evaluation of algorithmic decision making.

Figure 5: Escape the Bubble Game board (top), Player indicators (bottum left), Data tokens (bottum right)

Table 1: Question analysis result

Questions	
Total	50
Easy	30
Hard	20
Type of questions	
Easy	
True or false	10
Multiple choice	10
Matching	5
Sequencing	5
Hard	
Scenario based questions	5
Algorithmic Analysis questions	5
Critical Thinking questions	10
Aimed at learning objective	
Knowing how algorithms work	17
Inbetween	6
Being aware of the use of the use of algorithms in social media	3
Having the skills to cope with or even influ-ence algo-rithmic operations	5
Being able to critically evaluate algorithmic deci-sion-making	11
Other	8
Theme/Topic	
Data used by algorithms	12
Filter Bubble	6
Content personalization	3
Definitions	5
Social Media in general	8
Ethics	3
Influence Algorithms	4
Privacy	1
Algorithmic thinking	3
Possible influence of algorithmic tailored content	5

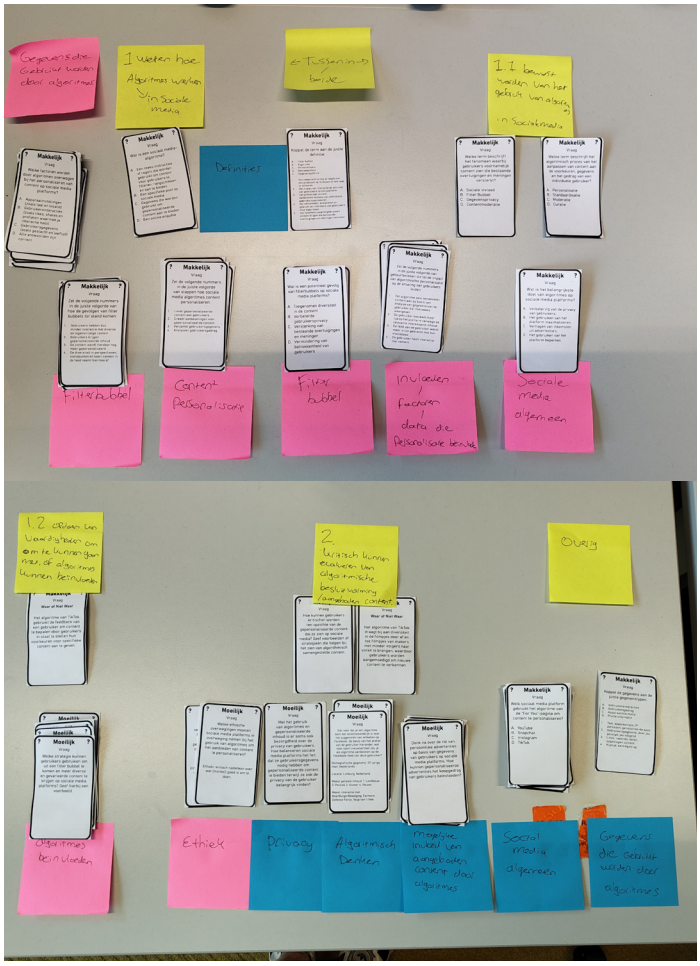


Figure 6: Question analysis

3.2.4 Step 5: Test

The game was tested in two settings: in a design walkthrough with teachers, and in a play test with Industrial Design students.

Design Walkthrough

Three design walkthrough sessions were held with five teachers from three different high schools. After demonstrating the design, a semi-structured interview was conducted, covering general impressions, the game questions, and its relevance to students' experiences (Appendix G). Interview notes were transcribed and thematically analysed for insights (figure 7).

The game was seen as fun and promising but needing improvement. Teachers felt students might perceive it as a test due to the heavy focus on questions. They suggested adding more game elements, such as player interaction and visual effects like lights. The most apparent and crucial feedback was that the questions were difficult and should be made easier for the target age group.

Playtesting

"Escape the Bubble" was playtested in two sessions with six Industrial Design students. These students were chosen as the sessions included a co-design part after playtesting (Appendix H).

An interesting observation from both sessions was that players had the next player read questions aloud, which was later incorporated to enhance social cohesion. Additionally, no players used data tokens for hints from generative AI, so this feature was removed in the next iteration.

The game was evaluated using the Game Experience Questionnaire (GEX) (IJsselsteijn et. al., 2013). Players rated statements (0= not at all, 4- extremely) and scores and averages were calculated for each component in each module of the questionnaire (figure 8).

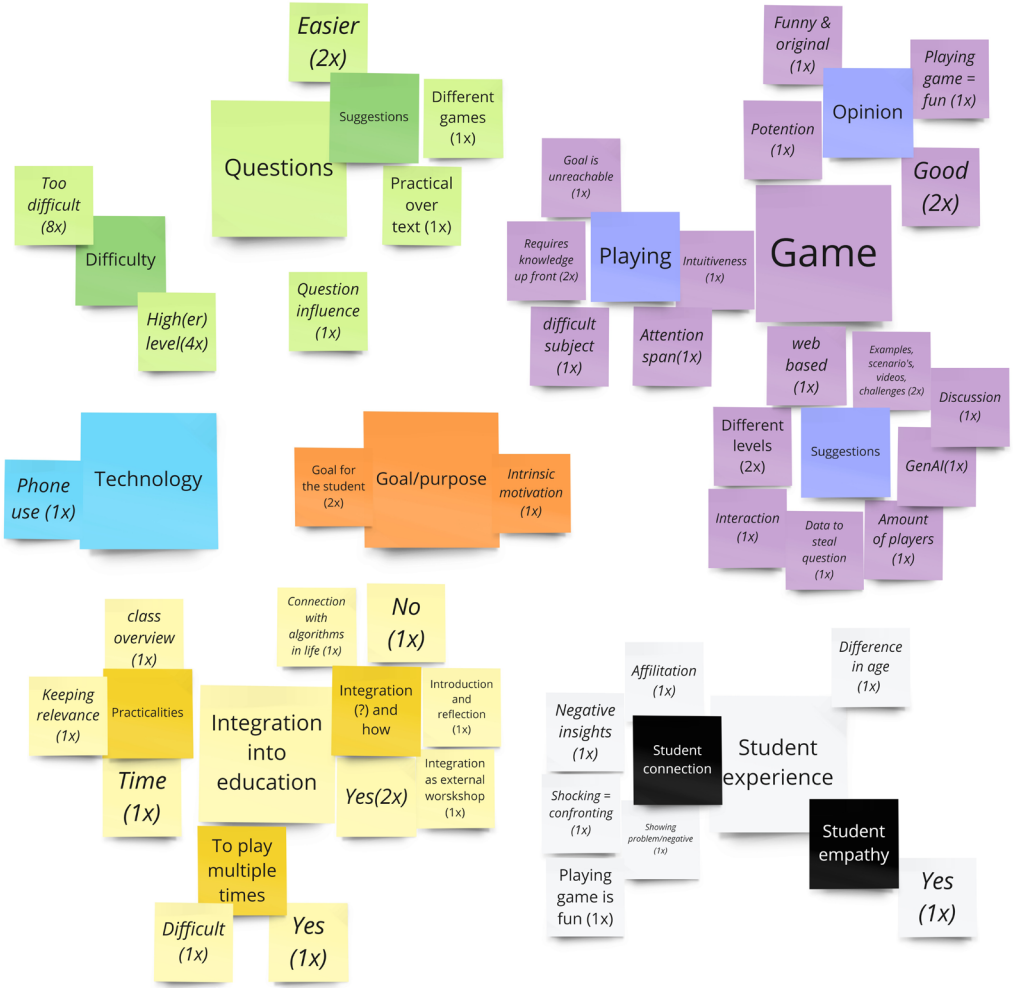


Figure 7: Thematic analysis Design Walkthrough

GEQ- Core module

Competence

2. I felt skilful
10. I felt competent
15. I was good at it
17. I felt successful
19. I felt that I could explore things

2.233333

Sensory and Imaginative Immersion

3. I was interested in the game's story
12. It was aesthetically pleasing
18. I felt imaginative
19. I felt that I could explore things
27. I found it impressive
30. It felt like a rich experience

1.722222

Flow

5. I was fully occupied with the game
13. I forgot everything around me
25. I lost track of time
28. I was deeply concentrated in the game
31. I lost connection with the outside world

1.4

Tension / Annoyance

22. I felt annoyed
24. I felt irritable
29. I felt frustrated

0.5

Challenge

11. I thought it was hard
23. I felt pressured
26. I felt challenged
32. I felt time pressure
33. I had to put a lot of effort into it

1.6

Negative affect

7. It gave me a bad mood
8. I thought about other things
9. I found it tiresome
16. I felt bored

1.041667

Positive affect

1. I felt content
4. I thought it was fun
6. I felt happy
14. I felt good
20. I enjoyed it

2.7

GEQ- Social Presence module

Psychological Involvement Empathy

1. I empathized with the other(s)
4. I felt connected to the other(s)
8. I found it enjoyable to be with the other(s)
9. When I was happy, the other(s) was(were) happy
10. When the other(s) was(were) happy, I was happy
13. I admired the other(s)

2.361111

Psychological Involvement Negative feelings

7. I felt jealous about the other(s)
11. I influenced the mood of the other(s)
12. I was influenced by the other(s) moods
16. I felt revengeful
17. I felt schadenfreude (malicious delight)

1.111111

Behavioural Involvement

2. My actions depended on the other(s) actions
3. The other's actions were dependent on my actions
5. The other(s) paid close attention to me
6. I paid close attention to the other(s)
14. What the other(s) did affected what I did
15. What I did affected what the other(s) did

1.5

GEQ- Post Game module

Positive Experience

1. I felt revived
5. It felt like a victory
7. I felt energised
8. I felt satisfied
12. I felt powerful
16. I felt proud

1.944444

Negative Experience

2. I felt bad
4. I felt guilty
6. I found it a waste of time
11. I felt that I could have done more useful things
14. I felt regret
15. I felt ashamed

0.222222

Tiredness

10. I felt exhausted
13. I felt weary

0.166667

Returning to Reality

3. I found it hard to get back to reality
9. I felt disoriented
17. I had a sense that I had returned from a journey

0.277778

Figure 8: GEX results

Four components were rated relatively low in comparison with other components. It was decided to improve *challenge* and *behavioural involvement* such that they improve the *flow* and *returning to reality* in the next iteration.

3.3 Iteration 1

3.3.1 Step 2: Research

Research in the iteration consisted of measuring algorithmic literacy and doing research towards a framework for game analysis.

Measuring Algorithmic Literacy

Multiple sub questions have been answered by measuring algorithmic literacy among three target groups throughout the project: teachers, Industrial Design students, and students aged 12 to 16. Involving teachers' and students' scores provided context for the younger students' results. A questionnaire incorporating the Algorithmic Literacy Scale and the Algorithmic Media Content Awareness Scale (Zarouali et al., 2021; Dogruel et al., 2022) was used (Appendix I). The former measures awareness and knowledge of algorithms, while the latter scale is a self-report scale of awareness of algorithms in media content on four components. Tables 2, 3, and 4 show participants and summarized results for each scale, with full details in Appendix J.

In the Algorithmic Literacy scale, students aged 12 to 16 scored much lower on both knowledge and awareness, especially low on awareness (Table 3). Despite self-reporting awareness of algorithms in media content, their scores are still lower on all dimensions compared to teachers and Industrial Design students (Table 4).

Table 2: Participants

Age	**Count**
Teacher	12
24 - 25	2
31 - 40	4
41 - 50	3
51 - 60	3
ID Student	7
20- 21	1
22 - 23	4
24 - 25	2
HS Student	12
13	1
14	2
15	5
16	3
17	1
TOTAL	31

Table 3: Average score (%) of the Algorithmic Literacy scale

Component/Group	Teachers	ID students	HS Students
Algoritmic Knowledge	74.2	83.12	64.39
Algoritmic Awareness	54.17	42.90	8.33

Table 4: Average score of the ALMA-scale (1= not at all aware, 5= completely aware)

Component/Group	Teachers	ID students	HS Students
Content filtering	4.75	4.61	4.31
Automated Decision Making	4.42	4.05	3.83
Human Algorithm Interplay	4.81	4.76	4.39
Ethical Considerations	4.50	4.05	3.58

MDA Framework

To analyze "Escape the Bubble," the MDA framework was used, (Hunicke et al., 2004). The full list of mechanics, dynamics, and aesthetics for "Escape the Bubble" is in Appendix K. The analysis showed a lack of mixed mechanics, which corresponds with the lower GEX scores for *challenge, behavioural involvement* and *flow*.

3.3.2 Step 3: Design

Co-Design

To improve challenge and behavioural involvement such that they improve the flow and returning to reality, the MDA framework was used in co-design sessions with ID students (figure 9). After playtesting participants were asked to improve the game by proposing mechanics, dynamics, and aesthetics in two rounds: from a designer's and a player's perspective. In a third round, the best ideas were mixed to create game concepts that result in all types of aesthetics.

Full results of this co-design session can be found in appendix L. The sessions inspired the creation of a new game idea by the variety of proposed mechanics, dynamics and aeshtetics. For example having two teams, a user and a company team (mechanics), competing against each other (dynamic) that creates challenge and fellowship (aesthetic), key elements in the next concept.

Figure 9: Impression of the Co-Design sessions

Social Media Game

Inspired by the co-design sessions, and aiming to improve challenge, behavioural involvement, flow and returning to reality, a list of mechanics, dynamics and aesthetics was created for a new game (appendix m). This led to the creation of Social Media Battle, a game where two duo's compete: one as users navigating a new social media platform and the other as the company of this new social media platform controlling the algorithms. A full description of the game can be read in chapter 4: Final Design.

Figure 10: Figma mock-up of BeYou
Prototype file
Prototype demo

3.3.3 Step 4: Develop

Lo-fi prototype

In Social Media Battle, correctly answering questions is still used to advance in the game. Difficult questions were removed, and complex ones simplified. Actions for both teams were developed and printed on simple cards, along with algorithm updates and the questions. Additionally, a lo-fi prototype game board was created for testing, as well as a Figma mock-up of the social media platform that the game uses (figure 10 & 11).

Figure 11: Lo-Fi Prototype Social Media Battle

Developing Final Design

In development of the final design, various choices and changes in the design were made.

The game board's appearance was inspired by and aimed to look like a circuit board, featuring chips and electronic lines (figure 13). Instead of using dice, an algorithm determines players' positions, displayed using lights, an element suggested by teachers. The position for each LED is determined by pressing a button, all controlled by a ESP8266 which has been programmed using Arduino (figure 12, appendix O). Additionally, game rules were formulated and tested.

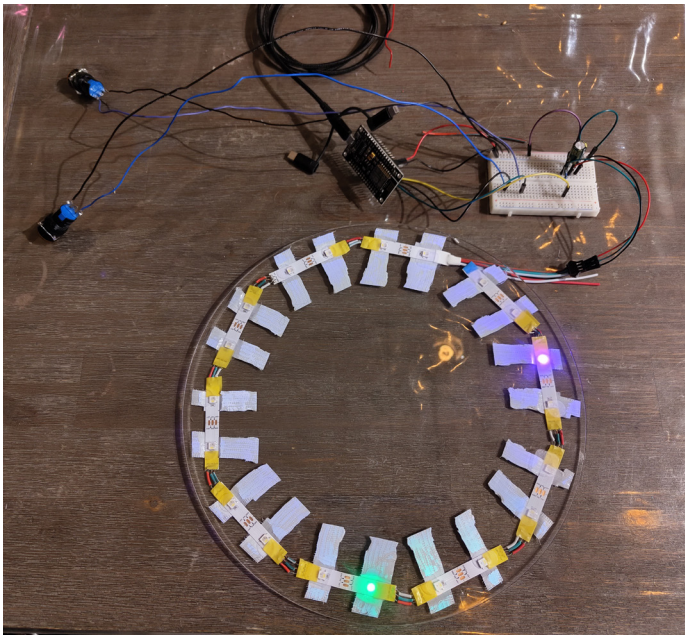


Figure 12: Realizing final prototype

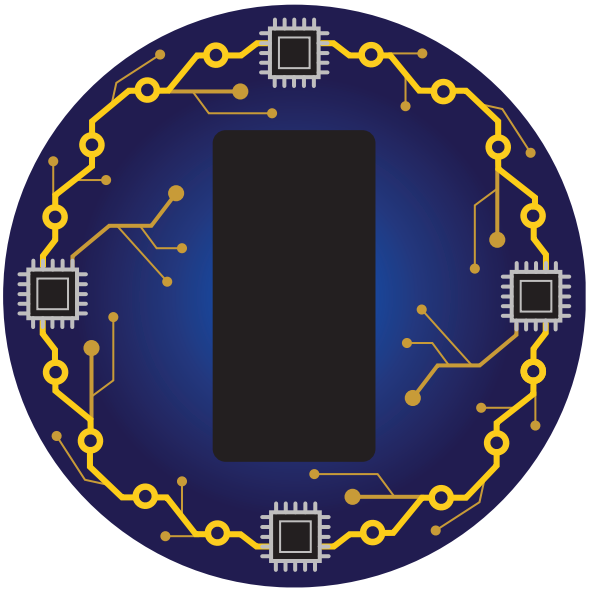


Figure 13: Visual game board

3.3.3 Step 5: Test

The game was tested in four sessions with a total of 13 students aged 13 to 17. Two sessions used the lo-fi prototype, while two sessions tested the final prototype with game rules as shown in the next chapter. Testing involved taking notes on engagement, understanding of game mechanics, strategy, decision-making, and game balance. Afterward, interviews asked students about the game, questions and actions, the design, and whether they learned about social media algorithms. Full details are in Appendix N.

Results on the abovementioned aspects are given, supported by interview results.

Engagement
Students were moderately to highly engaged with the game. In three out of four tests, moderate engagement initially stemmed from the time needed to grasp the game. However, once students understood the rules, engagement notably increased, which is supported by interview results in which student indicated the game is fun. In one test, students even wanted to continue playing during their break.

Understandig of Game Mechanics
In all user tests, taking turns and drawing cards for actions or questions were clear. However, performing platform actions, their costs, earning data tokens or update percentages were not initially clear. After instructions or reading the game rules, these aspects became clear. Initially, it was taught the game rules needed improvement. In the interview students indicated they did not read them well enough.

Strategy & Decision-making
Both duos discussed strategy in every test. The user duo deliberated on platform actions based on available data tokens, while the company duo focused on the user's actions to determine algorithm updates. Initially slow, but decision-making improved as understanding of the game rules increased.

Game Balance
In all user tests, the user duo progressed faster. The balance between positive and negative actions, question difficulty, and landing spots was well-maintained. Although understanding the game took time, once grasped, gameplay pace increased in every test.

Students complimented the design, associating it with a motherboard, electronics, chips and data. Additionally, turn taking by use of an algorithm and lights was experienced as '*nice*', '*innovative*' and '*better than throwing a dice*'.

Figure 14: Playtesting with students aged 13 to 17

4. Final Design

This chapter provides a detailed description of the final design.

4.1 Social Media Battle: User v/s Company

Social Media Battle: User v/s Company is an educational game that aims to enhance algorithmic literacy among students aged 12- to 16-year-olds. The game helps students become aware of how algorithms work on social media, teaches them to critically evaluate algorithmic decision-making and develop the skills to manage or even influence these operations.

In Social Media Battle, two duo's compete: one as users navigating a social media platform and the other as the company of a new social media platform: BeYou, that controls control the algorithms.

The user duo explores the personal feed of BeYou, performing actions like liking, commenting, and sharing, each costing data tokens. Their goal is to first reach a 90% filter bubble in round 1 and then reduce it to 10% in round 2.

The company starts with the 'like algorithm' and duo updates their algorithm such that they can collect data, aiming to gather all data of the user duo by the end of the second round. They start with the Like Algorithm and can acquire additional updates as the game progresses, winning round 1 when owning half the updates.

A duo wins the game when they achieve their goal for both rounds. If each duo wins one round the game results in a draw.

Both duos can reach their goal by taking turns pressing the button, moving their pawns on the game board, landing on a position that determines whether to draw a questions or action card. Correct answers allow the user duo to act on the platform or the company duo to earn update percentages, which can be used to update their algorithm and collect more data from the user.

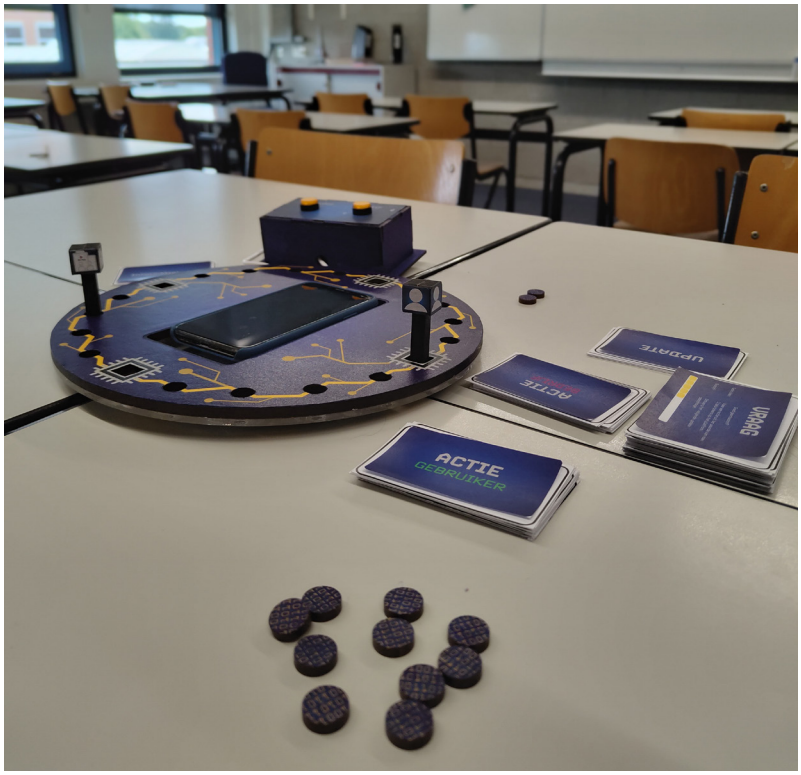


Figure 15: Social Media Battle

4.2 Game Content

Game board, turn taking box and pawns.
The circular game board, representing a filter bubble, allows a phone to be placed in the middle and the pawns to be placed in the 'question' (data point) or 'action' (chip) location (figure 15). The two pawns, one for each duo, can be placed on and attach to the game board magnetically. The turn taking box includes two buttons, one for each duo, and is placed next to the game board. Pressing a button creates a new location for the pawn to be placed and determines whether to draw a question or action card.

Cards

Question cards:
These cards display the questions for duos to answer. One side shows the question and answer, while the other side shows what the user or company earns with a correct answer. Questions are read aloud by the opposing duo. There are various types of questions, varying in difficulty and in what duo's earn accordingly (table 5).

Table 5: Questions, update and actions

Question type	Update / Action
True / False	20% update, action of max 1 data tokens
Multiple choice	25% update, action of max 1 data tokens
Connections	33% update, action of max 2 data tokens
Sequencing	33% update, action of max 2 data tokens
Scenario based	40 % update, action of max 3 data token
Algorithmic analysis	40 % update, action of max 3 data token
Critical thinking	50 % update, action of max 3 data token

Action cards:
There are two piles of action cards, one for each duo. It contains actions or events that can either positively or negatively a turn.

Update cards:
There are a total of seven update cards that show what type of algorithm update it is, how many data tokens the company receives when they possess the update and what percentage is required to earn the update (table 6).

Table 6: Possible updates

Update	Earnings & Requirement
Watch time algorithm	earn 3 data tokens if user perform this action, Requires 300%
Interactions algorithm	earn 2 data tokens if user perform this action, Requires 200%
Comments algorithm	earn 1 data token if user performs this action, Requires 100%
Share algorithm	earn 1 data token if user performs this action, Requires 100%
Follow algorithm:	earn 2 data tokens if user performs this action, Requires 200%
Not interesting algorithm	earn 1 data token if user performs this action, Requires 100%)
Like Algorithm	earn 1 data token if user performs this action, Requires 0%

Information card:
This card shows which actions on the platform can be taken and how many data tokens these actions cost (table 7).

Table 7: Possible Actions & costs

Action	Costs
Like	1 data token
Comment	1 data token
Share	1 data token
Follow	2 data tokens
Watch again	3 data tokens
Interaction (hashtag)	2 data tokens
Not interested	1 data token

Example cards in their design can be found in appendix Q

Data Tokens
Data tokens represent the data the user gives away when using a platform. In the game the user needs to give their data to the company when taken an action, but only if the company has the corresponding algorithm.

Game rules
The game rules give an introduction to, and explain the rules of the game (Appendix P).

Figure 16: Data tokens

BeYou platform (Application)
The user duo needs to use the fake social media platform 'BeYou', created for this game. The user duo has the goal to enter and exit a specific filter bubble by taking actions on the platform. The bubble meter will show their progress.

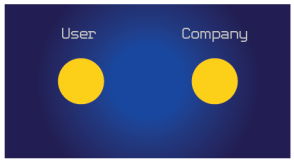
Playing Social Media Battle helps students understand the pervasive role of algorithms in social media. The game encourages critical evaluation and equips them with the knowledge and skills needed to understand and influence these algorithms, enabling more conscious and responsible social media use.

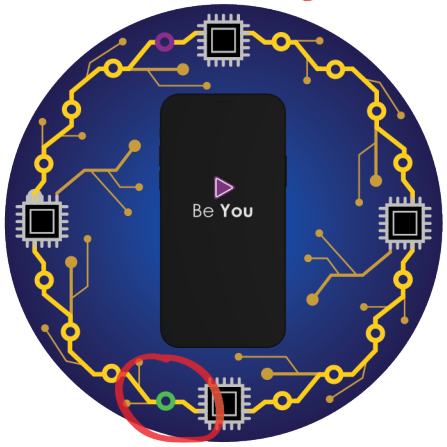
Figure 17: BeYou platfrom and the bubble meter

4.5 Example Turn

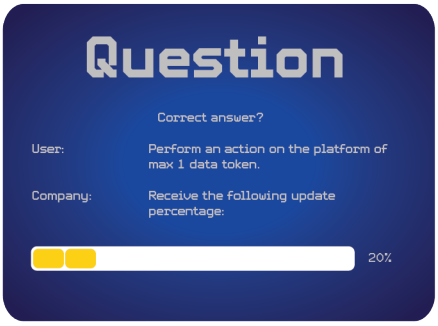
Situation:
The user duo filter bubble progress is 30%. The company duo owns the Like algorithm and the Not-Interested algorithm.

The user duo is at turn, presses their button and end up on a question location.

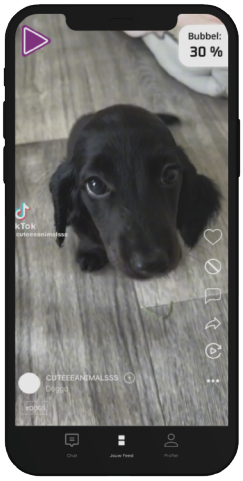




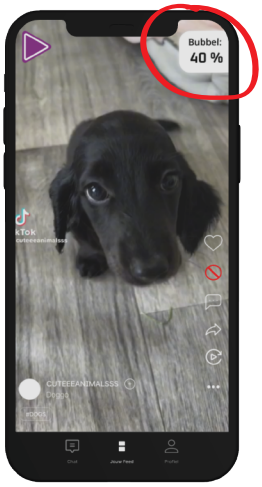
They draw a question card which is read by the company duo.



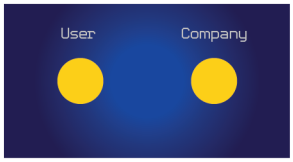
They answer correctly and are allowed to take action of max 1 data token on the platform



They see a video about a dog but need to enter a filter bubble with 90% car content.



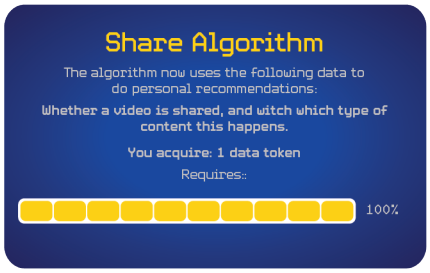
They choose to press 'not interested', raising the bubble with 10%. This costs them 1 data token since the company duo owns this algorithm.



The company duo is at turn, presses their button and end up on an action location.

They draw an action card that positively impacts their game, earning 60 % update.

With this extra 60 % they choose to update their algorithm with the Share Algorithm.



5. Discussion

In this chapter, major design and process decisions are discussed in light of research findings. Additionally, limitations of the process and the design are discussed, and future work is listed.

5.1 Design Decisions

5.1.1 Gamification

Social Media battle incorporates gamification to educate students upon algorithms on social media. Gamification, using game design elements in non-game contexts, has been shown to enhance learning engagement and outcomes (Deterding et al., 2011; Majuri et. al., 2018; Mohamad et. al., 2018; Kalogiannakis et al., 2021). Teacher interview results suggested incorporating group work and competition, game design elements included in the final design.

Pre- and post-tests with algorithmic literacy scales were planned to study learning outcomes, but time constraints duo to students' class obligations prevented post-tests.

Initially, it was intended to investigate the learning outcomes after playing the game with use of the algorithmic literacy scales by doing a pre and post-test. Due to students' class obligations, little time was left to do a post test. Thus, no quantitative data supports the game's impact on learning outcomes. However, nearly all students reported learning from the game, with one student realizing they were less aware than initially thought and giving too high scores in the questionnaire. This suggests the self-report scores might be inflated for others as well, potentially affecting overall results.

5.1.2 MDA Framework

To analyse and improve the initial game idea, the MDA framework was used, breaking game design into Mechanics (rules), Dynamics (system), and Aesthetics (fun) (Hunicke et al., 2004). Designers create mechanics, that give rise to dynamics and lead to aesthetic experiences, while players experience it in reverse. Although not specifically created for educational games, the framework has been used to analyse gamification models in education suggesting effective gamification requires mixing mechanics to create dynamics resulting in all aesthetics (Kusuma et al., 2018). This mixing has been the goal in both the co-design sessions as well as for the development of Social Media Battle.

5.1.2 Game Experience Questionnaire

To analyse and improve the initial game idea, the MDA framework was used, breaking game design into Mechanics (rules), Dynamics (system), and Aesthetics (fun) (Hunicke et al., 2004). Designers create mechanics, that give rise to dynamics and lead to aesthetic experiences, while players experience it in reverse. Although not specifically created for educational games, the framework has been used to analyse gamification models in education suggesting effective gamification requires mixing mechanics to create dynamics resulting in all aesthetics (Kusuma et al., 2018). This mixing has been the goal in both the co-design sessions as well as for the development of Social Media Battle.

5.3 Limitations & Future work

There were several limitations in both the process and the design.

The project aimed to use a Learning Experience Design (LXD) approach. While the approach and tools have been used, the focus shifted towards developing and evaluating the design rather than the overall experience. Future work should emphasize creating and evaluating an experience (with the game) that helps achieve the desired learning outcome. This directly relates to the plans in the FMP proposal.

The game was primarily evaluated on design aspects, revealing design improvements. The questions were still too difficult or lengthy and need further simplification and more should be added to support two rounds of gameplay. Duos frequently read questions themselves, with difficulty covering the answer. A separate list of answers could enhance gameplay. A physical “percentage slide” could replace collecting question cards for update percentages and allows leftover update percentage to be indicated. Lastly, the game should include a complete “BeYou” application instead of a partly mock-up for round 1, which also related to the plans in the FMP proposal.

6. Conclusion

This report has detailed the design process of the creation of Social Media Battle: User v/s Company, an educational game for enhancing algorithmic literacy among students aged 12 to 16. This game aims to teach and make students more aware of how algorithms work social media, to critically evaluate algorithmic decision-making and develop the skills to manage or influence these operations. Through gameplay, students learn how their actions and the algorithms shape their online experience. They engage in strategic decision-making, reflecting on the creation and impact of filter bubbles.

Social Media Battle has been designed by taking a learning experience design approach. While it can be debated upon achieving a learning experience, playtesting showed positive results in learning outcomes, game elements and design. Despite needing improvements, the game has potential to be used in a complete learning experience, which future work in the FMP will develop further.

Acknowledgements

I want to express sincere gratitude to my coach for providing invaluable feedback throughout this project. Special thanks to the teachers and students involved in this project for their collaboration and valuable input during user tests. Lastly, I want to thank fellow students for their participation in co-creation and their informal feedback and insights in this project.

References

Anderson, J. & Rainie, L. (2024, April 14). Theme 7: The need grows for algorithmic literacy, transparency and oversight. Pew Research Center. https://www.pewresearch.org/internet/2017/02/08/theme-7-the-need-grows-for-algorithmic-literacy-transparency-and-oversight/

Areeb, Q. M., Nadeem, M., Sohail, S. S., Imam, R., Doctor, F., Himeur, Y., Hussain, A., & Amira, A. (2023). Filter bubbles in recommender systems: Fact or fallacy—A systematic review. WIREs Data Mining and Knowledge Discovery, 13(6). https://doi.org/10.1002/widm.1512

Coe, E., Doy, A., Enomoto, K., & Healy, C. (2023, April 28). Gen Z mental health: The impact of tech and social media. McKinsey & Company. https://www.mckinsey.com/mhi/our-insights/gen-z-mental-health-the-impact-of-tech-and-social-media#/

De Baas Op Internet (n.d,) Aan de slag. https://debaasopinternet.nl/aan-de-slag

de Groot, T. de Haan, M. & van Dijken, M. (2023) Learning in and about a filtered universe: young people's awareness and control of algorithms in social media, Learning, Media and Technology, 48:4, 701-713, DOI: 10.1080/17439884.2023.2253730

De InternetHelden. (n.d.). De InternetHelden. https://beinternetawesome.withgoogle.com/nl_nl

Deterding, S., Dixon, D., Khaled, R., & Nacke, L. (2011). From game design elements to gamefulness. In Proceedings of the 15th International Academic MindTrek Conference: Envisioning Future Media Environments (MindTrek '11). https://doi.org/10.1145/2181037.2181040

Design Council. (n.d.). Framework for Innovation - Design Council. https://www.designcouncil.org.uk/our-resources/framework-for-innovation/

Dogruel, L., Masur, P., & Joeckel, S. (2021). Development and Validation of an Algorithm Literacy Scale for Internet Users. Communication Methods and Measures, 16(2), 115–133. https://doi.org/10.1080/19312458.2021.1968361

Dwivedi, Y. K., Hughes, L., Ismagilova, E., Aarts, G., Coombs, C., Crick, T., Duan, Y., Dwivedi, R., Edwards, J., Eirug, A., Galanos, V., Ilavarasan, P. V., Janssen, M., Jones, P., Kar, A. K., Kizgin, H., Kronemann, B., Lal, B., Lucini, B., . . . Williams, M. D. (2021). Artificial Intelligence (AI): Multidisciplinary perspectives on emerging challenges, opportunities, and agenda for research, practice and policy. International Journal of Information Management, 57, 101994. https://doi.org/10.1016/j.ijinfomgt.2019.08.002

Fayyaz, Z., Ebrahimian, M., Nawara, D., Ibrahim, A., & Kashef, R. (2020). Recommendation Systems: Algorithms, Challenges, Metrics, and Business Opportunities. Applied Sciences, 10(21), 7748. https://doi.org/10.3390/app10217748

Floor, N. (2023a). This is learning experience design: What It Is, How It Works and Why It Matters. New Riders Publishing.

Floor, N. (2023b, December 14). Empathy Map for Learners. Learning Experience Design. https://lxd.org/news/empathy-map-for-learners-and-learning-experience-design/

Gillespie, T. (2014). The Relevance of Algorithms. In The MIT Press eBooks (pp. 167–194). https://doi.org/10.7551/mitpress/9780262525374.003.0009

Haroon, M., Chhabra, A., Liu, X., Mohapatra, P., Shafiq, Z., & Wojcieszak, M. (2022). YouTube, the Great Radicalizer? Auditing and Mitigating ideological biases in YouTube recommendations. arXiv (Cornell University). https://doi.org/10.48550/arxiv.2203.10666

Hunicke, R., Leblanc, M.G., & Zubek, R. (2004). MDA : A Formal Approach to Game Design and Game Research.

IJsselsteijn, W. A., de Kort, Y. A. W., & Poels, K. (2013). The Game Experience Questionnaire. Technische Universiteit Eindhoven.

Jahnke, I., Schmidt, M., Earnshaw, Y., & Tawfik, A. A. (n.d.). Theoretical Considerations of Learning Experience Design. https://edtechbooks.org/eme_6606/toward_theory_of_LXD_jahnke_earnshaw_schmidt_tawfik

Kalogiannakis, M., Papadakis, S., & Zourmpakis, A. (2021). Gamification in Science Education. A Systematic Review of the literature. Education Sciences, 11(1), 22. https://doi.org/10.3390/educsci11010022

Kramer, A. D. I., Guillory, J., & Hancock, J. T. (2014). Experimental evidence of massive-scale emotional contagion through social networks. Proceedings of the National Academy of Sciences of the United States of America, 111(24), 8788–8790. https://doi.org/10.1073/pnas.1320040111

Learning Experience Design. (2023, November 9). Home - Learning Experience design. https://lxd.org/

Learning Experience Design. (2024, January 15). Learning experience design process - Learning Experience Design. https://lxd.org/fundamentals-of-learning-experience-design/learning-experience-design-process/

Learning Experience Design. (2023, November 27). What is a learning experience? - Learning Experience Design. https://lxd.org/fundamentals-of-learning-experience-design/what-is-a-learning-experience/

leermaterialen. (n.d.). SLO. https://www.slo.nl/sectoren/vmbo/digitale-geletterdheid-vmbo/digitale-geletterdheid-vo/leermaterialen/mediawijsheid/

Majuri, J., Koivisto, J., & Hamari, J. (2018). Gamification of education and learning: A review of empirical literature. GamiFIN Conference.

Malcorps, S., Claes, A., Philippette, T., & Dufrasne, M. (2023). Algorithmic literacy and media practices among young people in Brussels. Brussels Studies. https://doi.org/10.4000/brussels.6901

Mohamad, S. N. M., Sazali, N. S. S., & Salleh, M. A. M. (2018). Gamification approach in education to increase learning engagement. International Journal of Humanities, Arts and Social Sciences, 4(1), 22.

Morris, P. (2022). Teaching Algorithmic Literacy within a Media Literacy Program. International Council for Media Literacy. https://ic4ml.org/journal-article/teaching-algorithmic-literacy-within-a-media-literacy-program/

Murray, C. (2023, March 14). TikTok Clones: How Spotify, Instagram, Twitter And More Are Copying Features Like The 'For You' Page. Forbes. https://www.forbes.com/sites/conormurray/2023/03/13/tiktok-clones-how-spotify-instagram-twitter-and-more-are-copying-features-like-the-for-you-page/

Oeldorf-Hirsch, A., & Neubaum, G. (2023). What do we know about algorithmic literacy? The status quo and a research agenda for a growing field. New Media & Society, 0(0). https://doi.org/10.1177/14614448231182662

Pariser, E. (2011a, March). Beware online "filter bubbles" [Video]. TED Talks. https://www.ted.com/talks/eli_pariser_beware_online_filter_bubbles

Pariser, E. (2011b). The filter bubble: What the Internet is Hiding from You. Penguin Press HC.

Powers, E. (2017). My News Feed is Filtered? Awareness of news personalization among college students. Digital Journalism, 5(10), 1315–1335. https://doi.org/10.1080/21670811.2017.1286943

Rombouts, M., Van Dorsselaer, S., Scheffers-van Schayck, T., Tuithof, M., Kleinjan, M., & Monshouwer, K. (2020). Jeugd en riskant gedrag 2019. Trimbos-instituut. https://www.trimbos.nl/wp-content/uploads/sites/31/2021/09/af1767-jeugd-en-riskant-gedrag-2019.pdf

Ross Arguedas, A., Robertson, C., Fletcher, R., & Nielsen, R. (2022). Echo chambers, filter bubbles, and polarisation: a literature review . Reuters Institute for the Study of Journalism.

Rusanen, P. A. (2021, December 10). Learning the basics of Algorithmic Literacy | University of Helsinki. University of Helsinki. https://www.helsinki.fi/en/news/artificial-intelligence/learning-basics-algorithmic-literacy

Schmidt, M., Huang, R. Defining Learning Experience Design: Voices from the Field of Learning Design & Technology. TechTrends (2021). https://doi.org/10.1007/s11528-021-00656-y

Swart, J. (2021). Experiencing Algorithms: How Young People Understand, Feel About, and Engage With Algorithmic News Selection on Social Media. Social Media + Society, 7(2). https://doi.org/10.1177/20563051211008828

Tawfik, A. A., Gatewood, J., Gish-Lieberman, J. J., & Hampton, A. J. (2021). Toward a Definition of Learning Experience Design. Technology, Knowledge and Learning, 27(1), 309–334. https://doi.org/10.1007/s10758-020-09482-2

The Wall Street Journal. (2021, July 21). How TikTok's algorithm figures you out | WSJ [Video]. YouTube. https://www.youtube.com/watch?v=nfczi2cI6Cs

TikTok. (2020, November 4). How TikTok recommends videos #ForYou. Newsroom | TikTok. https://newsroom.tiktok.com/en-us/how-tiktok-recommends-videos-for-you

TikTok - the Hmm. (2023, May 22). The Hmm. https://thehmm.nl/education/tiktok/

Willson, M. (2016). Algorithms (and the) everyday. Information, Communication & Society, 20(1), 137–150. https://doi.org/10.1080/1369118X.2016.1200645

Zarouali, B., Boerman, S. C., & De Vreese, C. H. (2021). Is this recommended by an algorithm? The development and validation of the algorithmic media content awareness scale (AMCA-scale). Telematics and Informatics, 62, 101607. https://doi.org/10.1016/j.tele.2021.101607

Reflection

In this reflection, I will reflect upon my choices in the design process towards the creation of Social Media Battle: User v/s Company. I reflect upon the integration of expertise areas, the development of skills and my overall competence as designer and I relate to how these learning outcomes support my FMP.

My aim in this project was to create a design for education about algorithms in social media, a similar topic as in a previous attempt of the preparation final master project. In that attempt, the integration of expertise areas and the design and research processes were insufficient. It was not clear how I extended the knowledge and skills I already had in the project, and I had trouble deciding upon design and research activities and drawing conclusions that help making decisions. These insights provided motivation to improve these aspects in this attempt of the project.

The project aim is still stemming from my professional identity and vision, and the desire to combine and use my experience from my two studies: Industrial Design and Science Education. In my professional identity I mention I strive towards a future in which the roles I see for myself from both studies (innovator & educator) are combined. As an educational designer, it requires to use and combine design principles with learning (theories). This preparation FMP project has been used to explore an approach that applies this: Learning Experience Design. Applying and learning from using this approach was an important personal goal, and has allowed me to achieve another goal of improving decision making.

During this project a LX Design approach has been taken and several methods have been used, such as the empathy maps for learners, the learning experience canvas and ways to best formulate learning outcomes and objectives. Taking this approach and applying these methods has directly improved my design and research processes skills, organizing and planning skills, and user and society expertise area.

With the creation of empathy maps I have learned a method to understand users in the context of being a learner: who they are, wat they see, know and do. It allows me to create designs that are better steered towards reaching the learning outcome for the learner.

Using the LX map has helped me tremendously in creating a strategy and making design decisions, the most valuable and important learning aspect of this project. I learned how to make decisions more quickly, without the need for thorough validation. For example, in the previous attempt of this project it took plenty of time to come up with a design idea that addressed all aspects of a learning outcome. While formulating learning objectives in the LX canvas for this project, I realized it would be difficult to address all aspects of algorithmic literacy and made the decision to prioritize only two. As a designer, these quicker design decisions allow me to spend more time on other aspects and create a design (process) that goes more in depth on multiple aspects.

In that sense, I also indirectly learned from taking an LXD approach. By going more in depth on other aspects, it has allowed me to spend time on improving other skills and expertise area's such as Design and Research processes, Technology and Realization, Creativity and Aeshtetics and Math, Data and Computing.

I learned to apply and use the MDA framework and the Game Experience Questionnaire. Moreover, I learned to steer such a framework towards using it in a valuable co-design session. Learning this framework and evaluation method extends my knowledge of appropriate methodologies and allow me to gather insights that can directly feed into my designs.

Regarding Technology & Realization and Creativity & Aeshtetics I learned to combine and integrate sensors and actuators (buttons and lights), and explore and create prototypes with use of different

techniques and different materiality. These aspects offer me the skills to choose appropriate and creative realization methods to create high quality prototypes such as Social Media Battle, which improves the communication of design ideas.

In this project I conducted two studies (GEX and Algorithmic literacy scales) that have resulted in a lot of data. Instead of losing overview, I learned to process such amounts of data by searching and learning new features of, and gaining skills in using Excel. These skills let me gather insights from plenty of quantitative data that can potentially lead to design decisions without the fear of losing overview and its possible consequences.

Despite that I learned a lot from the application and tools of LXD, reflecting on the application upon the whole project I feel it has not led to the result in terms of experience that it actually aims for. Towards the end, the focus has been on the design instead of the experience. This can also be noticed throughout the design process chapter and is also debated about in the discussion. Therefore, I am planning on continuing using a Learning Experience Design approach in my FMP and retain the focus on creating an experience. This will be elaborated on in the proposal.

Lastly, a goal regarding Business and Entrepreneurship was to be able to position a design in a company by including several companies or experts that focus on educational design. Several experts and companies have been reached out to, but unfortunately without responses apart from one expert, with whom I will stay in contact. Because it has received little further attention, in my FMP I still aim to collaborate with a company and improve skills within B&E, for which I am going to do my best in the upcoming weeks.

Overall, major steps have been taken in my design and research processes skills, which also have allowed me to learn a variety of things and go in depth into other expertise areas. Taking a LXD approach has provided me with skills and insights in my aim to combine design and education. The project leaves some learning opportunities that will be addressed in my FMP.

FMP Proposal

Introduction

In this additional section of the report I provide a proposal for my Final Master Project (FMP) and discuss it in relation to my Professional Identity and Vision (PIV), the Masters' track Research design and Development (RDD) and the intented outcomes of the master program Industrial Design (ID). It starts by summarizing my professional Identity and Vision, after which the project scope and project management will be detailed, involving background on the proposed design direction, design opportunities, design approach, planning and risks. Lastly, the project fit with the track and study will be discussed. This Final Master Project completes my development of six and a half years at the Eindhoven University of Technology, including the bachelor Industrial Design and a joint degree with the master Industrial Design and the master Science Education.

Professional Identity & Vision

This chapter summarizes my professional identity and vision. A full description can be found in Appendix R.

Professional Identity

In my professional identity, I describe myself as a studious and technology-driven person, often diving into new interests to fully understand concepts. I am motivated to use my knowledge to help others and improve their lives, particularly through technology, design, and education. As an early adopter, I explore new technologies to understand their potential for enhancing our lives, which inspired me to study Industrial Design. My passion for communicating technology to others inspired me to study Science Education, through which I gained valuable educational experience.

As an educator, I aim to present technology in a comprehensible manner, enabling users to make informed decisions about adopting new technologies and critically evaluating existing ones. As a designer, I strive to innovate and create designs that improve lives, with a focus on enhancing digital literacy through educational designs. I adopt a user-centered design approach, valuing user input to ensure designs meet their needs, while also learning to combine the roles with use of Learning Experience Design.

My role as an early adopter ensures feasibility within a design process, balancing realism with creativity. In team settings, I emphasize a positive social atmosphere, ensuring all voices are heard, which reflects my people-oriented personality.

Vision

I envision a future in which technology improves our daily life by seamlessly blending in, creating a symbiotic relationship between humans and technology. However, rapid technological development and a lack of awareness pose challenges. People struggle to keep up, make informed decisions, and maintain a critical attitude towards technology use.

As designers, I argue we must strive for transparency and better explanations of digital technologies. Users need to have a critical attitude and form digital literacy, which can be supported by education. By combining design and education, I aim to create educational designs that enhance digital literacy, encouraging a critical attitude to technology use and adoption.

These educational designs should explain how digital technology works, for example through embedding algorithmic literacy. They should also educate on the consequences of technology use and how to achieve meaningful use. This will improve digital literacy, empowering people to make informed decisions about integrating technology into their lives.

To realize this vision, I emphasize a user-centered design approach to understand user needs. Creating learning experiences and effectively communicating about digital technology will stimulate awareness and digital literacy. This combination will help technology create a positive impact and improve our daily lives.

Project Scope

In the FMP, I plan to continue the work of my preparation project, which aimed to enhance algorithmic literacy in students aged 12 to 16. This led to the creation of "Social Media Battle: User vs. Company," an educational game designed to teach students about social media algorithms (Figure 18). The game helps students to be more aware of and understand how algorithms work, evaluate algorithmic decisions critically, and develop skills to manage or influence these operations. Through gameplay, students learn how their actions and the algorithms shape their online experience. They engage in strategic decision-making, reflecting on the creation and impact of filter bubbles.

Throughout the preparation project I used a Learning Experience Design approach to learn and aim to combine the fields of design and education. The preparation FMP project report has discussed the need for teaching algorithmic literacy. In the FMP I am planning on applying LXD again to create a complete learning experience in which the game will be used. Besides the need, the project scope was chosen for several reasons.

First, reflecting on the use of LXD in the preparation FMP, I applied various tools but have not tested and do not feel like I established a true learning experience. The second half of the project focused on game creation and design without testing whether playing the game achieved the learning outcome beyond asking if students learned about algorithms in social media. Teachers noted that the game questions required pre-existing knowledge, which the students lacked, making it harder to achieve the game's goals. Additionally, no methods were designed to help transfer the gained knowledge to real-world situations after playing the game. It is expected that solely playing the game does not create a memorable learning experience or significantly enhance algorithmic literacy in daily life. Therefore, in the FMP, I plan to create a comprehensive learning experience, including necessary pre-existing knowledge, playing the Social Media Battle, and methods to help students apply the gained algorithmic literacy in daily life.

Second, teachers gave feedback on the game's use, with multiple saying they wouldn't use it in their classrooms due to a lack of confidence in the topic, which is supported by literature. Only 43% of teachers feel very or more than sufficiently competent in digital literacy (DUO Onderwijsonderzoek & Advies, 2023). They suggested the game to be used in workshops led by external experts. Schools receive subsidies to hire these external parties to improve digital literacy (Ministerie van Volksgezondheid, Welzijn en Sport, 2024), creating business opportunities for the FMP.

Lastly, there is plenty of learning material on digital literacy, but very little focuses specifically on algorithmic literacy or algorithms in social media. Most existing material centers on media literacy, covering topics like privacy and fake news (Leermaterialen, n.d.; De InternetHelden, n.d.). The same applies to workshops and materials provided by external parties (Workshops VO | Beeld & Geluid, n.d.; Mediawijsheid | Digitale Geletterdheid | Alle Soorten Onderwijs, 2024; Chris Voorkom, 2024). This highlights a gap for creating a learning experience to enhance algorithmic literacy in social media.

Figure 18: Close-up Social Media Battle

Design Challenge

The design challenge for the FMP is formulated as follows:

Create a learning experience that makes use of the educational game Social Media Battle, enhances algorithmic literacy of social media algorithms in students aged 12 to 16 years old and enables them to apply this in daily life.

In order to create this learning experience, several corresponding design and research questions have been formulated which have been categorized:

Design question:

How can a learning experience be created that makes use of the educational game Social Media Battle, enhances algorithmic literacy of social media algorithms in students aged 12 to 16 years old and enables them to apply this in daily life?

Research Questions:

Social Media Battle

- To what extent does playing Social Media Battle achieve the desired learning outcome related to algorithmic literacy?

Learning experience

- What are potentially effective activities, methods and instructional strategies to create a learning experience enhancing algorithmic literacy?
- How can the learning experience be structured to ensure that students can transfer the knowledge gained from Social Media Battle to their daily interactions with social media?
- How can feedback from teachers and students be integrated into the iterative design process to improve the learning experience?

Impact

- What are the measurable impacts of the learning experience on students' algorithmic literacy towards algorithms in social media and how can they be measured?

Facilitator role

- What is the role of the facilitator in the effectiveness of the learning experience?

Answering these questions will help in creating the desired outcome. Since the design challenge includes all students aged 12 to 16, it will be narrowed down further to a specific target group in education. This will be done in the first phase of the project, as depicted, and described in the planning. Note that the design challenge and research questions are work in progress and can change during the process.

Design Direction

The envisioned outcome for this project is a comprehensive learning experience that embeds the educational game Social Media Battle and enhances algorithmic literacy among students aged 12 to 16 years old. The intention of the learning experience is to not only deepen students' understanding of social media algorithms but also empower them to use their algorithmic literacy in their daily lives. The proposed learning experience will take the form of a workshop composed of several interconnected parts designed to maximize engagement and learning outcomes.

A potential workshop structure is shown below but will eventually be created with input from research and student and teacher feedback.

A potential method for this closing session is the "If this plan", a method suggested in an interview with an expert on digital resilience from Movez Lab at Erasmus University Rotterdam. In this method, students write statements like "IF I encounter particular content on social media, THEN I can take this action I learned," which will help them develop practical strategies for managing their social media interactions in daily life.

This method, and the whole proposed workshop, is a potential outcome but depicts the proposed design direction of the FMP. The exact methods and activities will be created through research, co-design and iterative testing. Research of this project will explore various methods to determine the most effective ways to achieve the desired learning outcomes.

Since the intention is to use Social Media Battle in the workshop, the game needs to be developed further and realized for use in class. Parallel with creating the workshop, minor design improvements will be done, but a focus will be given on the technology and realization of the game, addressing one of my chosen expertise areas.

Potential Workshop Structure

1

Interactive introduction
an engaging introduction touching upon basics of algorithms in social media, aiming to establish the necessary knowledge for playing Social Media Battle while retaining enough room for challenging questions in the game.

2

Playing round 1
Playing the first round of Social Media Battle.

3

Sharing insights round 1
Activity to share insights and reflections

4

Playing round 2
Playing the second round of Social Media Battle.

5

Sharing insights round 2
Activity to share insights and reflections

6

Interactive closing
Activity to close the workshop and helps students to apply their newly acquired algorithmic literacy in daily life.

Differences with the preparation FMP

The FMP will be a continuation of the preparation FMP project. To ensure the FMP will be a project with a different take, major differences are listed below.

Approach
Both projects use(d) Learning Experience Design. The difference is that in the preparation project solely a variety of tools have been used to create a design, whereas LXD in the FMP will be used more deeply to create a learning experience.

Design
While the preparation has resulted in a game, the FMP will result in a learning experience that uses the improved game. Design principles will be used such that the creation of a learning experience relates to the departments' mission and program outcomes.

Expertise Areas
User & Society is and will be the most prominent in both projects. However, the game's improvement requires more emphasis and specialization in Technology & Realization which will therefore be more apparent in the FMP. Additionally, while little attention was given to Business & Entrepreneurship in the preparation, it will be more apparent in the FMP, as creating a learning experience with the game provides business opportunities.

Project Management

Approach

In the FMP a Learning Experience Design approach will be taken with use of the book from Niels Floor (2023a). Key design principles used in his perspective on LXD come from interaction design, (user) experience design, graphic design and game design, which are combined with elements of learning such as education, instructional design, cognitive psychology and educational sciences (Learning Experience Design, 2023). One of the aspects that distinguishes LXD from other principles is that it focusses on the overall experience of a learner to create a learning experience: a 'holistic experience that is intentionally designed and carefully crafted to help the learner achieve a meaningful learning outcome that is (mostly) predefined' (Learning Experience Design, 2023). LXD represents a combination of design and learning, aiming to create educational experiences that are not only instructive but also deeply engaging and learner centered.

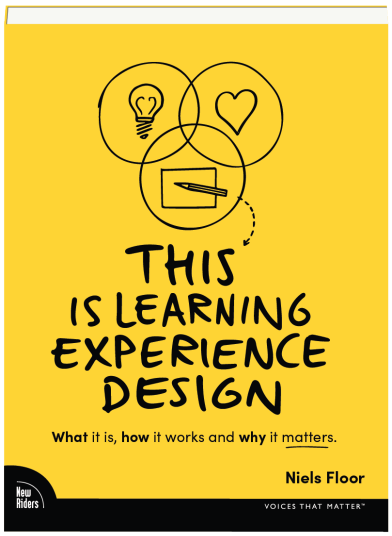
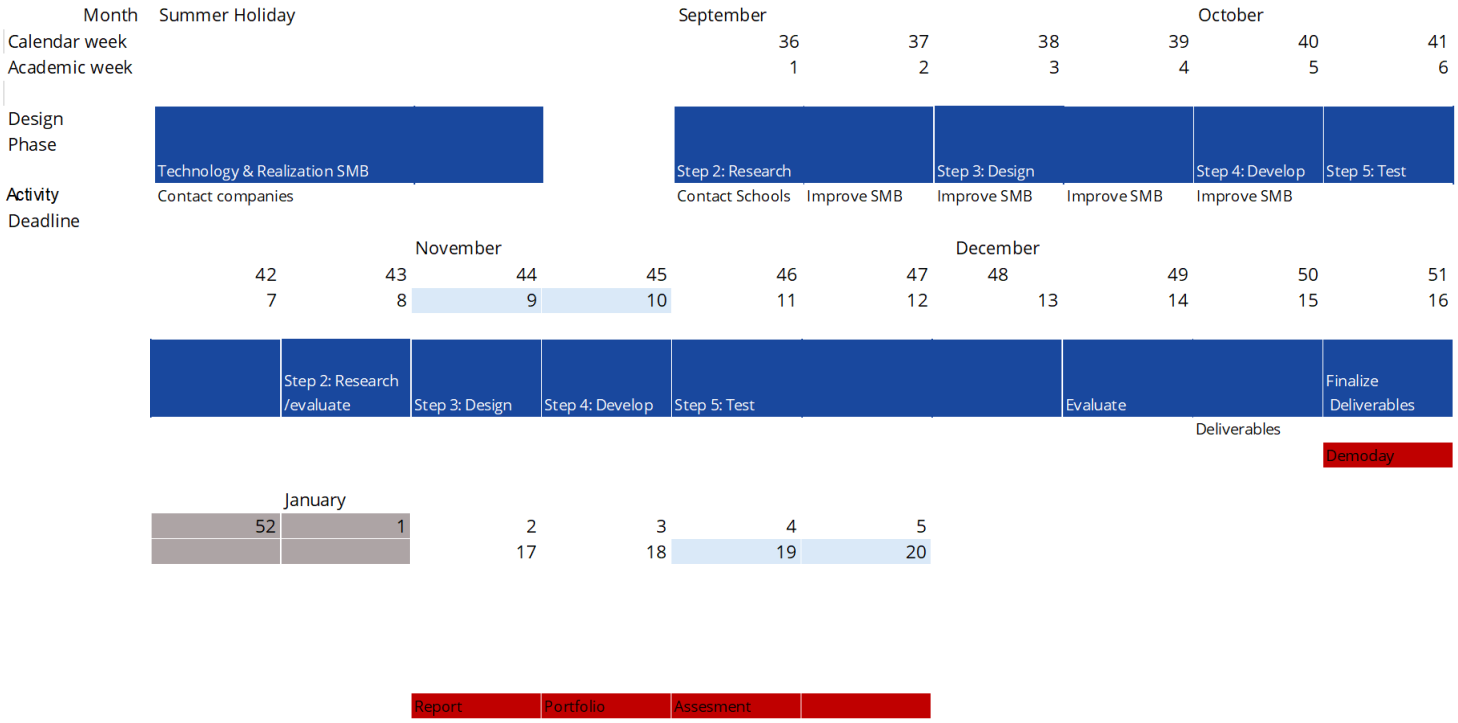


Figure 19: Learning Experience Design book (Floor, 2023a)

Planning

The planning gives a global overview of the phases of the project. The description of each phase will detail which questions will be addressed. One iteration will be done.



Technology & Realization SMB:
Improving and realizing the Social Media Battle game requires T&R specialization. Time during the holidays will be dedicated to finding a realization method and learning the basics of a program to realize the platform. Additionally, companies will be contacted for collaboration, and the ERB form for students will be addressed.

Step 2 research:
Much of the research into the topic and on learners was covered in the preparation project. However, in step 2 a thorough understanding of LX will be developed, and research into effective activities and methods for the learning experience will be conducted. Iterative Step 2 will involve evaluating the test performed in Step 5 and conducting additional research based on the findings.

Step 3: Design
The learning experience will be designed using research and collaboration with teachers and students. In the iterative step 3, the learning experience will be refined based on test results and additional research.

Step 4: Develop
The learning experience will be brought to life with all necessary tools and materials. Throughout the initial Steps 2, 3, and 4, the Social Media Battle game will be fully realized.

Step 5: Test
Testing the learning experience will be done two times: first, testing various methods and activities, and testing a fully designed and developed learning experience in the iterative step 5.

Goals

Learning experience designer (DRP, C&A, U&S)
In my aspiration to combine design and education, my goal is to become a learning experience designer. I will not become a LX designer overnight, nor after doing two projects. Mastering LXD requires thorough understanding and practice. Thoroughly applying LXD in my FMP will help me to deeply understand LXD and in becoming a LX designer.

Business & after graduation (B&E)
I want to learn to position the design and the learning experience within a business context. The final report will include a business-focused chapter, developed through learning business analysis methods and obtaining feedback from various companies.
This process also helps in exploring career paths after graduation. I can potentially start in design, embracing and using my expertise on education, or start in education, embracing and using my expertise in design. By involving companies in both fields, I can explore both fields, reflect upon it in my final reflection and decide upon a career path after graduation

Realizing Social Media Battle (T&R)
To fully realize the Social Media Battle game, I aim to specialize in technology and realization. The game will use a screen instead of a phone, requiring new skills to embed and realize this aspect. Additionally, a complete version of the digital game (BeYou platform) needs to be developed, likely using a program like Unity rather than Figma. Learning such a program and finding effective realization methods will be part of the goal, but also take time. This is therefore taken into account in the planning. This goal is achieved when a fully working prototype of the full game is made.

Risks

Two major risks are foreseen for the FMP:

1. Slow or No Contact
Risk: Testing the learning experience with Dutch high school students may be hindered by slow or no response from teachers due to high workload. Gathering feedback from companies may be hindered by slow or no contact as well.

Mitigation: Contact teachers directly at the project's start to set testing dates, or reach out to school principals or managers. For company involvement many companies will be contacted and excluded if responses are excessive.

2. Realization of Social Media Battle
Risk: The technological requirements or necessary skills for realizing the game might be too high.

Mitigation: Conduct extra research and work during the summer. If challenges persist, abandon the use of a screen and focus on realizing the platform.

Project Fit

In the FMP I aspire to further combine design and education, a domain relatively underrepresented in the department. The focus of the RDD track is to support specialization to succeed in a R&D or design department of a small-to-medium enterprise or multinational corporation by developing competencies in a domain relevant to this company or institution. Combining design and education, and achieving the goal of becoming a LX designer, increases the potential to work for a small-to-medium enterprise or corporation within this field. However, as mentioned in one of the goals, I am still exploring my path after graduation. I do know that I do not want to start in education as a teacher, but by achieving the goal of my role as designer it will clarify my unique position as designer within the R&D domain, aligning with the attitude needed in the track.

The department of Industrial Design has an innovative educational approach to educate students to become engineers that combine insights into different fields of knowledge, as integrators of visions and 'problemfinders', and the designers of intelligent systems, products and related services in a societal context (The Department, n.d.). By integrating various academic disciplines, projects are executed where "integration of emerging technology into everyday life" and "application of technology in a societal context" play a major rol (Mission, n.d.). In my FMP I will combine the academic fields, knowledge and disciplines of design and education, creating a service including an educational design for a societal context.

Throughout my studies, I slowly changed from doing projects that aimed for integration of emergent technology, towards projects that applied technology in a societal context. However, I do not see these two indistinguishable. In my vision I state technology can have a positive impact by seamlessly blending in with daily life, aligning with designing for integration of technology into everyday life. But to achieve this, enhancing digital literacy in society must be addressed first, aligning with the application of technology in a societal context. In the FMP I aim to address a problem and create a design in the form of a learning experience to be applied in a societal context. The result will hopefully aid in solving the problem, enabling conscious and responsible social media use, making sure users (students) can integrate this technology in their daily life in a meaningful way.

Conclusion

In this document I have outlined a proposal for my Final Master Project. In this project I aim to create a learning experience that makes use of the educational game Social Media Battle, enhances algorithmic literacy of social media algorithms in students aged 12 to 16 years old and enables them to apply this in daily life. By improving the Social Media Battle game from a Technology and Realization perspective, and using a Learning Experience Design approach, I will work on personal goals while achieving the design challenge. The FMP aligns with my personal professional identity and vision and fits within both the masters' track RDD and the departments mission.

References

Chris Voorkom. (2024, April 17). Workshop Mediawijsheid – Everybody Appy - Chris Voorkom. https://chrisvoorkom.nl/scholen/workshop-mediawijsheid-everybody-appy/

DUO onderwijsonderzoek & advies (2023, Oktober) Rapportage Digitale Geletterdheid in het VO. https://ecp.nl/wp-content/uploads/2023/12/Rapportage-ECP-Monitor-Digitale-Geletterdheid-VO-16-oktober-2023.pdf

Floor, N. (2023a). This is learning experience design: What It Is, How It Works and Why It Matters. New Riders Publishing.

Ministerie van Volksgezondheid, Welzijn en Sport. (2024, May 6). Verbetering basisvaardigheden 2024. Subsidie | Dienst Uitvoering Subsidies Aan Instellingen. https://www.dus-i.nl/subsidies/verbetering-basisvaardigheden-2024

Mediawijsheid | Digitale Geletterdheid | Alle soorten onderwijs. (2024, May 27). Digiwijzer. https://digiwijzer.nl/expertise/mediawijsheid/

Mission. (n.d.). https://www.tue.nl/en/our-university/departments/industrial-design/the-department/mission

Learning Experience Design. (2023, November 27). What is a learning experience? - Learning Experience Design. https://lxd.org/fundamentals-of-learning-experience-design/what-is-a-learning-experience/

The department. (n.d.). https://www.tue.nl/en/our-university/departments/industrial-design/the-department

Workshops VO | Beeld & Geluid. (n.d.). https://www.beeldengeluid.nl/onderwijs/workshops/vo

Appendices

Appendices start on the next page.

Appendix A
Design Brief

This document is a design brief for the project Preparation FMP in the second year of the Master Industrial Design at the Eindhoven University of Technology.

Project Overview

This section will provide context for the design project by outlining the problem & challenge that is going to be addressed, as well as identifying key stakeholders involved.

Children nowadays grow up in a world in which technology is developing at an extremely rapid pace. From an early age on they have been using digital technologies, like tablets, smartphones, laptops, and maybe even smart home devices. Moreover, the majority also make use of services and social media platforms, all before they start to think critically. In all these technologies, algorithms are playing a major role and have potential influence on their lives. This ranges from harmless influence like getting recommended a specific movie on Netflix, to possibly harmful influence on norms and values through recommended videos on social media. Several studies have indicated that postsecondary school students are unaware of the impact of algorithms on their everyday lives. Moreover, they lack an understanding of what algorithms are and the critical attitude to question algorithms and their impact. In sum, high school students lack algorithmic literacy, defined as "being aware of the use of algorithms in online applications, platforms, and services, knowing how algorithms work, being able to critically evaluate algorithmic decision-making as well as having the skills to cope with or even influence algorithmic operations" (Dogruel et al., 2021: 4).

Currently, the Netherlands is creating core objectives for Digital Literacy to be implemented in the core curriculum in secondary schools. That means that not much teaching material has been developed. On top of that, unfortunately, algorithmic literacy is not a specific element within digital literacy as described by SLO. It is touched upon within other domains, such as media literacy. However, algorithms, especially in the form of AI nowadays, are having a greater role in our lives. I think algorithmic literacy should be a domain in itself. In this project I want to create an educational design that addresses the lack of algorithmic literacy in high school students, and thereby also creating attention that algorithmic literacy is an important specific domain within digital literacy. I am aiming to create an educational design that enhances algorithmic literacy in high school students.

I am a designer who has experience in both design and in education. In order to combine these studies, I am going to take a learning experience design approach, based on the book from Niels Floor.

Project Approach

This section gives an short description of the approach that will be taken in this project.

This project aims to take a learning experience design approach for multiple reasons. Since the design is meant for educational purposes, it is important to incorporate learning and educational principles, which are embedded in the learning experience design approach. Moreover, the designer aims to combine design and education, which is possible by taking this approach. The intention is to learn and reflect upon the approach after the project, comparing it with existing approaches.

Besides the approach, it is important to keep an ethical attitude throughout the project, ensuring ethical aspects such as privacy, data security and inclusivity are continuously being considered, in sessions with human involvement (especially students) but also within the design.

How Might I?

A focused and actionable How Might I Question is proposed that outlines the project in a single question. Additionally, research questions are formulated that will be answered and help the creation of a design.

How might I, through educational design, enhance students (12-16) algorithmic literacy, that is "being aware of the use of algorithms in online applications, platforms, and services, knowing how algorithms work, being able to critically evaluate algorithmic decision-making as well as having the skills to cope with or even influence algorithmic operations" (Dogruel et al., 2021: 4)?

Because enhancing all aspects of algorithmic literacy through a single design is quite ambitious, the how might we question is split up in three sub-questions of which one will be chosen after the user-study.

- How might I design educational materials or experiences that effectively teach about, and make high school students aware of algorithms and their impact on daily life?
- How might I empower high school students to not only understand algorithms but also to have the skills to cope with or even influence algorithmic operations to shape their impact on themselves and/or society?
- How might I engage high school students in critical thinking and evaluation of algorithmic decision-making processes?

Additional Research questions:

- What is the current state of algorithmic literacy amongst students aged 12 to 16 years old?
- Are there specific aspects of algorithmic literacy that students have difficulty with?
- In what way is algorithmic literacy currently stimulated in education and what learning material does exist?
- How can design enhance algorithmic literacy?
    - Which innovative technologies and their interactions might enrich learning algorithmic literacy?

Target Users

The intended users of the design, including any relevant demographics or psychographics, are described.

The target users are high school students 12-16 years old. This is purposely a very broad target user group, since the intention of the design is that it can be used in schools in general, across a variety of grades and levels. Teaching material can be made alongside the design, suitable for the grade and level, but is out of scope of this project.

The existing level of algorithmic literacy and the specific challenges these students face in developing algorithmic literacy will be investigated through the creation of an empathy map (LXD), as well as studying the current algorithmic literacy by use of a yet to be determined research method.

Creating empathy maps will provide valuable insights into the specific needs, preferences, and challenges of this target user group. Additionally, conducting research to assess the current state of algorithmic literacy among these students will further inform the design process.

Overall, this approach ensures that the design is tailored to the needs of the target users while also allowing for scalability and applicability across different school settings.

Project Goals

The project Goals will outline what the project aims to achieve, distinguishing between personal and project goals.

Personal Goals regarding Expertise Areas:

- **Business / Companies (B&E)**

I want to explore my position as designer in a company as well learn how to position a design in a company, including creating a proper value proposition. For the latter I am going to apply yet to determine methods and include several companies to provide feedback upon the results. Eventually, my goal is to work together with a company in my FMP. During this preparation project I therefore am going to include companies and experts. Doing so has a twofold contribution: the companies involved can give an expert perspective on the current project and design, and by doing so with multiple companies I can find out which company would be suitable to do my FMP at. Companies will be involved by networking and reaching out to companies. This goal is achieved once I have found a company by the time I am going to write my FMP proposal.

- **Decision-making (DRP)**

I want to improve my decision-making skills based on too little information, to fasten the design process in comparison with earlier individual projects. It is what designing includes, which supports my design and research skills as a designer. To do so, after a concrete design direction is chosen, I am going to make a planning in which moments for design decisions are included and moments for a helicopter view upon the project are set. These reflection moments and the process up until that point in time will be discussed with the coach.

- **Design Principle (DRP, C&A, U&S)**

I want to be able to design from and apply different design principles. Therefore, I am going to learn and take inspiration from the design discipline learning experience design (LXD) and critically reflect upon the principle and its methodologies.

- **Technologies (T&R, M,D&C)**

I want to be able to create prototypes with the use of a variety of innovative technologies. Therefore, I want to learn and apply new innovative technologies I am not familiar with in my design and compare their pro and cons against the (existing) technologies I know.

- **Testing & Analysis (MDC):**

In line with learning LXD, as a designer I want to be able to apply a variety of user tests and testing methods including evaluation methods. Therefore, I want to learn user testing and evaluation methods I am not familiar with, which also holds new analysing methods. I am reflecting on and comparing these learned methods to the ones I am already familiar with.

Personal Goals regarding project:

- Professional Growth: Enhance my skills and expertise in educational design using a learning experience design approach, particularly in the area of algorithmic literacy.
- Contribution to Education: Make a meaningful impact on education by creating a design and experience that empowers high school students to navigate the digital world more effectively.
- Collaboration: Foster collaboration with educators, students, and stakeholders to co-create and refine the educational design solution.
- Innovation: Explore innovative approaches and technologies to enhance learning experiences and promote algorithmic literacy among high school students.
- Knowledge Sharing: Share my insights and findings with the educational community to contribute to the broader discourse on algorithmic literacy in schools.

Project goals:

- Enhance Algorithmic Literacy: create a design that improves high school students' awareness and understanding of algorithms, their impact on daily life, the ability to critically evaluate algorithmic decision-making processes and empower them to develop the skills necessary to cope with and influence algorithmic operations to shape their impact on themselves and society.
- Integration into Education: Create a design that can be integrated into the educational framework in secondary schools to support teaching digital/algorithmic literacy in the curriculum.
- Accessibility: Ensure that the educational design solution is accessible and adaptable for use in various school settings, accommodating different grade levels, learning styles, and technological capabilities.
- Evaluation and Improvement: Continuously evaluate the effectiveness of the educational design solution through feedback from students, teachers, and stakeholders, and iterate based on insights gathered to enhance its impact.

Succes criteria

This section specifies measurable criteria for evaluating the success of the design solution.

1. **Increase in Algorithmic Literacy**: Measure the improvement in high school students' Algorithmic literacy, that is:
    a. **Awareness and Understanding**: Measure the improvement in awareness and understanding of algorithms and their impact through pre- and post-assessments, surveys, or interviews.
    b. **Critical Thinking Skill Development**: Assess the development of students' critical thinking skills related to algorithmic decision-making through observation, self-assessment, or feedback from teachers.
    c. **Empowerment and Influence:** Measure students' perceived ability to cope with and influence algorithmic operations through self-assessment surveys or interviews.
2. **Implementation in Education:** Determine the extent to which the educational design solution can be integrated into the curriculum or utilized in educational settings through documentation, or feedback from schools or companies.
3. **Design Evaluation:** Apart from the intended goal of the design and the corresponding success criteria, also evaluate the design on several aspects, such as aesthetics, usability, intuitiveness, business opportunities and level of engagement by use of surveys or through qualitative feedback from teachers, students, companies and other stakeholders.

Reasoning:

1. **Increase in Algorithmic Literacy:** The breakdown of this criterion into three sub-categories (awareness and understanding, critical thinking skill development, empowerment and influence) provides a comprehensive framework for assessing the impact of the educational design solution on students' algorithmic literacy. It covers both cognitive and affective aspects of learning, which is essential for evaluation.
2. **Implementation in Education**: This criterion is crucial for evaluating the practicality and feasibility of the design solution within educational settings. By documenting the extent of integration and gathering feedback from schools or companies, I will be able to assess the potential for scalability and adoption.
3. **Design Evaluation**: Evaluating the design on various aspects such as aesthetics, usability, intuitiveness, business opportunities, and engagement provides valuable insights into the effectiveness and appeal of the design solution. This criterion ensures that the design not only meets its intended goals but also resonates with its target users and stakeholders.

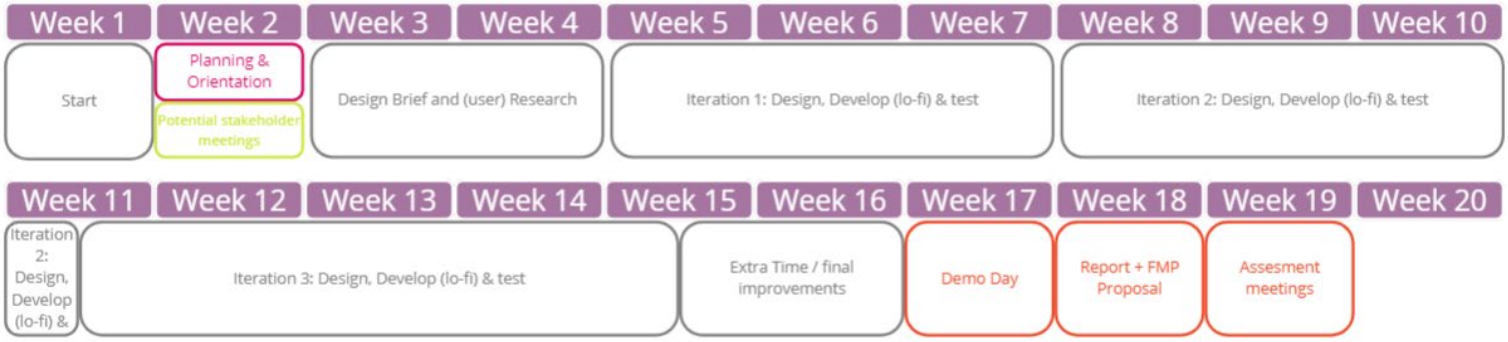
Resources

This section will detail the resources available for the project, including people, tools, and materials.

1. People:
    a. Direct stakeholder: EckartCollege Eindhoven:
    This secondary school includes mavo, havo and vwo and is very proactive in collaboration and innovation in education. People involved at Eckart are Jeroen van Eijl, teacher media literacy, and other teachers (as part of the new AI Team). They will provide insights in the context in which the design will be used, as well as experience in education and possibly teaching materials that they already use. Since the design will be made in collaboration with them, teachers will provide continuous feedback in the design process from their perspective and expertise as teachers. Moreover, students from Eckart will be involved in user-testing the design solution.
    b. Other schools/teachers/students:
    The intention of the design is that it will be made to be accessible and adaptable for use in various school settings, accommodating different grade levels, learning styles, and technological capabilities. Therefore, other schools within the personal network of the designer will be contacted, and their teachers and where possible students will be involved in the project as well.
    c. Experts/Companies:
    Experts and companies will be involved to give feedback on several aspects of the design. Experts in the field of education or specifically algorithmic literacy will be involved to address the learning goals the design will stimulate and the way it creates an experience to achieve this. Companies will be involved in discussing business aspects of the design solution and to discuss opportunities, value, and the placement of the design in a company.
    d. Teachers/Coaches:
    Teachers and coaches will be involved to provide feedback on the process and design choices. They will use their experience in design to do so.
2. Materials & Tools:
    It is not clear yet what materials and tools will be needed to create the design solution. However, it is highly possible that this will be a combination of hardware and software, so the right tools to create this need to be determined. An innovative technology analysis will be done to make decisions on what technologies can be used for the design, and accordingly what tools are needed for making use of these technologies and how they can be obtained. The faculty of Industrial Design provides many possibilities to make use of tools and materials.

    Tip: Consider providing more details about the criteria that will be used to evaluate and select the tools and technologies, such as compatibility with educational objectives, accessibility, and ease of use.

3. Time:
   See planning:



In the detailed planning, several moments to monitor the progress of the project are included.

Constraints

Any limitations or constraints that may impact the design process or solution are listed.

Time

There is a time limit for this project, for which a planning is made. There are several timeframes I created in this planning to adhere to. Moreover, deadlines for this project are DemoDay and the Report deadline, which are in week 17 and week 18. In terms of flexibility, I incorporated a week and a half extra time in case this is needed.

Technological constraints

It has yet to be determined if and what technology is going to be used in the design. A possible constraint could be that technology will be used that the designer has no(t yet) knowledge about. However, since this is a project in which it is intended to learn, the designer will study and apply this technology. It is possible that the design solution is a stand-alone and new product, but also that it can be integrated into existing systems or platforms. A second technological constraint is then that the infrastructure on high schools do not allow the design solution to be implemented, which is an aspect to consider in the process.

Tip: It's important to have a plan in place for addressing these challenges and acquiring the necessary knowledge and skills.

Educational constraints

The curriculum in the Netherlands does not include algorithmic literacy specifically. It is interwoven with existing learning materials on digital literacy. However, to meet educational standards, it is best to take a look at existing learning objectives to see whether the design solution matches these, although it focusses on algorithmic literacy. Secondly it is good to think about how the design will accommodate different learning styles, grade levels, and educational contexts. Moreover, the design should be inclusive and accessible to all students.

Stakeholder (as resources) constraints:

Teachers as stakeholders are also resources in this project. However, their participation is voluntary besides their job as a teacher. Due to their job, their time and effort for this project is constrained and an aspect to consider.

For the design solution, I need to reflect upon the level of depth which is required for my study. The stakeholders, as in the schools, their expectations will be fulfilled very quickly while the design does not even achieve the required depth, like my previous project.

Ethical Constraints:

The design process and design solution should prioritize ethical considerations, including privacy, data security, and inclusivity, to ensure a responsible process and implementation and usage of the design.

Assumptions

A list of assumptions about the project, design, stakeholders or target users.

User Behavior Assumptions

- The students aged 12-16 years old lack algorithmic literacy.
    - They lack algorithmic awareness and knowledge.
    - They lack a critical attitude towards algorithms and their use.
    - They lack the understanding of how to influence algorithms.
- The students prefer an innovative way of teaching over traditional teaching on algorithms.
- It does not matter for the students what innovative way is being used, as long as it is not traditional teaching it is better.
- Students' reading skills are very poor, so the design should not include too much reading.

Tip: explore the reasons behind students' lack of algorithmic literacy and their specific preferences for innovative teaching methods.

Technology Assumptions:

- Not every school has access to innovative technologies such as VR.
- It is possible to integrate generative AI into the design solution.
- There is a baseline level of technological proficiency among teachers and students that will facilitate the adoption and implementation of the design solution.

Educational Assumptions:

- The design solution will not create algorithmic literacy in these students but supports the creation and/or stimulates it.
- It is better to create a design that is made for group use, or involves multiple people, since collaboration is one of the aspects it would then also support. Moreover, collaborative learning is proven to be effective.

Stakeholder assumptions

- The stakeholders (schools & teachers) are very easily satisfied with a solution that only helps a bit in their teaching, since there is a limit to learning material on this. Besides, not many teachers feel confident in teaching algorithmic literacy.

Tip: It's important to consider strategies for effectively engaging and persuading stakeholders of the value and importance of algorithmic literacy education.

Ethical Assumptions:

The design solution will prioritize ethical considerations, including privacy, data security, and inclusivity, to ensure responsible implementation and usage.

Risks

Potential risks or challenges that may arise during the design process or implementation of the solution are identified and addressed.

User-acceptance risks:

There may be resistance or reluctance among students or teachers to adopt the design solution, particularly if it diverges significantly from traditional teaching methods.

Mitigation: Conduct user testing and gather feedback early in the design process to identify and address potential usability issues and concerns.

Technical Risks:

Technical solutions are difficult to learn, the innovative technology does not add value to teaching algorithmic literacy, or the technology does not fit within the dimensions of the design.

The technology in the design is too expensive for schools to integrate, or it is too difficult for schools to implement.

Mitigation: a choice for an innovative technology will be made based on its value to the learning experience, and a planning to learn and apply this technology will be created. A business plan including costs for schools will be made, and the design will be crafted such that it is understandable for teachers as well as students.

Resource risks:

Any resources will not be available, for whatever reason, in due time to create a design, which impacts the planning of the project.

Mitigation: resources and their availability will be investigated; the planning will be changed accordingly.

Schedule risks:

Seeking contact and arranging meetings with experts, stakeholders and or schools will slow down the process of the project.

Technological difficulties, or difficulties while creating the design will slow down the process.

Mitigation: more stakeholders will be involved; sessions will be planned early and the intention of these sessions will be adopted to what is needed in this phase of the project.

Dependency Risks:

The project's success may be dependent on the timely delivery of external dependencies, such as data sources, software licenses, or approvals.

Mitigation: Identify critical dependencies early in the project and establish clear communication channels with external stakeholders to minimize delays and ensure timely delivery.

External risks:

The ERB form for children will take longer time to be approved since it has to go through the ethics board, which could influence the planning.

The developments and regulations in technology, especially in AI, could have an impact on the design, since these technologies or regulation might change the application of algorithms.

Mitigation: create an ERB as quick as possible for student involvement, as well as keeping up with the developments of technological advances and regulations.

Quality risks:

Not scoping the project down to a more narrow part of algorithmic literacy could impact the design process, in not really knowing what to actually design.

Since the designer is also learning to apply new knowledge, such as new ways to study usability, business opportunities etc., there is a risk that these studies will leverage false data.

Mitigation: Scope the project according to the planning, and make choices to try and learn, instead of validating choices.

References:

Leyla Dogruel, Philipp Masur & Sven Joeckel (2022) Development and Validation of an Algorithm Literacy Scale for Internet Users, Communication Methods and Measures, 16:2, 115-133, DOI: 10.1080/19312458.2021.1968361

Appendix B
User-study set-up & Results Empathy Map

This document is a set-up for a user-study I will conduct for my M2.1 Preparation FMP project at the faculty of Industrial Design at the Eindhoven University of Technology. The user study is meant to get a better understanding of the users of the final design and thereby improve the quality of this design. The study involves a short interview about their experience with algorithmic literacy in education, but mostly focusses on co-creating an empathy map for the learners: the students. Students may not experience difficulties with algorithms or their algorithmic literacy, but as studies indicate there is actually a lack of it. As teachers have a general understanding and overview of the skills of their students, an empathy map will be made with teachers. Possibly, empathy maps will also be created with students, to see if there are any interesting differences between the results and how the design can evolve around these differences.

Introduction (2 min)

Welkom, Ik ben Yorn Thijssen, en zit in het laatste jaar van mijn master Industrial Design op de TU/e. Dit doe ik in combinatie met de lerarenopleiding, die ik voornamelijk vorig jaar heb gevolgd. In dit laatste jaar doe ik twee projecten, waarvan dit project ter voorbereiding dient voor mijn afstudeerproject.

In dit voorbereidend project wil ik de combinatie opzoeken tussen mijn twee opleidingen. Ik wil een ontwerp gaan maken dat in het onderwijs gebruikt kan worden, dat mogelijk op zichzelf staat, of waar mogelijk onderwijs bij ontwikkeld zou kunnen worden.

Het onderwerp waarvoor ik een ontwerp wil gaan maken gaat in op algoritmische geletterdheid. Nu kennen jullie de termen digitale geletterdheid, en hebben jullie wellicht een beeld van, maar om het concreet te maken, algoritmische geletterdheid is geformuleerd als: "**Bewust zijn van** het gebruik van algoritmes in online toepassingen, platforms en diensten, **weten** hoe algoritmes werken, in staat zijn om **kritisch te evalueren** hoe algoritmische besluitvorming plaatsvindt, en ook de **vaardigheden** hebben om om te gaan met of zelfs **invloed** uit te oefenen op algoritmische operaties". (Dogruel et al., 2021). Dit is een zere brede term, die ook niet dusdanig is terug te vinden in digitale geletterdheid zoals beschreven door SLO. Het zit verweven in de nieuwe kerndoelen, veel in het gedeelte *mediawijsheid*. Algoritmes gaan echter veel verder dan alleen media, en zelf vind ik het daarom ook een onderdeel dat iets meer aandacht mag verdienen, zeker gezien de huidige en zeer snelle ontwikkelingen op dit gebied.

Een ontwerp maken dat dit allemaal aankaart is vrij lastig, en daarom wil ik dit een stuk verkleinen, zodat het ontwerp aan algoritmische geletterdheid bijdraagt. Dit wil ik met jullie gaan doen door jullie een paar vragen te stellen, en door de algoritmische geletterdheid van de leerling in beeld te krijgen zoals jullie als docenten dat zien, d.m.v. een Empathy Map. Hier leg ik later meer over uit. Wellicht en hopelijk laten de vragen en/of het invullen van de empathy map jullie ook nadenken over bepaalde aspecten of geeft het bepaalde inzichten waar jullie ook wat mee kunnen.

Leyla Dogruel, Philipp Masur & Sven Joeckel (2022) Development and Validation of an Algorithm Literacy Scale for Internet Users, Communication Methods and Measures, 16:2, 115-133, DOI: 10.1080/19312458.2021.1968361

Interview Questions (10 min)

Because Algorithmic Literacy is not a standard domain to have integrated in Dutch curricula, but digital literacy is, several questions will go into digital literacy.

With 1 or 2 teachers: oral interview.

1. Kan je wat over jezelf vertellen en over je ervaringen als docent en eventuele andere neventaken binnen het onderwijs?
2. Wordt er aandacht besteed aan digitale geletterdheid op deze school? Op welke manier?
3. Heb je een rol t.a.v. digitale geletterdheid op deze school? Zo ja, wat is deze? Zo nee, hoe probeer je digitale geletterdheid in jouw lessen te verwerken?
4. Na het horen van het begrip algoritmische geletterdheid (herhalen indien nodig), wordt er op deze school aandacht aan (een van de) aspecten van algoritmische geletterdheid besteed? Op welke manier?
5. Na het horen van het begrip algoritmische geletterdheid, hoe algoritmisch geletterd zou u uzelf inschatten op een schaal van 0-100? Waarom dit getal?

With 3 or more teachers: written interview.

1. Leeftijd
2. Voor welk vak bent u docent, en heeft u nog andere neventaken binnen het onderwijs?
3. Hoeveel jaar ervaring heeft u in het onderwijs?
4. Wordt er aandacht besteed aan digitale geletterdheid op de school waar u werkzaam bent?
    a. Ja: Op welke manier?
    b. Nee: wat is de reden dat er geen aandacht aan wordt besteed?
5. Heeft u een rol t.a.v. digitale geletterdheid op de school waar u werkzaam bent?
    a. Ja: wat houdt deze rol in?
    b. Nee: hoe probeert u digitale geletterdheid in uw lessen te verwerken?
6. Na het horen/lezen van het begrip algoritmische geletterdheid (herhalen indien nodig), wordt er op de school waar u werkzaam bent aandacht aan (een van de) aspecten van algoritmische geletterdheid besteed?
    a. Ja: op welke manier?
    b. Nee
7. Na het horen/lezen van het begrip algoritmische geletterdheid, hoe algoritmisch geletterd zou u uzelf inschatten op een schaal van 0-100?
    a. Toelichting

Empathy Map (max 25 min)

Zoals ik al benoemde wil ik de algoritmische geletterdheid van leerlingen in beeld brengen zoals jullie die als docenten zien en ervaren. Hierbij gaan we gebruik maken van een Empathy Map, waarin acht driehoeken te zien zijn met ieder een vraag. We starten bij: Wie is de leerling en gaan met de klok mee met het beantwoorden van de vragen. Voor iedere vraag stel ik 2 minuten in, waarna we positieve en negatieve aspecten opschrijven die de leerling (de)motiveren om algoritmische geletterdheid te leren. Deze aspecten kunnen vrij vaak uit de antwoorden van de 8 vragen gehaald worden.

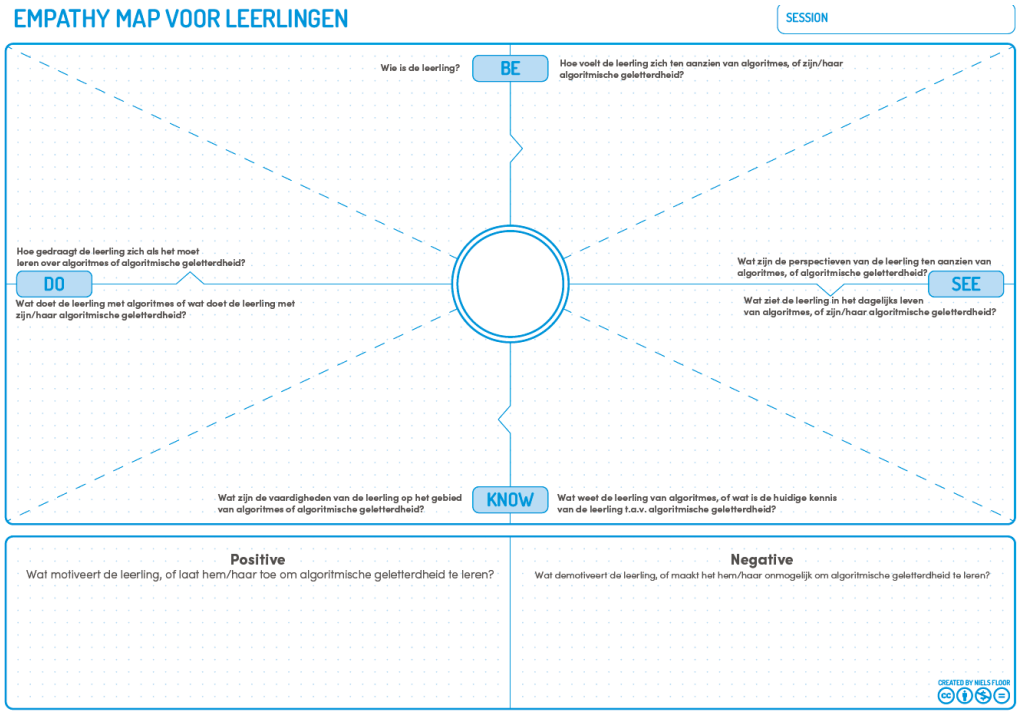
Het invullen van deze map gebeurt met een leerdoel in gedachte, en logischerwijs is deze leerdoel het creëren of verbeteren van algoritmische geletterdheid.

De vragen:

- Wie is de leerling?
- Hoe voelt de leerling zich ten aanzien van algoritmes of zijn/haar/hen algoritmische geletterdheid?
- Wat zijn de perspectieven van de leerling ten aanzien van algoritmes of algoritmische geletterdheid?
- Wat ziet de leerling in het dagelijks leven terug op het gebied van algoritmes of zijn/haar algoritmische geletterdheid?
- Wat weet de leerling van algoritmes of wat is de huidige kennis van de leerling t.a.v. algoritmische geletterdheid?
- Wat zijn de vaardigheden van de leerling op het gebied van algoritmes of algoritmische geletterdheid?
- Wat doet de leerling met algoritmes of wat doet de leerling met zijn/haar/hen algoritmische geletterdheid?
- Hoe gedraagt de leerling zich als het moet leren over algoritmes of algoritmische geletterdheid?

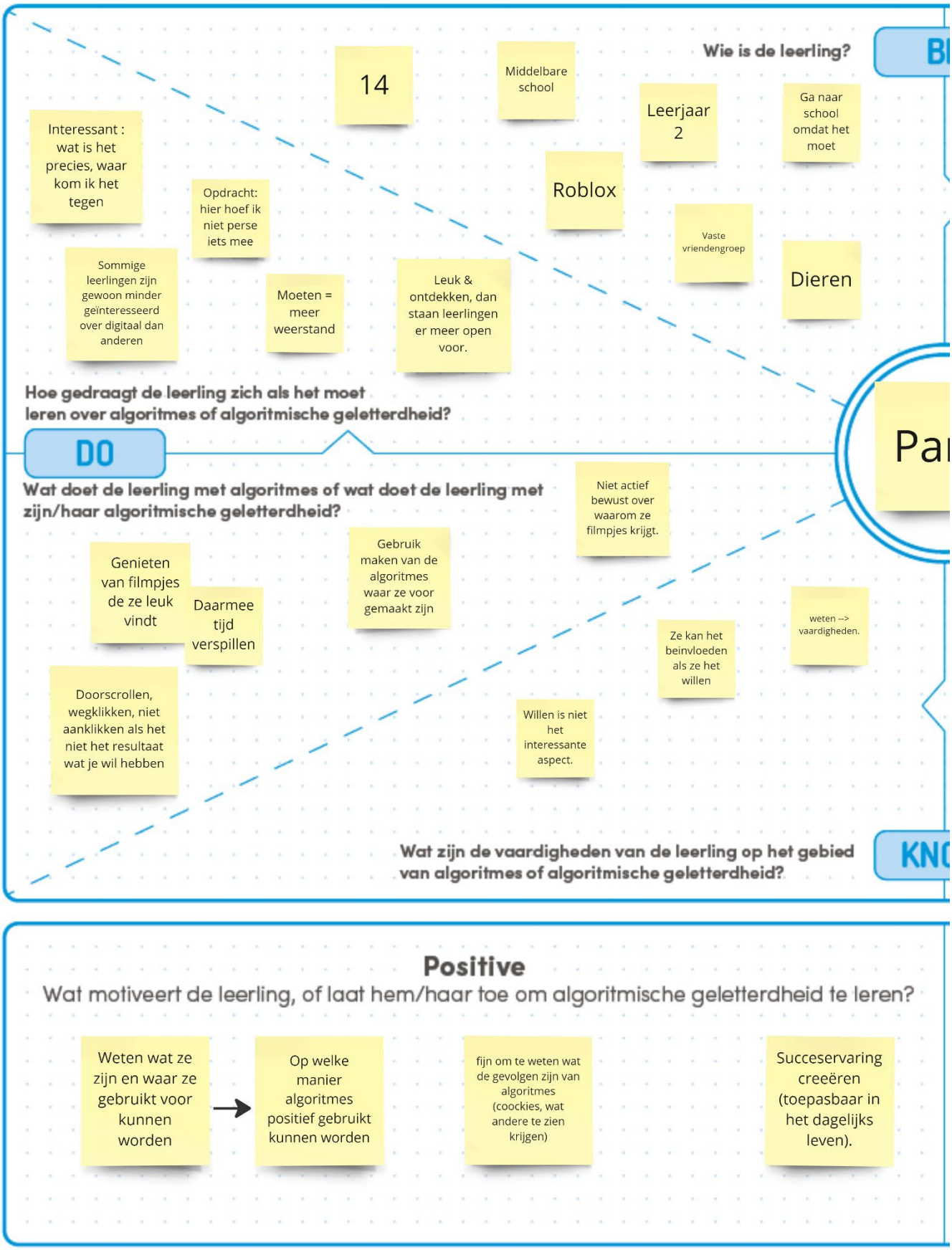
Positief: wat motiveert de leerling, of laat hem/haar/hen toe om algoritmische geletterdheid te leren?

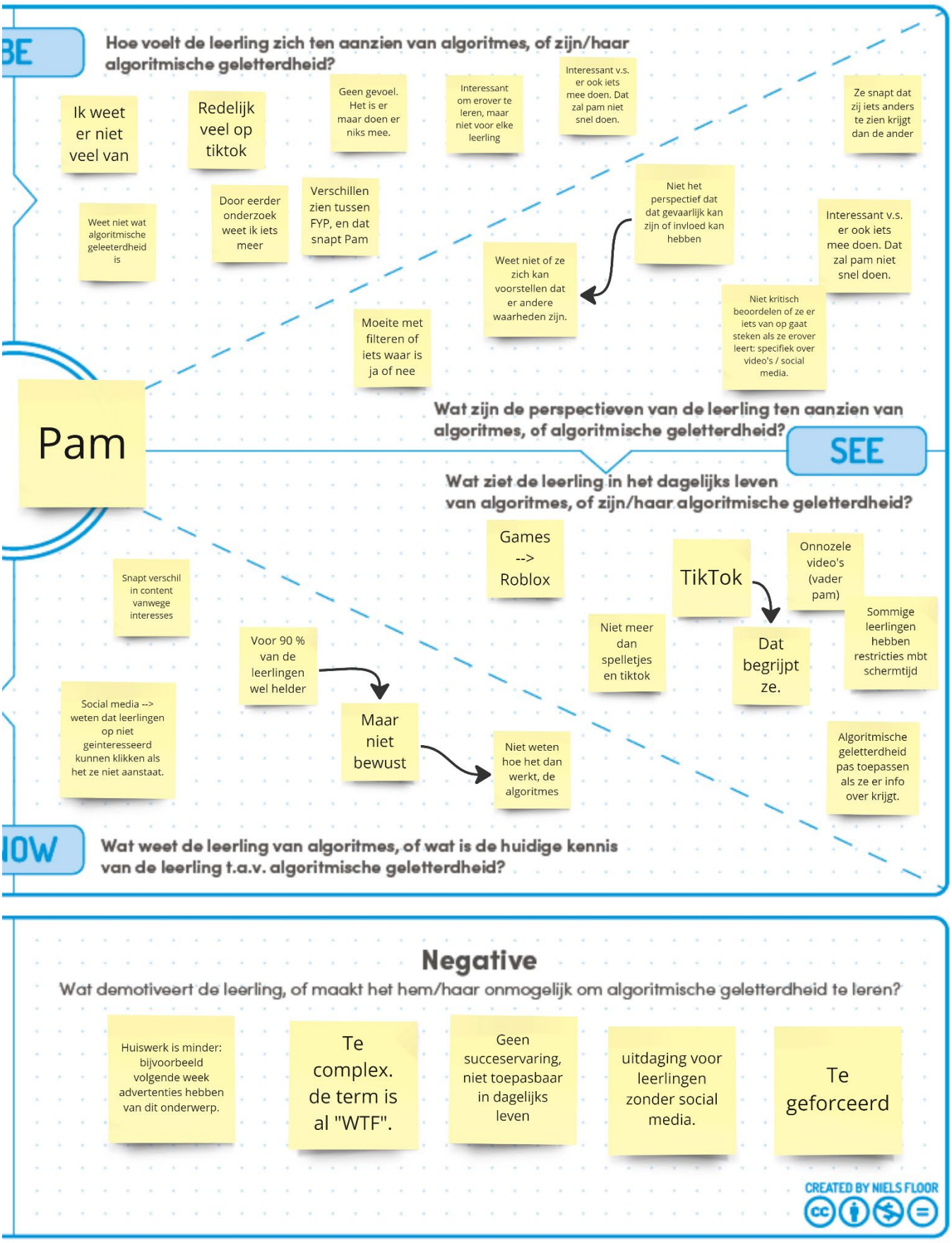
Negatief: Wat demotiveert de leerling, of maakt het hem/haar onmogelijk om algoritmische geletterdheid te leren.



Results Empathy mapping:

Empathy map 1, with teacher.



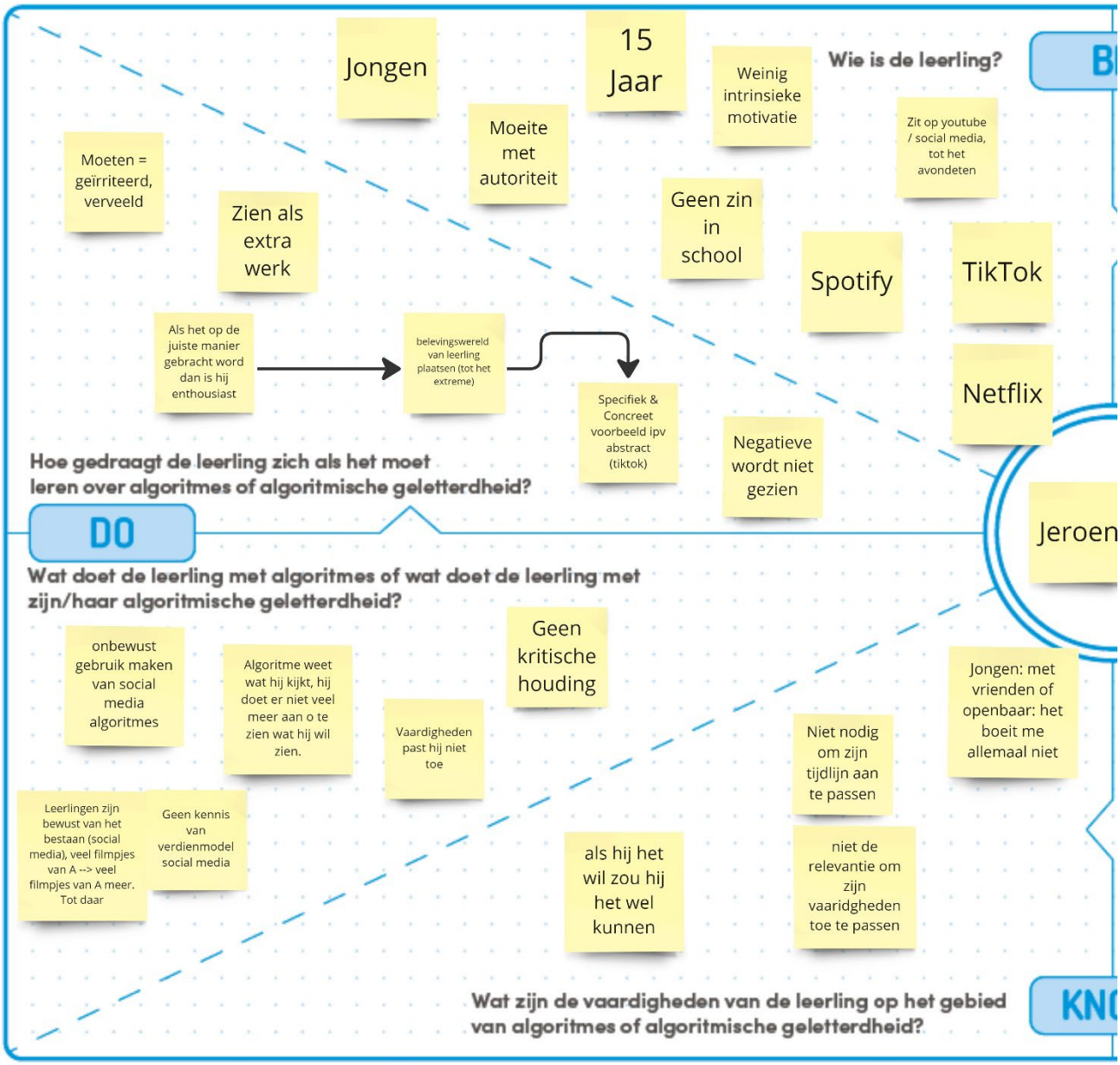


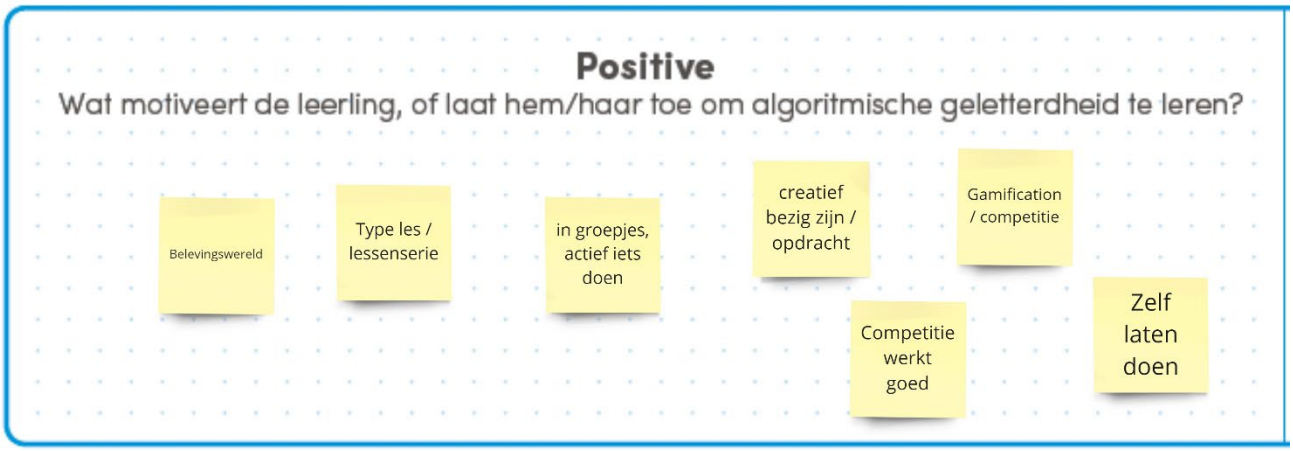
Negative

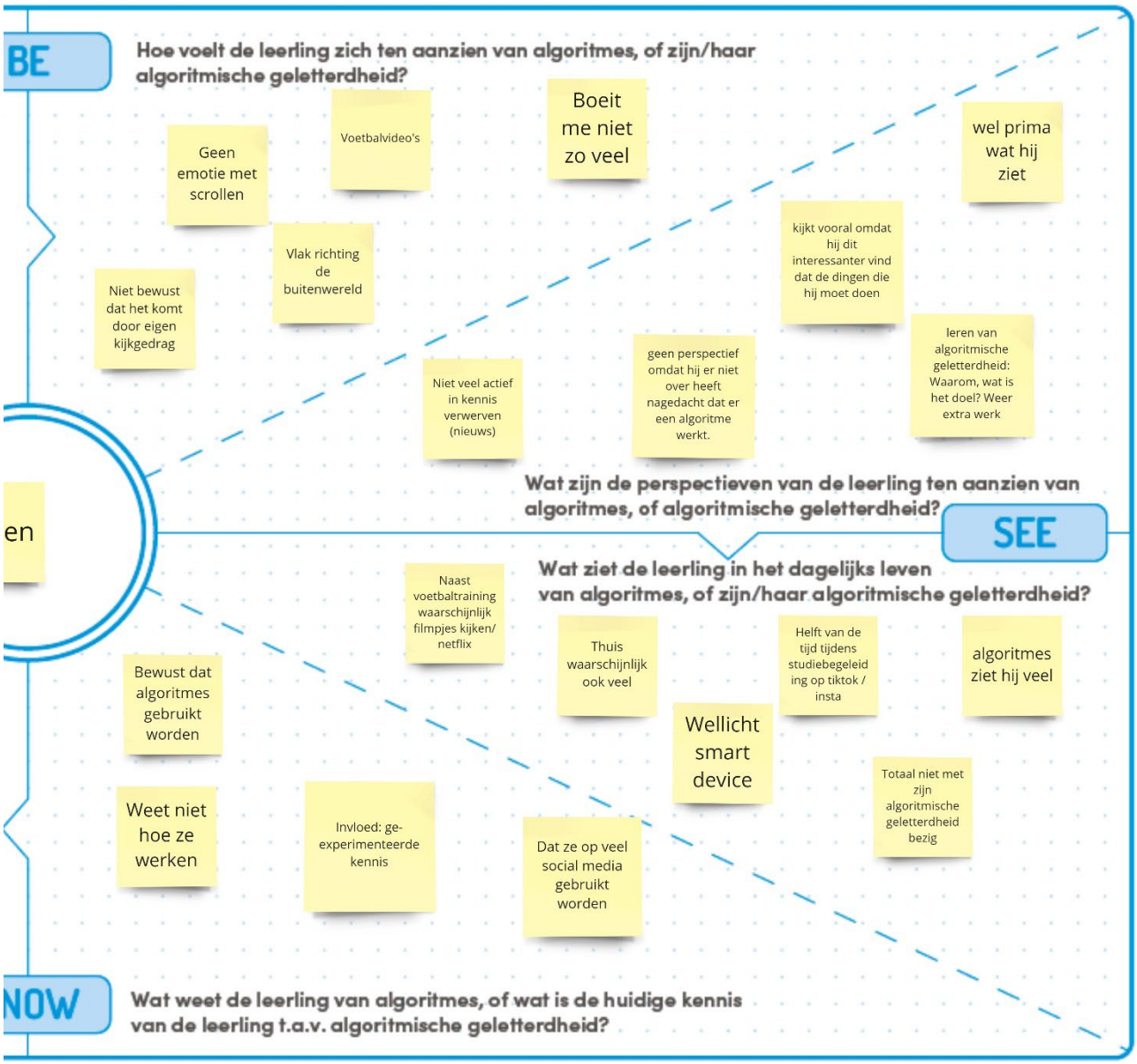
Wat demotiveert de leerling, of maakt het hem/haar onmogelijk om algoritmische geletterdheid te leren?

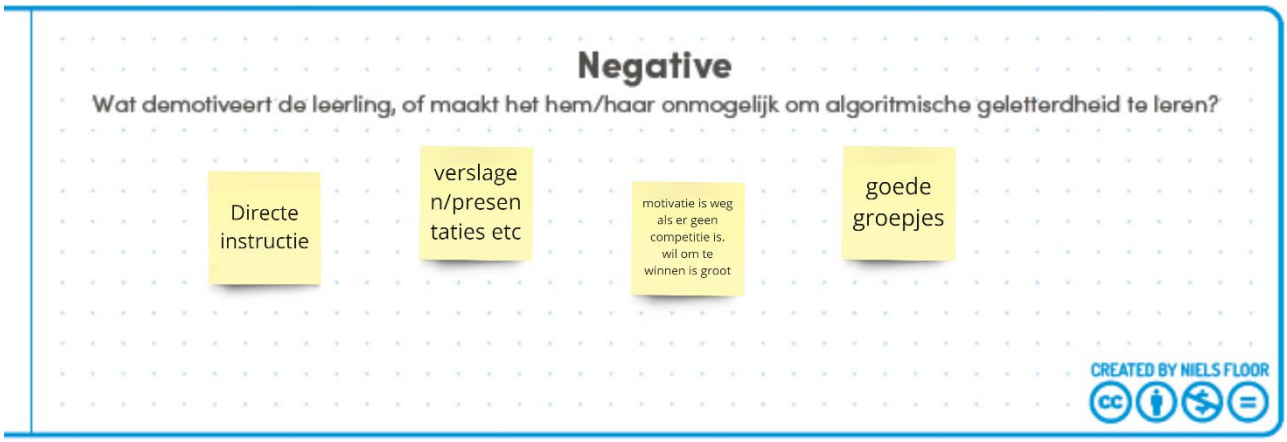
- Huiswerk is minder: bijvoorbeeld volgende week advertenties hebben van dit onderwerp.
- Te complex. de term is al "WTF".
- Geen succeservaring, niet toepasbaar in dagelijks leven
- uitdaging voor leerlingen zonder social media.
- Te geforceerd

Empathy map 2, with (student) Teacher.

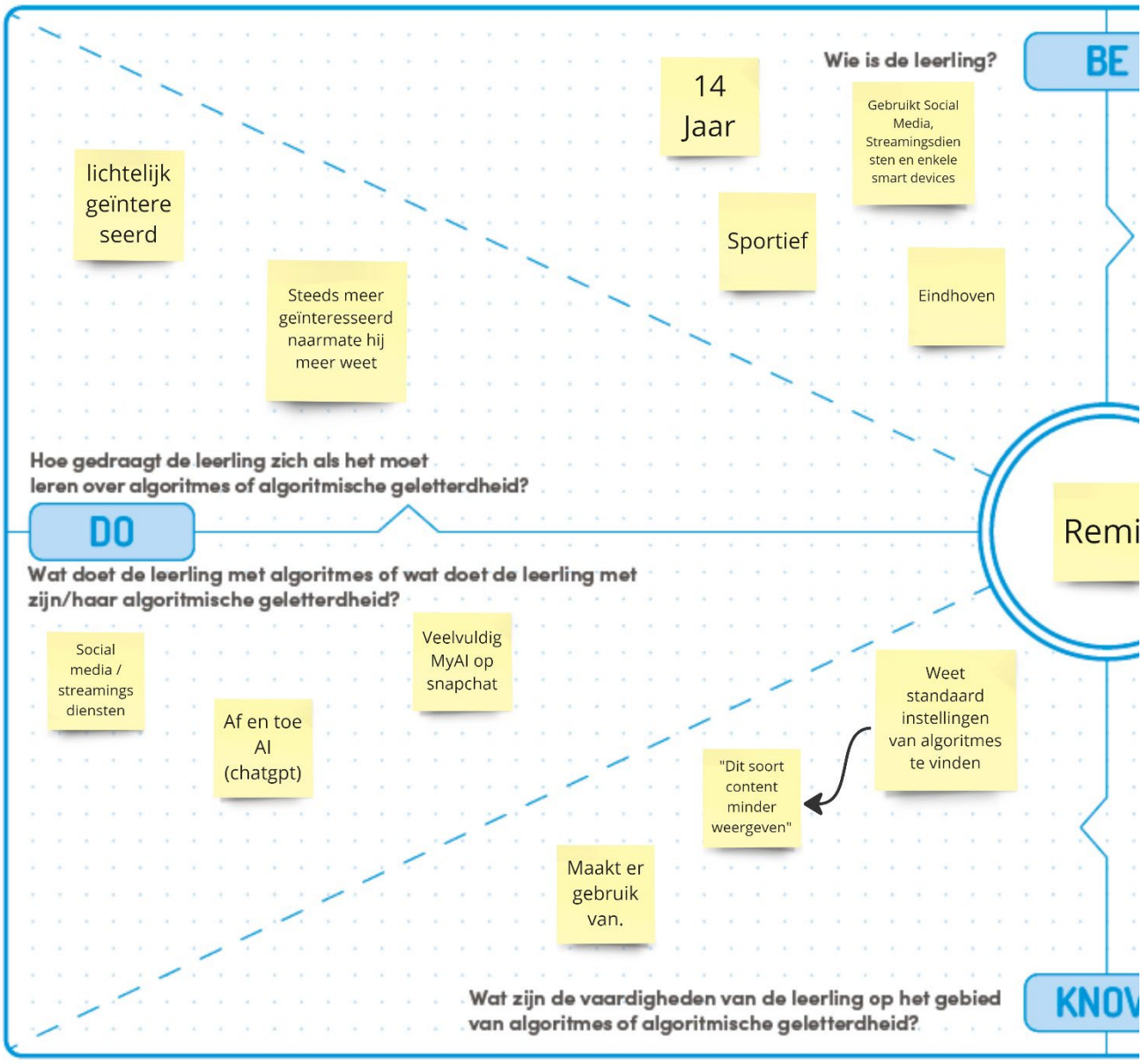


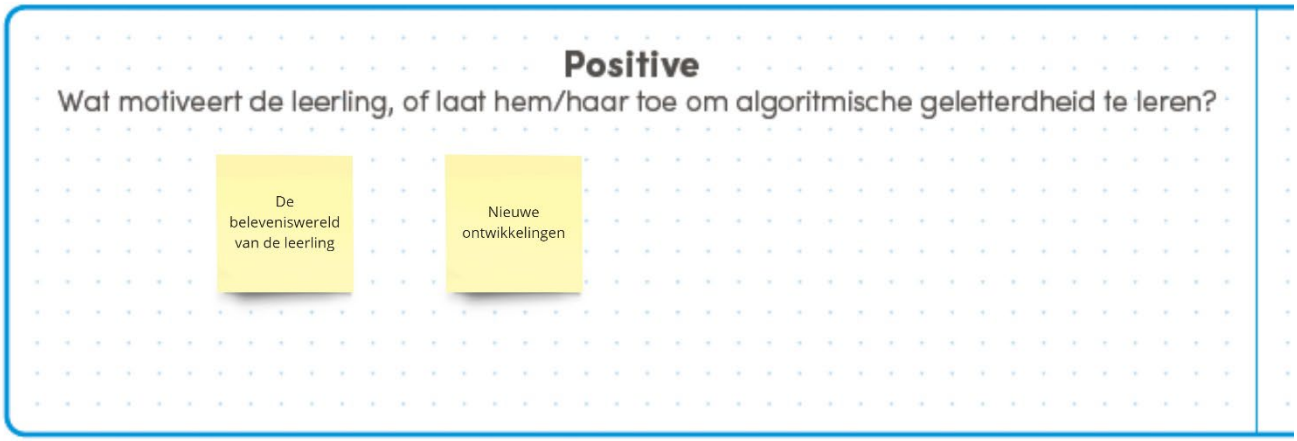


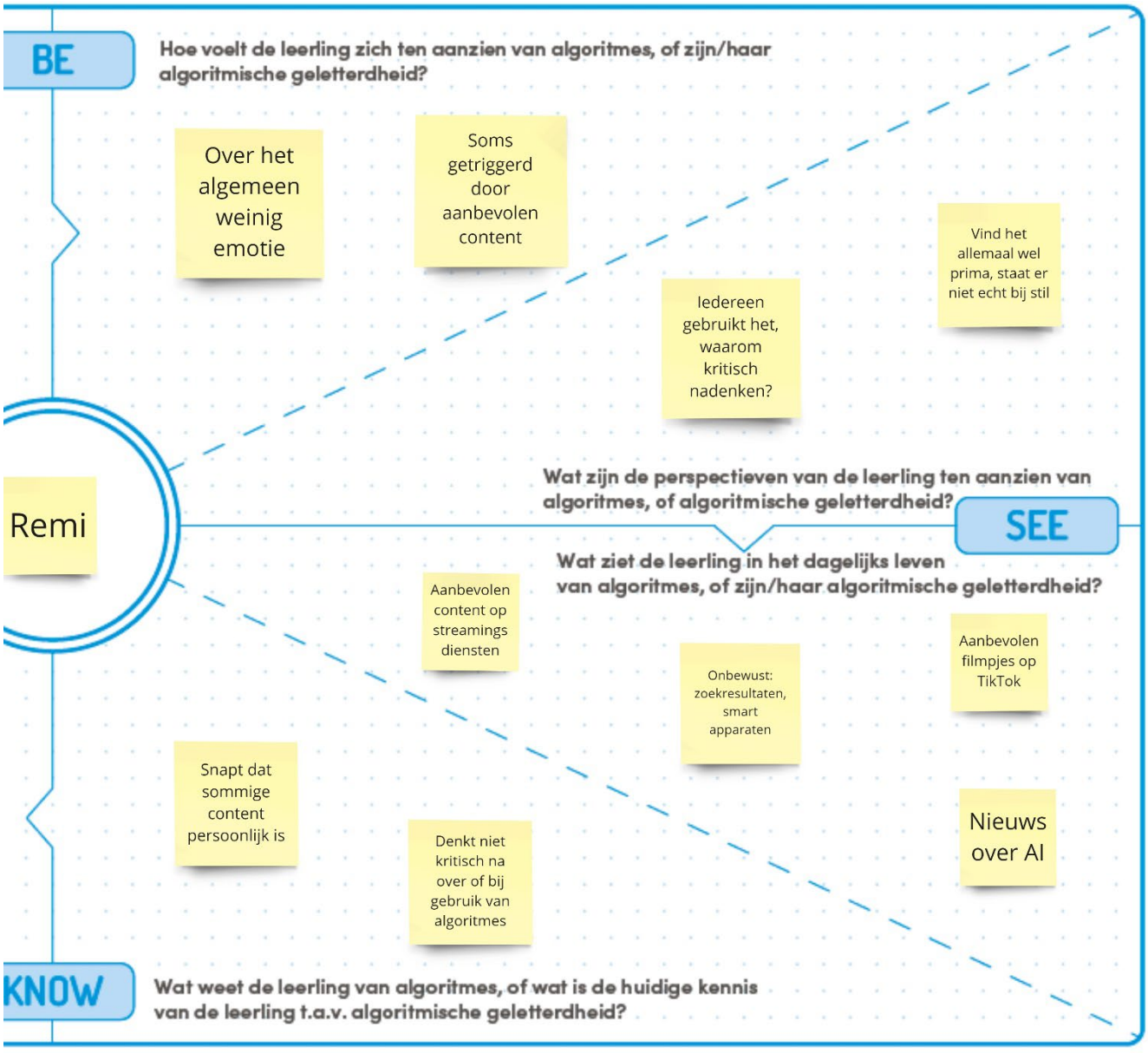

BE
Hoe voelt de leerling zich ten aanzien van algoritmes, of zijn/haar algoritmische geletterdheid?
Geen emotie met scrollen
Voetbalvideo's
Boeit me niet zo veel
wel prima wat hij ziet
Vlak richting de buitenwereld
kijkt vooral omdat hij dit interessanter vind dat de dingen die hij moet doen
Niet bewust dat het komt door eigen kijkgedrag
leren van algoritmische geletterdheid: Waarom, wat is het doel? Weer extra werk
Niet veel actief in kennis verwerven (nieuws)
geen perspectief omdat hij er niet over heeft nagedacht dat er een algoritme werkt.
Wat zijn de perspectieven van de leerling ten aanzien van algoritmes, of algoritmische geletterdheid?
SEE
Wat ziet de leerling in het dagelijks leven van algoritmes, of zijn/haar algoritmische geletterdheid?
Naast voetbaltraining waarschijnlijk filmpjes kijken/ netflix
Thuis waarschijnlijk ook veel
Helft van de tijd tijdens studiebegeleiding op tiktok / insta
algoritmes ziet hij veel
Bewust dat algoritmes gebruikt worden
Wellicht smart device
Totaal niet met zijn algoritmische geletterdheid bezig
Weet niet hoe ze werken
Invloed: ge-experimenteerde kennis
Dat ze op veel social media gebruikt worden
NOW
Wat weet de leerling van algoritmes, of wat is de huidige kennis van de leerling t.a.v. algoritmische geletterdheid?


Negative
Wat demotiveert de leerling, of maakt het hem/haar onmogelijk om algoritmische geletterdheid te leren?
Directe instructie
verslagen/presentaties etc
motivatie is weg als er geen competitie is. wil om te winnen is groot
goede groepjes
CREATED BY NIELS FLOOR

Empathy map, 1st person perspective






BE
Hoe voelt de leerling zich ten aanzien van algoritmes, of zijn/haar algoritmische geletterdheid?
Over het algemeen weinig emotie
Soms getriggerd door aanbevolen content
Iedereen gebruikt het, waarom kritisch nadenken?
Vind het allemaal wel prima, staat er niet echt bij stil
Remi
Wat zijn de perspectieven van de leerling ten aanzien van algoritmes, of algoritmische geletterdheid?
SEE
Wat ziet de leerling in het dagelijks leven van algoritmes, of zijn/haar algoritmische geletterdheid?
Aanbevolen content op streamings diensten
Onbewust: zoekresultaten, smart apparaten
Aanbevolen filmpjes op TikTok
Snapt dat sommige content persoonlijk is
Denkt niet kritisch na over of bij gebruik van algoritmes
Nieuws over AI
KNOW
Wat weet de leerling van algoritmes, of wat is de huidige kennis van de leerling t.a.v. algoritmische geletterdheid?


?
Negative
Wat demotiveert de leerling, of maakt het hem/haar onmogelijk om algoritmische geletterdheid te leren?
Het is overal en wordt gebruikt door iedereen
Er is te veel om er over te leren
CREATED BY NIELS FLOOR

Appendix C

SWOT analysis emergent technologies for education

This document contains a SWOT analysis on emergent technologies and methods for education, conducted for the project Preparation FMP in the second year of the Master Industrial Design at the Eindhoven University of Technology. It was originally created in a table in Miro, but for readability reasons it has been transferred to a document.

Analysis set up:

This analysis has been conducted with inspiration from the use of ChatGPT. A selection of emergent technologies and methods for education was made. For each part of the SWOT analysis, the chatbot helped in formulating questions to be answered for each technology or method on the list. It also aided in answering the questions for each of them.

Questions:

Strengths:

1. How does the technology enhance student engagement and motivation in learning?
2. In what ways does the technology support active learning and hands-on exploration of concepts?
3. How does the technology facilitate personalized learning experiences to meet individual student needs?
4. How does the technology promote collaboration, communication, and critical thinking skills among students?
5. How does the technology enable the integration of real-world contexts and problem-solving activities into the curriculum?

Weaknesses:

1. What are the potential limitations or challenges in implementing the technology in educational settings?
2. How might the technology exacerbate existing educational inequalities or accessibility issues?
3. What technical skills or resources are required for teachers and students to effectively use the technology?
4. How might the technology distract from or detract from the core learning objectives or curriculum goals?
5. What are the ethical considerations or concerns associated with the use of the technology in education?

Opportunities:

1. How can the technology be leveraged to address specific educational needs or learning gaps?
2. What innovative teaching and learning strategies can be enabled by the technology?
3. What opportunities exist for collaboration with industry partners or experts to enhance learning experiences?
4. How can the technology be integrated with existing educational tools and resources to enhance their effectiveness?

Threats:

1. What are the potential risks or challenges in terms of data privacy and security when using the technology in education?
2. How might the rapid pace of technological change impact the relevance and sustainability of the technology in education?
3. What regulatory or policy barriers could hinder the adoption or implementation of the technology in educational settings?
4. How might the technology contribute to digital overload or screen time concerns among students?
5. What are the potential societal implications or unintended consequences of widespread adoption of the technology in education?

List of Technologies/Methods:

Virtual Reality (VR)

Virtual Reality (VR) is a technology that immerses users in a computer-generated environment, simulating physical presence in a digital world. Through specialized headsets and controllers, users can interact with and explore these environments in a 360-degree view, often feeling a sense of presence and engagement as if they were actually there. VR applications range from gaming and entertainment to training, education, and therapeutic uses.

Augmented Reality (AR) / Mixed Reality (MR)

Augmented Reality (AR) is a technology that overlays digital information onto the real world, typically viewed through a smartphone, tablet, or AR glasses. By blending digital elements with the physical environment, AR enhances users' perception of reality, offering interactive and immersive experiences that can range from gaming and entertainment to practical applications like navigation and education. It does so by adding contextual information, virtual objects, or interactive elements in real-time. Unlike AR, which overlays digital content onto the real world, Mixed Reality (MR) seamlessly integrates virtual objects into the user's physical surroundings, enabling more immersive and interactive experiences where virtual and real-world elements interact in real-time.

Generative Artificial Intelligence (genAI)

Generative artificial intelligence (generative AI, GenAI, or GAI is artificial intelligence capable of generating new data instances, such as text, images or other data, using generative models, often in response to prompts. Generative AI models learn the patterns and structure of their input training data and then generate new data that has similar characteristics.

Gamification

Gamification involves applying game design elements and principles to non-game contexts, such as education or business, to engage and motivate users. By incorporating elements like points, badges, leaderboards, and progress tracking, gamification aims to make tasks or activities more enjoyable and increase user participation and achievement. It leverages psychological mechanisms inherent in games, such as competition, collaboration, and feedback, to enhance motivation and drive desired behaviours.

Robotics

Robotics is a field of technology focused on the design, construction, operation, and use of robots to perform tasks autonomously or with minimal human intervention. Robots are programmable machines that can carry out a range of functions, from industrial automation and manufacturing to assistance in healthcare, exploration, and education. Advances in robotics have led to the development of increasingly sophisticated and versatile robots capable of interacting with and adapting to their environments.

Mobile Learning

Mobile learning, often abbreviated as m-learning, refers to the use of mobile devices such as smartphones, tablets, and laptops for educational purposes. It allows learners to access educational content, resources, and interactive activities anytime, anywhere, thus promoting flexibility and convenience in learning. Mobile learning leverages the portability and connectivity of mobile devices to facilitate personalized, on-the-go learning experiences that can complement traditional classroom instruction or serve as standalone learning solutions.

Tangibles (user interface)

Tangibles refer to physical objects or manipulatives used in educational contexts to facilitate learning experiences. These objects can include blocks, models, puzzles, or other hands-on materials that students can manipulate and interact with. Tangibles are often employed to enhance understanding, promote engagement, and foster experiential learning by providing learners with tangible representations of abstract concepts or ideas.

Tangible user interfaces refer to physical objects or elements that users can manipulate to interact with digital systems or applications. These tangible interfaces bridge the gap between the physical and digital worlds, enabling users to engage with technology through tactile interactions. Tangible interfaces often enhance user experiences by providing intuitive, hands-on interactions and can be particularly useful in fields such as education, gaming, and interactive design.

SWOT Virtual Reality

Strengths

1. **Increased motivation** for students **through Immersive learning experiences**
2. It allows to create visual immersive content to explain concepts, providing hand-on experiential learning, in which multiple ways of active learning can be implemented, such as gamification, visually, with audio, etc.
3. It can be supportive for more visual learners, however, it is difficult to create a personalized experience for each student with VR.
4. VR can support collaboration and communication by making use of assignments/questions outside of the immersive environment that one has to look for in the immersive environment. critical thinking depends on the content.
5. VR enables many possibilities to integrate real world problems, since one can be placed anywhere in the world through VR.

Additional Strengths:

- VR can enhance understanding
- VR can be combined with other tecnologies or principles, such as gamification that can be used within VR environment.
- enables access to otherwise inaccessible places and scenarios, breaking down physical and geographical barriers, and providing equal learning opportunities for all students.

Weaknesses

1. It requires specialized equipment and setup; depending on what equipment is used, but it can be expensive; Teachers skills and confidence in using it might be low;
2. Depending on equipment, might be possible that glasses wearers cannot use it.
3. If it is intended to be used in class: Basic knowledge on VR is required, knowing how to handle the equipment and operate the system.
4. The technology itself might be interesting at such a level, that it distracts from the content which the technology provides (which is aiming to align with learning objectives).
5. There can be risks involved with students health, since VR can evoke nausea.

Opportunities

1. Since VR can simulate real-world environments, it allows for access to otherwise inaccessible places and scenarios, breaking down physical and geographical barriers. Moreover, it can enhance the learning experience by explaining concepts in a more immersive manner than from video or photos. Depending on the context which VR is used for, it can address any type of learning gaps, however it should have value.
2. it can foster personal learning, in ones own pace, or on the other hand foster collaboration, thereby collaborative learning in constructivism (21st century skills).
3. Industry partners of experts could make content in VR that explains their industry processes if a visit is for example not possible (cleaning room f.e.)
4. existing education material could be replaced to a VR environment, ensuring more motivation and enabling a different way of learning.

Threats

1. If no data is going to be collected, there is no risk of using this technology regarding data and privacy.
2. Both hardware and software wise the development could impact the use of this technology. The content that will be made will be outdated quickly, so this has to be updated. If the content is too bad for the newer hardware, it is not sustainable
3. No regulatory or policy barriers known for the implementation of VR in education, except for the use of subsidy for innovative technologies, which might come short..
4. Since VR makes use of a screen, it adds to the daily screen time and digital overload for this age group. However, since smartphones are forbidden in class, sometimes even in school, it does not compete up with the previous screen time before this was not forbidden.
5. If this technology will become standard in education, it might change the societal perspective on the use of VR/AR glasses in reality (f.e. Apple Vision Pro).

Additional threats:

- Potential for isolation and disconnection from reality
- Not every school is ready for VR
- Doubtful whether explaining while students are in VR works.
- Teachers may not know how it works

Summary SWOT Virtual Reality:

+ Increased motivation and possibly understanding through Immersive learning experiences

+ visual immersive content providing hand-on experiential and active learning

+ Supportive for visual learners

+ Able to support collaboration and communication

+ Integrate real world problems

+ enables access to otherwise inaccessible places and scenarios

- Requires specialized equipment and setup

- Can be expensive

- Might not be accessible for people who wear glasses

- Basic knowledge to handle the equipment is needed

- Technology might distract from learning objectives

- Health, especially nausea, can be an issue

O If implemented correctly, it can address learning gaps

O Can facilitate personal learning and collaboration

O Content can be made by industry partners

O Existing material can be made to, and be taught in VR

T No risk of data & Privacy of no data is collected.

T Developments could impact the use

T No regulatory or policy barriers known

T adds to the daily screen time and digital overload

T Teachers might not adopt the technology because skills are needed

SWOT Augmented Reality (AR) / Mixed Reality (MR)

Strengths

1. It enhances engagement and motivation by enhancing real world learning experiences, that capture attention and make it more enjoyable, fostering curiosity and motivation.

2. By allowing students to interact with visual objects overlaid in the real world, enabling them to tangibly explore concepts or ideas promoting deeper understanding.

3. It can enhance the learning experience for more visual learners, and within the technology it is possible to adjust the difficulty level to personalize learning even more.

4. It allows shared experiences in f.e. problem solving, to take place, thereby possibly fostering collaboration and communication.

5. How does the technology enable the integration of real-world contexts and problem-solving activities into the curriculum? By overlaying digital information onto the physical environments, the tech allows educators to create contextualized learning experiences that can bridge the gap between the theoretical and the real world application of concepts.

Weaknesses

1. One is dependent on the use of digital devices such as tablets, mobile phones or AR glasses. While the former and the latter ca be expensive, the middle option is currently forbidden in classrooms. Moreover, not all content might be suitable for AR implementation, and technical complexities such as maintenance, integration and teacher training exist.

2. It wideness the digital divine between the ones who have access to AR devices and the ones who don't: If used with the mobile phone, it showcases the people with phones that can easily handle AR (often more expensive phones) and the ones that don't, indicating possible financial inequality and possibly differences in learning experiences and outcomes.

3. If it is intended to be used in class: Basic knowledge on AR is required, knowing how to handle the equipment and operate the system/program (f.e. navigation through the application). Moreover, Access to compatible devices, stable internet connections, and appropriate software are also necessary resources.

4. If it is not integrated thoughtfully and without added value: the technology itself might be interesting at such a level, that it distracts from the content which the technology provides (which is aiming to align with learning objectives)

5. Privacy, data security, and the potential for addiction / overreliance on technology. Moreover, the accuracy and bias of AR content, as well as its potential impact on social interaction and cognitive development.

Oppertunities

1. It allows educators to create contextualized learning experiences that can bridge the gap between the theoretical and the real world application of concepts. Moreover it gives oppertunitites to differentiate between students on how to teach concepts.

2. IT allows for enhanced visual explanations, as well as exploratory/experiential learning or gamification, thereby adhering to social constructivism through its possible applications in the class such.

3. Companies or industry partners could create real-world applications and experiences and showcase models that would otherwise be too large, expensive, fragile etc. to bring

4. Existing material could make use of AR experiences if this enhances the learning experience and thus also the outcome.

Threats

1. Depending on the application, if no data is collected and the application is just visuals, there is challenge in terms of privacy or security .

2. The use of AR/MR can quickly become outdated if new technologies arise or the development of the content or technique is faster then the development of devices on which the AR environment is run. Educators need to keep track of developments to effectively keep integrating AR.

3. No regulatory or policy barriers known for the implementation of AR/MR in education, except for the use of subsidy for innovative technologies, which might come short.

4. Since AR makes use of a screen, it adds to the daily screen time and digital overload for this age group. Educators should balance AR experiences with other learning activities that promote offline engagement and physical movement, and they should establish guidelines for responsible use of AR devices to mitigate the risk of excessive screen time.

5. If this technology will become a standard tool to be used in education, it might change the societal perspective on the use of VR/AR glasses in reality and in daily life (f.e. Apple Vision Pro / AR glasses). Moreover, it could showcase and exacerbate differences between schools with differing access to AR. It could also influence perceptions of reality and students' engagement with traditional forms of learning

Summary SWOT Augmented Reality (AR) / Mixed Reality (MR)

+ Enhances engagement and motivation through real-world learning experiences

+ Facilitates tangible exploration of concepts, promoting deeper understanding

+ Benefits visual learners by providing visual overlays in real-world environments

+ Encourages shared experiences in problem-solving, fostering collaboration and communication

+ Enables integration of real-world contexts into the curriculum by overlaying digital information onto physical environments

- Dependency on digital devices, some of which may be expensive or prohibited in classrooms

- Possibly widens the digital divide, potentially exacerbating inequalities in access to technology

- Requires basic knowledge of AR, compatible devices, stable internet, and appropriate software

- Risk of distraction if not integrated thoughtfully, privacy and security concerns, potential for addiction and bias in content

O Facilitates contextualized learning experiences and differentiation in teaching methods

O Enhances visual explanations and supports exploratory learning approaches

O Industry partnerships can provide real-world applications and experiences

O Existing material can be enhanced with AR experiences to improve learning outcomes

T Privacy and security risks if data is collected, risk of becoming outdated with rapid technological advancements

T No significant regulatory barriers, but potential challenges with funding and subsidies

T Contributes to digital overload and excessive screen time for students

T Societal implications include changes in perceptions of reality, exacerbation of inequalities, and impact on traditional learning methods

SWOT Generative Artificial Intelligence (genAI)

Strentghs

1. By using genAI in a meaningful way, it can enhance learners' enjoyment, satisfaction, and curiosity, thus improving their task motivation (https://www.mdpi.com/2078-2489/15/1/33). It can create diverse and engaging content such as personalized exercises, interactive stories, or virtual environments, which can make learning more interesting and motivate students to actively participate.

2. By (letting students) generate unique problem sets or simulations, generative AI allows students to explore concepts hands-on and learn by doing, which is a key aspect of active learning.

3. Generative AI can tailor educational content to individual students' needs, based on their learning style, pace, and mastery by using the correct prompts. This personalization can enhance understanding.

4. There are several possibilities through which genAI could do this. It could f.e. be used to foster collaboration and communication by creating prompts together to leverage the best results. Communication with genAI is improved while collaboration is fostered by discussing prompt writing. But Generative AI can also generate complex, open-ended tasks or projects that require students to collaborate, communicate, and apply critical thinking skills to solve.

5. How does the technology enable the integration of real-world contexts and problem-solving activities into the curriculum? Generative AI can create realistic scenarios or problems relevant to real-world contexts, helping students see the practical application of what they're learning and enhancing problem-solving skills, which could be integrated into the curriculum.

Weaknesses

1. GenAI is not always correct, there are ethical considerations regarding privacy, but the most challenging limitation is understanding the use: both teachers and students need to know how to do correct prompt writing to leverage the best results

2. If not properly designed or trained, AI systems might favour certain types of learners over others, leading to biased outcomes. Applications might not be fully accessible to students with disabilities. It might also lead to a lack of human interaction, which is crucial for emotional and social learning

3. Basic understanding of AI and algorithms helps users to understand and effectively use the answers given by genAI.

4. Since genAI can be asked anything, it could be misused by asking not favourable questions, or questions that go way beyond the learning material, distracting from the learning objectives. Moreover, by fostering dependency on generated content rather than developing essential skills such as critical thinking, creativity, and problem-solving. Students might rely on AI-generated materials without fully understanding the underlying concepts or processes.

5. Possible biases in genAI, Data privacy of students, and their digital citizenship are key aspects to keep in mind when integrating genAI in eduaction. Moreover, the way it is integrated has to be thought through, since it can possibly create dependency on generated content (see 4).

Oppertunities

1. Generative AI can tailor educational content to individual students' needs, based on their learning style, pace, and mastery, while it is also possible to generative new learning material for existing learning gaps.

2. GenAI enables students to explore concepts and create their own learning material, providing an exploratory and hands-on learning strategy. But also interactive and experiential learning, through f.e. immersive simulations or role-playing scenarios that allow students to learn by doing. It can also facilitate collaborative learning by generating group projects or discussion prompts.

3. It can be used to create realistic case studies or industry-specific problems for students to solve, providing them with valuable real-world experience.

4. It can be used to generate additional content for textbooks or online courses, or to create personalized study guides based on a student's progress and performance. It can also be used to automate grading or feedback, saving teachers time and allowing them to focus on other tasks.

Threats

1. There is a possibility for a security breach, having the consequence of possible valuable and personal data to be openly accessible.

2. The rapid pace of technological change can make it challenging for educational institutions to keep up. There's a risk that the technology could become obsolete, or that new, more effective technologies could emerge.

3. What regulatory or policy barriers could hinder the adoption or implementation of the technology in educational settings? The use of AI in education is subject to various laws and regulations, including data protection laws, privacy laws, and laws related to accessibility and discrimination. Moreover, there is the existing discussion about the added value of genAI in education.

4. The use of AI in education often involves increased use of digital devices, which can contribute to digital overload or excessive screen time.

5. What are the potential societal implications or unintended consequences of widespread adoption of the technology in education? It could lead to job displacement if AI systems replace human teachers or administrators.

Summary SWOT genAI

Strengths:

- Enhances enjoyment, satisfaction, and curiosity
- Creates diverse and engaging content
- Supports active learning through hands-on exploration
- Possibilities to tailor educational content to individual student needs
- Fosters collaboration and communication
- Can create realisitic scenarios or real-world problems.

Weaknesses:

- Not always correct; requires proper understanding and training (prompt writing)
- Potential biases and lack of accessibility and human interaction
- Dependency on AI-generated content
- Ethical considerations regarding privacy and data biases

Oppertunities:

- Can Tailor content to individual student needs
- Supports exploratory and hands-on learning
- Provides real-world case studies and industry-specific problems
- Generates additional content for textbooks or personalized study guides

Threats

- Security breaches and data privacy concerns
- Rapid technological change and potential obsolescence
- Regulatory barriers and policy considerations regarding use of GENAI in education
- Digital overload and screen time concerns
- Job displacement due to automation in education

SWOT Gamification

Strengths

1. Through the implementation of (a variety of) game design elements, students engagement and motivation is enhanced. The winners effect literally activates the lymphatic system, making adrenaline and dopamine.

2. By presenting concepts in an interactive and immersive format it supports hands-on exploration and active learning. Through gamified simulations, quests, or challenges, students actively engage with the material, experiment with different strategies, and learn through trial and error, possibly fostering deeper understanding.

3. Elements that are used in gamification can suit the learning style and pace of individual students, facilitating personalized learning.

4. How does the technology promote collaboration, communication, and critical thinking skills among students? Dependent on the content of the game/gamified content, but gamification often incorporates collaborative elements such as team challenges, multiplayer games, or peer-to-peer competition. By working together to solve problems, students develop communication skills, learn from each other's perspectives, and engage in critical thinking processes to overcome challenges and achieve shared goals.

5. By presenting students with authentic challenges and simulations, gamification prepares students to apply their knowledge and skills to real-life situations, promoting deeper learning and making learning more relevant and meaningful.

Weaknesses

1. Students potentially prioritize the extrinsic rewards of the gamified content, instead of the intrinsic motivation to learn the material. Moreover, the time effort to gamify the learning material or the costs of gamified content are limitations as well.

2. Applications might not be fully accessible to students with disabilities, so designing gamified content should be with accessibility in mind to ensure inclusivity.

3. It depends on the gamified content, or game that is used. Sometimes it comes with instructions, and if a game is made for algorithmic literacy, instructions should be made. If the game is made for a device, students should have access to such a device.

4. A focus on the gamified elements could distract from the learning material and objectives. Designing gamified activities that strike the right balance between enjoyment and educational content is essential to ensure that students remain focused on meaningful learning outcomes.

5. Gamification could manipulate students into certain behaviors if not designed correctly. It should respecting their autonomy and agency. It can also possibly foster addictive behaviors or increase competition and stress among students.

Oppertunities

1. Learning material or content can be tailored to gamification, through which it is given in a new innovative way instead of traditional teaching, adhering to the needs of current generation students. This can be done by creating a game or incorporating game elements such as rewards, challenges, and progression systems into educational activities.

2. Differentiation as well as collaborative or social constructivism can be adhered to by using gamification. Specific strategies include a.o. game-based simulations, quests, and interactive storytelling to create immersive learning experiences. Gamified platforms can facilitate personalized learning paths, adaptive feedback mechanisms, and collaborative problem-solving activities, fostering critical thinking, creativity, and collaboration among students.

3. Gamified content can be tailored to or created by industry partners. Industry partners can contribute domain-specific expertise, resources, and real-world scenarios to gamified learning environments, enriching the educational content and providing students with valuable insights into industry practices and challenges.

4. How can the technology be integrated with existing educational tools and resources to enhance their effectiveness? Existing educational material, assesment or other classroom activities can be translated into a game or be given through gamified methods. Moreover, digital gamified content can be put on existing digital devices.

Threats

1. If digital gamification is used, then there are risks for sensative and personal data colection and storage, thus data privacy, and data breaches, if students use it on their own devices.

2. Developments could improve the (digital) gamified content, but classic and analogue gamification methods will keep having their impact and result. However, educators need to adapt to evolving gamification techniques and technologies to maintain their effectiveness and relevance in supporting learning outcomes

3. Educators may face challenges related to compliance with educational standards or guidelines, as well as bureaucratic hurdles in securing funding or approvals for gamification initiatives

4. Only if digital gamification is used, it will add to the digital overload and screen time of students. Excessive use of gamified platforms or gamification techniques may lead to distractions, addiction, or negative impacts on students' mental health and well-being.

5. What are the potential societal implications or unintended consequences of widespread adoption of the technology in education? Possible consequence of reinforcing competition or fostering a gaming mentality that prioritizes extrinsic rewards over intrinsic motivation for learning. There may also be concerns about the gamification of assessments or grading systems, leading to shallow learning or gaming the system to achieve higher scores

Summary SWOT Gamification

Strengths:

- Enhances engagement and motivation through game design elements
- Supports hands-on exploration and active learning
- Facilitates personalized learning through adaptive content
- Promotes collaboration, communication, and critical thinking skills through the game-elements
- Prepares students for real-life situations through authentic challenges

Weaknesses:

- Risk of prioritizing extrinsic rewards over intrinsic motivation
- Accessibility limitations for students with disabilities
- Required skills depend on specific game content or devices
- Potential distraction from learning objectives, gamified activities need to strike the right balance between enjoyment and educational content
- Possibility of manipulating student behavior or fostering addictive tendencies

Oppertunities

- Tailoring learning material to gamification for innovative teaching methods
- Differentiating instruction and fostering collaboration through gamified platforms
- Collaboration with industry partners to enrich educational content
- Integration with existing educational tools and resources for enhanced effectiveness, such as digital devices already in use.

Threaths:

- Risks of data privacy and security breaches with digital gamification
- Need for adaptation to evolving gamification techniques and technologies
- Challenges related to compliance and bureaucratic hurdles
- Contribution to digital overload and screen time concerns
- Societal implications such as reinforcing competition or shallow learning behaviors

SWOT Robotics

Strenghts

1. Robotics in education enhances student engagement and motivation by providing interactive and hands-on learning experiences. The physicality of robots can capture students' interest and possibly encourages active participation in lessons, leading to increased enthusiasm for learning

2. It supports active learning and hands-on exploration of concepts by allowing students to program and manipulate robots to solve problems and complete tasks. This hands-on approach fosters experiential learning, enabling students to gain a deeper understanding of abstract concepts through real-world experimentation and discovery.

3. Students can possibly work at their own pace and choose projects or activities that align with their interests, abilities, and learning styles.

4. Robotics promotes collaboration, communication, and critical thinking skills among students through collaborative robotics projects and activities. Working in teams to design, build, and program robots encourages cooperation, peer interaction, and problem-solving, fostering the development of essential 21st-century skills.

5. The technology enables the integration of real-world contexts and problem-solving activities into the curriculum by providing authentic, hands-on experiences that mirror real-world challenges.

Weaknesses

1. Implementing robotics could come with high costs, as well as the need for ongoing maintenance and technical support. Moreover, it requires technical skills for setup and a teacher with knowledge on robotics.

2. It might not be accessible for all students, which possibly exacerbates the existing inequality with accessibility to tools for these students. Moreover, it could widen the gap between schools with access to robotics resources and those without. Students from disadvantaged backgrounds may face barriers in accessing robotics education opportunities, leading to disparities in learning experiences and outcomes

3. What technical skills or resources are required for teachers and students to effectively use the technology? Educators need training to integrate robotics into their curriculum, develop robotics-related lesson plans, and support student learning. They need the skills to operate the robotics. Moreover, access to hardware and software is needed.

4. If not integrated thoughtfully into educational practices. Overemphasis on robotics activities or projects may lead to a narrow focus on technical skills at the expense of other important educational outcomes, such as critical thinking, creativity, and collaboration.

5. Data privacy and security, particularly when students interact with online platforms or share personal information as part of robotics projects. There may also be ethical questions regarding the use of robots in social contexts, such as the potential impact on human-robot relationships and the ethical implications of programming robots to perform certain tasks or behaviors.

Oppertunities

1. It could be implemented into a diverse set of activities and projects that facilitates learning of specific educational needs such as problem-solving and critical thinking. Moreover, robots can assist in teaching abstract concepts in subjects like mathematics or physics, making learning more tangible and engaging for students who may struggle with traditional methods.

2. Project-based learning, where students collaborate to design, build, and program robots to solve real-world problems. Additionally, robotics can facilitate flipped classroom models, where students engage in hands-on activities during class time and use online resources for reinforcement and review outside of class.

3. It can enhance learning experiences by providing students with access to real-world applications and career insights in fields such as engineering, manufacturing, and robotics development. Industry partnerships can for example offer mentorship opportunities, internships, and guest lectures,

4. By incorporating robotics projects into existing curricula and educational frameworks. For example, robotics kits can complement STEM programs by providing hands-on activities that reinforce concepts in science, technology, engineering, and mathematics.

Threats

1. If the robotics collect and use (personal) data, then data privacy and security is a risk, as well as the risk of data breaches or unauthorized access to robotics platforms, and concerns about the privacy implications of using internet-connected robots in educational settings and. The appropriate software should be used.

2. The rapid pace of robotics development could impact the relevance of integrating robotics in education, lacking behind on real-time developments. Educators need to stay informed about evolving robotics trends and developments to effectively integrate the latest innovations into teaching practices while ensuring that investments in robotics infrastructure and resources remain adaptable to future changes

3. Restrictions on the use of robots in educational settings or concerns about safety standards and liability, could hinder the adoption or implementation of robotics technology in education

4. Programming robotics would increase the digital overload and screen time of students, whereas hands-on working with robotics does not. Excessive use of robotics platforms or robotics-related activities may lead to distractions, addiction, or negative impacts on students' mental health and well-being

5. Reinforcing inequalities between schools or regions with differing access to robotics resources. There may also be concerns about the impact of robotics on employment patterns, as well as ethical questions regarding the use of robots in educational settings and their influence on human-robot relationships

Summary SWOT robotics

Strengths:

- Enhances engagement and motivation through hands-on learning experiences and the physicality of robots
- Supports active exploration of concepts by programming and manipulating robots, fascilitating experiential learning
- Facilitates personalized learning
- Promotes collaboration, communication, and critical thinking skills through robotics projects and activities
- Integrates real-world contexts into the curriculum

Weaknesses:

- High costs and technical requirements for implementation
- Accessibility limitations and potential exacerbation of inequality
- Need for technical skills and resources for effective use for both teachers and students
- Risk of narrowing educational focus on technical skills
- Concerns about data privacy, security, and ethical implications

Opportunities:

- Addresses specific educational needs and learning gaps, such as problem solving
- Enables innovative teaching and learning strategies such as flipped classooms
- Collaboration with industry partners can enhance learning experiences
- Integration with existing educational tools can enhance effectiveness

Threats:

- Risks of data privacy and security breaches if robots collect data
- Challenges in keeping up with rapid technological change
- Regulatory barriers and safety concerns for integrating robotics in educaton
- Potential for digital overload and screen time concerns
- Societal implications such as reinforcing inequalities and ethical dilemmas

SWOT Mobile Learning

Strengths

1. It can possibly enhance engagement and motivation because it allows students to learn differently than traditional methods, possibly through providing access to interactive and multimedia-rich content that caters to diverse learning preferences. The convenience of accessing learning materials anytime, anywhere encourages students to take ownership of their learning and fosters a sense of autonomy and self-directed learning.

2. Mobile devices enable students to engage with educational content through immersive activities, experiments, and real-world applications, promoting experiential learning and deeper understanding of concepts.

3. Because of the variety of possibilities, mobile learning allows for a variety of ways in which the same is being taught, meeting individual student needs, moreover by allowing students to access content at their own pace and tailor their learning paths to their individual needs and interests.

4. Through features such as discussion forums, group projects, and collaborative learning activities. Mobile devices enable students to collaborate remotely, share ideas, and engage in peer-to-peer learning, fostering teamwork, communication skills, and problem-solving abilities.

5. By providing access to authentic learning experiences and resources. Students can use mobile devices to conduct research, gather data, and explore real-world issues, connecting classroom learning to real-life applications and promoting the development of critical thinking, problem-solving, and decision-making skills.

Weaknesses

1. The integration of a personal device for all students might come with high costs. Moreover, students as well as teachers might become dependent on their device and on internet connection. Also issues related to digital equity and access, such as unequal access to devices and reliable internet connectivity among students. Additionally, concerns about the quality and credibility of online content, as well as distractions from non-educational apps or websites, may impact the effectiveness of mobile learning initiatives.

2. Widening the digital divide between students / schools who have access to mobile devices and those who do not. Students / schools from disadvantaged backgrounds may face barriers in accessing mobile learning resources, leading to disparities in learning experiences and outcomes.

3. Both teachers and students require technical skills and resources to effectively use mobile learning technology. Moreover, everyone must have a personal device and internet connection.

4. Excessive screen time or reliance on mobile devices for learning may lead to a loss of focus, reduced attention spans, and diminished engagement with traditional forms of instruction or offline activities.

5. Data privacy and security, particularly regarding the collection and use of student data by educational apps and platforms. There may also be ethical questions regarding the use of mobile devices in the classroom, such as the potential for student surveillance or the invasion of student privacy

Oppertunities

1. By providing access to educational resources and opportunities for personalized learning It allows students to learn differently than traditional methods, possibly through providing access to interactive and multimedia-rich content that caters to diverse learning preferences and needs. It might also enhance students digital skills, addressing the need for digital literacy.

2. M-learning allows flipped classrooms, where students engage with instructional content and activities on mobile devices outside of class time, freeing up classroom time for interactive discussions, collaborative projects, and hands-on activities. Additionally, mobile devices can facilitate blended learning approaches that combine traditional face-to-face instruction with online learning components, allowing for greater flexibility and customization in teaching and learning.

3. Content in mobile learning can be created by industry partners. This access to industry-specific resources, tools, and technologies that enrich students' learning experiences and prepare them for future career opportunities.

4. Personal device (laptops/tablets) classes already exist, in which students learn the existing methods in digital methods by allowing students access to course materials, submit assignments, and participate in discussions from their smartphones or tablets. Additionally, mobile apps and tools can complement traditional instructional methods and resources, providing opportunities for personalized learning, formative assessment, and student engagement.

Threats

1. Data privacy and security, particularly regarding the collection and use of student data by educational apps and platforms, and the possibility of data breaches. There may also be ethical questions regarding the use of mobile devices in the classroom, such as the potential for student surveillance or the invasion of student privacy.

2. Development may impact the use of mobile learning and devices. Educators need to stay informed about trends and developments to effectively integrate the latest innovations into teaching practices while ensuring that investments, infrastructure and resources remain adaptable to future changes.

3. Regulatory or policy barriers, such as restrictions on the use of mobile devices in educational settings or concerns about data privacy and security, could hinder the adoption or implementation of mobile learning technology in education.

4. It may contribute to digital overload or screen time concerns among students if not used thoughtfully. Excessive use of mobile devices for learning or leisure activities may lead to distractions, reduced attention spans, and negative impacts on students' mental health and well-being.

5. It might exacerbate inequalities between schools or regions with differing access to technology resources, raises concerns about the impact of mobile technology on social interactions, communication skills, and cognitive development, as well as ethical questions regarding the use of student data and the influence of technology on teaching and learning practices.

Summary SWOT Mobile Learning

Strengths:

- Enhances engagement and motivation through diverse learning experiences and the possibility to access learning material anytime, anywhere.
- Supports active exploration of concepts and personalized learning paths
- Promotes collaboration, communication, and critical thinking skills through features such as discussion forums and group projects.
- Integrates real-world applications into the curriculum such as conducting research gathering data.

Weaknesses:

- High costs and dependency on personal devices
- Concerns about the quality and credibility of online content, as well as distractions from non-educational apps or websites,
- Widening the digital divide and accessibility issues
- Technical skills and resources required for effective use
- Concerns about digital distraction, screen time, student serveillance and data privacy

Opportunities:

- Addresses diverse learning preferences and needs through acces to interactive multimedia-rich content
- Enables flipped classrooms and blended learning approaches
- Collaboration with industry partners enriches learning experiences through acces to industry-specific resources
- Integration with existing educational tools, such as the use of a personal device, can enhance effectiveness

Threats:

- Risks of data privacy breaches and ethical concerns
- Impact of technological developments on relevance and sustainability
- Regulatory barriers and policy restrictions On the use of mobile devices in education
- Potential for digital overload and screen time concerns
- Exacerbation of inequalities and concern about societal implications of widespread adoption like impact of mobile technology on social interactions, communication skills, and cognitive development

SWOT Tangibles (user interfaces)

Strengths

1. Tangibles (user interfaces) can enhance engagement and motivation by providing tangible representations of abstract concepts or ideas that can be intuitive and provide hands-on interactions and interactive experiences that appeal to different learning styles, capturing students' interest and encouraging active participation in lessons/

2. Tangibles allow students to manipulate physical objects to explore abstract concepts, fostering experiential learning and deeper understanding through tangible interactions.

3. Tangible interfaces can be customized to accommodate individual student needs and preferences

4. Tangible(s) user interfaces often involve collaborative activities that require students to work together, communicate ideas, and solve problems collectively, fostering teamwork, peer learning, and higher-order thinking skills.

5. Tangibles provide opportunities for students to engage in authentic, hands-on activities that mirror real-world scenarios, promoting contextualized learning and facilitating the application of theoretical knowledge to practical problem-solving situations.

Weaknesses

1. Acquiring and maintaining the tangibles, including the costs, and compatibility with existing educational infrastructure: tangibles should be appropriately integrated for explaining abstract concepts.

2. Availability and accessibility of tangible interfaces may vary among schools or communities, potentially widening the gap between students with access to such resources and those without.

3. Both teachers and students may require training and support to effectively use tangible interfaces in education. Educators need technical skills to integrate tangibles into their teaching practices, develop appropriate lesson plans, and troubleshoot technical issues. Students need guidance on how to use tangible interfaces effectively, and may require access to specialized software or equipment.

4. Excessive focus on tangibles or overly complex interfaces may distract students from essential concepts or curriculum goals

5. Issues related to data privacy and security, particularly if tangible interfaces collect sensitive student information. Additionally, possible concerns about the equitable distribution of resources and access to tangible learning experiences, or potential biases in the design or implementation of tangible interfaces.

Opportunities

1. Tangible interfaces can cater to diverse learning styles and abilities, providing tactile and interactive experiences that accommodate different preferences and needs. For example, they can support students with disabilities or those who struggle with traditional instructional methods by offering alternative modes of interaction and representation of content.

2. Tangible user interfaces open up possibilities for creative and experiential learning approaches, f.e. interactive lessons, simulations, and hands-on activities that engage students in active exploration and discovery of concepts, fostering deeper understanding.

3. Industry experts can provide insights, resources, and real-world applications that enrich educational content and offer students exposure to industry-relevant skills and practices in which tangibles or TUI can be used that represent concepts within their industry.

4. They can complement and enhance existing educational tools and resources by providing additional modes of interaction and engagement. They can be integrated with digital learning platforms, interactive whiteboards, and educational software to create seamless learning experiences that combine physical and digital elements

Threats

1. If tangible user interfaces are used to gather personal or sensitive student data, then data privacy and security is a risk, considering possible data breaches.

2. Development may impact the use of mobile learning and devices. New advancements and innovations could quickly render existing technologies obsolete, leading to challenges in maintaining and updating tangible interfaces to keep pace with evolving educational needs and standards.

3. Regulatory or policy barriers, such as restrictions on the use of TUI in educational settings or concerns about data privacy and security, could hinder the adoption or implementation of TUI technology in education.

4. While tangibles, in their analogue way, do not contribute to the digital overload and offers room to learn without a screen and therefore not contributing to screen time, Tangible user interfaces could slightly add to the digital overload and screen time.

5. Dependence on technology for learning and a shift away from traditional hands-on learning experiences, which could impact students' overall development and readiness for real-world challenges.

Summary SWOT Tangibles (user interfaces)

Strengths:

- Enhances engagement and motivation through hands-on interactions with physical objects
- Fosters experiential learning and deeper understanding of abstract concepts with physical objects
- Customizable to accommodate individual student needs and preferences
- Use of tangibles often involves and thus promotes collaboration, communication, and problem-solving skills
- Provides authentic, real-world mirroring learning experiences

Weaknesses:

- Acquisition and maintenance costs, compatibility issues
- Variability in availability and accessibility among schools
- Training and technical support required for teachers and students
- Risk of distraction from essential concepts and curriculum goals
- Concerns about data privacy, security, and equitable distribution of resources

Opportunities:

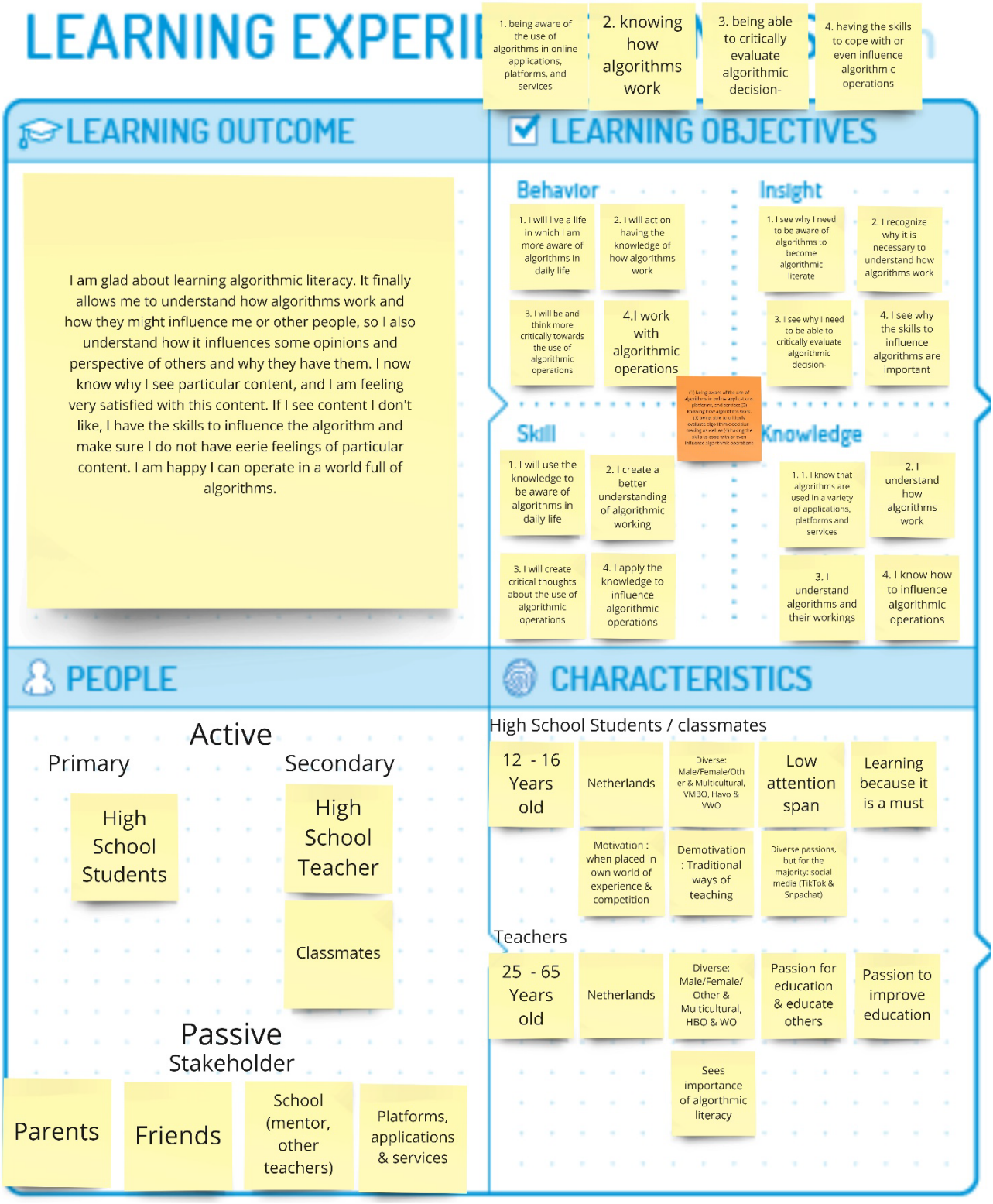
- Accommodates diverse learning styles and abilities
- Enables creative and experiential learning approaches
- Collaboration with industry experts enriches educational content through creating exposure to industry-relevant skills and practices in which tangibles or TUI can be used that represent concepts within their industry.
- Enhances existing educational tools and resources by providing additional methods and modes of interaction

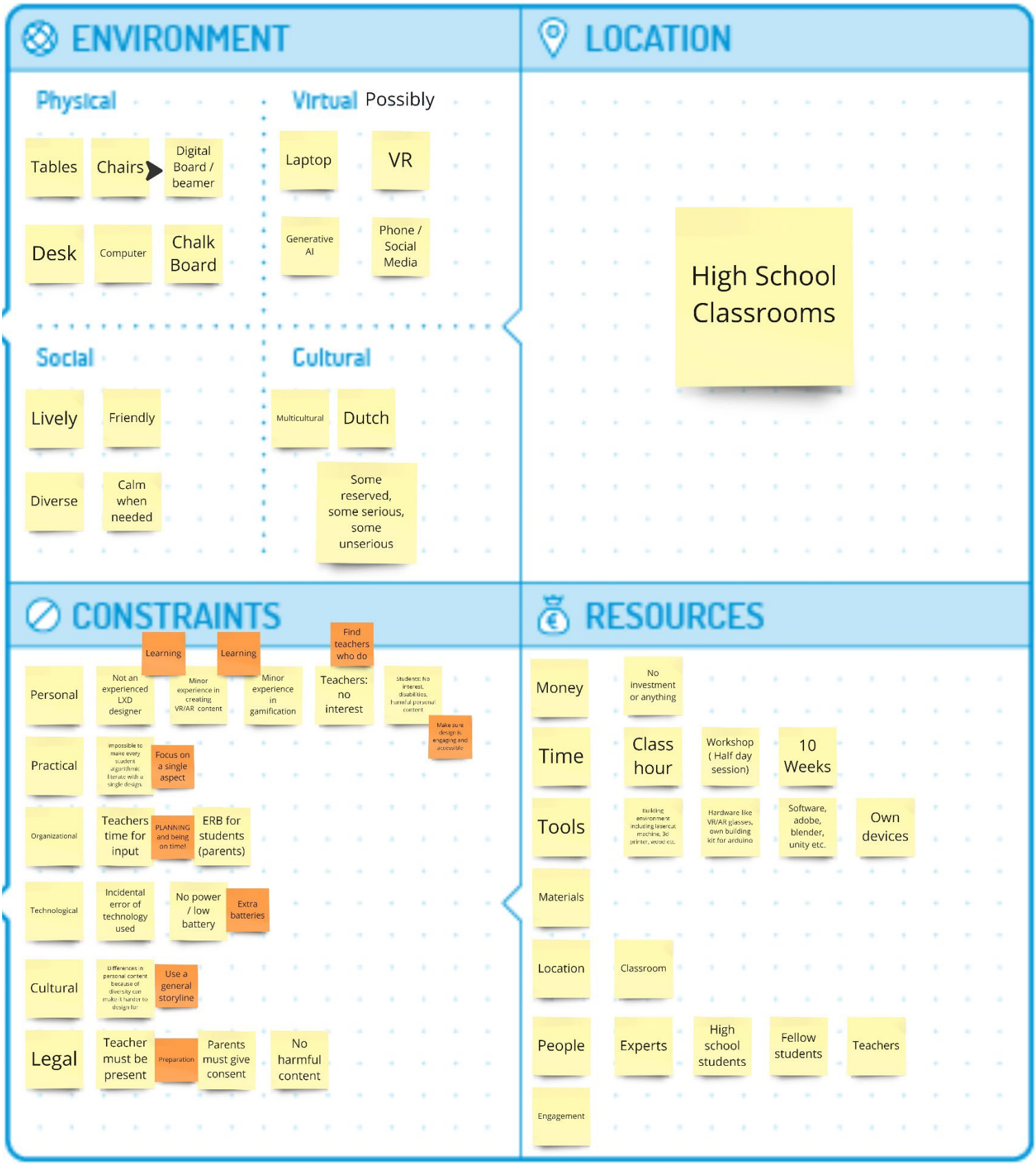
Threats:

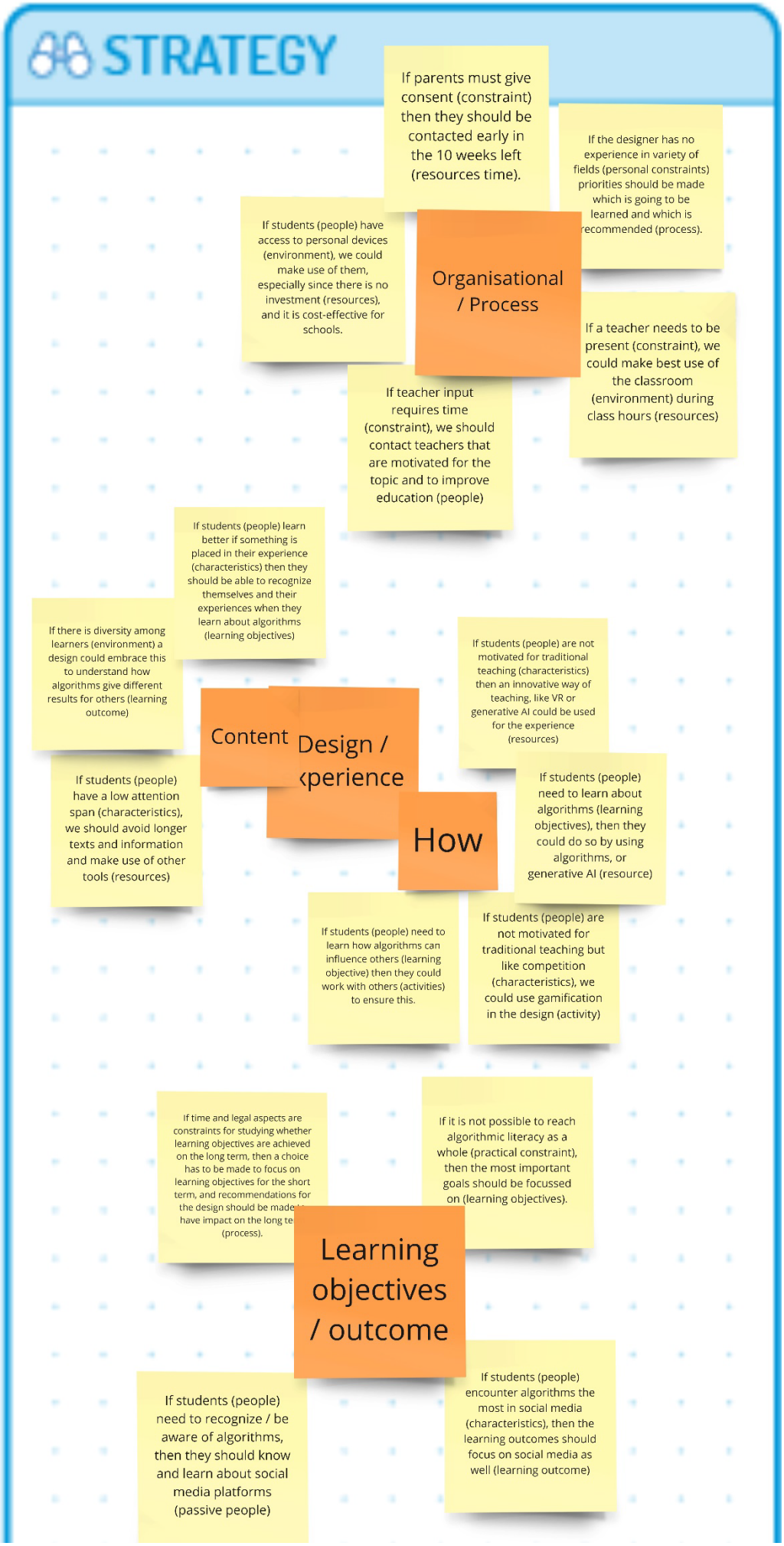
- Risks of data privacy breaches if collecting sensitive student data
- Impact of technological advancements on relevance and sustainability
- Regulatory barriers and policy restrictions hindering adoption
- Contribution to digital overload and screen time concerns, but with TUI only.
- Dependence on technology potentially impacting traditional learning experiences and students learning.

Appendix D: LX Canvas

Version 1:



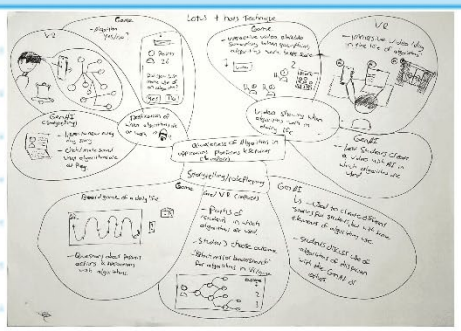

ENVIRONMENT
Physical
Tables
Chairs
Digital Board / beamer
Desk
Computer
Chalk Board
Virtual Possibly
Laptop
VR
Generative AI
Phone / Social Media
Social
Lively
Friendly
Diverse
Calm when needed
Cultural
Multicultural
Dutch
Some reserved, some serious, some unserious
LOCATION
High School Classrooms
CONSTRAINTS
Personal
Learning
Not an experienced LXD designer
Learning
Minor experience in creating VR/AR content
Minor experience in gamification
Find teachers who do
Teachers: no interest
Students: No interest, disabilities, harmful personal content
Make sure design is engaging and accessible
Practical
Impossible to make every student algorithmic literate with a single design.
Focus on a single aspect
Organizational
Teachers time for input
PLANNING and being on time!
ERB for students (parents)
Technological
Incidental error of technology used
No power / low battery
Extra batteries
Cultural
Differences in personal content because of diversity can make it harder to design for
Use a general storyline
Legal
Teacher must be present
Preparation
Parents must give consent
No harmful content
RESOURCES
Money
No investment or anything
Time
Class hour
Workshop (Half day session)
10 Weeks
Tools
Building environment including laser cut machine, 3d printer, wood etc.
Hardware like VR/AR glasses, own building kit for arduino
Software, adobe, blender, unity etc.
Own devices
Materials
Location
Classroom
People
Experts
High school students
Fellow students
Teachers
Engagement

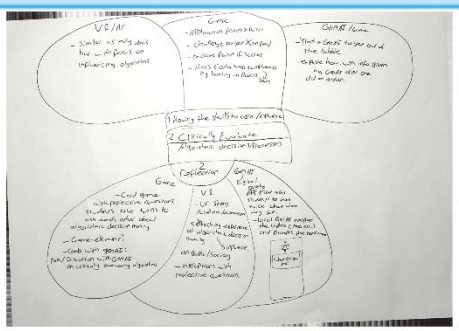

STRATEGY
If parents must give consent (constraint) then they should be contacted early in the 10 weeks left (resources time).
If the designer has no experience in variety of fields (personal constraints) priorities should be made which is going to be learned and which is recommended (process).
If students (people) have access to personal devices (environment), we could make use of them, especially since there is no investment (resources), and it is cost-effective for schools.
Organisational / Process
If a teacher needs to be present (constraint), we could make best use of the classroom (environment) during class hours (resources)
If teacher input requires time (constraint), we should contact teachers that are motivated for the topic and to improve education (people)
If students (people) learn better if something is placed in their experience (characteristics) then they should be able to recognize themselves and their experiences when they learn about algorithms (learning objectives)
If there is diversity among learners (environment) a design could embrace this to understand how algorithms give different results for others (learning outcome)
If students (people) are not motivated for traditional teaching (characteristics) then an innovative way of teaching, like VR or generative AI could be used for the experience (resources)
Content
Design / xperience
How
If students (people) have a low attention span (characteristics), we should avoid longer texts and information and make use of other tools (resources)
If students (people) need to learn about algorithms (learning objectives), then they could do so by using algorithms, or generative AI (resource)
If students (people) need to learn how algorithms can influence others (learning objective) then they could work with others (activities) to ensure this.
If students (people) are not motivated for traditional teaching but like competition (characteristics), we could use gamification in the design (activity)
If time and legal aspects are constraints for studying whether learning objectives are achieved on the long term, then a choice has to be made to focus on learning objectives for the short term, and recommendations for the design should be made
have impact on the long te
(process).
If it is not possible to reach algorithmic literacy as a whole (practical constraint), then the most important goals should be focussed on (learning objectives).
Learning objectives / outcome
If students (people) need to recognize / be aware of algorithms, then they should know and learn about social media platforms (passive people)
If students (people) encounter algorithms the most in social media (characteristics), then the learning outcomes should focus on social media as well (learning outcome)

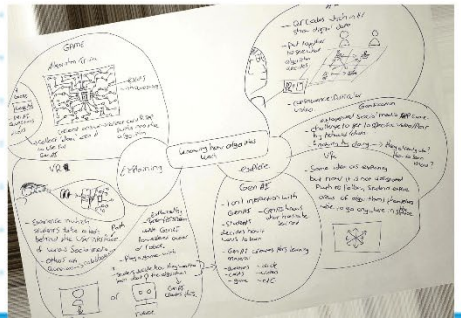
ACTIVITIES

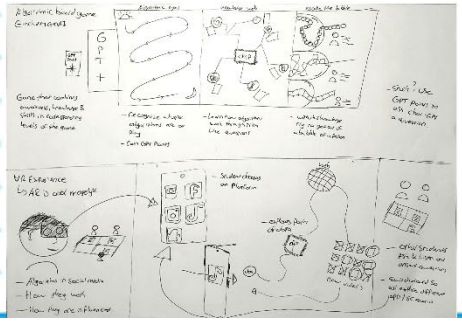
Priority of objectives:

1. knowing how algorithms work
   - with that → Being aware of the use of algorithms in online applications, platforms, and services,
   - with that → having the skills to cope with or even influence algorithmic operations
2. being able to critically evaluate algorithmic decision-making









PROCESS

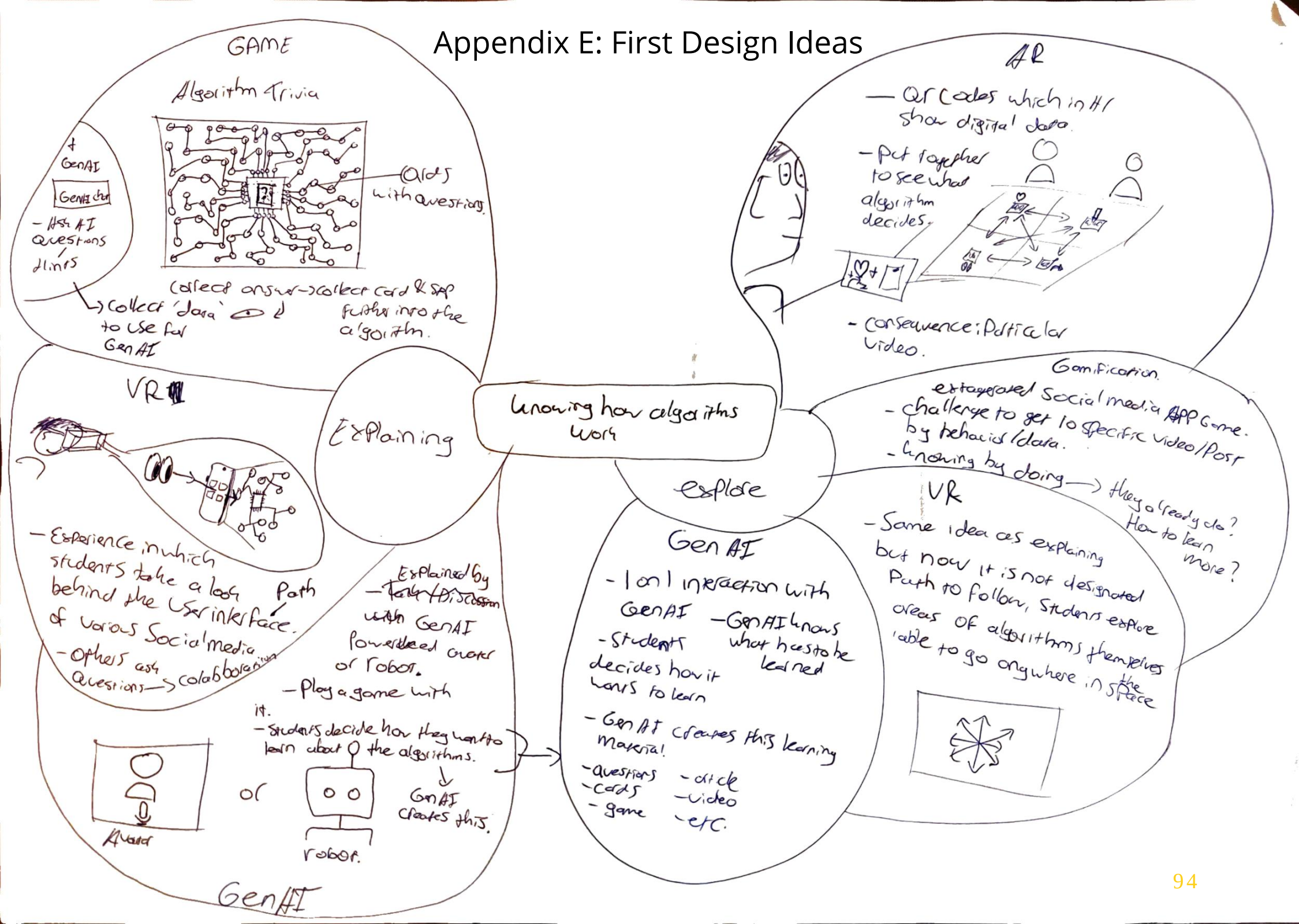
When will the learning experience take place?

- Starts when kids start using social media
- Design is used in the classroom, during a class
- Maybe multiple times during secondary school
- Students keep using social media, so are aware and conscious after playing the game
- Learning experience extents to when they see content and apply algorithmic literacy learned
- Students see algorithms in other fields (in the future), and might critically address them, extending the learning experience.

When will the learning activities take place?

- Social media use: every day
- Design: During class: within 30-45 minutes
- Various time between using design and using social media again
- Design: Possibly multiple times during secondary school

Appendix E: First Design Ideas



VR/AR

- similar as edlg ideas but with focus on influencing algorithms.

Game

- Application / cards x Points
- challenge to get X on Read
- receive Points if succes.
- Hints (other ways to influence) by handing in Points → learn

GenAI / Game

- 'Train a GenAI to get out of the bubble
- explore how, with info given by GenAI (AI one did an action.

1 Having the skills to cope / influence

2 Critically Evaluate

Algorithmic decisions/Processes

2 Reflection

Game

- Card game with reflective questions, students take turns to ask each other about algorithmic decision making
- Game-elements?
- Combi with genAI: talk / Discussion with GenAI on critically evaluating algorithms

VR

- VR Story / Video / animation

shocking experience of algorithmic decision making. → influence on People / Society

- interruptions with reflective questions.

GenAI / Digital overlay

App that asks students to think twice about what they see.

- local GenAI interprets the video (tags etc.) and prompts the notification

Lotus + hats Technique

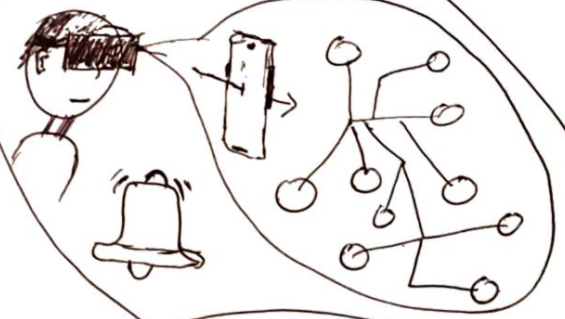
Game
- Algorithm yes/no?

Points 26

Did you just make use of an algorithm?

yes no

VR



Notification of when algorithms are at work

GenAI (storytelling)

- listen to new every day story
- click/make sound when algorithms are at play.

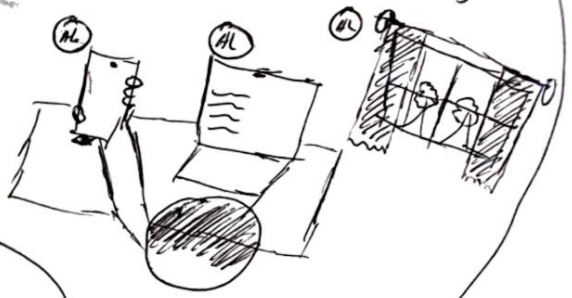
Game
- interactive video, alert/do something when you think algorithms work. keeps score

1 Video

2 Score

Video showing when algorithms work in daily life

VR
- Immersive video 1 day in the life of algorithms



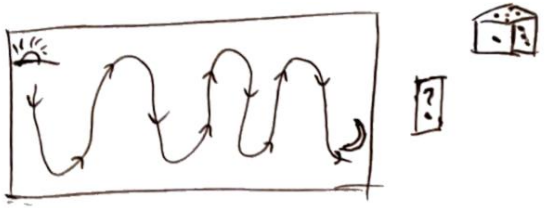
GenAI
- Let students create a video with AI in which algorithms are used.

awareness of Algorithms in applications platforms & services (& impact)

Storytelling/roleplaying

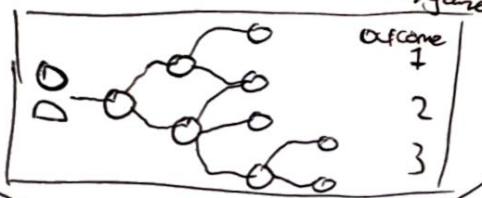
Game

Board game of a daily life



- Questions about persons actions & interactions with algorithms.

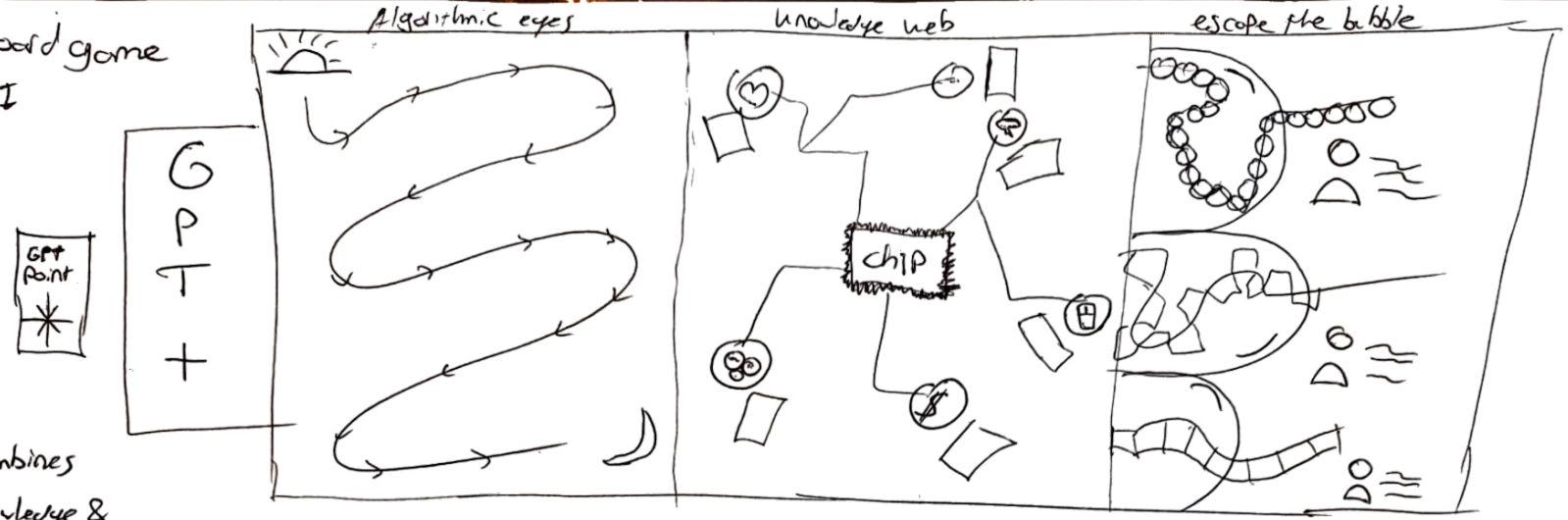
Game/VR (impact)
- Paths of students in which algorithms are used
- Student's choose outcome
- 'Black mirror bandersnatch' for algorithms in VR/game.



GenAI

LS - Used to create different stories for students, but with same elements of algorithms use.
- Students discuss use of algorithms of this person with the GenAI or others.

Algorithmic board game
(including GenAI



Game that combines awareness, knowledge & skills in corresponding levels of the game

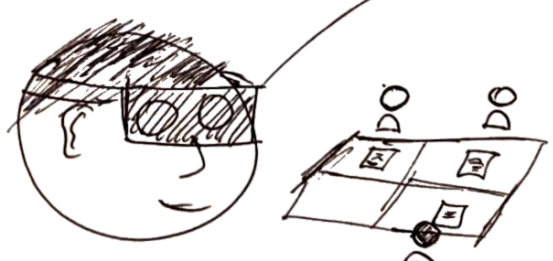
- Recognize where algorithms are at play.
- Earn GPT Points

- Learn how algorithms work through trivia like questions

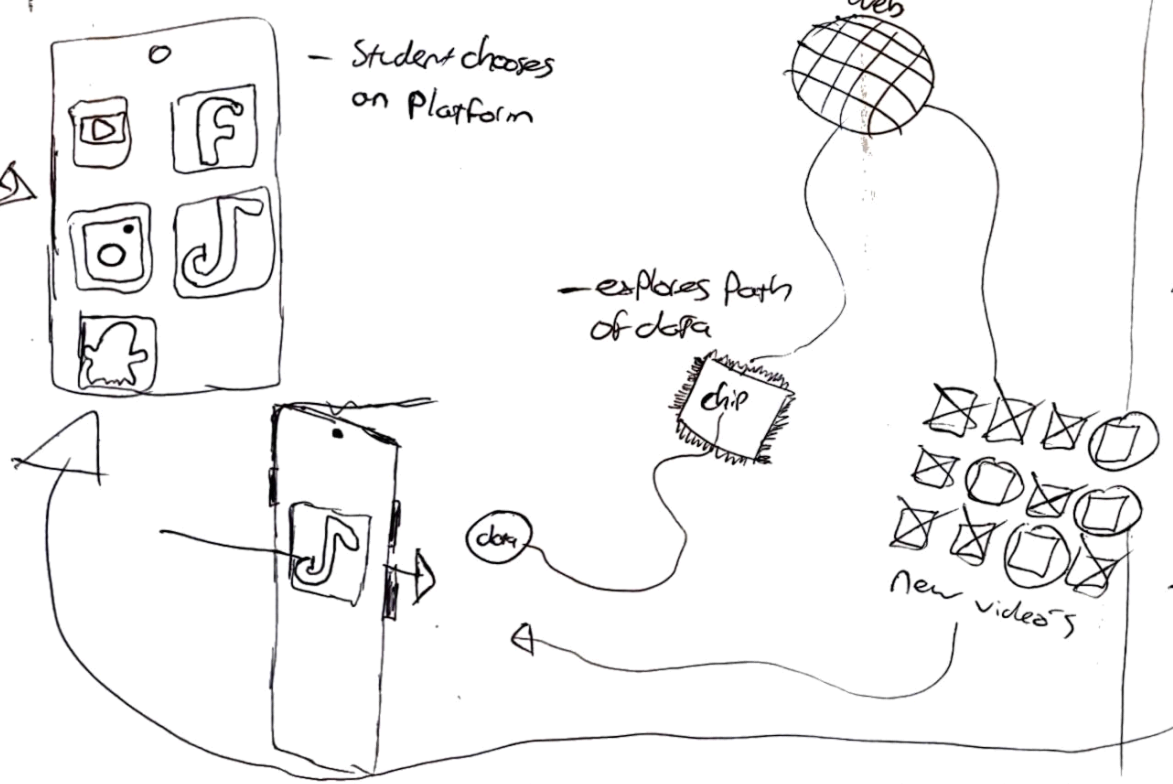
- with this knowledge try to get out of a bubble of a person.

- Stuck? Use GPT Points to ask Chat-GPT a question.

VR Experience
↳ AR is also possible.



- Algorithms in Social media
- How they work
- How they are influenced



Escape the bubble

Algorithmic Literacy game

- Not yet defined: aspects to study.

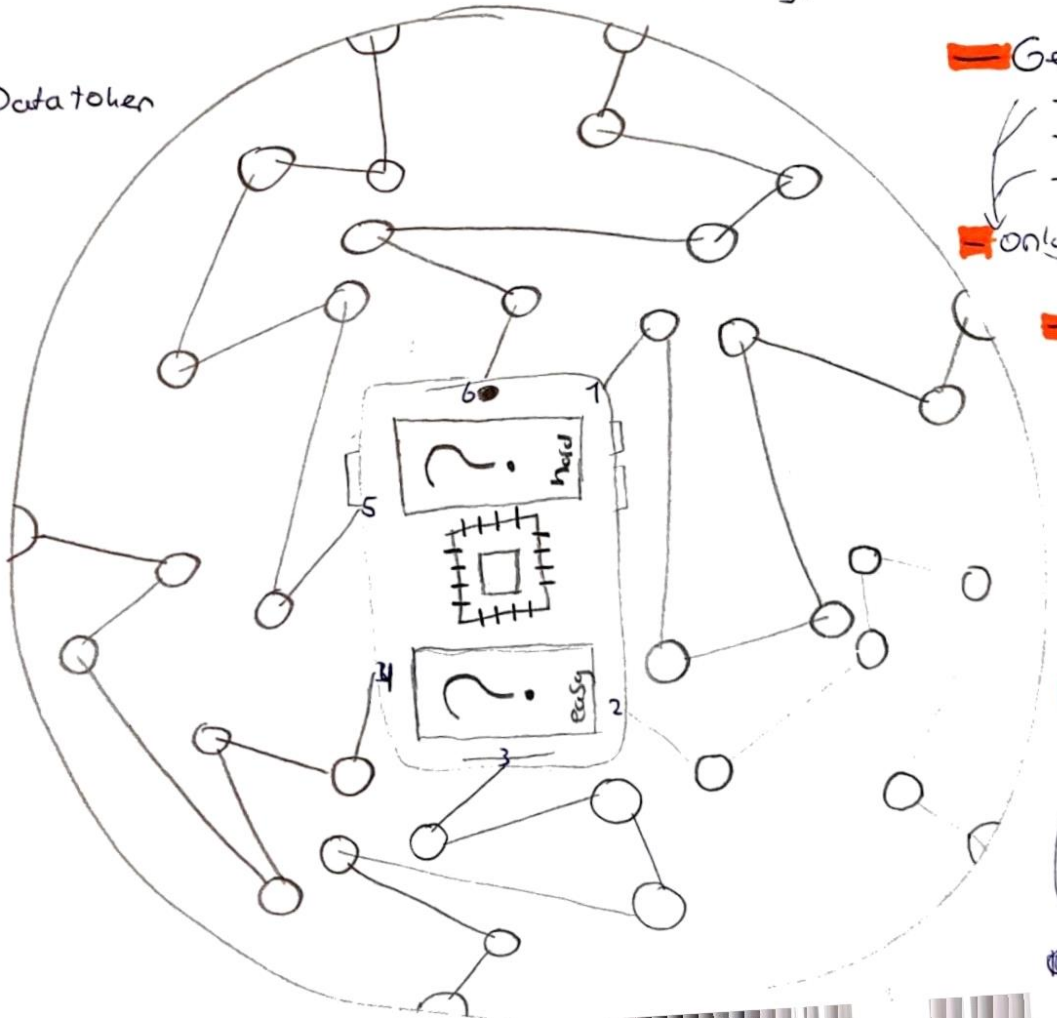
- Story of a person in a bubble on all (social) media platforms
- Person is not happy / shocking bubble / causing harm
  - no knowledge, skills or critical attitude towards algorithms
  - in this game: help to escape the bubble
  - every game a new story generated by GenAI
- Players play as digital pin / thumbtack
- Players need to answer questions on cards to move towards the edge of the bubble
  - easy questions: move 1 place
  - Hard questions: move 1 place + data token

In order to escape/pop the bubble, the first person to do so wins.

- Data tokens can be used to use GenAI to help Players with answering questions, if they do not know the answer.

- With each step forward, all players receive information on how to escape the bubble (not watch the videos, like others, etc.) in text/video/from GenAI.

- After each question, there is a reflective question building upon the question to talk about and create the critical mentality.



Data token

- GenAI options:
  - small screen
  - application - standalone
  - web APP
- only available w/ if data is 'read':
  - use NFC to read if there is data,
    - ↳ with small screen: implement NFC reader
    - ↳ with laptop: design reader to connect in USB port.
  - screen option: Add videos to watch for questions
    - ↳ 'read' where player are.
    - ↳ or: Scan QR code on Card. or: Cards are NF

Appendix G
Design Walkthrough Teachers

This document is a set-up for a design walkthrough I will conduct for my M2.1 Preparation FMP project at the faculty of Industrial Design at the Eindhoven University of Technology. The design walkthrough is meant to get feedback upon an early design idea in order to improve the design. The study involves a short interview about their experience with algorithmic literacy in education, but mostly focusses on a walkthrough of the current design after which a semi-structured interview will take place about the game and its content.

Introduction (2 min)

Welkom, Ik ben Yorn Thijssen, en zit in het laatste jaar van mijn master Industrial Design op de TU/e. Dit doe ik in combinatie met de lerarenopleiding, die ik voornamelijk vorig jaar heb gevolgd. In dit laatste jaar doe ik twee projecten, waarvan dit project ter voorbereiding dient voor mijn afstudeerproject.

In dit voorbereidend project zoek ik de combinatie op tussen deze twee opleidingen. Ik ben een ontwerp aan het maken dat in het onderwijs gebruikt kan worden, dat mogelijk op zichzelf staat, of waar mogelijk onderwijs bij ontwikkeld zou kunnen worden.

Het onderwerp waar dit ontwerp op ingaat is op algoritmische geletterdheid. Nu kennen jullie de termen digitale geletterdheid, en hebben jullie wellicht een beeld van algoritmische geletterdheid , maar om het concreet te maken, algoritmische geletterdheid is geformuleerd als: "**Bewust zijn van** het gebruik van algoritmes in online toepassingen, platforms en diensten, **weten** hoe algoritmes werken, in staat zijn om **kritisch te evalueren** hoe algoritmische besluitvorming plaatsvindt, en ook de **vaardigheden** hebben om om te gaan met of zelfs **invloed** uit te oefenen op algoritmische operaties". (Dogruel et al., 2021). Dit is een zere brede term, die ook niet dusdanig is terug te vinden in digitale geletterdheid zoals beschreven door SLO. Het zit verweven in de nieuwe kerndoelen, veel in het gedeelte *mediawijsheid*. Algoritmes gaan echter veel verder dan alleen media, en aangezien leerlingen er elke dag mee te maken hebben vind ik het een onderwerp dat meer aandacht verdient, zeker gezien de huidige en zeer snelle ontwikkelingen op dit gebied.

De sessie van vandaag staat in het teken van het in kaart brengen van de context waarin het ontwerp gebruikt gaat worden door middel van een aantal vragen over digitale en algoritmische geletterdheid op deze school, waarna ik het ontwerp en gebruik er van laat zien en ik graag feedback ontvang, ook door middel van een aantal vragen.

Leyla Dogruel, Philipp Masur & Sven Joeckel (2022) Development and Validation of an Algorithm Literacy Scale for Internet Users, Communication Methods and Measures, 16:2, 115-133, DOI: 10.1080/19312458.2021.1968361

Consent Form (3 min)

Interview Questions (10 min)

Because Algorithmic Literacy is not a standard domain to have integrated in Dutch curricula, but digital literacy is, several questions will go into digital literacy.

With 1 or 2 teachers: oral interview.

1. Kan je wat over jezelf vertellen en over je ervaringen als docent en eventuele andere neventaken binnen het onderwijs?
2. Wordt er aandacht besteed aan digitale geletterdheid op deze school? Op welke manier?
3. Heb je een rol t.a.v. digitale geletterdheid op deze school? Zo ja, wat is deze? Zo nee, hoe probeer je digitale geletterdheid in jouw lessen te verwerken?
4. Na het horen van het begrip algoritmische geletterdheid (herhalen indien nodig), wordt er op deze school aandacht aan (een van de) aspecten van algoritmische geletterdheid besteed? Op welke manier?
5. Na het horen van het begrip algoritmische geletterdheid, hoe algoritmisch geletterd zou u uzelf inschatten op een schaal van 0-100? Waarom dit getal?

Doorgaand op de laatste vraag, naast deze vragen om de context in kaart te brengen, ga ik ook de algoritmische geletterdheid in kaart brengen van docenten en leerlingen, om te kijken hoe beide ervoor staan, of er verschillen zijn en of er wellicht aspecten uitkomen waar ik rekening mee moet houden in mijn ontwerp. Hiervoor heb ik een vragenlijst op forms waarin de algoritmisch geletterdheid wordt gemeten dat ongeveer 5 tot 10 minuutjes duurt om in te vullen. Zou ik mogen vragen of ik deze nu of straks mag doorsturen zodat u deze ook kunt invullen? En eventueel collega's? Uiteindelijk zal ik deze data analyseren en vergelijken, en mocht u het interessant vinden hoe u het heeft gedaan zal ik dit doorsturen.

Design walktrough (10 min)

Het ontwerp

Het ontwerp wat ik momenteel aan het ontwikkelen ben is een spel over algoritmes in sociale media. Hierbij is het belangrijk om te onthouden dat het dus nog in ontwikkeling is, de onderdelen die ik ga benoemen nog niet vaststaan en ik open sta voor leuke ideeën dat het spel wellicht beter maken. Mochten deze er zijn, benoem ze dan ook vooral meteen!

Zoals je misschien wel weet, of zelf ervaart, creëert iedereen zijn eigen persoonlijke bubbel op sociale media, soms ook wel een filter bubbel genoemd. Dit gebeurt op basis van de gegevens die gebruikers aanleveren aan de algoritmes waarop deze platforms draaien, waaronder je gebruikersgedrag zoals hoe lang je naar bepaalde content kijkt, met het gevolg dat je vaak alleen maar content ziet die (het platform denkt dat) je leuk vindt of overeenkomt met je bestaande meningen en perspectieven, en waardoor je dus minder met diverse content, meningen en perspectieven in aanraking komt.

Met dit spel hoop ik leerlingen algoritmisch geletterd te maken ten aanzien van algoritmes in sociale media. Oftewel bewust maken van het gebruik van algoritmes in sociale media, kennisgeven zodat ze **weten** hoe ze werken, en hoe ze voorgestelde content **kritisch kunnen evalueren**, en ook de **vaardigheden** aanbieden om om te gaan met, of zelfs **invloed** uit te kunnen oefenen op deze algoritmes.

Het verhaal waar het bij het spel om gaat is dat er een persoon is die in een online bubbel zit, en deze eigenlijk wil doorbreken om andere content te zien, vandaar ook het spelbord. Het doel van het spel is om de persoonlijke bubbel 'door te prikken' die door deze algoritmes is gecreëerd. Studenten spelen als een digitale punaise en zullen de ‘data’ weg af moeten leggen om de rand van de bubbel te bereiken. Dit doen ze door om de beurt vragen, natuurlijk over algoritmes, te beantwoorden. Als ze een vraag correct is, mogen ze een stap zetten op het bord om uiteindelijk de rand van de bubbel te bereiken en zo de bubbel 'door te prikken'. Als het antwoord fout is, blijft de speler op dezelfde plek staan.

Er zijn in het spel twee stapels kaarten met vragen: één met makkelijke vragen en één met moeilijkere vragen. Een makkelijke vraag correct beantwoorden betekent één stap vooruitgaan. Een moeilijke vraag correct beantwoorden, is één stap vooruitgaan en daarbij een data ontvangen.

Data kan gebruikt worden wanneer een speler vastloopt bij een vraag. De data kunnen ingewisseld worden voor een hint voor deze vraag te ontvangen van generatieve AI. Hiermee leren leerlingen over algoritmes door gebruik te maken van algoritmes, waarmee hopelijk ook de link wordt gelegd met wat ze leren naar algoritmes buiten sociale media, zoals generatieve AI.

3 à 4 vragen spelen om de werking duidelijk te maken.

Post-walktrough interview (15 min)

Vragen over het spel algemeen:

1. Wat is je eerste indruk van het spel?
    a. Is het spel, en het verhaal wat erbij gaat horen, interessant voor jou om te gebruiken?
    b. Denkt u dat het spel intuïtief is om te spelen? Waarom wel/niet?
    c. Zijn er aspecten van het spel die er voor u uitspringen om een bepaalde reden?
2. Hoe zou je dit spel als docent gebruiken?
    a. Zou je het bijvoorbeeld in de klas gebruiken/spelen? Een les eromheen creëren (met discussie, opdrachten, reflectie, etc.)?
3. Hoe denk je dat leerlingen zouden reageren op dit spel?
    a. Wat denk je dat ze er (minder) leuk aan vinden?
    b. Zouden leerlingen het spel, en het verhaal ook interessant vinden?
    c. Zouden ze zich kunnen inleven in het verhaal, en daarom ook het spel willen spelen?
4. Is het in jouw ogen een spel om vaker te spelen/ of als docent om vaker te gebruiken (op die manier zoals beschreven bij de vorige vraag)?
    a. Wat zou het spel nog kunnen bevatten of toegevoegd worden zodat leerlingen het vaker willen en kunnen spelen?

Vragen over de vragen in het spel:

5. Wat vind je van de vragen die leerlingen moeten beantwoorden? (geef een overzicht van het soort vragen, het verschil tussen makkelijke en moeilijke vragen, en voorbeeldvragen)
    a. Van de type vragen, makkelijk & moeilijk en de afwisseling hierin?
    b. Verschil tussen makkelijke en moeilijke vragen?
    c. Zijn de vragen relevant voor deze groep leerlingen?

Vragen over het verhaal/beleveniswereld van het spel:

6. Denk je dat het spel aansluit bij de belevingswereld van leerlingen?
    a. Hoe denk je dat dit zo is?
    b. Wat denk je dat de meeste impact maakt?
    c. Hoe denk je dat het meer impact zou kunnen hebben?
        i. Moeten de verhalen naar jouw mening zowel algemene als negatieve voorbeelden bevatten, of moeten ze meer neigen naar schokkende verhalen zodat het spel, en het leren, wellicht serieuzer worden genomen?

Afronding/conclusie

7. Denkt u dat het spel kan bijdragen aan de algoritmische geletterdheid van de leerlingen?
    a. Waarom wel/niet?
    b. Welk onderdeel van het spel doet dit naar uw inziens het meest en waarom? Heeft u suggesties hoe dit beter kan?
8. Heeft u nog andere suggesties, opmerkingen of toevoegingen die het spel en/of de impact hiervan zouden kunnen verbeteren.

Appendix H
User-Test ID Students

This document is a set-up for a user test and co-design session I will conduct for my M2.1 Preparation FMP project at the faculty of Industrial Design at the Eindhoven University of Technology. This session is meant to get feedback upon an early design idea to eventually improve the design, as well as brainstorm together on how to make these improvements. The session consists of two parts. Part 1 involves a quick playing session of the current game, after which participants will fill in the GEQ. In the second part of the session a co-creation will take place in 3 rounds, in which the MDA framework will be used.

Total Time (Roughly 1 hour / 60 min)

1. **Introduction, including consent form (5 min)**
2. **Game explanation (5 min)**
3. **Game testing (15 min)**
4. **GAME EXPERIENCE QUESTIONNAIRE (5 min)**
5. **Co-Design explanation (3 min)**
    1. **Co design first round M→D→A (7 min)**
    2. **Co design second round A→D→M (7 min)**
    3. **Co design third round Combinations (7 min)**
6. **Extra time for questions/feedback/talk (6 minutes)**

Introduction, including consent form (5 min)

Welkom, zoals jullie weten doe ik zowel ID als de lerarenopleiding en momenteel ben ik bezig met mijn M2.1, ter voorbereiding op mijn afstuderen. Hierin zoek ik de combinatie op tussen deze twee opleidingen, want ik ben een ontwerp aan het maken dat in het onderwijs gebruikt kan gaan worden.

Het onderwerp waar dit ontwerp op ingaat is op algoritmische geletterdheid. Misschien kennen jullie de termen digitale geletterdheid, en hebben jullie wellicht een beeld van algoritmische geletterdheid , maar om het concreet te maken, algoritmische geletterdheid is geformuleerd als: "**Bewust zijn van** het gebruik van algoritmes in online toepassingen, platforms en diensten, **weten hoe** algoritmes werken, in staat zijn om **kritisch te evalueren** hoe algoritmische besluitvorming plaatsvindt, en ook de **vaardigheden hebben** om om te gaan met of zelfs **invloed** uit te oefenen op algoritmische operaties". (Dogruel et al., 2021). Dit is een zere brede term, die momenteel ook niet dusdanig is terug te vinden in digitale voor het onderwijs. Het zit een beetje binnen het domein mediawijsheid. Algoritmes gaan echter veel verder dan alleen media, en aangezien leerlingen er elke dag mee te maken hebben vind ik het, naast dat leerlingen er over leren ook een onderwerp dat meer aandacht verdient, zeker gezien de huidige en ook zeer snelle ontwikkelingen. En hiervoor heb ik een ontwerp bedacht, een spel, wat ik vandaag met jullie wil testen en onderdelen wil co-designen.

Vandaag heeft dus ook twee delen. In het eerste deel het testen van het spel, waar ik zo meer uitleg over geef, waarna ik jullie wil vragen om de Game Experience Questionnaire in te vullen. In het tweede deel wil ik met jullie gaan kijken naar wat het spel zou kunnen verrijken, of anders kan, zodat het een beter spel gaat worden, door gebruik te maken van het MDA framework in drie kleinere rondes.

Game explanation (5 min)

Het ontwerp wat ik momenteel aan het ontwikkelen ben is een spel over algoritmes in sociale media. Zoals je misschien wel weet, of zelf ervaart, creëert iedereen zijn eigen persoonlijke bubbel op sociale media, soms ook wel een filter bubbel genoemd. Dit gebeurt op basis van de gegevens die gebruikers aanleveren aan de algoritmes waarop deze platforms draaien, waaronder je gebruikersgedrag zoals hoe lang je naar bepaalde content kijkt, met het gevolg dat je vaak alleen maar content ziet die (het platform denkt dat) je leuk vindt of overeenkomt met je bestaande meningen en perspectieven, en waardoor je dus mogelijk minder met diverse content, meningen en perspectieven in aanraking komt.

Met dit spel hoop ik leerlingen algoritmisch geletterd te maken ten aanzien van algoritmes in sociale media, Waarbij de nadruk ligt op kennisgeving, zodat ze **weten** hoe ze werken, en hoe ze voorgestelde content **kritisch kunnen evalueren**. Door de kennis te leveren komt bewustmaken van, en ook de **vaardigheden** aanbieden om om te gaan met, of zelfs **invloed** uit te kunnen oefenen op deze algoritmes, ook aan bod.

Het verhaal waar het bij het spel om gaat is dat er een persoon is die in een online bubbel zit, en deze eigenlijk wil doorbreken om andere content te zien, vandaar ook het spelbord. Het doel van het spel is om de persoonlijke bubbel 'door te prikken' die door deze algoritmes is gecreëerd. Studenten spelen als een digitale punaise en zullen de ‘data’ weg af moeten leggen om de rand van de bubbel te bereiken. Dit doen ze door om de beurt vragen, natuurlijk over algoritmes en social media, te beantwoorden. Als ze een vraag correct is, mogen ze een stap zetten op het bord om uiteindelijk de rand van de bubbel te bereiken en zo de bubbel 'door te prikken'. Als het antwoord fout is, blijft de speler op dezelfde plek staan.

Er zijn in het spel twee stapels kaarten met vragen: één met makkelijke vragen en één met moeilijkere vragen. Een makkelijke vraag correct beantwoorden betekent één stap vooruitgaan. Een moeilijke vraag correct beantwoorden, is één stap vooruitgaan en daarbij data ontvangen.

Data kan gebruikt worden wanneer een speler vastloopt bij een vraag. De data kunnen ingewisseld worden voor een hint voor deze vraag te ontvangen van generatieve AI. Hiermee leren leerlingen over algoritmes door gebruik te maken van algoritmes, waarmee hopelijk ook de link wordt gelegd met wat ze leren naar algoritmes buiten sociale media, zoals generatieve AI.

Game Testing (15 min)

Dus de regels in het kort:

- Om beurten een vraag kiezen (makkelijk/moeilijk) en beantwoorden
- Vraag goed: stap vooruit
- Vraag fout: blijven staan
- Moeilijke vraag goed: krijg je data
- Data is in te zetten voor een hint bij generatieve AI: in de vorm van, mag ik een hint bij deze vraag.
    - Voor nu: Deels wizard of oz, door mij.
- Voor nu: wie als eerste 3 vragen goed heeft (waarschijnlijk, ivm tijd), die wint.

GAME EXPERIENCE QUESTIONNAIRE (5 min)

Vul de game experience questionnaire in.

Co-Design (25 min)

Explanation

In deze co-design sessie wil ik met jullie gaan nadenken over hoe het spel verbeterd kan worden. Dit gaan we doen aan de hand van het MDA framework, dat staat voor Mechanics, Dynamics en Aesthetics. Het framework is een manier om te kijken naar, en spellen te begrijpen, waarbij er gekeken wordt naar de mechanics, dynamics en aesthetics. Het model breekt spellen eigenlijk uiteen in 3 componenten, namelijk regels, systeem en plezier. De designcomponenten zijn mechanics, dynamics en aeshetics. De mechanics ondersteunen de dynamics, en deze zorgen weer voor de aesthetics. Vaak zijn het ook combinaties van alle 3 die het spel vorm geven.

Mechanics

Dit verwijst naar de regels, systemen en procedures van een game. Het zijn de bouwstenen waaruit de game is opgebouwd, zoals de controlemechanismen, de interacties tussen objecten en de doelstellingen van het spel. Een voorbeeld is dat er, in het geval van mij spel, vragen zijn, data zijn, en dat dit achievements zijn.

Dynamics

Dit verwijst naar de interacties en het gedrag dat ontstaat wanneer spelers de mechanica van het spel gebruiken. Dynamics beschrijven hoe de mechanica van een spel tot leven komen tijdens het spelen. Een voorbeeld uit mijn spel is bijvoorbeeld dat spelers data krijgen als ze een moeilijke vraag goed hebben, of een stap vooruit mogen zetten als ze een vraag goed hebben.

Aesthetics

Dit verwijst naar de emotionele reacties en ervaringen van spelers tijdens het spelen van een game. Aesthetics beschrijven de beleving van het spel, inclusief de gevoelens, emoties en betekenissen die het oproept bij de speler. In het framework noemen ze er 8, maar het is niet gelimiteerd tot deze 8.

Een speler ervaart het spel eigenlijk vanuit de aeshtetics, die de toon zetten, die opgebouwd zijn vanuit de zichtbare en merkbare dynamics, en uiteindelijk de bouwstenen van de mechanics.

Een ontwerper kijkt vanuit de mechanics, hoe dit de dynamics creëert en uiteindelijk de aesthetics. Met ontwerpen is het echter belangrijk dat er vanuit beide perspectieven wordt gekeken. Dat gaan we ook doen in deze sessie.

3 rondes

De sessie bestaat uit 3 rondes. In de eerste ronde gaan we kijken vanuit het ontwerpersperspectief, de tweede vanuit het spelersperspectief en in de 3^{e} ronde gaan we combinaties maken. In de eerste 2 rondes vraag ik jullie om te starten vanuit mechanics (ronde 1, ontwerpersperspectief) of de aeshtethics (ronde 2, spelersperspectief) en de dynamics en aesthetics, of dynamics en mechanics er bij te bedenken, om zo spelelementen te creëren die het spel zouden kunnen verbeteren.

Om jullie te helpen heb ik een overzicht van de mechanics, dynamics en aesthetics die het spel momenteel bevatten, en een lijst met mogelijke mechanics, dynamics en aeshtetics. Maar dit zijn er maar een aantal, je kunt ook zelf met ideeën komen vanuit eigen ervaring van het spelen van spellen.

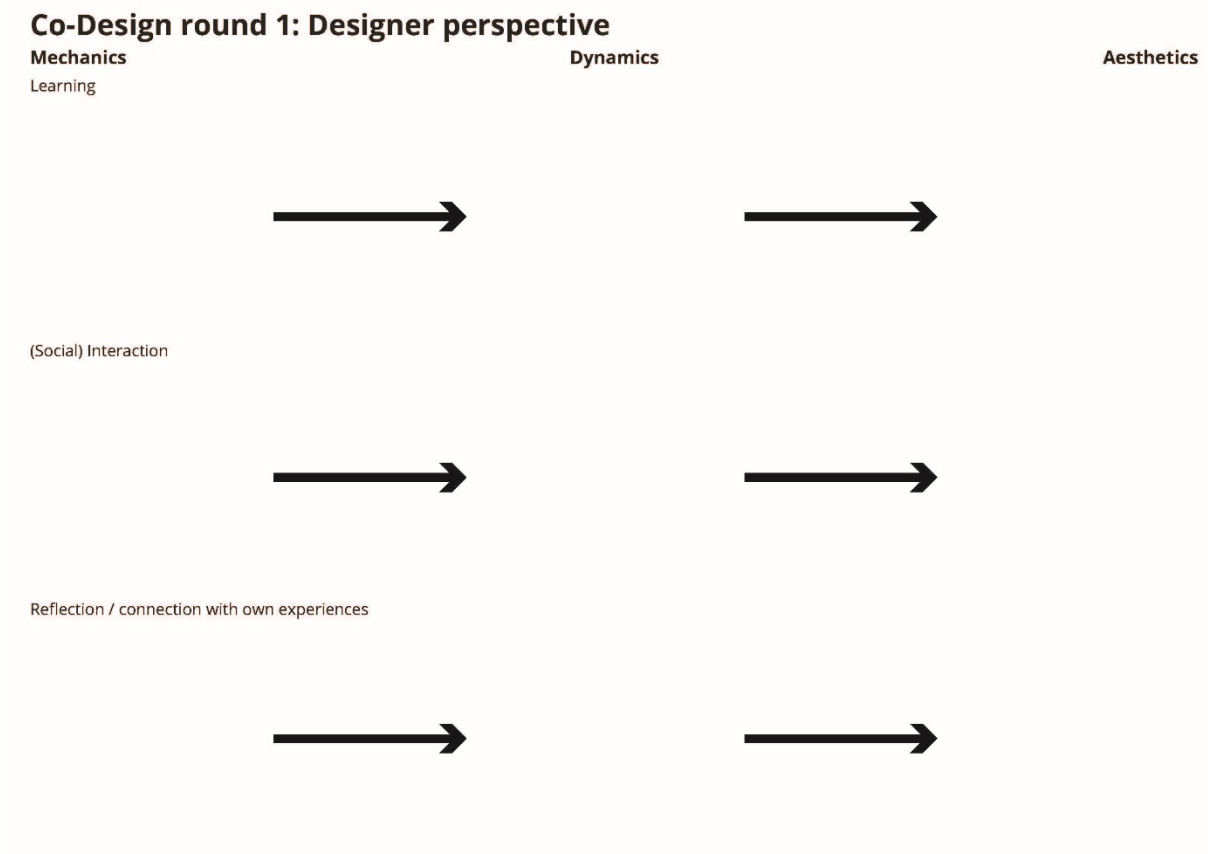
First round (7min)

In de eerste ronde bedenk je een mechanic die het spel zou kunnen bevatten en/of verbeteren richting de doelen, hieraan koppel je een dynamic, en welke aesthetic dit ondersteunt. Als voorbeeld uit het huidige spel:

Spelers kunnen een achievement krijgen (mechanic) → Achievement is te krijgen bij een moeilijke vraag goed (Dynamic) → spelers ervaren sensation en/of Challenge (aeshtetics)

MDA die de volgende doelen bevorderen:

- Het leren.
- Sociale interactie met andere spelers.
- Reflectie/koppelen met eigen social media gebruik.
- Vrije keuze.



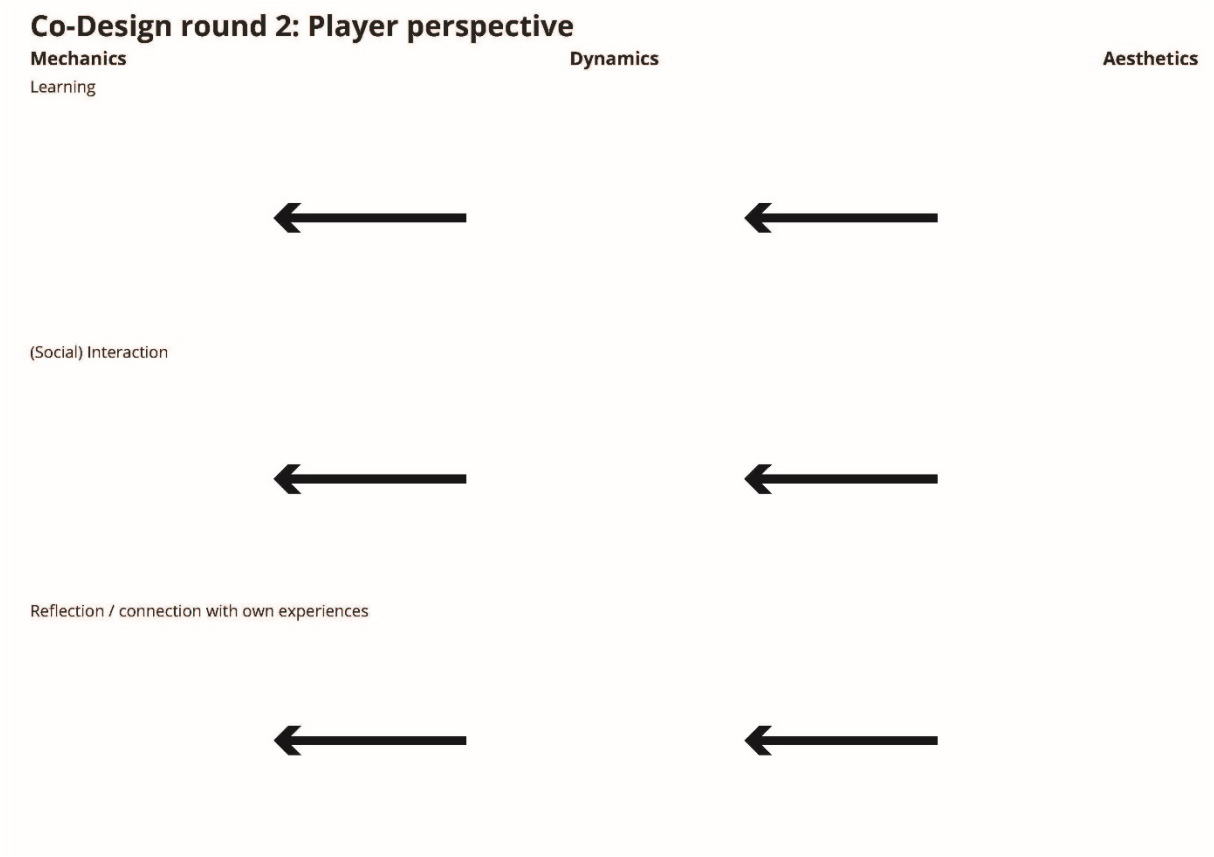
Second round (7 min)

In de tweede ronde gaan we het andersom doen, vanuit het spelersperspectief, en starten we met het bedenken van een aesthetic, waaraan we een dynamic koppelen en uiteindelijk de mechanic. Als voorbeeld uit het huidige spel:

Er is een verhaal dat de spelers interesseert (aesthetic) → spelers zetten stappen om het verhaal te voltooien (dynamics) → er is een spelbord dat de stappen toelaat (mechanic)

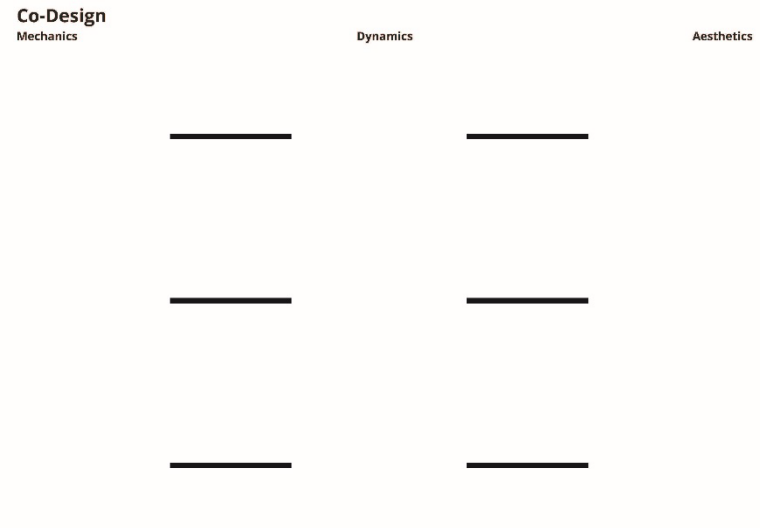
MDA die de volgende doelen bevorderen:

- Het leren.
- Sociale interactie met andere spelers.
- Reflectie/koppelen met eigen social media gebruik.
- Vrije keuze.



Third round (7 min)

Een spel staat natuurlijk niet met enkele lijnen van het MDA framework, maar een mix van verschillende mechanics, dynamics en aesthetics die op elkaar aansluiten, en eigenlijk zoveel mogelijk aesthetics creeëren. In deze laatste ronde gaan we kijken naar wat we hebben opgeschreven, en combinaties bedenken die nieuwe spelelementen zouden kunnen vormen.



Appendix I
Algorithmic literacy scale

Algorthmic Knowledge scale

What do you think algorithms do on the Internet? (True / False / I don't know)

- *Algorithms recognize that results, such as e.g., search results, are incomplete and automatically correct themselves.*
- *Algorithms can develop themselves in a completely different direction from that for which they were created.*

You will now see some statements about algorithms, some of them are true, some are false. (True / False / I don't know)

- *I can influence algorithms with my internet usage behavior*
- *The database used by an algorithm is not decisive in determining its quality.*
- *When searching for a job online, job offers displayed may vary from person to person despite the same search entry.*
- *The use of algorithms which deliver personalized content can mean that the content you find is mostly consistent with your pre-existing opinions.*
- *Algorithms are able to think like human beings.*
- *Algorithms are independent of government censorship.*
- *Algorithms present both chances and risks.*
- *For some media companies, content that is repeated regularly (e.g., traffic reports) is already written by algorithms.*
- *Humans are never involved when algorithms are used.*

Wrong/false answers are underlinded

Algorithmic Awareness scale

There is a large amount of data that can be used in the development and application of algorithms. Here you can see a selection of possible sources. Select the possible sources of data used by algorithms. (Is used / Is not used / I Don't know).

- *Smart speaker (e.g. Alexa)*
- *Smart TV*
- *Wearable computing devices such as activity trackers, heart rate monitors*
- *Internet-Browsers (e.g. Internet Explorer, Firefox, Opera, Google Chrome)*
- *Electronic payment (credit-, debit cards)*
- *Cell Phone Towers*
- *Computer Games*

Algorithms are already being used in very different areas. Do you know which of the following functions are often performed by algorithms? (Are performed by algorithms / are not performed by algorithms / I Don't know)

- *To create weather forecasts*
- *To make product recommendations*
- *To create financial news (stock markets)*
- *To personalize advertisements*

Scale above:

Leyla Dogruel, Philipp Masur & Sven Joeckel (2022) Development and Validation of an Algorithm Literacy Scale for Internet Users, Communication Methods and Measures, 16:2, 115-133, DOI: 10.1080/19312458.2021.1968361

Scale below:

Zarouali, B., Boerman, S. C., & De Vreese, C. H. (2021). Is this recommended by an algorithm? The development and validation of the algorithmic media content awareness scale (AMCA-scale). Telematics and Informatics, 62, 101607. https://doi.org/10.1016/j.tele.2021.101607

The Algorithmic Media Content Awareness Scale (AMCA-Scale)

Please indicate to which extent you are aware of the following statements about algorithms in media content.

1 = not at all aware 5 = completely aware

Content filtering

- *FIL1: Algorithms are used to recommend [media content] to me on [platform name].*
- *FIL2: Algorithms are used to prioritize certain [media content] above others.*
- *FIL3: Algorithms are used to tailor certain [media content] to me on [platform name].*
- *FIL4: Algorithms are used to show someone else see different [media content] than I get to see on [platform name].*

Automated decision-making

- *ADM1: Algorithms are used to show me [media content] on [platform name] based on automated decisions.*
- *ADM2: Algorithms do not require human judgments in deciding which [media content] to show me on [platform name].*
- *ADM3: Algorithms make automated decisions on what [media content] I get to see on [platform name].*

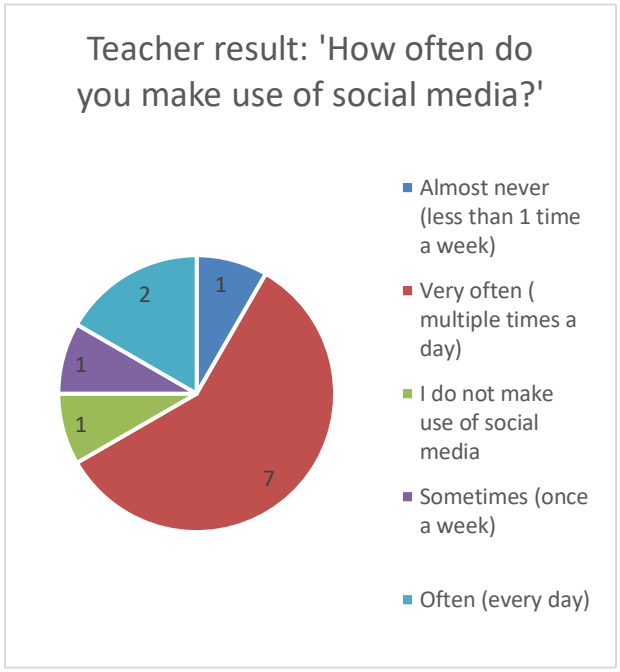
Human-algorithm interplay

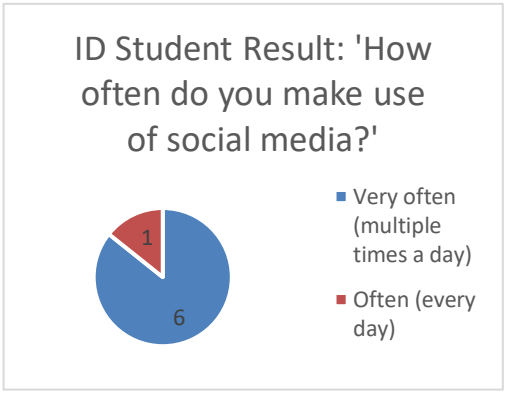
- *HAI1: The [media content] that algorithms recommend to me on [platform name] depend on my online behavior on that platform.*
- *HAI2: The [media content] that algorithms recommend to me on [platform name] depend on my online behavioral data.*
- *HAI3: The [media content] that algorithms recommend to me on [platform name] depend on the data that I make available online.*

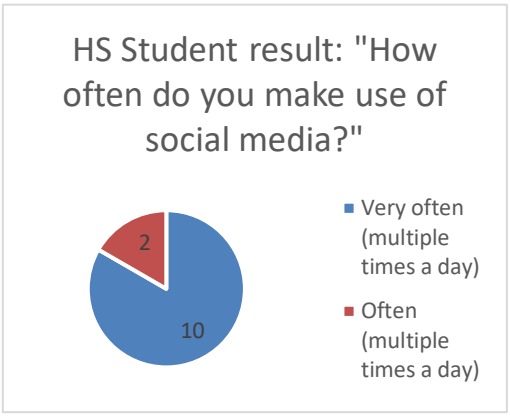
Ethical considerations

- *ETH1: It is not always transparent why algorithms decide to show me certain [media content] on [platform name].*
- *ETH2: The [media content] that algorithms recommend to me on [platform name] can be subjected to human biases such as prejudices and stereotypes.*
- *ETH3: Algorithms use my personal data to recommend certain [media content] on [platform name], and this has consequences for my online privacy.*

Appendix J: Results Algorithmic Literacy Questionnaire







	Correct Answer	Teachers Score (%)	ID Student Score (%)	High School student score (%)
Algoritmic Knowledge (True or false)				
Algorithms recognize that results, such as e.g., search results, are incomplete and automatically correct themselves.	FALSE	25	28.57142857	41.66666667
Algorithms can develop themselves in a completely different direction from that for which they were created.	TRUE	41.66666667	71.42857143	8.333333333
I can influence algorithms with my internet usage behavior		83.33333333	100	100
The database used by an algorithm is not decisive in determining its quality.	FALSE	58.33333333	71.42857143	50
When searching for a job online, job offers displayed may vary from person to person despite the same search entry.	TRUE	91.66666667	100	83.33333333
The use of algorithms which deliver personalized content can mean that the content you find is mostly consistent with your pre-existing opinions.	TRUE	100	85.71428571	100
Algorithms are able to think like human beings.	FALSE	83.33333333	100	83.33333333
Algorithms are independent of government censorship.	FALSE	66.66666667	85.71428571	41.66666667
Algorithms present both chances and risks.		100	100	91.66666667
For some media companies, content that is repeated regularly (e.g., traffic reports) is already written by algorithms.	TRUE	66.66666667	71.42857143	41.66666667
Humans are never involved when algorithms are used.	FALSE	100	100	66.66666667
AVERAGE SCORE Algorithmic knowledge		**74.24242424**	**83.11688312**	**64.39393939**
Algoritmic Awareness (checkbox)				
There is a large amount of data that can be used in the development and application of algorithms. Here you can see a selection of possible sources. Select the possible sources of data used by algorithms. (Is used / Is not used / I Don't know).	ALL OPTIONS WERE CORRECT	41.66666667	42.85714286	8.333333333
Algorithms are already being used in very different areas. Do you know which of the following functions are often performed by algorithms? (Are performed by algorithms / are not performed by algorithms / I Don't know)	ALL OPTIONS WERE CORRECT	66.66666667	42.85714286	8.333333333
AVERAGE SCORE Algorithmic awareness		**54.16666667**	**42.85714286**	**8.333333333**

RESULTS ALMA	Teachers	ID Students	Students
Content filtering			
FIL1: Algorithms are used to recommend content to me on social media.	4.916666667	4.714285714	4.416666667
FIL2: Algorithms are used to prioritize certain content above others.	4.666666667	4.857142857	4.166666667
FIL3: Algorithms are used to tailor certain content to me on social media.	4.583333333	4.285714286	4.416666667
FIL4: Algorithms are used to show someone else see different content than I get to see on social media.	4.833333333	4.571428571	4.25
Average	**4.75**	**4.607142857**	**4.3125**

Automated Decision Making			
ADM1: Algorithms are used to show me content on social media based on automated decisions.	4.5	4.142857143	3.916666667
ADM2: Algorithms do not require human judgments in deciding which content to show me on social media.	4.083333333	3.857142857	3.583333333
ADM3: Algorithms make automated decisions on what content I get to see on social media.	4.666666667	4.142857143	4
Average	**4.416666667**	**4.047619048**	**3.833333333**

Human Algorithm Interplay			
HAI1: The content that algorithms recommend to me on social media depend on my online behavior on that platform.	4.833333333	5	4.5
HAI2: The content that algorithms recommend to me on social media depend on my online behavioral data.	4.666666667	4.857142857	4.416666667
HAI3: The content that algorithms recommend to me on social media depend on the data that I make available online.	4.916666667	4.428571429	4.25
Average	**4.805555556**	**4.761904762**	**4.388888889**

Ethical Considerations			

ETH1: It is not always transparent why algorithms decide to show me certain content on social media.	4.166666667	3.571428571	3.25
ETH2: The content that algorithms recommend to me on social media can be subjected to human biases such as prejudices and stereotypes.	4.666666667	4	3.25
ETH3: Algorithms use my personal data to recommend certain content on social media, and this has consequences for my online privacy.	4.666666667	4.571428571	4.25
Average	**4.5**	**4.047619048**	**3.583333333**

Appendix K: MDA analysis of Escape the Bubble

Mechanics

Player progression
- Achievement (step forward)
- Achievement (data)

Tasks
- Mission (help character break out of the bubble, reach the end of data stream)

Game content
- Questions
  - Hard
  - Easy
- Data Token
- Turn – based

Additional Feature
- Feedback (right/wrong answer)
- Map / Board
- Background story
- Hints

Dynamics

Receive badges, achievement, or other rewards
With a correct answer, students receive a reward which is moving one step forward. With a correct answer on a hard question, students receive 'data' as reward.

Linear Progression
Students give correct answers to move forward in linear progression

Different Difficulty
Questions that are either easy or hard to answer.

Hints
The game will provide help to guide players during gameplay if asked.

Turn – based
During gameplay, players take turns in order to continue the game.

Quiz system
Different types of questions with points/rewards for each correct answer.

Aesthetics

Sensation (game as sense-pleasure):
sense of pleasure/joy (as the result of trying something new);

Challenge (game as obstacle course):
being challenged to finish certain tasks;

Fellowship (game as social framework):
engaged in social networking;

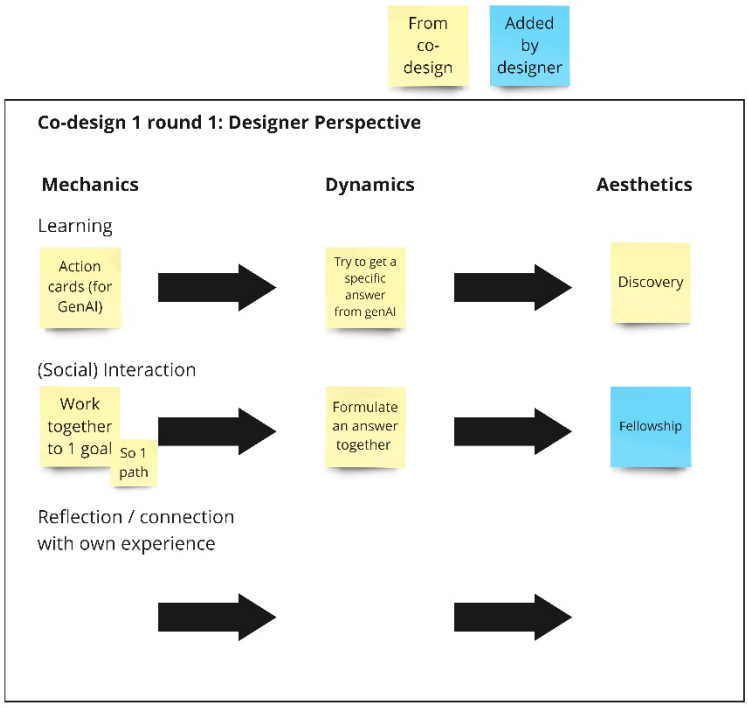
Fantasy (game as make-believe):
immersion to virtual/imaginary world;

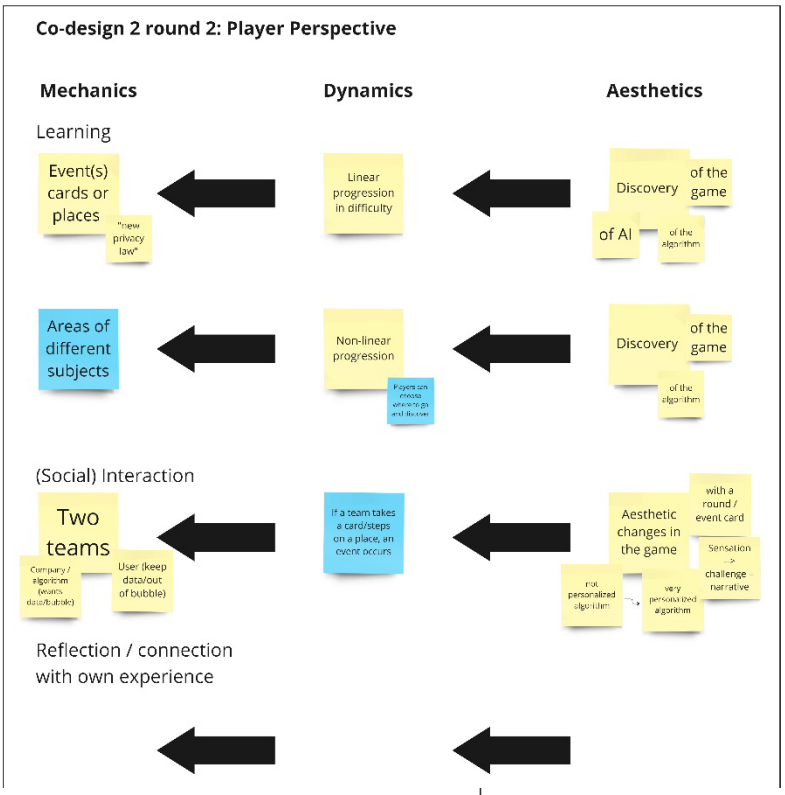
Submission (game as pastime):
devotion/connection to the game, as a whole;

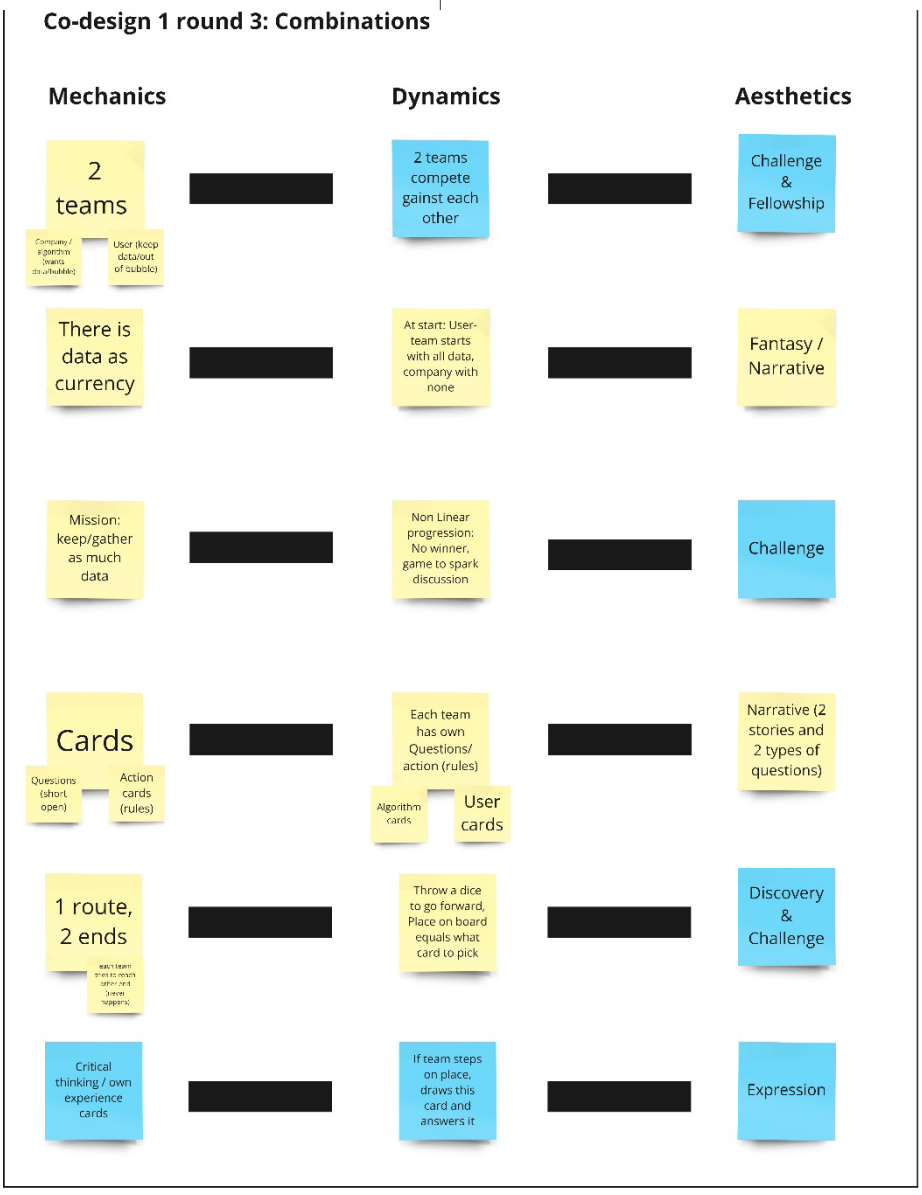
Narrative (game as drama):
storyline that catch player's interest, drives player to keep coming back.

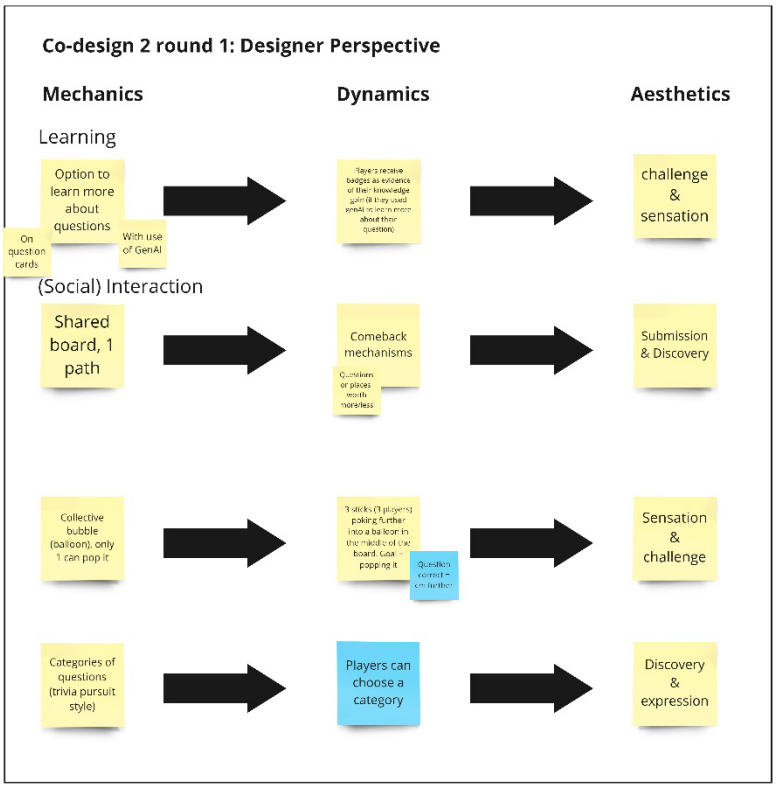
Mechanics	Dynamics	Aesthetics
Player progression Achievement (step forward)	**Receive badges, achievement, or other rewards** With a correct answer, students receive a reward which is moving one step forward	**Challenge (game as obstacle course):** being challenged to finish certain tasks;
Player progression Achievement (data)	**Receive badges, achievement, or other rewards** With a correct answer on a hard question, students receive 'data' as reward.	**Sensation (game as sense-pleasure):** sense of pleasure/joy (as the result of trying something new);
Tasks Mission (help character break out of the bubble, reach the end of data stream)	**Linear Progression** Students give correct answers to move forward in linear progression	**Narrative (game as drama):** storyline that catch player's interest, drives player to keep coming back.
Game Content Questions	**Quiz system** Different types of questions with points/rewards for each correct answer.	**Sensation / Challenge**

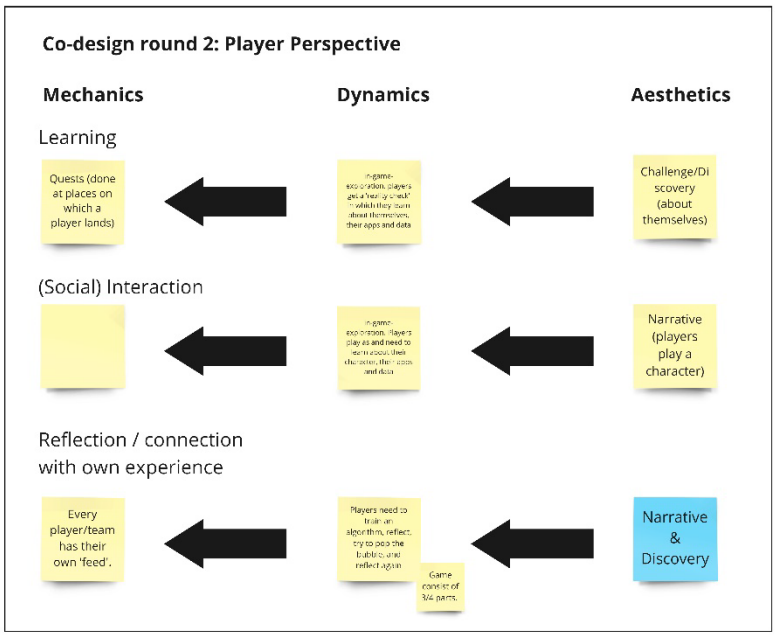
Appendix L: Co-Design session results

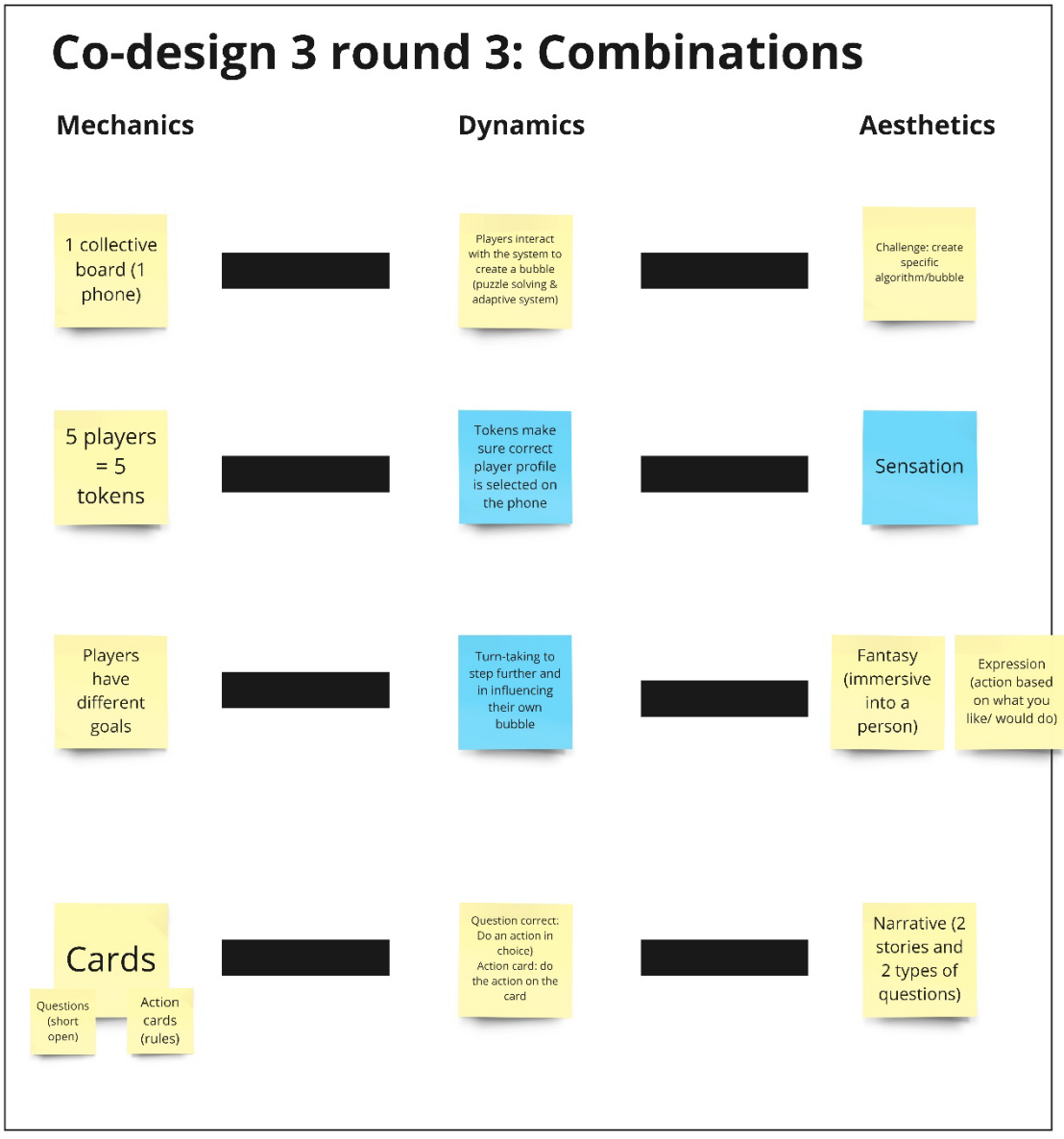




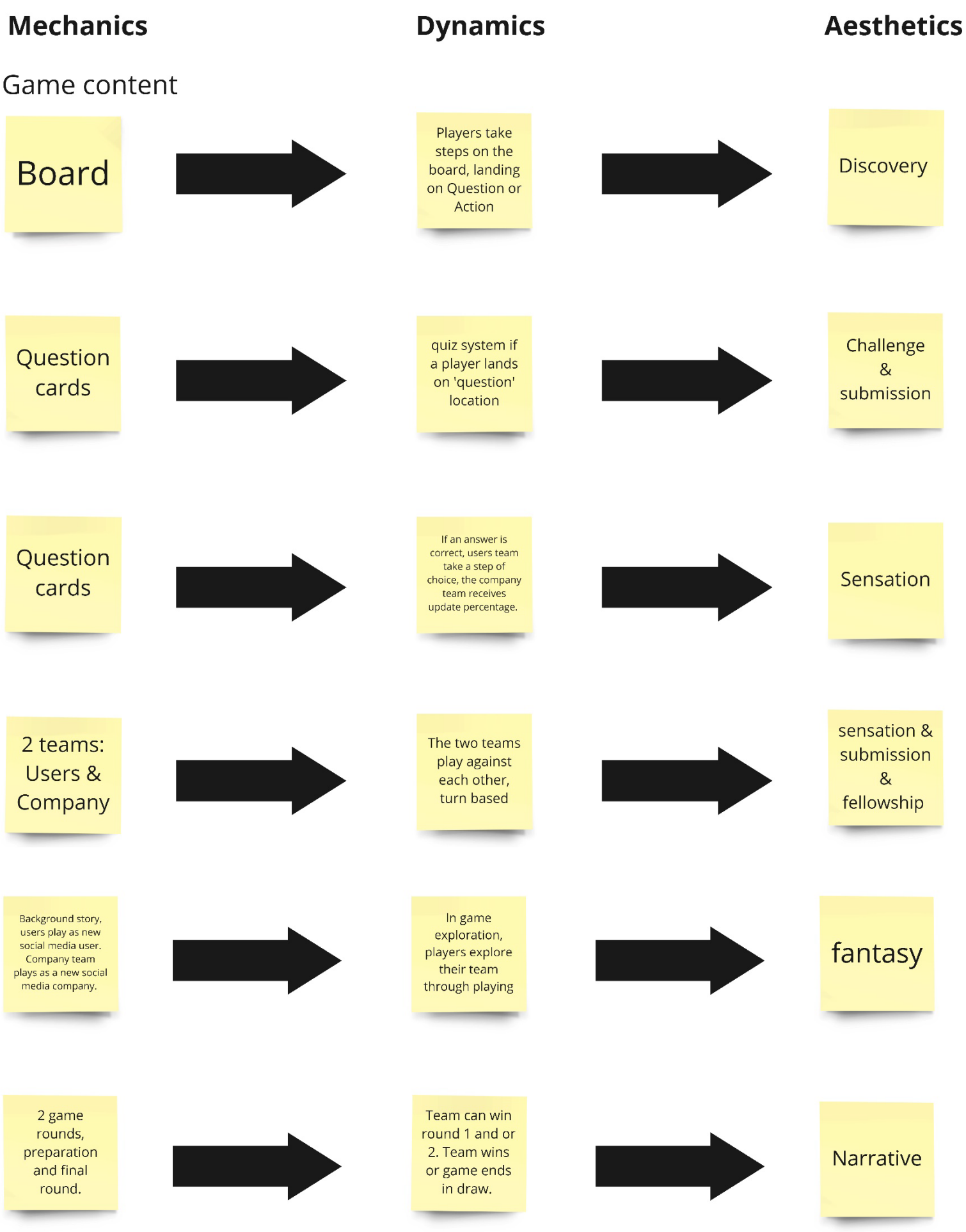


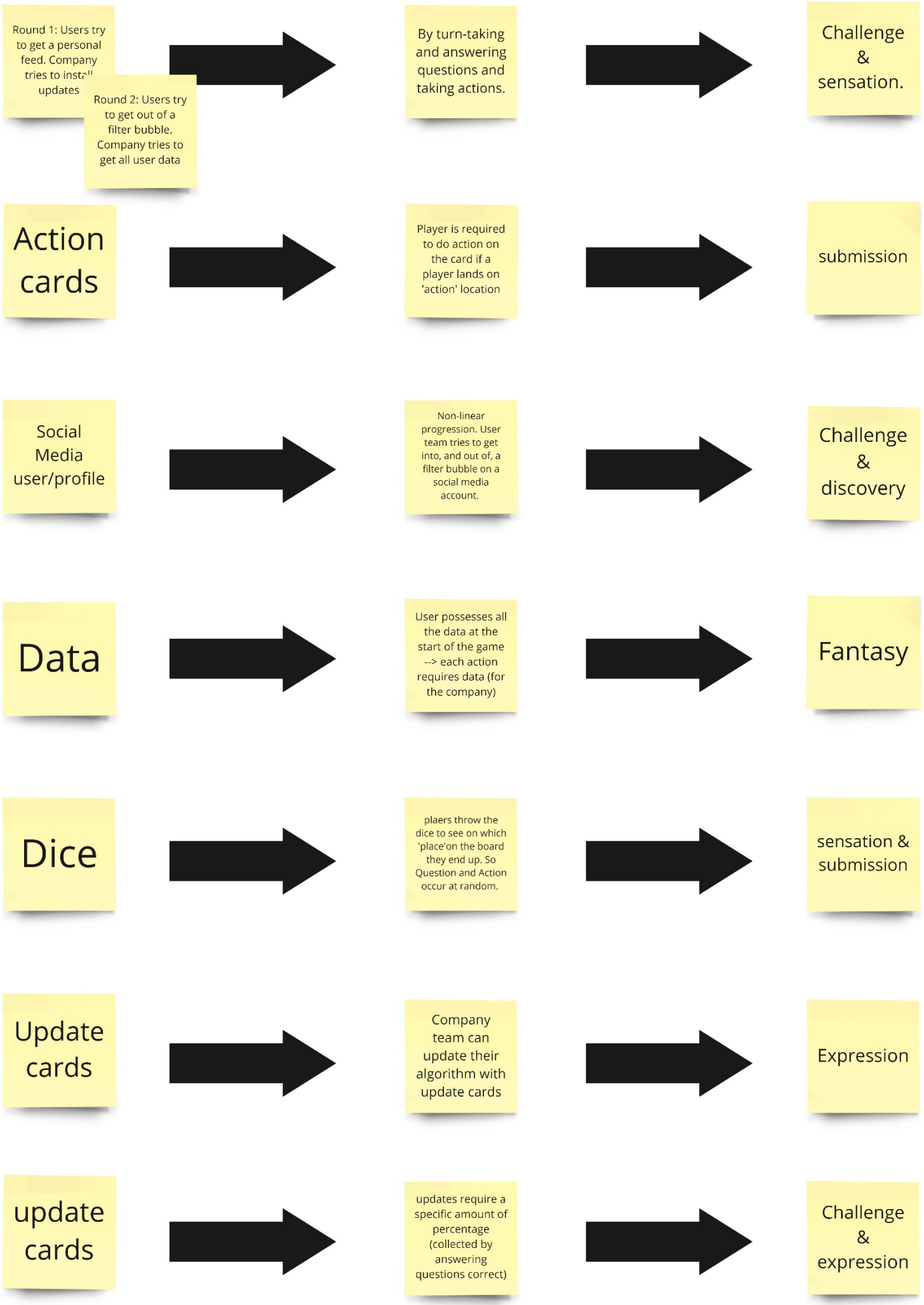

Co-design 2 round 1: Designer Perspective
Mechanics
Dynamics
Aesthetics
Learning
Option to learn more about questions
On question cards
With use of GenAI
challenge & sensation
(Social) Interaction
Shared board, 1 path
Comeback mechanisms
Submission & Discovery
Collective bubble (balloon), only 1 can pop it
Sensation & challenge
Categories of questions (trivia pursuit style)
Players can choose a category
Discovery & expression


Co-design round 2: Player Perspective
Mechanics
Dynamics
Aesthetics
Learning
Quests (done at places on which a player lands)
Challenge/Discovery (about themselves)
(Social) Interaction
Narrative (players play a character)
Reflection / connection with own experience
Every player/team has their own 'feed'.
Narrative & Discovery


Co-design 3 round 3: Combinations
Mechanics
Dynamics
Aesthetics
1 collective board (1 phone)
Players interact with the system to create a bubble (puzzle solving & adaptive system)
Challenge: create specific algorithm/bubble
5 players = 5 tokens
Tokens make sure correct player profile is selected on the phone
Sensation
Players have different goals
Turn-taking to step further and in influencing their own bubble
Fantasy (immersive into a person)
Expression (action based on what you like/ would do)
Cards
Questions (short open)
Action cards (rules)
Question correct: Do an action in choice)
Action card: do the action on the card
Narrative (2 stories and 2 types of questions)

Appendix M: MDA Social Media Battle




Round 1: Users try to get a personal feed. Company tries to install updates
Round 2: Users try to get out of a filter bubble. Company tries to get all user data
By turn-taking and answering questions and taking actions.
Challenge & sensation.
Action cards
Player is required to do action on the card if a player lands on 'action' location
submission
Social Media user/profile
Non-linear progression. User team tries to get into, and out of, a filter bubble on a social media account.
Challenge & discovery
Data
User possesses all the data at the start of the game --> each action requires data (for the company)
Fantasy
Dice
plaers throw the dice to see on which 'place'on the board they end up. So Question and Action occur at random.
sensation & submission
Update cards
Company team can update their algorithm with update cards
Expression
update cards
updates require a specific amount of percentage (collected by answering questions correct)
Challenge & expression

Appendix N

Set-up & Results User Test Leerlingen

This document is a set-up for a user test I will conduct for my M2.1 Preparation FMP project at the faculty of Industrial Design at the Eindhoven University of Technology. The user test will be performed with students aged 12-17 and is meant to test the current design and gather insights in order to improve the design. The study involves a short questionnaire to measure and self-report their algorithmic literacy, testing the design by playing the game with use of a lo-fi prototype, after which participants will fill in the same questionnaire and a semi-structured interview about the game.

Introductie (2 min)

Welkom, ik ben Yorn Thijssen, en ik studeer de master Industrial Design op de TU/e, in combinatie met de lerarenopleiding. In een ontwerpproject wat ik nu doe zoek ik de combinatie op tussen deze twee opleidingen. Ik ben een ontwerp aan het maken dat gebruikt kan worden in het onderwijs, en waar jullie dus hopelijk wat van leren.

Het onderwerp waar dit ontwerp op ingaat is op algoritmische geletterdheid. Nu is dat een lastig term, maar eigenlijk gaat het hierbij grofweg om: je bewustzijn en kennis van algoritmes, en hoe je er mee om gaat. Mijn ontwerp, een spel, heeft als doel om dit bij jullie te verbeteren, dus jullie bewustzijn en kennis van algoritmes, en hoe jullie er mee omgaan, om dat te verbeteren. Vandaag ga ik dus testen of dat met mijn ontwerp ook lukt. Hierbij is het belangrijk om te onthouden dat het spel wordt getest, en niet jullie. Dus jullie worden ook nergens op beoordeeld, en als je het niet fijn vindt tijdens het testen mag je ook altijd stoppen.

Hoe gaan we dit doen? Natuurlijk door het spel te spelen, maar om te weten of het spel jullie iets bij brengt wil ik jullie vragen om een vragenlijst in te vullen, en dit na het spelen ook te doen zodat ik de antwoorden kan vergelijken. Tijdens het spelen van het spel zal ik ook het e.e.a. opschrijven wat me opvalt, en na het spelen en invullen van de vragenlijst zal ik ook een paar vragen stellen over het spelen, mits daar tijd voor is.

Questionnaire (10 min)

https://forms.office.com/e/PG2iwRAM60

Speluitleg (5 min)

Het spel gaat over algoritmes in iets wat jullie waarschijnlijk veel gebruiken: sociale media.

Zoals je misschien wel weet, of zelf ervaart, creëert iedereen zijn eigen persoonlijke bubbel op sociale media, soms ook wel een **filter bubbel** genoemd. Dit gebeurt op basis van de gegevens die gebruikers aanleveren aan de algoritmes waarop deze platforms draaien, waaronder je gebruikersgedrag zoals hoe lang je naar bepaalde content kijkt, met het gevolg dat je vaak alleen maar content ziet die (het platform denkt dat) je leuk vindt of overeenkomt met je bestaande meningen en perspectieven, en waardoor je dus minder met diverse content, meningen en perspectieven in aanraking komt.

Met dit spel hoop ik jullie hiervan bewust te maken, dus van het gebruik van algoritmes in sociale media, kennisgeven zodat jullie **weten** hoe ze werken, en hoe je voorgestelde content **kritisch kunnen evalueren**, en ook je de **vaardigheden** aanbieden om om te gaan met, of zelfs **invloed** uit te kunnen oefenen op deze algoritmes.

Play testing the game (20-25 min) (Timewise: maybe only 1 round)

Lo-fi prototype: explain the game rules

Final Prototype: give the game rules.

Aspects to observe and note during gameplay:

Engagement and Interaction: (High, medium, low)

- How engaged are the students while playing?
- Are they actively discussing strategies and decisions with their partners?
- Do they show signs of enjoyment or frustration at any point?

Understanding of Game Mechanics:

- Do students understand how to use the dice, action cards, and question cards?
- Are they able to grasp the concept of earning updates and using data tokens?
- Do they follow the rules correctly, or do they need frequent clarifications?

Strategy and Decision Making:

- How do the user duo strategize to get into and out of content bubbles?
- How does the company duo prioritize earning updates and using algorithms?
- Do they make decisions quickly or take time to deliberate?

Game Balance:

- Does either duo seem to have a significant advantage?
- Are the actions and questions balanced in terms of difficulty and impact?
- Is the game progressing at a reasonable pace?

Frequency of rule clarification needed:

Pace of game progression:

Post test interview (10 min)

Vragen over het spel algemeen:

1. Wat vonden jullie van het (spelen van) spel?
2. Zou je het spel vaker willen spelen, waarom wel/niet?
    a. Wat zou je anders doen als je het nog een keer zou spelen?
3. Vind je dat er strategie in het spel zit, oftewel, dat je een bepaalde strategie kunt toepassen om het spel te winnen? Waarom wel/niet?
    a. Hadden jullie genoeg informatie om beslissingen te maken over je acties?

Vragen t.a.v. begrijpen van algoritme en data:

4. Was het duidelijk hoe jullie acties de content op de feed beïnvloedde? (user)
5. Was het duidelijk hoe de updates en de algoritmes het verkrijgen van de data beïnvloedde?

Vragen over de vragen/acties in het spel:

6. Wat vonden jullie van de vragen die je moest beantwoorden?
    a. Waren ze te begrijpen/duidelijk?
7. Wat vonden jullie van de acties op de actiekaartjes?
    a. Waren ze duidelijk?

Vragen over het design van het spel:

8. Hoe vinden jullie het spel er uit zien?
    a. Als je het ontwerp ziet, waar moet je dan aan denken?
9. Wat vinden jullie ervan dat je op een knop drukt en je locatie wordt bepaald?
10. Waren de spelregels duidelijk?

Afronding/conclusie

11. Vonden jullie het geheel bij elkaar passen? Oftewel, het verhaal van het nieuwe platform, dat je speelt als gebruiker tegen het platform, de data en de algoritmes, en de vragen en acties?
12. Heb je wat geleerd tijdens het spelen van het spel?
13. Waren er onderdelen van het spel die onduidelijk waren, of die verbetering nodig hebben volgens jullie?

Participants:

1: test 1, 2: test 2, 3: test 3, 4: test 4

Notes:

- 4: “WOW, it looks clean”

Icons:

- 1: Icon for user or company is clear.
- 3: Icons of user and company are clear
- 4: Data tokens are clear: participant mentioned the 1 and 0

Questions:

- 1: Questions that require connection or sequencing or long questions are hard to do without looking at the card, so the students laid another card on top of the card to hide the answer.
- 1: Questions require quite some time, discussing the answer also.
- 1: Some questions are quite long, so they let the other duo read it themselves.
- 1: Participants played it in a fair manner, letting the other duo check the answer.
- 2: Players did not read all questions aloud, especially if the questions were long. They let the other players read it themselves.
- 2: It was noticeable that the students really were thinking about the answer.
- 2: The game takes a long time due to the long questions.
- 2: Write on the question card that it is an open question. The question and answers was not clear.
- 3: Idea for answers: list of answers instead of on the card
    - Maybe a blurred part which is only visible if a layer is put on top (red transparent layer)
- 3: Questions take a long time
- 3: The information on the front of the question cards is clear
- 4: Instantly the idea of putting another card on a question card was given

Gameplay:

- 1: At the start the students are searching for what is what
- 1 The positions, so the questions or action placements, are clear.
- 1: After some time at the start the game is clearer and the tempo of playing increases.
- 1: It was noticeable that the company duo had less interaction in the game due to them not interacting with the platform.
- 1: The company duo was alert in receiving the data, asking the other duo for the data.
- 3: Action of MAX 2 tokens is clear, so 1 is also possible
- 3: User and company can end up on the same spot. Were put on each other.
- 4: Participants wondered in the beginning whether when it costs more data tokens, it does more towards the bubble
- 4: Earning algorithms and handing in data tokens was not fully clear
- 4: Participants were all focused on the video

Strategy:

- 1: The user duo discussed how they would likely get into the bubble.
- 1: The company duo noticed the actions of the user duo to choose an update and receive data.
- 1: The user duo noticed that liking a correct video earns them 10 percent.
- 3: Rise of 10% of the bubble is clear, also the reason why.
- 4: User duo doubted whether to choose like comment or share, but strategically chose comment instead of liking so it would cost them no data token.
- 4: User duo discussed what to do with a video, and whether to follow, and correctly saw that when they would click the + icon that they would follow, and that was not what they wanted.
- 4: Company duo strategically chose the not interested algorithm in order to receive most data tokens.
- 4: User duo again doubted what to do, what action would do the most, and after seeing follow would do 20%, they correctly guessed the costs and the percentage is linked.

Cards:

- 1: Action cards of which the action has passes were put away.
- 1: There was a leftover percentage after handing in the percentage for an update.
- Create additional cards.
- 3: Action cards are clear
- 4: There was confusion about taking action and taking an actioncard

Game rules:

- 3: Difficult words in the rules
- 3: Takes some time to read the rules (10-15 min)
- 3: Add that questions that are done need to be put away

Aspects observed during Gameplay in user test 1 & 2:

Engagement and Interaction: (High, medium, low)

- How engaged are the students while playing?
- Are they actively discussing strategies and decisions with their partners?
- Do they show signs of enjoyment or frustration at any point?

Test 1:

The students started with medium engagement with the game. But later, after they better understood the game, it went to high engagement. Especially with the questions. They were frustrated when they got it wrong. They also intensively discussed what action or update to choose.

User test 2:

Students were medium engaged for the entire game and only sometimes discussed strategies with their partner. However, no frustration was shown.

Test 3:

Students started with low to medium engagement because they needed to read the instructions, and this required some time. After reading the instructions they were willing to start the game but did not really know how. So, it took some time before they understood what to do and the engagement went up. Since this test was a 1vs1 test they did not discuss with a partner, but they discussed with each other. No frustration was noticeable.

Test 4:

Students were very engaged from the start and actively discussed their strategies and answers before taking them. It took some time before they fully understood the game, but after they understood the engagement was even higher. Sometimes frustration was visible, but that belonged to the game since the action cards involve negative actions.

Conclusion Engagement and Interaction:

Overall students were medium to highly engaged with the game. In 3 out of 4 user tests, the medium engagement was due to the time it took to understand the game. Once the students understood the game and its rules, it was noticeably visible that engagement went up. In all tests, students discussed the questions as well as the strategy with their partner. Sometimes frustration was visible when a question was answered wrong, or an action was drawn that negatively impacted the duo, however this is part of the game.

Understanding of Game Mechanics:

- Do students understand how to use the dice, action cards, and question cards?
- Are they able to grasp the concept of earning updates and using data tokens?
- Do they follow the rules correctly, or do they need frequent clarifications?

Test 1 and 2:

The dice, action card and taking questions and read them aloud were all clear from the start. In the beginning the updates and data tokens were not fully clear, but after some clarification they understood it and even thought about it themselves after taking an action.

Test 3:

Taking turns and taking a question or action card was clear from the start. Earning updates, taking action and the cost of data tokens did take some longer to understand. However, with the use of the instructions they were constantly able to take the correct steps. After a while they did understand everything.

Test 4:

Taking turns, taking the question and action cards were clear at the start. However, earning update percentage and handing in the tokens was not clear. After repeating their goal, they eventually all understood the game. So, some clarification was needed, but they wanted to play longer once they understood the game.

Conclusion Understanding of Game Mechanics.

In all user tests, taking turns, landing on an action or question spot and taking the corresponding cards were clear. Taking action on the platform, the costs of this action and thus handing data tokens to the company duo and earning update percentage that can be handed in for an update were not fully clear. However, after some instructions (test 1 and 2) or reading the game rules (test 3 and 4), these aspects of the game became clear as well.

Strategy and Decision Making:

- How do the user duo strategize to get into and out of content bubbles?
- How does the company duo prioritize earning updates and using algorithms?
- Do they make decisions quickly or take time to deliberate?

Test 1 and 2:

The user duo discussed what actions to take to get into the bubble, while the company duo discussed which update to take in order to earn as much data tokens as possible. This often took some time.

Test 3:

The user considered at each video what action to take in order to reach the bubble. The company was not able to achieve an update. Taking this decision took some time, but not frustrating long.

Test 4:

User duo discussed which action to take at each video, while the company duo discussed which update to choose. It sometimes took some time but a decision was made relatively quickly.

Conclusion Strategy and Decision making:

Both duos discussed a strategy in every test. For the user duo this involved deliberating on which action to take on the platform, considering the amount of data tokens. For the company duo this involved discussing which actions the user took most and thus which algorithm update to receive. At the start of the game this took a while, but after understanding the game rules better, decisions were taken more quickly.

Game Balance:

- Does either duo seem to have a significant advantage?
- Are the actions and questions balanced in terms of difficulty and impact?'
- Is the game progressing at a reasonable pace?

User test 1 and 2:

The user duo is a bit more engaged in the game duo to their interaction with the platform. Also, the company duo only receives little data tokens in the first round, so either the platform should be extended, or the user duo starts with less data. The questions seemed to be challenging since not all questions were answered correctly, so this is a good balance. However, it could become a bigger challenge with younger students.

Test 3:

Since the players did not go very far in the game, it was not clear whether each player had a significant advantage. Actions and questions, and getting on these places, are correctly balanced. The game does take some time because of the long questions.

Test 4:

The user duo seems to have an advantage, being able to get into the content bubble more quickly than the company duo is able to earn percentage.

Conclusion Game Balance:

In all user tests, it was visible that the user duo was able to reach their goal more quicky than the company duo. While the user duo is able to reach the required 90% of the bubble relatively quick, it is hard for the company to earn multiple updates. Positively and negatively impacting actions and the difficulty in the questions, as well as landing on these spots, are well balanced. It does take some time to fully understand the game, but I every user test the pace went up when the students understood the game to the full extend.

Appendix O: Arduino Code

```
#include <Adafruit_NeoPixel.h>
#ifdef __AVR__
#include <avr/power.h>  // Required for 16 MHz Adafruit Trinket
#endif

#define PIN 14  // pin on which the LEDs are connected to the board

#define NUMPIXELS 20  // Popular NeoPixel ring size

Adafruit_NeoPixel pixels(NUMPIXELS, PIN, NEO_RGBW + NEO_KHZ800);

#define DELAYVAL 500  // Time (in milliseconds) to pause between pixels

const int buttonPin1 = 12;  // the number of the pushbutton pin
const int buttonPin2 = 13;
const int ledPin = LED_BUILTIN;  // the number of the LED pin

long PrevRandNumb1;
long NewRandNumb1;
long PrevRandNumb2;
long NewRandNumb2;

// variables will change:
int buttonState1 = 0;  // variable for reading the pushbutton status
int buttonState2 = 0;

void setup() {
  Serial.begin(9600);
  randomSeed(analogRead(0));
  // initialize the LED pin as an output:
  pinMode(ledPin, OUTPUT);
  digitalWrite(ledPin, HIGH);
  // initialize the pushbuttons pin as an input:
  pinMode(buttonPin1, INPUT_PULLUP);
  pinMode(buttonPin2, INPUT_PULLUP);
  pixels.begin();  // INITIALIZE NeoPixel strip object (REQUIRED)
  pixels.setBrightness(150);
}

void loop() {
  // read the state of the pushbutton value:
  buttonState1 = digitalRead(buttonPin1);
  Serial.println("Button 1 = ");
  Serial.println(buttonState1);
```

```
  buttonState2 = digitalRead(buttonPin2);
  Serial.println("Button 2 = ");
  Serial.println(buttonState2);

  // check if the pushbutton is pressed. If it is, the buttonState is HIGH:
  if (buttonState1 == HIGH) {  //User Player, so random number 1
    PrevRandNumb1 = NewRandNumb1;
    pixels.setPixelColor(PrevRandNumb1, pixels.Color(0, 0, 0));

    NewRandNumb1 = PrevRandNumb1 + random(1, 10);

    if (NewRandNumb1 > 19) {
      NewRandNumb1 = NewRandNumb1 - 19;
    }

    Serial.println(PrevRandNumb1);
    Serial.println(NewRandNumb1);
if (NewRandNumb1 > PrevRandNumb1) {
    for (int i = PrevRandNumb1; i < NewRandNumb1; i++) {
      pixels.setPixelColor(i, 0, 255, 255);
      pixels.show();
      delay(200);
      pixels.setPixelColor(i, 0, 0, 0);
      pixels.show();
    }
    pixels.setPixelColor(NewRandNumb1, 0, 255, 255, 0);
    pixels.show();
    delay(100);
    pixels.setPixelColor(NewRandNumb1, 0, 0, 0, 0);
    pixels.show();
    delay(100);
    pixels.setPixelColor(NewRandNumb1, 0, 255, 255, 0);
    pixels.show();
    delay(100);
    pixels.setPixelColor(NewRandNumb1, 0, 0, 0, 0);
    pixels.show();
    delay(100);
    pixels.setPixelColor(NewRandNumb1, 0, 255, 255, 0);
    pixels.show();
    delay(100);
    pixels.setPixelColor(NewRandNumb1, 0, 0, 0, 0);
    pixels.show();
    delay(100);
    pixels.setPixelColor(NewRandNumb1, 0, 255, 255, 0);
    pixels.show();
  }

  if (NewRandNumb1 < PrevRandNumb1) {
```

```
  for (int i = PrevRandNumb1; i < NUMPIXELS; i++) {
    pixels.setPixelColor(i, 0, 255, 255);
    pixels.show();
    delay(200);
    pixels.setPixelColor(i, 0, 0, 0);
    pixels.show();
  }
  for (int i = 0; i < NewRandNumb1; i++) {
    pixels.setPixelColor(i, 0,255, 255);
    pixels.show();
    delay(200);
    pixels.setPixelColor(i, 0, 0, 0);
    pixels.show();
  }
  pixels.setPixelColor(NewRandNumb1, 0, 255, 255, 0);
  pixels.show();
  delay(100);
  pixels.setPixelColor(NewRandNumb1, 0, 0, 0, 0);
  pixels.show();
  delay(100);
  pixels.setPixelColor(NewRandNumb1, 0, 255, 255, 0);
  pixels.show();
  delay(100);
  pixels.setPixelColor(NewRandNumb1, 0, 0, 0, 0);
  pixels.show();
  delay(100);
  pixels.setPixelColor(NewRandNumb1, 0, 255, 255, 0);
  pixels.show();
  delay(100);
  pixels.setPixelColor(NewRandNumb1, 0, 0, 0, 0);
  pixels.show();
  delay(100);
  pixels.setPixelColor(NewRandNumb1, 0, 255, 255, 0);
  pixels.show();
}

} else {
  // turn LED off:
}

if (buttonState2 == HIGH) {
  PrevRandNumb2 = NewRandNumb2;
pixels.setPixelColor(PrevRandNumb2, pixels.Color(0, 0, 0));

NewRandNumb2 = PrevRandNumb2 + random(1, 10);

if(NewRandNumb2 >19){
  NewRandNumb2 = NewRandNumb2-19;
```

```
  }

  Serial.println(PrevRandNumb2);
  Serial.println(NewRandNumb2);

if (NewRandNumb2 > PrevRandNumb2) {
    for (int i = PrevRandNumb2; i < NewRandNumb2; i++) {
      pixels.setPixelColor(i, 255, 0, 0);
      pixels.show();
      delay(200);
      pixels.setPixelColor(i, 0, 0, 0);
      pixels.show();
    }
    pixels.setPixelColor(NewRandNumb2, 255, 0, 0, 0);
    pixels.show();
    delay(100);
    pixels.setPixelColor(NewRandNumb2, 0, 0, 0, 0);
    pixels.show();
    delay(100);
    pixels.setPixelColor(NewRandNumb2, 255, 0, 0, 0);
    pixels.show();
    delay(100);
    pixels.setPixelColor(NewRandNumb2, 0, 0, 0, 0);
    pixels.show();
    delay(100);
    pixels.setPixelColor(NewRandNumb2, 255, 0, 0, 0);
    pixels.show();
    delay(100);
    pixels.setPixelColor(NewRandNumb2, 0, 0, 0, 0);
    pixels.show();
    delay(100);
    pixels.setPixelColor(NewRandNumb2, 255, 0, 0, 0);
    pixels.show();
  }

  if (NewRandNumb2 < PrevRandNumb2) {
    for (int i = PrevRandNumb2; i < NUMPIXELS; i++) {
      pixels.setPixelColor(i, 255, 0, 0);
      pixels.show();
      delay(200);
      pixels.setPixelColor(i, 0, 0, 0);
      pixels.show();
    }
    for (int i = 0; i < NewRandNumb2; i++) {
      pixels.setPixelColor(i, 255, 0, 0);
      pixels.show();
      delay(200);
      pixels.setPixelColor(i, 0, 0, 0);
```

```
      pixels.show();
    }
    pixels.setPixelColor(NewRandNumb2, 255, 0, 0, 0);
    pixels.show();
    delay(100);
    pixels.setPixelColor(NewRandNumb2, 0, 0, 0, 0);
    pixels.show();
    delay(100);
    pixels.setPixelColor(NewRandNumb2, 255, 0, 0, 0);
    pixels.show();
    delay(100);
    pixels.setPixelColor(NewRandNumb2, 0, 0, 0, 0);
    pixels.show();
    delay(100);
    pixels.setPixelColor(NewRandNumb2, 255, 0, 0, 0);
    pixels.show();
    delay(100);
    pixels.setPixelColor(NewRandNumb2, 0, 0, 0, 0);
    pixels.show();
    delay(100);
    pixels.setPixelColor(NewRandNumb2, 255, 0, 0, 0);
    pixels.show();
  }

  } else {
    // turn LED off:
  }

  delay(200);
}
```

Appendix P

Spelregels Social Media Battle

Inleiding

Er is een nieuw social media platform gelanceerd: BeYou. Het bedrijf achter BeYou wil dat het platform het meest gebruikte platform gaat worden door de beste persoonlijke feed te creëren voor iedere gebruiker. Dit bereiken ze met behulp van algoritmes en de data van gebruikers. Maar doen die algoritmes dat wel goed, hoeveel en welke data geef je af en is een persoonlijke feed wel altijd fijn? Ga de strijd aan in de Social Media Battle: het spel waarin je de dynamiek van algoritmes in social media ontdekt.

In dit spel strijden twee duo's tegen elkaar: één duo speelt als een nieuwe gebruiker van het platform, en het andere duo speelt als het bedrijf achter BeYou. Wie weet zijn doel als eerste te bereiken?

Speldoel

- **Gebruikersduo**: Verken het platform, kom in een filter bubbel, en breek er weer uit door de juiste acties uit te voeren op het platform. Maar pas op, elke actie kost je data!
- **Bedrijfsduo**: Update je algoritme en verzamel hiermee alle data van de gebruiker.

Spelverloop

Het spel bestaat uit twee rondes:

1. **In de bubbel komen**
2. **Uit de bubbel komen**

Elke ronde kan worden gewonnen door het gebruikersduo of het bedrijfsduo.

Spelinhoud

- Speelbord, Gebruiker pion & Bedrijf Pion
- Vraagkaartjes, Actiekaartjes, Updatekaartjes & een Informatiekaart
- Data tokens
- Doosje met knoppen
- BeYou platform (Applicatie)

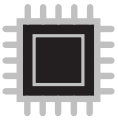
Voorbereiding

1. Verdeel de spelers in twee duo's: het gebruikersduo en het bedrijfsduo.
2. Plaats het speelbord in het midden en leg de telefoon in het midden van het bord.
3. Leg alle kaarten in juiste stapeltjes op tafel. Schud indien nodig.
4. Gebruikerduo: pak X datatokens en bekijk de informatiekaart voor de kosten van elke actie.
5. Bedrijfduo: bekijk alle beschikbare updates en pak het 'Like Algoritme'. Met dit algoritme start je het spel.
6. Open de Social Media Battle Applicatie en start het spel. Het bedrijfsduo begint.

Spelregels

Vraagpunt

Actiepunt



1. **Beurtverdeling**:

- Duo's drukken op de juiste knop en verplaatsen hun pion over het bord naar de juiste locatie.
- Bij het landen op een vraagpunt, pakt het andere duo een vraagkaartje en leest de vraag voor. Bij het landen op een actiepunt trekt het duo een actiekaartje en voert het de actie uit.
- Bij het goed beantwoorden van een vraag, mag het gebruikerduo een actie uitvoeren op het platform of ontvangt het bedrijfsduo een updatepercentage.
- Bij een fout antwoord gebeurt er niets.

2. **Acties uitvoeren op BeYou**:

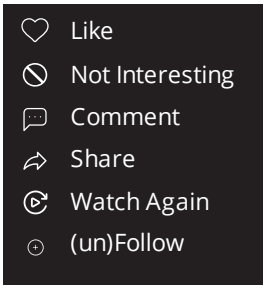
    - Elke actie die het gebruikerduo uitvoert op het platform kost een bepaalde hoeveelheid data. Deze staan op de informatiekaart aangegeven. Geef het bedrijfsduo de juiste hoeveelheid data na het uitvoeren van een actie.

3. **Ronde 1: In de bubbel komen**:
    - Het gebruikerduo wint als ze een bubbel van minimaal 90% hebben bereikt.
    - Het bedrijfsduo wint als ze de helft van de updates hebben verzameld.

4. **Ronde 2: Uit de bubbel komen**:
    - Het gebruikersduo wint als ze de bubbel hebben verkleind tot 10% of minder.
    - Het bedrijfsduo wint als ze alle data van de gebruiker hebben verzameld. Het algoritme kan in deze ronde nog steeds worden geüpdatet om meer data te krijgen van het gebruikersduo.

Acties op het platform

Het gebruikers duo kan de volgende acties uitvoeren op het platform:



- Like
- Comment
- Share
- Volgen/Ontvolgen
- Opnieuw Kijken
- Interactie (hashtag bekijken)
- Markeren als 'niet interessant'

Algoritme updates:

Het bedrijfsduo kan de volgende updates voor het algoritme verzamelen:

- Like Algoritme (in bezit bij de start van het spel)
- Comment Algoritme
- Share Algoritme
- Volg Algoritme
- Kijktijd Algoritme
- Interactie Algoritme
- Niet-interessant Algoritme

Einde van het spel

Een ronde eindigt als één van de duo's hun doel heeft bereikt van de desbetreffende ronde. Het spel eindigt zodra één van de duo's hun doel heeft bereikt in de tweede. Een duo wint het spel als ze beide rondes hebben gewonnen, of het spel eindigt in een gelijkspel als elk duo één ronde heeft gewonnen. Het winnende duo heeft zijn strategie en kennis van social media algoritmes het beste ingezet.

Vragen en Antwoorden

- **Wat zijn data tokens?** Data tokens vertegenwoordigen de hoeveelheid data die een gebruiker genereert en afstaat door acties op het platform uit te voeren.

- **Wat zijn algoritme updates?** Algoritme updates optimaliseren de gepersonaliseerde feed en hiermee dus ook het vermogen van het bedrijf om data van de gebruikers te verzamelen.

- **Hoe werkt de bubbelmeter?** De bubbelmeter geeft aan hoeveel procent de gebruiker in een filter bubbel zit. Het doel van het gebruikersduo is om deze eerst boven 90% te krijgen (ronde 1) en vervolgens weer naar 10% of minder te verlagen (ronde 2).

Tips voor Spelen

- Bij elke video is maar 1 actie mogelijk, bedenk en bespreek goed welke actie je wilt uitvoeren!
- Scrollen is geen actie die je uit kunt voeren.
- Elke video speelt maar 1 x af. Scroll pas verder als je in een volgende beurt een actie mag uitvoeren en let goed op bij het bekijken.
- Werk goed samen met je partner en ontwikkel een strategie.
- Gebruik je kennis van algoritmes en social media om de vragen goed te beantwoorden.
- Let op de acties van het andere duo en pas je strategie daarop aan.

Game Rules Social Media Battle

A new social media platform has been launched: BeYou. The company that owns BeYou wants the platform to become the most used platform by creating the best personal feed for every user. They will achieve this with the help of algorithms and user data. But do these algorithms work well, how much data what kind of data do you give away, and is a personalized feed always desirable? Engage in the Social Media Battle: the game where you discover the dynamics of algorithms on social media.

In this game, two duos compete against each other: one duo plays as a new user of the platform, and the other duo plays as the company that owns BeYou. Who will achieve their goal first?

Game Objective

- **User Duo**: Explore the platform, get into a filter bubble, and break out of this bubble again by performing the right actions on the platform. But beware, every action costs data!
- **Company Duo**: Update your algorithm and collect all the user's data.

Game Progression

The game consists of two rounds:

1. Entering the bubble
2. Exiting the bubble

Each round can be won by either the user duo or the company duo.

Game Components

- Game board, User Pawn & Company Pawn
- Question cards, Action cards, Update cards & an Information card
- Data tokens
- BeYou platform (Application)
- Turntaking box

Preparation

1. Divide the players into two duos: the user duo and the company duo.
2. Place the game board in the center of the table and put the phone in the middle of the board.
3. Arrange all cards into the correct piles on the table. Shuffle if necessary.
4. **User Duo**: take X data tokens and review the information card for the cost of each action.
5. **Company Duo**: review all available updates and take the 'Like Algorithm'. You start the game with owning this algorithm.
6. Open the Social Media Battle Application and start the game. The company duo begins.

Game Rules

1. **Turn Sequence**:
    - Duos press the correct button and move their pawn on the board to the correct location.
    - Landing on a question point, the other duo picks a question card and reads the question aloud. Landing on an action point, the duo draws an action card and performs the action.
    - Correctly answering a question allows the user duo to perform an action on the platform or gives the company duo an update percentage.
    - Nothing happens if an answer is incorrect.
2. **Performing Actions on BeYou**:
    - Every action the user duo performs on the platform costs a certain amount of data, as indicated on the information card. Give the company duo the correct amount of data after performing an action.

3. **Round 1: Entering the Bubble**:

    - The user duo wins if they achieve a bubble of at least 90%.
    - The company duo wins if they collect half of the updates.

4. **Round 2: Exiting the Bubble**:

    - The user duo wins if they reduce the bubble to 10% or less.
    - The company duo wins if they collect all the user data. The algorithm can still be updated in this round to gather more data from the user duo.

Actions on the Platform

The user duo can perform the following actions on the platform:

- Like
- Comment
- Share
- Follow/Unfollow
- Re-watch
- Interaction (viewing a hashtag)
- Mark as 'not interested

Algorithm Updates

The company duo can collect the following updates for the algorithm:

- Like Algorithm (possessed at the start of the game)
- Comment Algorithm
- Share Algorithm
- Follow Algorithm
- Watch Time Algorithm
- Interaction Algorithm
- Not Interested Algorithm

End of the Game

A round ends when one of the duos achieves their objective for that round. The game ends once one of the duos reaches their goal in the second round. A duo wins the game if they win both rounds. The game ends in a draw if each duo wins one round. The winning duo has best utilized their strategy and knowledge of social media algorithms.

Questions and Answers

- **What are data tokens?** Data tokens represent the amount of data a user generates and gives up by performing actions on the platform.

- **What are algorithm updates?** Algorithm updates optimize the personalized feed and thus the company's ability to collect user data.

- **How does the bubble meter work?** The bubble meter indicates what percentage the user is in a filter bubble. The user duo's goal is to first raise this above 90% (round 1) and then reduce it to 10% or less (round 2).

Tips for Playing

- Only one action is possible per video; think and discuss well which action you want to take!
- Scrolling is not an action you can perform.
- Each video plays only once. Scroll further only when you can perform an action in the next turn and pay close attention while watching.
- Work well with your partner and develop a strategy.
- Use your knowledge of algorithms and social media to answer questions correctly.
- Pay attention to the actions of the other duo and adjust your strategy accordingly.

Appendix Q: Action, update and example question cards in design