PLAY AND LEARN

Point 3

Squad: Play and Learn
Group: Physical activity and playful learning B2
Coach: Tilde Bekker

1007178 S. van Kempen
1236095 R. Hendrixc
1232304 B. Liefhebber
1250574 B. Weeda
1245656 F. Rijnders

2018/2019

University of Technology Eindhoven

Index

Introduction 3
Pressure cooker 4
Research
Knippenbergcollege 5
Interviews 6
Observation 7
Change of concept direction
Midterm demoday 8
Framework and game ideation 9
Usertest with university students 10
Prototype 11
Stakeholder Demo Day 12
Final Demo Day
User test 13
Final Concept 13
Business Analysis 14
References 15
Reflections 16
Appendix
- I Details Interviews 24
- II Details Observation 26
- III Poster Midterm 28
- IV Bottlenecks 29
- V Scenarios 31
- VI Test results 33
- VII Code 34
- VIII Poster Demoday 38
- IX Pitch Stakeholders 39
- X Pitch Demoday 40
- XI Board of Innovation 41
- XII Value proposition 42
- XIII Benchmark webs competitors 43
- XIV SWOT Analysis 45
- XV Business model canvas 46

Introduction

Point-C is a playmat focussed on incorporating physical exercise in a classroom to keep students motivated and focused in class, rather than letting students remain seated during an entire class. The target group is the domain class of the first grade middle school students at the Dr. Knippenbergcollege in Helmond, who is the contact for interviews, user tests, observations, etc.

Aside from the focus points named above, Point-C also aims to work on children's 21st century skills; these are skills that have been included in modern (domain) education, to prepare students for the new society, some of these skills are: self-regulation, independence, leadership, flexibility, creativity, teamwork, communication, ICT. The Point-C focuses on some specific skills, which will be discussed in this report.

This report will chronologically take the reader through the design iterations of group B2: Physical Activity and Playful learning. This group consists of five second year students and is part of the Play and Learn squad in the department of Industrial Design at the Technical University of Eindhoven. Each iteration starts with its main goal, which is a result of the previous one, and ends with the most valuable insights of the action.

Pressure cooker

For the first week of the project contained a 'pressure cooker'; a short design process where a designer rapidly goes through all steps of the process to come up with a first concept. The first concept in this case was an adaptation of Kahoot. Kahoot is an online platform where custom-made quizzes can be hosted, people (most of the time students) join and compete with each other to give the correct answer the quickest by selecting one of four coloured boxes on their screen. This game was used as a foundation for an activity that combined a quiz with physical activity, where the multiple choice options are picked by physically going to the desired platform or throwing a ball in the corresponding basket.

This first step was in the right direction however further exploration was needed. Furthermore was it not necessary to stick to the game Kahoot this soon, and recommended to explore other game options as well.

Several examples of how this concept could be implemented were thought of. Some ideas were created, for instance combining Kahoot with throwing personal balls into baskets, running to projected squares on the ground, a version of "the floor is lava" and throwing objects with velcro onto the wall. However, these ideas all remained very superficial. Furthermore, games like the one where the students were throwing balls into a basket could get very messy and chaotic.

They were simply a way to choose between four options in a fun way. The focus lay upon a few 21st century skills in particular: teamwork and developing ICT skills (mainly data tracking). The progression of the students in the activity could be monitored to make students familiar with data tracking.

Research

First the limitations of a classroom environment (Minister van Onderwijs & Wetenschap., 2018), different 21st Century Skills and the classroom game Kahoot were explored in more detail.

The 21st Century Skills were developed because the education system, as it was traditionally, was not providing all the necessary skills modern work demands. 21st Century Skills aim to make sure that the education system becomes more in tune with the demands of our times and the needs of today's students (Trilling, B. & Fadel, C., n.d.).

The 21st Century Skills can be placed in three overall categories: Learning and innovation skills, Digital literacy skills and Career and life skills.
There are eleven 21st Century Skills in total. At first the focus was on digital literacy because this was easily implementable into the Kahoot framework. With it, the students could track the data on their own growth.

Recent findings suggest that a Game-Based Learning approach might be effective in facilitating students' 21st century skill development (Qian, M., & Clark, K. R., 2016). That is why the game-element of classroom activities was also included in the research. As mentioned before the game that seemed particularly popular among middle school students was Kahoot.

In Kahoot teachers can create their own quizzes with four multiple choice answers. This four choices framework gave some ideas about how physical activities could be used to select the answers. Since there are scores being kept from who got the answers right and who answered the quickest, this can easily be translated into data for the students to review and reflect on.

In addition, Kahoot is very popular among students and it is proved to enrich the quality of learning in the classroom. The highest influence was reported on classroom dynamics, engagement, motivation and improved learning experience (Licorish, S. A., Owen, H. E., Daniel, B., & George, J. L., 2018). Another paper about kahoot showed the aspects of kahoot that are considered as beneficial by students. The immediate feedback for example was very important,and students seemed to work together more in other lessons because they started conversations easier after playing a game with the whole class. Furthermore they were looking forward to go to class because the game would be played (Iwamoto, D. H., Hargis,
J., Taitano, E. J. & Vuong, K., 2017).

Knippenberg

The only knowledge acquired regarding teaching came from SLO. Their curricular spiderweb was the go to source for information about a lessonplan and strategy but the question was to which level these sources were actually used by the teachers themselves. Therefore the goal was to gain basic information regarding lesson structure, possible problems during a lesson and innovative education present at the school (since neither interview was taken at the Knippenbergcollege). There were 5 interviews conducted, each of approximate 1 hour at two different schools: d'Oultremontcollege in Drunen and dr. Mollercollege in Waalwijk.

These interviews gave a few points of interest for the project. Teachers have a very tight time schedule, especially in the final three years. The limitations from the final exams cause for a difficult implementation of new education forms or other activities.

Additionally there are motivation problems during the various phases in secondary school. A new activity or an activity that would be different from the normal lesson and visually explains the material would excite the students and give a motivation boost regarding the topic. A development where the teacher does not have to prepare as much work, which at the same time changes up a normal lesson would be beneficial for both student and teacher.

Due to national limitations the traditional education takes over in the 3rd year. The domain education is new and therefore in an exploratory phase. Many details are still uncertain. For example they do not quite know when one passes the year or not. Most importantly the transition between the two education forms might form a problem. The big differences in learning methods and testing are possible difficulties for the students. However they do believe that a switch in education is arising.

Lastly the school is working with tablets instead of normal books. At the moment it is mostly the same material but just digitally, however different methods might be feasible with the tablet that would not be possible before. This does need time to develop however.

Interviews

The only knowledge acquired regarding teaching came from SLO. Their curricular spiderweb was the go to source for information about a lesson-plan and strategy but the question was to which level these sources were actually used by the teachers themselves. Therefore the goal was to gain basic information regarding lesson structure, possible problems during a lesson and innovative education present at the school (since neither interview was taken at the Knippenbergcollege). There were 5 interviews conducted, each of approximate 1 hour at two different schools: d'Oultremontcollege in Drunen and dr. Mollercollege in Waalwijk.

These interviews gave a few points of interest for the project. Teachers have a very tight time schedule, especially in the final three years. The limzitations from the final exams cause for a difficult implementation of new education forms or other activities.

Additionally there are motivation problems during the various phases in secondary school. A new activity or an activity that would be different from the normal lesson and visually explains the material would excite the students and give a motivation boost regarding the topic. A development where the teacher doesn't have to prepare as much work, which at the same time changes up a normal lesson would be beneficial for both student and teacher.

Observation

An observation at the Knippenbergcollege was conducted on the 12th of October. One of their new courses (M&M) in the domain education was visited to see how the course is cross-curricular and how the lessons are structured.

For the project multiple things can be extruded from this observation. Even though the children are working by themselves and do take the responsibility to ask questions, they do get distracted after a while. Also the implementation of the change-up and games by the teacher might be an effective way on which a new development can be based upon. Instead of the multiple choice test like kahoot, a test where the teacher can quickly determine the right answer gives more room for interesting new games.

Concept changes

While visiting eight teachers and speaking with them about the concept, some interesting insights were gained. The teachers said they did not have time left to prepare an extra in-class activity like ours, a few times a week. Besides this, the most important insight was that the teachers already had their very own way of teaching the course material. The domain education has a new way of teaching the course material. Furthermore the rubrics and more deepening information about the class material were not accessible. For us, this was reason enough to abandon the implementation of course material and start looking for a new direction. However, several aspects were considered interesting such as the short activity within the class, the direct feedback of Kahoot and the possible implementation of 21st Century Skills. These aspects were aimed to be remained in our next direction or design.

Inspiration for a new direction was gathered by looking at the needs of teachers and students, through observation and conversation. One thing mentioned by one of teachers was that they did not really find a way to get distracted students back to focus. This seemed like an interesting new opportunity to design for. Observation showed us that the break in between the block hours of the domain class, meant to bring back their focus, is not used very efficient. Students are free to do anything, but start looking at their phones immediately. Bringing a physical activity in this break was matching with two of our initial requirements: providing a game in class and stimulating physical activity. A 2015 pedagogical study showed that introducing an energizer in class increases the amount of steps taken by a student, and furthermore does not conflict with the instruction time of a teacher (Bailey, DiPerna, 2015). A 2006 study by the University of East Carolina supports this increased physical activity, and also shows both teachers and students enjoy energizers and even improves the on-task behavior of students (Mahar, Scales, Kenny, Collins, Shields, 2006)

Giving the students some distraction from the course material will even give them a motivation/focus boost for the rest of the block hours. Namely, research shows that a short physical activity improves the attention of students on their tasks (Mahar, 2011). Next to the increased physical activity and focus boost, an exergame (combining a game with a physical exercise), has a lot of cognitive benefits for students. According to a research project in name of the Royal University of Leuven, exergames improve students reaction speed, confidence, social interaction etc. This last skill even matches with one of the 21st century skills focussed on in this project (see 'Framework and game ideation') (Verhoeven, Gers, Verdonck, 2014) .

Each member wrote down the skills he/she assumed to be the most valuable for our project for the domain education, as some kind of requirement for our design. The main skills that matched with the concept of a game for domain education, where students work project-based were: teamwork, assertivity, leadership, communication and creativity.

The idea that came from the group brainstorming within this direction was to create a framework to select from, and play one of many possible energizers, which are small games, with the class in groups. A few interesting energizers were selected that fitted well to the skills, but the group decided that these should only work as a base for our next step. Because one of the difficult points was to keep the energizers attractive to play, this was one of the points that would be asked to get feedback about during the midterm demo day, next to tips for designing the transition back to the lesson.

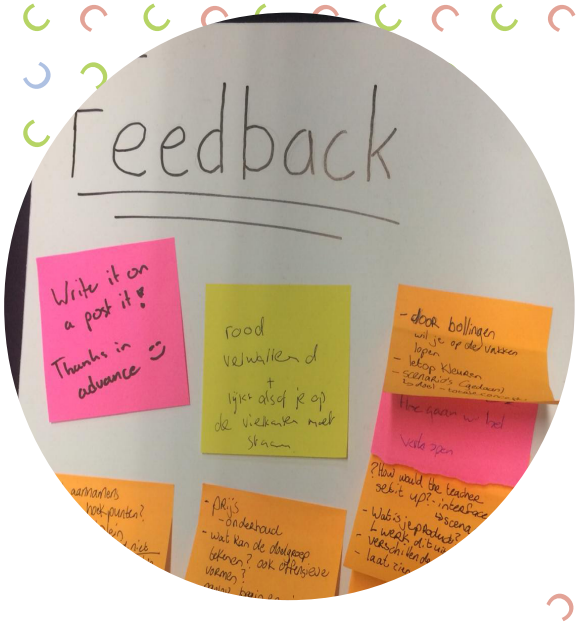
Midterm Demoday

The midterm demo day was held to have a feedback moment during the project. This feedback could then be used in further iterations.

Through a short presentation and answering questions feedback was gained. Next to the verbal communication and critique viewers gave us, they also had the ability to write tips and tops on post its for extra feedback which could not be lost.

In the end a few aspects needed attention. The direction was clear according to our audience. The execution however was vague, since there was no prototype or idea to solve the problem. It was also unclear how many times the concept would be used.

The existing games are designed surrounding a certain or more 21st century skills. However it seemed that the 21st century skills weren't chosen carefully. A clear explanation for these decisions are needed.



The framework ability instead of just delivering a game drew was an important aspect. To refrain from the concept getting repetitive there must be a platform for game development. However to enable teachers with a lack of time to use the concept a few predeveloped games should be available.

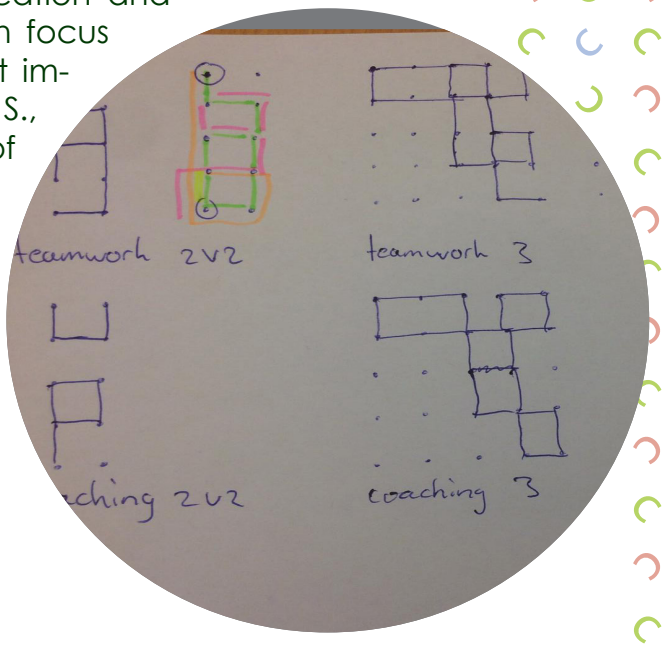
Framework and game ideation

Since the focus was put purely on a concentration boost and not on the course material itself there was a lot more freedom in ideating on which games would fit our design. The requirements were that it should: stimulate (or regain) the focus of the students, be motivating, and include physical activity.

The teacher is the central character in this context because they would need to judge when the concentration boost is needed for the students. The product will be a physical object coupled with a service that allows for a range of physical classroom activities.

The physical framework for the games was designed first. Several ideas like digiboard enhancements, a grid of ceiling spotlights and products integrated in the floor came up. Eventually a compromise was made between the latter two, a floor mat that had a grid of LED strips in it. This was chosen because it was easy to set up (rolling out a mat on the floor would only take a moment) but still interactive and responsive through the LED strips.

The 21st Century Skills: creativity, communication and collaboration were selected to be the main focus of the activity. These three c's are the most important skills that employers look for (Adams, S., 2015). They are also in line with the four C's of 21st Century Skills (Applied Educational Systems, Inc., n.d.), the other one being critical thinking. Since it was decided to step away from the course material with this design and the skill of critical thinking mostly revolves around problem solving, which is already done in class, it was left out.



Once the framework was conceptualised a few fun and engaging games were thought up. Because of the limited time in this project, one game would be worked out into the prototype for the purpose of testing and showing the concept.
The Shapes game, where the goal is to work together to recreate a shape by walking in the same lines as the example, was worked out.

To test if the basics of the game worked, a lo-fi prototype was created by drawing lines on a big sheet of paper. The reactiveness would be re-enacted by placing post-it notes on the lines that would be drawn.
With this setup the user tests with both university students and the middle school students of the Dr. Knippenbergcollege could be done.

Usertest with university students

At first the plan was to conduct two user tests at the Dr. Knippenbergcollege itself because this would be the most accurate representation of how the students from that age group would react. However, it was soon stated that doing more than one user test at the middle school would not be possible since they had multiple requests from other students to do user tests as well. Mitchell Jacobs gave some advice about the best option for user testing. The best way to go forward was to start with what could already be tested with university students. After making a list of all the aspects that needed to be tested (Appendix IV), the things that could be tested with university students were singled out. This way the user test with middle school students could focus more on the context and the flow of the game.
In order to prepare for what could happen during the user tests a few scenarios of our user test were made, both positive and negative. Eventually the Shapes game was tested on the lo-fi prototype with university students (see experiment in appendix). The rules were shortly explained to them and then they played different versions of the same game. It was then recorded how long they took for the explanation and the game. The participants were also asked for their feedback and which version of the game they liked best. This would become the version that could later be used for the test with the middle school students.

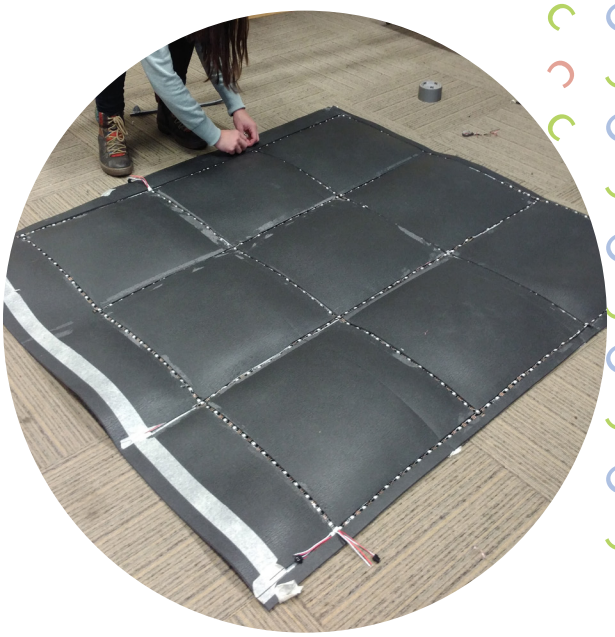
The results (Appendix VI) show that most students finished the game in about one minute or less. This means multiple games could be played in one break. The version of the game where one person directed the others was found less fun than the version where everyone was able to see the shapes and commu-

nicate. It took them only a few seconds to calm down after the game and get their focus back. This would of course have to be tested further with middle school students.

Prototype

The goal for the physical prototype that was created was to show visitors and assessors how our product will look and mainly how it will work when put into a classroom. A physical prototype was made to show the materials, spacing and function of Point-C. The decision was made to show only a section of the final product, considering the available space at the demo day would be limited. A section of 1.5 by 1.5 metres was made while the envisioned final size is to be closer to 4 by 4 metres.
The prototype consists of 8 sections of programmable RGB-Ledstrips, which are controlled by an arduino that runs a program to drive the leds in the desired fashion. While writing the code for the prototype, the decision was made to leave out the sensors that would be incorporated into the crosspoints of the ledstrips, as the remaining time was too little to make everything work. To still be able to show how the mat would work, one of the games that had been thought out would be shown by making the mat display different colours by pressing a button. The code was then adjusted to show a set figure for the 'shapes game'.

This so called 'Wizard of Oz' design allowed the function and appearance of the final product to be shown to everyone who stopped by to listen and see our demo. The code for the prototype consists of two major parts: first the use of the adafruit NeoMatrix library to control the leds. Secondly, the use of a button linked to a counter to make the leds display different colours based on the number of clicks, similar to how different slides of a powerpoint are displayed when the mouse is clicked.



Stakeholder Demoday

The last stakeholder meeting was set-up as a demo day in which the students could get feedback from multiple stakeholders whom were involved with schools, students and/or teaching. Most of the stakeholders were teachers from primary and secondary schools. Therefore the goal was to get feedback from the audience on the product itself.
A promotional pitch was created, targeted on the audience. This was done by letting the audience imagine themselves being in a classroom with domain education and telling them the current situation. Afterwards the solution was introduced with a very specific explanation.

Most of the stakeholders were really excited about Point-C, even a teacher from a primary school would have loved if t the final prototype could be tested at his school. A couple of stakeholders gave more ideas for games, such as 'memory', and they suggested to look at 'brain breaks' - another term for energizers - to compare the goals of the games. They suggested this, because they thought the pitches could be improved by describing the goal of the product itself and of the games more elaborate.

Final Demoday

As our audience would be mainly fellow design students, designers or experts, getting feedback on our process was the approach we stepped into the Demo Day with.
The goal that was set for the demo day was to collect feedback and insights from visitors that can be used to further think about and improve Point-C in our last week, if possible by a user test or other validation.

To reach the goal, it had to be clear what Point-C is about, which was done through the means of a working prototype, as well as a poster and short pitch. Whenever we had presented all of Point-C to someone, that person was asked t o give feedback on the whole product. All the feedback was then written down on post-it notes to later be processed with the group.

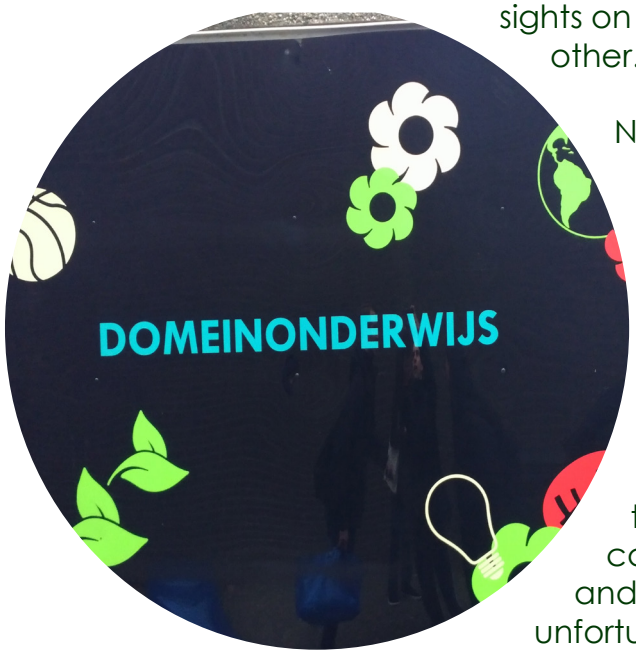
One of the most valuable insights we got on our project was from one of the visitors; he asked quite critical questions concerning the business aspect of the project, as well as asking whether it would be more useful to make Point-C a permanent installation on the playground as building up the mat would be an obstacle for teachers. Furthermore most people intuitively stepped on the squares in between the LED-strips instead of on the lines themselves. The

teacher coach also suggested to think about the sale of the product, how Point-C will be priced and what you get in the box if you buy it (mat, an app, support, etc.).

Another point were the chosen colours for the game demonstration; people thought a wrong step had been made because the lines turned red while drawing shapes, so this should be taken into consideration.

User test

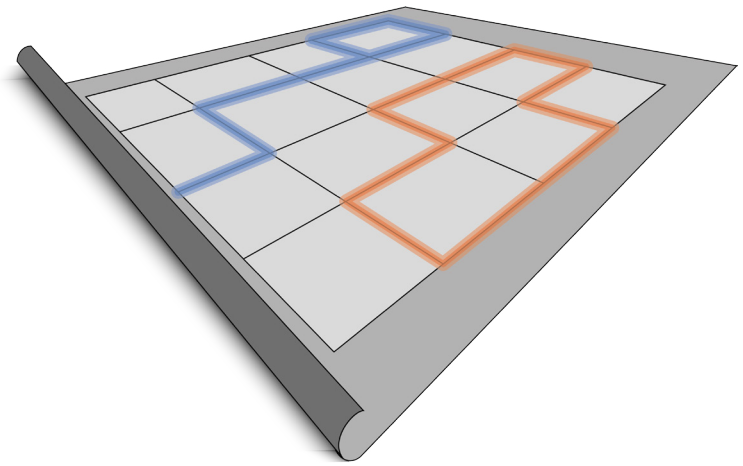
To further confirm the assumptions that were made within the concept, the plan was to setup a user test. Within this test the assumptions that could not be tackled through the earlier user test with students would be encountered. The same games with some altered aspects would be played to gain insights on the kids interactions with the product and each other.



Next to that an interview with the teacher for one of the two domain courses would take place. Since the test would be a snapshot of how the students would react, more information would be gathered through the teacher regarding the student's behaviour when the observers are not present since their presence can influence them. However after finally making an appointment at the dr. Knippenbergcollege and arriving at the school, it turned out the teacher was ill and therefore the meeting was canceled. It was already close to the demo day and rescheduling another meeting wasn't possible unfortunately.

Final concept

Point-C is a platform on which around 25 students can play an energizer in the classroom. It is a mat with the size of 4 by 4 meters which is rollable. On the mat a grid of 9 by 9 lines of LEDs is visible. On the intersection points of the lines spots and pressure sensors are implemented. The spot is bigger than the other LEDs, which makes it intuitive to step on. The pressure sensors makes the users able to draw lines between spots, by stepping on two connected spots one after each other. By doing this again, the users can erase a line. The 'passive' background color of the lines is white, drawn lines are represented by a blue, red, green and yellow colors, depending which team drew the lines, and the feedback will



be given by flickering in the according color.

The energizers that can be played on the platform will train the creativity, communication and collaboration skills of the users, which are 21st Century Skills. The mat is made rollable to stimulate communication and collaboration even more, since the user have to roll out the mat together because of the size, and rolling the mat out will create a pavlov effect; students are aware of and get engaged in the activity by setting it up themselves. However, it should be mentioned that this is an assumption, aimed to be user tested with the students (see 'User test').
A purchase of Point-C would include: the mat itself, access to an application, service and maintenance. Access will be granted by using the verification code belonging to the mat. In the application a catalog will be available with a set of energizers. This package is offered, since interviews with teachers gave the insight teachers do not have time to prepare extra in-class activities. Next to the catalog there is an option for the teacher to create games, change games and add aspects to games to stimulate creativity and to keep the game renewing. Furthermore the teacher can contact the Point-C company through the application if service or maintenance is needed.

Business Analysis

The concept would not be complete without thinking about the potential market launch of the product. To clarify the proposition of the concept to the assessors and clients, a business model canvas was created (see chapter 'Final Concept'). This has been done by first going through four steps, recommended by Mitchell Jacobs, creative director at design office Studio Tast Eindhoven: describing the stakeholders and their decision moments, listing their values, benchmarking the competitors and creating a SWOT-analysis.

1. The service/product/money flow between all the stakeholders visualized in a 'Board of Innovation' (appendix XI)
2. Value proposition: Point-C in relation to our main stakeholders: teachers and students (appendix XII)
3. Creating benchmark webs of potential competitors of the Point-C. These competitors are based on shared goals, target group, functionality etc. (appendix XIII)
4. SWOT-analysis with the strengths, weaknesses, opportunities and threats of Point-C. (Appendix XIV)

These steps led to the Business Model canvas of Point-C (Appendix XV). An estimation of the members of a start-up company and their salary has been made and also material costs are estimated. Around 25 units should be sold in the first year to break even.

References

1. Verhoeven, K., Gers, B., Verdonck, L. (2014, August). Exergames: meer dan een spel? Retrieved November 23, 2018 from https://kics.sport.vlaanderen/Fitheidgezondheid/Documents/140901_Exergames_meer_dan_een_spel.pdf

2. Bailey, C. G., DiPerna, J. C. (2015, fall). Effects of Classroom-Based Energizers on Primary Grade Students' Physical Activity Levels. Retrieved January 5, 2019 from https://search.proquest.com/openview/05721c0b251d54d5a313ae9d21acc918/1?pq-origsite=gscholar&cbl=35035

3. Mahar, M.T., Scales, D.P., Kenny, R.K., Collins, G., Shields, A.T. (1972). Energizers: Classroom-based Physical Activities K-2. Retrieved January 5, 2019 from http://thescholarship.ecu.edu/handle/10342/5943

4. Mahar, M.T. (June 1, 2011). Impact of short bouts of physical activity on attention-to-task in elementary school children. Retrieved November 20, 2018 from https://www.sciencedirect.com/science/article/pii/S0091743511000545

5. Van der Pijl, P. (October 12, 2018). How to really understand your customer with the value proposition canvas. Retrieved November 23, 2018 from https://designabetterbusiness.com/2017/10/12/how-to-really-understand-your-customer-with-the-value-proposition-canvas/

6. The value proposition canvas. Retrieved November 23,2018 from https://assets.strategyzer.com/assets/resources/the-value-proposition-canvas.pdf

7. Business model kit. Retrieved November 23, 2018 from https://www.boardofinnovation.com/tools/business-model-kit/

8. Dance Dance revolution. Retrieved November 23, 2018 from https://www.ddrclassroomedition.com/

9. Murray, P. Video games can educate: Wii classroom. Retrieved November 23, 2018 from http://www.teachhub.com/wii-classroom

10. Salaris en arbeidsvoorwaarden Industrieel Ontwerper. Retrieved January 8, 2019 from https://www.nationaleberoepengids.nl/Industrieel_Ontwerper#Arbeidsvoorwaarden

11. Salarissen voor een Industrial Engineer. Retrieved January 8, 2019 from https://www.glassdoor.nl/Salarissen/industrial-engineer-salarissen-SRCH_KO0,19.htm

12. Steck, E.E. (2015, May 21). A Simple Guide for Startups to Determine Your Marketing Budget. Retrieved January 8, 2019 from https://blog.quiet.ly/industry/a-simple-guide-for-startups-to-determine-your-marketing-budget/

13. Bosse, T., Brombacher, H., Hammersom, D., Mengelers, T., van Haaster, L. (2016, January). Project Report A.I.M. Retrieved November 19, 2018 from http://www.taramengelers.com/pdf/Final%20Report%20A.I.M.%20Vital%20Play.pdf

Reflections
Ruben

Starting off with the second design project of my study, I set myself the goal of sharpening my skills in both sketching and leadership. After spending the past semester on this project with my other teammates, I feel like have grown in several areas, including those I set goals for.

As we started off I tried very hard to lead the group in making a planning, dividing tasks and keeping notes. But I quickly found out that this is not the area for me, so I let off a bit and gave others more space to act freely. I feel, however, that I still had a presence as a leader when everyone got stuck on an important decision, or when one person spoke all the time, so another wouldn't. I learned I'm not a classical leader, but I can be counted on when needed, which still satisfies me enough to say I reached to goal I set.

As for sketching, I already knew I am a very visual person; meaning that I can better describe something by having a drawing or model. I also knew my drawing wasn't up to snuff to use for that purpose, so I spent some money on good markers, paper and an online course to sharpen my drawing skills. I succeeded to the level that I now understand how to draw in perspective and make use of colour and shadow more, but I still plan to follow a study course in the coming semester.

My role in the group has varied a bit, as I struggled with my personal life and rest of the study on the background during this project made for example my presence at meetings fluctuate, I could have definitely performed better on this front as I know I have done before.

Aside from that, I still feel like I put in a lot of effort into the group and made important decisions as well as taking on the tasks that had to be done. The areas of expertise I spent time with the most generally lied within those I am already comfortable with; I spent a lot of time on writing code, making the prototype and sketching or thinking out ideas and requirements. I picked up some new skills within these areas, and after working in some others like researching and testing I conclude that my specialty is working within the Creativity & Aesthetics and Technology & Realization areas. On top of that I found a new interest in the business side of design after a workshop from Mitchell from studio Tast.

Not all was perfect, and even though my periodic absence from meeting bothered me personally, Frans was almost systematically missing meetings. In my opinion, one can only be feeling ill for so many times in a few weeks. This came on top of the fact he almost always disagreed with what the others had to say or came up with, without suggesting any substitute himself. I admit this got better towards the last few weeks, but that was kind of too late for me.

I would have liked to spend more time on doing user testing and interviewing, I think everyone would have, but unfortunately the collaboration between us and the school we worked with lacked good communication and we had a hard time arranging meetings with them.

In the end I'm quite satisfied with what we have put up for the final concept, considering how much we struggled at first, we have done a lot of work and I am proud to tell people about Point-C.
All in all, I have enjoyed my time working on this project as I learned more about who I am as a person, what skills I possess and what my interest is for design. There are always things that can be improved, and communication is one of them, be it with clients or group members, without serious planning and arranging nothing will happen on its own.

Stan

My main goal for Project 2 was to use my knowledge I obtained from previous courses and projects. At the start of the project this was not really possible, because this project was set-up differently than I am used too. As being part of the physical activity squad, we had a client (Dr.Knippenbergcollege). Normally my projects started with thinking about problems which we wanted to solve, but this time we had to come up with an idea for someone else's problem.

To get this project started we had to get a lot of information, from the client itself, but also from papers. This was something new for me to do at the beginning of a project, but the meetings in which we discussed different papers, gave presentations about papers and meet with stakeholders from the client gave me a new experience on how to begin with a certain project.

After a couple of weeks we knew where we were up to and I could started using my knowledge. To work in the expertise area of 'user and society' I wanted to be part of the observation(s) and preparations of the user-tests. Since the communication with the client was not very good, it took a while before we could observe and do user-tests. This slowed us down a bit, until Mitchell motivated us to prepare as good as possible for validation moments like this to make those moment as efficient as possible. For the observation I already did this, since I already had experience with observations, but for the user-test Mitchell gave as a very nice tip. He suggested us to make multiple scenarios in which we describe every step that can go wrong and how it can go wrong. From those scenarios you get concludes which things you can already test by yourself and what you really have to test with the target group. This was very useful, although we did not get the opportunity to test it with the client, and I will definitely use this for future user-tests.

Last year I followed the Technology Entrepreneurship learning line and with the knowledge I got from that I wanted to work on the area of expertise 'business and entrepreneurship' during this project. Halfway through the project I did not work on this yet, because I found it hard to make a beginning. I did not know how to do it, because I had no experience with making a business plan if you already have a client. Luckily we got a business workshop from Mitchell and this really helped us out. He introduced us to a roadmap which will help you to create a business plan. Next time if I do not know how to start with the business part of a project, I will use this roadmap to help me out. Furthermore I think it will be more efficient to start working on the business plan simultaneously with the start of the project.
As part of the area of expertise 'creativity and aesthetics' I was responsible for the business cards and the visuals of the business part. Speaking of 'technology and realization' I did not work on the technology part of our project, but I did create the prototype for the first user-test and helped with creating the final prototype. In my next projects I want to take a bigger part in technology and realization, because I now I am good at it. In 'Math, Data and Computing' we only used math to calculate the measurements of the prototype. I think for the other things we did in this project, we all worked on it and divided the work well.

To conclude I learned a lot during this project, like: a new way of starting a project, how to share information from papers, how to get everything what you want out of the validation moments and how to create a business plan by following a roadmap. In the future I will try to use those learning points in my projects if possible and I will start sooner with creating a business plan, since this can bring you a lot of insights. I also want to take more responsibility regarding 'technology and realization'.

Bert

In this project I think I had quite a present role. From the first day on, I represented my group in the contact with tutors and fellow students via slack and email. Furthermore I attended all meetings and tutor meetings and prepared them with questions and short summary of the process. I started the project because I was interested in playful designs, and never faced playful learning in my courses or projects. My main learning goal was to make quicker choices during this project, as in my previous project we got stuck for too long. Furthermore I was aiming to improve my professional skills by presenting more. However, I learnt more than this while working on these goals.

Lessons
During the project, Tilde told me that exploring areas and switching between them during the design process was important. I found this interesting to hear and found out that making choices based on assumptions and looking at the potential, worked well. We may not have presented our pressure cooker or ideas after this in our final demo day, but by choosing these directions, we definitely got inspired for next iterations. I think all steps have been useful and have somehow contributed to the end product. Switching from area was quite a big step to me, but as it was part of one of my goals, I supported this switch. It taught me

that not all the previous effort is lost by doing this and that useful aspects are still visible in the final design.

Next to this, I am also glad to have gained knowledge on the business side of design, or as Mitchell told me, the proposition of your design to create business. I found out that by going through the steps he taught us, it was clear for who I was designing for. In the group meetings sometimes we tended to design too much for children, but when reminding ourselves that teachers may be even more important, we sticked to our design goal. In next projects I will definitely apply this method sooner, because it can be beneficial when creating adjusting your design, to know exactly who the stakeholders are, what their decision moments are etc.

However, this also brings me to a point which is a point I can definitely improve on, namely contacting these stakeholders and experts. Even though the communication with our client, the Dr. Knippenbergcollege, went anything but fluent and very unlucky, as well as the fact tutor meetings in the second quartile were scarce due to illness and other reasons, I think I could have done more effort to approach other schools and experts. In my future design projects, for me it will be important to be in closer contact with these people, as they know like no one else what steps are required, and what needs should be fulfilled for a successful design.

Group work

Speaking about the group, collaboration and contact went quite well. In the beginning of the project, we shared some personal qualities and goals regarding the competency areas and design values. We were quite diverse, which was useful for distributing tasks. But we also challenged ourselves; Bianca could work on her inexperienced user testing area, and I was given space present our process and pitch during both demo days. This has been really useful for me and I learned a lot during the pitching workshop, for example adjusting your pitch to your audience. I applied this during the stakeholder demo day with a promotional pitch for teachers, and the final demo day with a pitch focused more on validation and process, for fellow design experts (see appendices)

Meetings also went quite well, however I have to mention that Frans disagreed with almost everything proposed by anyone, which sometimes hindered the group flow. In my opinion, it is okay to have a critical opinion, as I also have one myself, but saying no to everything without support or solution is not a professional attitude in a design team. Next to this, his absence during meetings was above average, about which my opinion is the same.

Bianca

I chose the Play and Learn squad because I was interested in how playful designs had an impact on the way people learn. The main competencies that I wanted to improve were User & Society, Business & Entrepreneurship and professional skills such as proficiency in InDesign and Illustrator.

I wanted to take the time this project to focus on the Business & Entrepreneurship side. I tend to overlook that competency because the projects are usually too short to focus on and come in contact with the market. I developed a much better understanding of business processes from the workshop of Mitchell Jacobs. His roadmap really helped us put the business analysis on tracks. We eventually did a Board of Innovation, Value Proposition, we benchmarked and a made a SWOT analysis. For my next projects I will start with the business side of the design earlier on, and I will use the knowledge I've gained here to make a more detailed business analysis.

For User & Society I wanted to stay in contact with the users throughout the project to be able to get continuous feedback. We met with the Dr. Knippenberg-college for the first general meeting, and once for an observation. We had arranged a user test with a few students of the Dr. Knippenbergcollege, for which Frans and I did the planning and preparation. I had previously not planned any user tests, so this was a good learning experience for me. Sadly the user test was cancelled very last minute by the teacher, who happened to be ill that day. This was a setback, but it did force us to be resourceful and to get the information we needed from other places. Eventually we got to do the test with university students, which still gave us some important insights on the user perspective.

Regarding graphical design I first followed the Wervingsdagen courses Illustrator advanced and InDesign advanced, and learned a lot of new skills in those workshops. I got to implement these skills in this project when I made the poster for the final demo day and I am very pleased with the end result. I will continue to hone my skills in the Adobe programs and I will strive to do more graphical design in the upcoming projects.

Group

I feel like my role in the group was mainly to ideate and make decisions. Decision making was one of the points I needed to improve in my last project, so I tackled it here. I tried to be open minded towards others' ideas and to stop clinging to my own. I think this worked out pretty well in this project and I am able to be steadfast and move forward with a single idea much more comfortably now.
The group as a whole needed a bit of pushing and motivation in the beginning, but around the third week everyone in the team was taking initiative and doing their work properly. I do have to say that there were a lot of meetings where at least one person was absent. This was a shame since it meant that the communication and work went a lot slower than expected. I made sure I was present pretty much every time during meetings, tutors meetings and stakeholder meetings. In that aspect I feel like I was very involved with the project. Furthermore, I made the lo-fi prototype and helped with the final one, and I made sure my work was finished on time. I could definitely still improve in my planning but I feel like I have made quite a lot of progress in those areas regarding last year.

Frans

At the start of this project I had set some goals for myself. I wanted to refrain from the Technology & Realisation tasks since I have worked in that area almost exclusively in the previous project and wanted to develop in other areas. For the demodays I wanted to take the tasks upon for designing the elements that strengthen the pitch, so the poster, a video if it added value etc. Basically how to enhance our message through additional elements. Next to that I wanted to receive knowledge from outside our quiet and safe environment in the form of interviews and tests.

In the end I executed these tasks that I lay upon myself. Even though I would have liked to practice my verbal skills in the form of a pitch or presentation Bert ended up doing them, since I was not comfortable enough with my abilities and did not want to risk these important moments in the project. Most of the additional elements however were made by me in form of the midterm poster, the tear-off-calendar, visualisations and the report.

I had put some extra focus in the User & Society area in the form of user tests, interviews and the observation. In my last project I got the critique that we didn't visit any experts in the area of our product and to tackle this I started to search and find experts in the area of teaching: Teachers. I felt that we could gain more knowledge and go into a more appropriate direction if we conducted them. Even though my preparation could've been better in which questions I should've asked and the goal for the interviews I did receive insights that were important to the end result of the project.

This semester, including this project, has been a struggle for me. I was not in the right mental place and therefore had trouble with positivity, which has probably been noticed within the group in absence and mentality. I missed more meetings than I believe is appropriate because of it, however I did what I could to make up for it. When writing this report it came forward that I was too negative during meetings and that they have asked me to be more positive during meetings. This message has not come across clearly. I am a critical thinker but in my perfectionism can go to far. I have been working on this for a long time but this is the first time it bothered others instead of myself. My negative mindset probably enhanced this even further. It is unfortunate that this message did not get across for the sake of this project, but I am aware of it now and will make it a goal for upcoming projects. One of the reasons for this mindset is that I felt that we were on a too slow pace during the first half/ two thirds of the project. We were baffled on how to tackle this quite complex problem stated by dr. Knippenbergcollege. Also the communication with the school was not on point so events like user tests and observation in their classes were difficult to arrange. The mistake that we did however make was that we were waiting on these appointments for

knowledge and were not taking much action before these appointments. Only after the meeting with Mitchell it came forward that we could do things before such an appointment. After that we really started working, but it has bothered me that we were on a slow pace even though I didn't sometimes know what to do directly either.

Concluding I think that I took the right steps and fulfilled my personal goals. Both skill sets have still room for growth however they are way better developed than before. In upcoming teams I will focus on my critical thinking and make sure that I do not hinder the group with it. In terms of the project I think that there are interesting opportunities in the project's field, however I don't know how we could have handled it better, given the complexity of the task, my mental state and the difficulties with the dr. Knippenbergcollege.

Attachment I: Details Interview

After speaking to an arts & crafts, Dutch, chemistry, math and management & organization teacher a few things can be concluded. Most importantly: the SLO is barely used. The teachers are aware of its existence but never implement the source in their lesson structure. Instead of the SLO most teachers use "examenblad" which tells them which topics the students should understand heading into the exams.

A clear difference between the 1st, 2nd & 3rd grade in comparison to the 4th , 5th and 6th grade is visible as well. In the later classes the teachers have a higher workload to be able to finish every topic within the time they receive. A different way of learning the materials would be more time consuming, since it still has to be developed and find its flaws. However in the first three years the teachers have more time to play with the materials at hand. The bar is lower at the end of the third grade hence they have more room to develop different methods. Still the final exams in the last year cause limitations throughout all of secondary school.

Another difference between the first and last years is the student's ability to self-regulate. In the later years the student is more likely to be able to plan, study and evaluate without help. In the first few years the students are more chaotic and still have to develop these skills. Primary school does already deliver a nice stepping stone towards these skills, however they still need to develop. Therefore project based education is still guided by the teacher, where in the later classes the student is probably able to fulfill it with less help. Unfortunately there is less to no time for project based education in the later years as mentioned above. If however a teacher chooses to integrate group work and self-regulated work he sees that these students still have to develop nearly everything within such skills. This mainly happens since in the first years the teachers might have chosen to leave these kind of exercises out. Result here is that a student becomes lazy during classes and expects the teacher to explain it to him instead of actively trying to understand the topic.

Following this last statement: the best way for a student to follow his education is to give him the responsibility instead of the teacher. The teacher is naturally in a way responsible, but if the student believes that he is in no way responsible he will lie back and wait for the information to be explained. This is also visible in the low motivation and lack of planning skills in the few projects that the student have. The require a nudge from the teacher to raise the bar and improve instead of staying on the same level. So when the student recognises his own responsibility through his own goals and input, he is more likely to be more motivated or at least to invest more time into the exercises. He will focus towards his goals and try to achieve them, which is a maybe desirable approach.

Regarding the kahoot idea: some teachers use similar programs. Some problems do occur however. It sometimes takes more time to develop these implementations than to use them. However the visual explanation and immediate response does work more effectively for the students than the normal verbal response.

Attachment II: Details Observation

The course has 4 hours every week. One of these lessons is explanatory where the teacher explains the material at hand and what the students need to do. Later in the week there is a three hour block where the students have to work independently with the teacher as guidance. The observation was held during the 2nd hour of the week, so the first of the three independent hours.

The lesson started off with a small introduction from the teacher. He explained what they needed to do in the next upcoming three hours. He specifically mentioned that it does not matter where they end up if they did try their best. On the opposite the ones that were ahead were allowed to start on the end exercise, which follows after every block of exercises. The students may choose themselves in which way they want to work, how they plan their work and when they want to ask questions. It is all up to them to understand the material themselves instead of relying on the teacher. They can choose not to ask for help, but they will have to study it themselves. The introduction was approximately 7 minutes long.

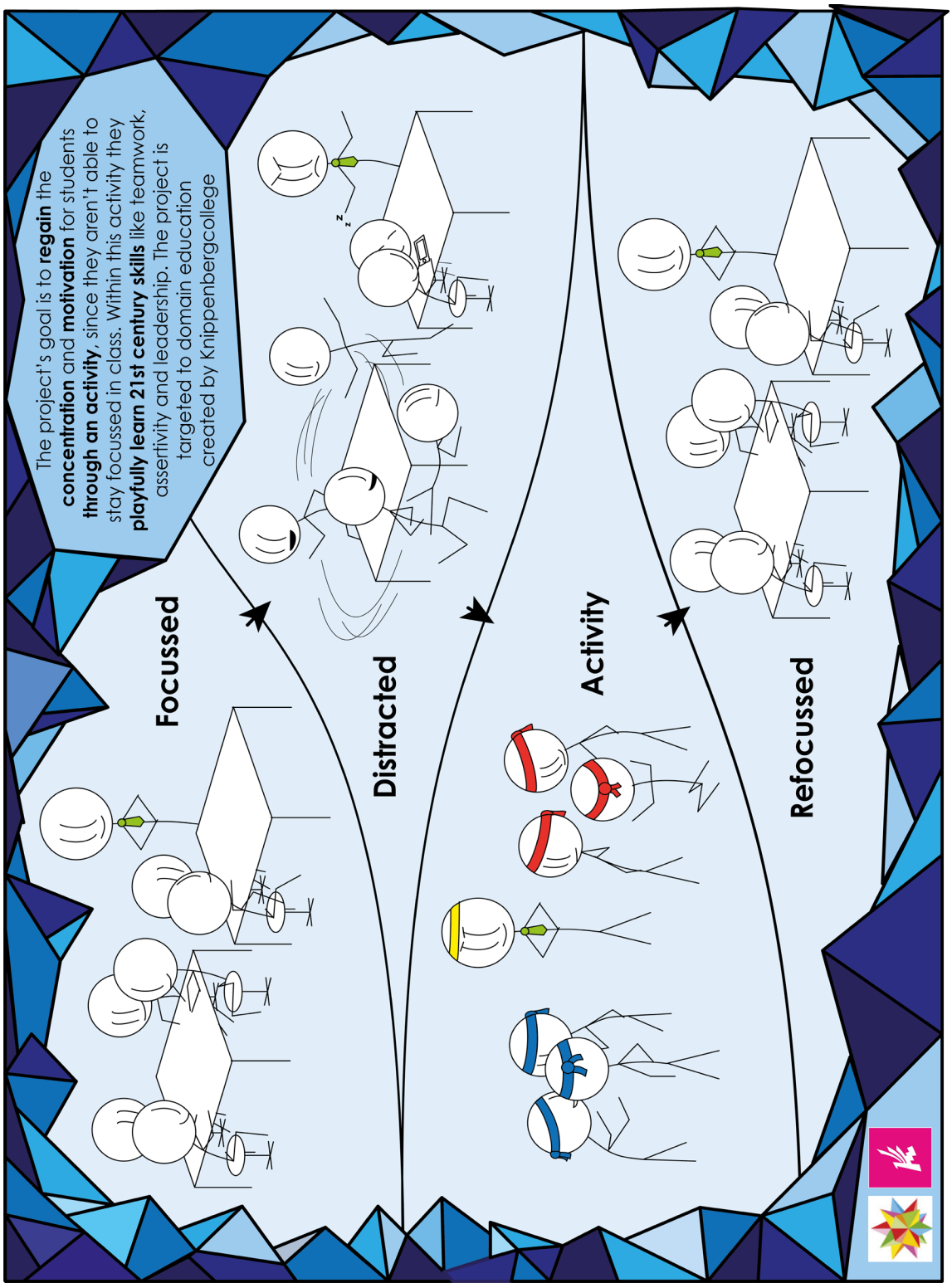
The group spread out quite quickly after the introduction. The domain education has 3 classrooms to themselves and different groups formed within these classrooms. In the "main" classrooms there were two groups of two, two groups of three and two individual students. The groups of two were working together quite efficiently and the individuals were clearly the bright kids of the class. They were ahead by quite a bit and were already asking for the end exercise during this first hour. A group of three weren't really studying the work topic, however they were discussing if the earth was flat or not. Even though this is not what they should be doing, they are thinking about certain facts and trying to question these facts which is not necessarily a bad thing. The teacher admires this but still redirects them to the topic at hand. This was after roughly 25 minutes into the lesson. In the other rooms there were some individual students and a large group of 6 students. In comparison to the two individuals in the main room, they were not as far but at a decent progress. After approximately 40 minutes one of these students was caught playing a game by the observers. The group of 6 were gossiping instead of studying.

Even though the students were spread out, the teacher was explaining a question to a student nearly consistently. The students came in frequently to ask for a little explanation regarding the topic or to ask for further instructions when an exercise was finished. When the teacher wasn't answering a question he would roam around the classrooms, but he stayed in the main room almost the entire hour.

The final 5 minutes of the hour are for the students. They are allowed to fill them any way they would like. Most of the students took their tablets and started playing games. The course is not really cross-curricular yet, but developments are taking place. In the observed hour the topic was climates so geography and in the previous week was based upon history. However there is overlap introduced in the end exercises. In the upcoming exercise the students would have to explain how hunters in the prehistory were able to live in a certain climate and therefore combine knowledge of both base courses.

In the explanatory lesson the teacher is implementing games and change-ups to gather attention and motivation regarding the subject. For example at the end of each lesson he would explain a brutal torture machine used in history. The students would be excited to stay concentrated until the end of the lesson due to their interest in these weird change-ups in the lesson. Every now and then the teacher takes the students outside to play a little game. In those games the students gain an advantage by answering a question correctly. In for example the game dots and boxes (kamertje verhuren) the students have to run an obstacle course before they may draw a fence, but if they answer a question correctly they may run to the playfield immediately.

Attachment III: Poster Midterm



Attachment IV: Bottlenecks

legend: [...] = testable for designers
[...] = testable for students
[...] = Not testable
[...] = Only with Children

1. Docent stops the lesson and gets the students together to start the energiser.

- It is unclear that the energiser will be played since the class is divided over multiple rooms
- It costs the teacher to much effort to get the students together
- The students are already distracted and with the concept they only receive an extra opportunity to stay distracted
- Some students prefer to keep working

2. Students create room for the energiser and lay down Point C.

- Moving the tables takes too much time
- The students do not cooperate in moving tables
- Placing Point C takes too much effort/time

3. The teacher chooses and explains the game and creates the teams.

- The explanation is unclear
- Students do not agree with the chosen game
- Students do not agree with the teams
- It takes the teacher too much time to create the teams
- The amount of students is uneven

4. Everyone gets ready to get started

- It takes too long to get ready since the start locations are unclear
- The game's goal is unclear

5. During the game

- Students walk over the squares instead of the edges
- The steps are too small/big
- It is unclear who wins
- There is no communication between the students during the game
- Playing the game creates too much noise and thereby hinders other classes
- Point C does not stay put
- Students do not recognise their mistakes since they cannot see what they have drawn
- The game takes too long too play
- Students trip on Point C and get injured

6. The game ends, Point C gets stored and the class setting gets rebuild

- It is unclear when the game has ended
- Students are too noisy when cleaning up
- Students do not cooperate when cleaning up
- Rebuilding the classroom setting takes too much time
- Storing Point C takes too much time
- Students try to linger in the playstate and do not help with cleaning up

7. The students resume working

- Students remain talking about the game
- Students mindset is still focussed on the game instead of work
- Discussions arise about the game and its winners
- Students feel like they are rewarded for their unconcentrated behaviour before the game
- The teacher cannot regain focus from his students after the game

Attachment V: Scenarios

Negative scenario

It's the start of a regular school day. The students all come in after each other. Some are still tired, some very hyper and loud. The chaos before everyone is settled down takes about 10 minutes; longer than usual. The teacher is already getting a bit annoyed because he is on a very tight schedule to teach the last 3 chapters before the test takes place, and he needs all the time he can get.

He rushes through the material and the attention span of the students quickly begins to run out. Some are starting to talk, others just stare out the window. After the third time the teacher tells the students to be quiet, he feels obligated to use the new attention gimmick the school provided for his lessons. Personally he thinks it's a waste of time he could be using to teach the students valuable information, but the school insists he uses it.

He shouts over the talking students that they're going to do one of those activity games. The students sigh, they just woke up and don't have any intentions of running around already. Reluctantly they get up out of their chairs, move the tables out of the way and lay the playing-mat down. The game involves them doing a kind of group-race. The teacher tells them to just use their regular table groups. The students, who had immediately run to their friends at the word "group", walk back to their normal groups disappointedly.

They play the game. Some students are somewhat motivated throughout it, but most groups are cheating and cutting corners. The teacher notices this and says they should participate or they will get a lower point for their "effort" rubric. The students pick up the pace and reluctantly finish the game.

When the teacher tells the students to put back the tables and chairs, most students are still talking about the game and can't hear him. The students are way too hyper to settle down right away. In total it takes another 5 minutes to get everyone and everything back in place.

The teacher ends up not having enough time to discuss all the chapters and he gives the students the last chapters as homework. The students obviously think this is unfair because they already have more than enough homework for the other courses.

When the students finally leave the classroom, nearly everyone has a worse mood than when they entered.

Positive scenario

It's the start of a regular school day. The students have been working independently on their assignments in the Domeinclass. After an hour the teacher notices that the students are starting to lose focus. He knows exactly the thing that will get them focussed again.

He tells the students it's time for a game with the Playmat. The students immediately get excited, jump out of their seats and start moving the tables to the side. Once that has been done and the Playmat has been started they all wait in suspense for the teacher to explain the game.

The teacher has picked a kind of group-race game to get them to work together and diffuse their energy a bit. He explains the game by setting an example of how the race works. The students immediately understand the rules.

The teacher tells them they can make any groups that they want, but like every time before, it can't be the exact same group as last energizer. The students quickly run to their friends, and then switch it up a little by swapping some people.

The game begins and all the students participate avidly. They all try to work together as well as possible to achieve the goal, and don't cheat. They know the teacher will notice if they do. After one team has won the first round, the teacher puts his own twist on the game: the students are only allowed to run in pairs of two. Because of the uneven numbers of the groups, this switches up everyone again.

The students play the second version of the game and after another team has won, the teacher turns off the Playmat. The students know that this means the game is over and they quickly quiet down. They put the tables back in their usual places and sit down at theirs own desk. The teacher is very pleased to see that the students are resuming their work quietly and are more focussed than they were before.

Attachment VI: Test Results

Test results from the test by the designers

	First test	Second test	Third test
Putting away tables and laying down Point C	1 min 21 sec	1 min 13 sec	1 min 04 sec
Time of the game (Teamwork)	1 min 56 sec	1 min 36 sec	1 min 41 sec
Storing Point C	27 sec	24 sec	19 sec
Rebuilding classroom setting	1 min 15 sec	57 sec	53 sec

Test results from the test performed by students

Is the explanation clear?	Yes
Explanation time	1 min 2 sec
Do they use Point C correctly?	Yes
Time of coaching game	1 min 39 sec
Time of coaching 2v2 game	30 sec
Time of teamwork game	1 min 55 sec
Time of teamwork 2v2 game	20 sec
Is it clear who wins?	Yes
Did they understand what they did wrong?	Yes
Is it clear when the game ends?	Yes
Did chaos arise?	Apart from competitive tension no
How long does it take before they regain their focus?	A short moment, but these are university students
Is the step size right?	Yes
Were they in eachother's way?	No

Attachment VII: Code

```
#include <Adafruit_GFX.h>
#include <Adafruit_NeoMatrix.h>
#include <Adafruit_NeoPixel.h>

// define pins for IO; 5 and 6 for led-strips, 4 for the button
#define PIN_1 6
#define PIN_2 5
#define BUTTON 4

// create 2 neopixel matrices, (collumns, rows, arduino pin, top left is start, zigzag pattern)
Adafruit_NeoMatrix matrix = Adafruit_NeoMatrix(4, 40, PIN_1,
                            NEO_MATRIX_TOP     + NEO_MATRIX_LEFT +
                            NEO_MATRIX_COLUMNS + NEO_MATRIX_ZIGZAG,
                            NEO_GRB            + NEO_KHZ800);

Adafruit_NeoMatrix matrix_2 = Adafruit_NeoMatrix(4, 40, PIN_2,
                              NEO_MATRIX_TOP + NEO_MATRIX_LEFT +
                              NEO_MATRIX_COLUMNS + NEO_MATRIX_ZIGZAG,
                              NEO_GRB            + NEO_KHZ800);

// create a set of colours to call for both matrices; [matrixname].Color(R, G, B)
const int black   = matrix.Color(0, 0, 0);
const int red     = matrix.Color(255, 0, 0);
const int green   = matrix.Color(0, 255, 0);
const int blue    = matrix.Color(0, 0, 255);
const int yellow  = matrix.Color(255, 255, 0);
const int purple  = matrix.Color(255, 0, 255);
const int cyan    = matrix.Color(0, 255, 255);
const int white   = matrix.Color(255, 255, 255);
const int pink    = matrix.Color(255, 0, 125);
const int orange  = matrix.Color(255, 165, 0);

const int black_2   = matrix_2.Color(0, 0, 0);
const int red_2     = matrix_2.Color(255, 0, 0);
const int green_2   = matrix_2.Color(0, 255, 0);
const int blue_2    = matrix_2.Color(0, 0, 255);
const int yellow_2  = matrix_2.Color(255, 255, 0);
const int purple_2  = matrix_2.Color(255, 0, 255);
const int cyan_2    = matrix_2.Color(0, 255, 255);
const int white_2   = matrix_2.Color(255, 255, 255);
const int pink_2    = matrix_2.Color(255, 0, 125);
const int orange_2  = matrix_2.Color(255, 165, 0);

// create an int to store count value for button
int count = 0;
int buttonState = 0;
int lastButtonState = 0;

// start matrix and setup lights
void setup() {
  pinMode(BUTTON, INPUT_PULLUP);
  Serial.begin(9600);

  matrix.begin();
  matrix.setBrightness(40);
```

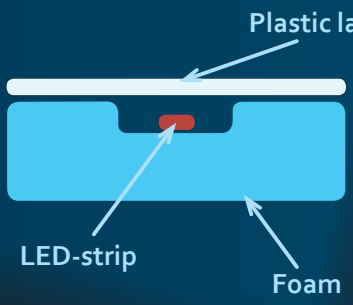
```
  matrix_2.begin();
  matrix_2.setBrightness(20);
  matrix.fillScreen(blue);
  matrix_2.fillScreen(blue_2);
  matrix.show();
  matrix_2.show();

  // leds split in rows and collumns,
change for() loop for length/name,
inside loop to
  // change the positions to draw

  /*                  rows -->
         col_1,col_2,col_3,col_4
          ____ ____ ____ ____
    row_1 |    |    |    |    | ^
          |____|____|____|____| | col-
umns
    row_2 |    |    |    |    |
          |____|____|____|____|
    row_3 |    |    |    |    |
          |____|____|____|____|
    row_4 |    |    |    |    |
          |____|____|____|____|

  */
  /*
    // first matrix is used for columns
    for (int col_1 = 0; col_1 < 15;
col_1++) {
    matrix.drawPixel(2, col_1, blue);
    }

    for (int col_2 = 15; col_2 < 30;
col_2++) {
    matrix.drawPixel(0, col_2, blue);
    matrix.drawPixel(1, col_2, blue);
    matrix.drawPixel(2, col_2, blue);
    matrix.drawPixel(3, col_2, blue);
    }

    for (int col_3 = 30; col_3 < 45;
col_3++) {
    matrix.drawPixel(0, col_3, blue);
    }

    /* 4th collumn | | unused
    for (int col_4 = 45; col_4 < 60;
col_4++) {
 matrix.drawPixel(1, col_4, blue);
      matrix.drawPixel(2, col_4, blue);
      matrix.drawPixel(3, col_4, blue);
      matrix.drawPixel(4, col_4, blue);
    }

    // second matrix used for drawing
rows
    for (int row_1 = 0; row_1 < 15;
row_1++) {
    matrix_2.drawPixel(1, row_1,
blue_2);
    matrix_2.drawPixel(2, row_1,
blue_2);
    }
    for (int row_2 = 15; row_2 < 30;
row_2++) {
    matrix_2.drawPixel(1, row_2,
blue_2);
    }
    for (int row_3 = 30; row_3 < 45;
row_3++) {
    matrix_2.drawPixel(0, row_3,
blue_2);
    matrix_2.drawPixel(1, row_3,
blue_2);
    matrix_2.drawPixel(2, row_3,
blue_2);
    }

    // 4th row | | unused
    for (int row_4 = 45; row_4 < 60;
row_4++){
      matrix_2.drawPixel(3, row_4,
blue_2);
    }
  */
}

void loop() {
  // checks whether the button has
been presed and released, then
change count

  buttonState = digitalRead(BUTTON);
  if (buttonState != lastButtonState) {
    if (buttonState == 1) {
      count++;
    }
```

```
    lastButtonState = buttonState;
  }

  // number of clicks before counter
resets
  if (count > 13) count = 0;

  // if count = 0; make the mat yellow
  if (count == 1) {
    matrix.fillScreen(blue);
    matrix_2.fillScreen(blue_2);
    matrix.show();
    matrix_2.show();
  }

  // 'presentation' for shape with
clicker
  // if count = 1; draw certain lines
  if (count == 2) {
    for (int row_3 = 26; row_3 < 40;
row_3++) {
      matrix_2.drawPixel(0, row_3,
red_2);
    }
    matrix.show();
    matrix_2.show();
  }

  if (count == 3) {
    for (int col_1 = 0; col_1 < 14;
col_1++) {
      matrix.drawPixel(2, col_1, red);
    }
    matrix.show();
    matrix_2.show();
  }

  if (count == 4) {
    for (int row_2 = 13; row_2 < 27;
row_2++) {
      matrix_2.drawPixel(1, row_2,
red_2);
    }
    matrix.show();
    matrix_2.show();
  }

  if (count == 5) {
    for (int col_2 = 14; col_2 < 27;
col_2++) {
  matrix.drawPixel(1, col_2, red);
    }
    matrix.show();
    matrix_2.show();
  }

  if (count == 6) {
    for (int col_3 = 27; col_3 < 40;
col_3++) {
      matrix.drawPixel(1, col_3, red);
    }
    matrix.show();
    matrix_2.show();
  }

  if (count == 7) {
    for (int row_2 = 14; row_2 < 27;
row_2++) {
      matrix_2.drawPixel(3, row_2,
red_2);
    }
    matrix.show();
    matrix_2.show();
  }

  if (count == 8) {
    for (int col_3 = 27; col_3 < 40;
col_3++) {
      matrix.drawPixel(2, col_3, red);
    }
    matrix.show();
    matrix_2.show();
  }

  if (count == 9) {
    for (int row_2 = 13; row_2 < 27;
row_2++) {
      matrix_2.drawPixel(2, row_2,
red_2);
    }
  }

  if (count == 10) {
    for (int col_2 = 14; col_2 < 27;
col_2++) {
      matrix.drawPixel(1, col_2, blue);
    }
    matrix.show();
```

```
  matrix_2.show();
 }

 if (count == 11) {
   for (int col_1 = 0; col_1 < 14;
col_1++) {
     matrix.drawPixel(1, col_1, red);
   }
   matrix.show();
   matrix_2.show();
 }

 if (count == 12) {
   for (int row_1 = 0; row_1 < 14;
row_1++) {
     matrix_2.drawPixel(0, row_1, red);
   }
   matrix.show();
   matrix_2.show();
 }

 if (count == 13) {
   for (int row_1 = 0; row_1 < 14;
row_1++) {
     matrix_2.drawPixel(0, row_1,
green);
   }
   for (int row_2 = 13; row_2 < 27;
row_2++) {
     matrix_2.drawPixel(1, row_2,
green);
     matrix_2.drawPixel(2, row_2,
green);
     matrix_2.drawPixel(3, row_2,
green);
   }
   for (int row_3 = 27; row_3 < 40;
row_3++) {
     matrix_2.drawPixel(0, row_3,
green);
   }
   for (int col_1 = 0; col_1 < 14;
col_1++) {
     matrix.drawPixel(1, col_1, green);
     matrix.drawPixel(2, col_1, green);
   }
   for (int col_2 = 14; col_2 < 27;
col_2++) {
     //matrix.drawPixel(
   }
   for (int col_3 = 27; col_3 < 40;
col_3++) {
     matrix.drawPixel(1, col_3, green);
     matrix.drawPixel(2, col_3, green);
   }
   matrix.show();
   matrix_2.show();
   delay(500);
   matrix.fillScreen(blue);
   matrix_2.fillScreen(blue);
   matrix.show();
   matrix_2.show();
   delay(500);
 }

matrix.show();
matrix_2.show();
delay(100);
}
```

Attachment VIII: Poster Demoday

Cross-section



Point C

Point C is an interactive device that provides energizers for high-school students in Domain education to bring back their focus. Within this activity they playfully learn 21st century skills like creativity, communication and collaboration in the classroom.
The project is targeted to Domain education, created by the Dr. Knippenbergcollege.

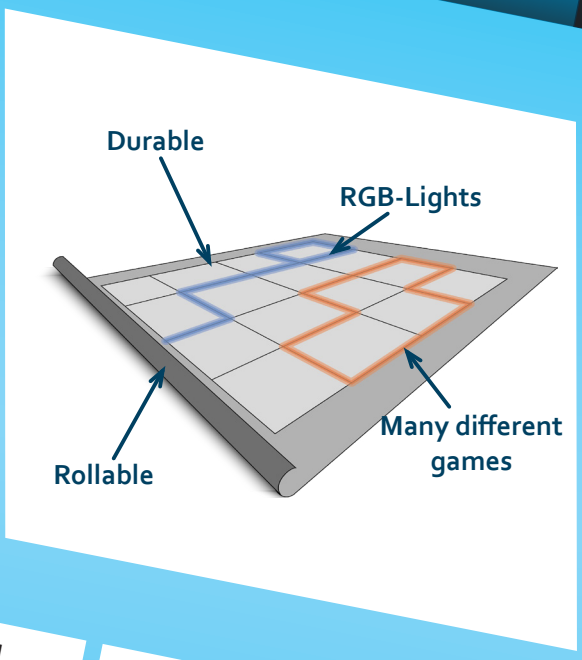
Creativity
Communication
Collaboration

Goal

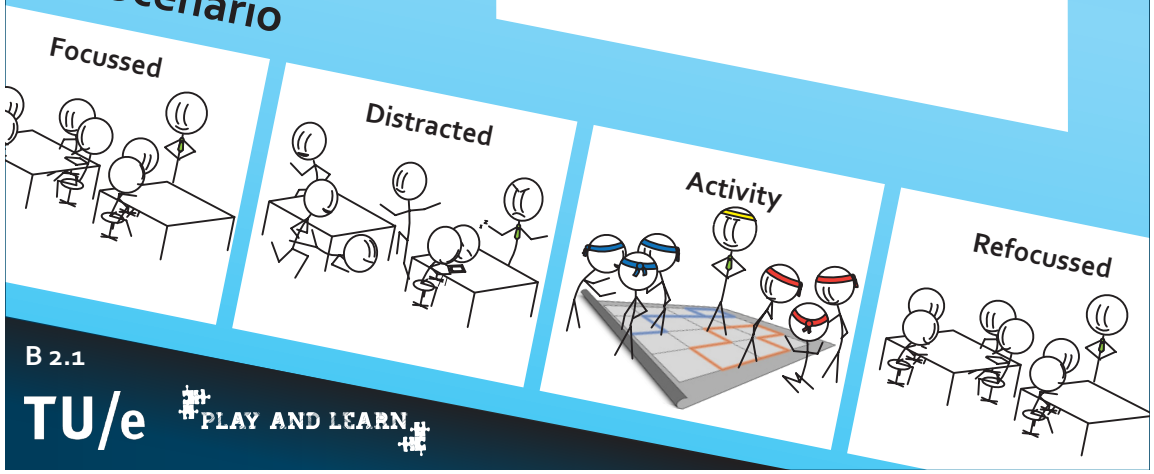
The project's goal is to regain the concentration and motivation of students through an activity, when they aren't able to stay focussed in class.

The rollable mat has a grid of LED-strips and pressure sensors at the junctions.

The various games are played by the students stepping on the junctions, and the mat giving feedback through the lights.



Scenario



B 2.1

TU/e #PLAY AND LEARN#

Attachment IX:
Pitch Stakeholders (dutch)

Stelt u zich eens voor dat u voor een domein klas stond. Alle leerlingen werken zelfstandig aan een vakoverschrijdende opdracht. Uw doel is om ze samen te laten werken aan geschiedenis, aardrijkskunde, kunst, maar na een uur beginnen ze met hun vrienden te praten over hun favoriete computerspel, voetballers of nieuwe make up. Wat is daarop de oplossing? U geeft ze een pauze van 5 minuutjes waarin ze mogen kletsen en op hun telefoon kijken. Niet naar onze mening! Met point-c vullen wij deze pauze op met een sportieve energizer, een kort spel in de klas dat fysieke activiteit vereist. Point-c is een mat met een raster van digitale ledstrips en druksensoren erin verwerkt, waarop de spellen worden gespeeld. Met de spellen werken de leerlingen passief aan een aantal van de 21 eeuwse vaardigheden, die steeds belangrijker worden in het onderwijs. Er wordt met name gefocust op Samenwerking, Creativiteit en Communicatie. Er wordt in random groepjes gespeeld, om de samenwerking van klasgenoten onderling te stimuleren. Door de sensoren in de Point-C wordt gewerkt met directe feedback vanuit de mat, iets wat bij een analoog spel in de klas niet mogelijk is.

Attachment X: Pitch Demoday

In the domain education at the dr. Knippenberg college first year students partly work on projects, instead of following all the traditional courses. These projects are given in three block hours, twice a week. As study and observation shows, children are not able to keep focused for this amount of time. Currently, the teacher gives the students a five minute break after each of the block hours. They are free to do anything, and of course all start looking at their phones.

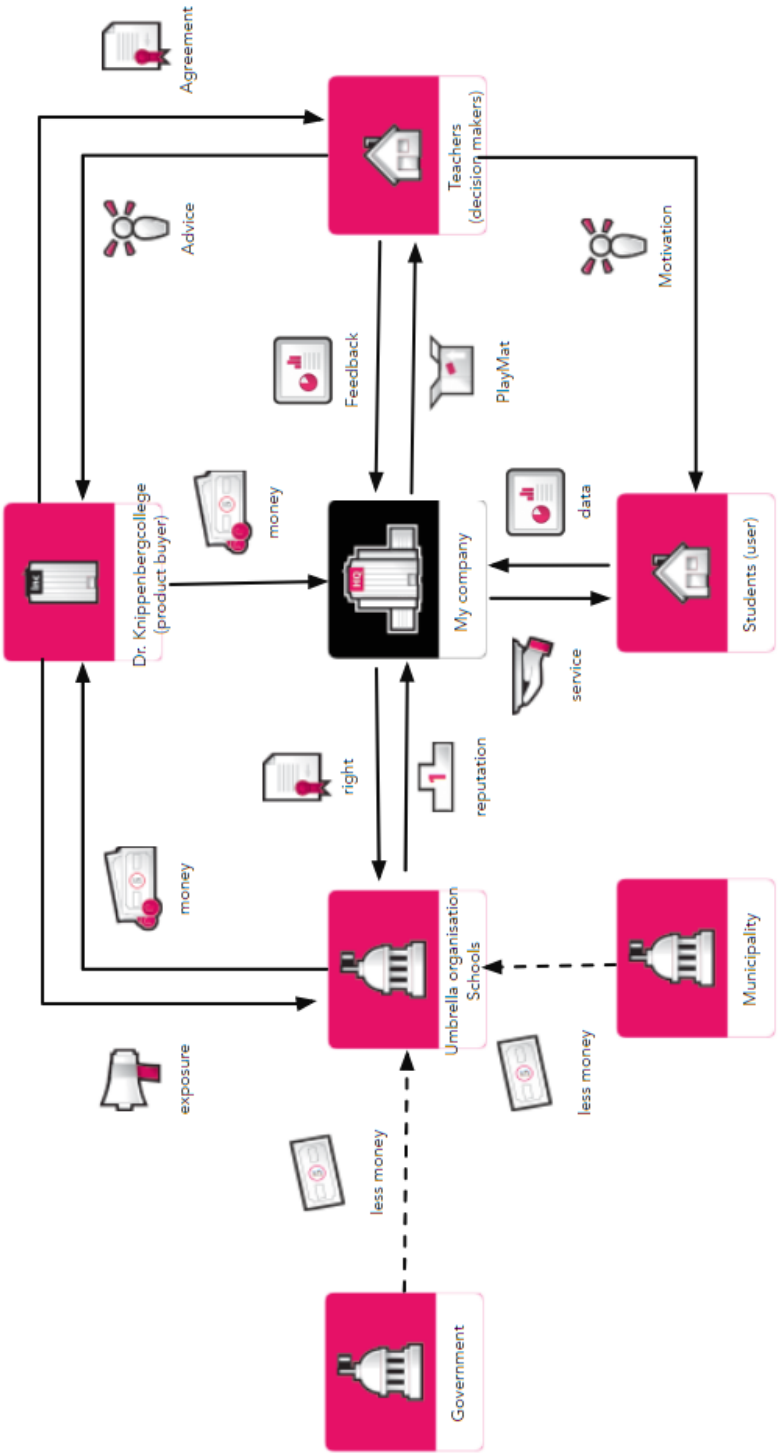
However, we want to engage them to be more physically active and stay motivated and focused in class. With our Point-C, the small breaks between block hours are filled with an energizer, a short physical activity, to bring back their focus.

Point-C is a mat that can be rolled out in class, and on which several short games can be played. The point-c itself contains a raster of led strips and pressure sensors at the crossing points. The crossing points can be connected when walking from point to point, as the leds change colour.

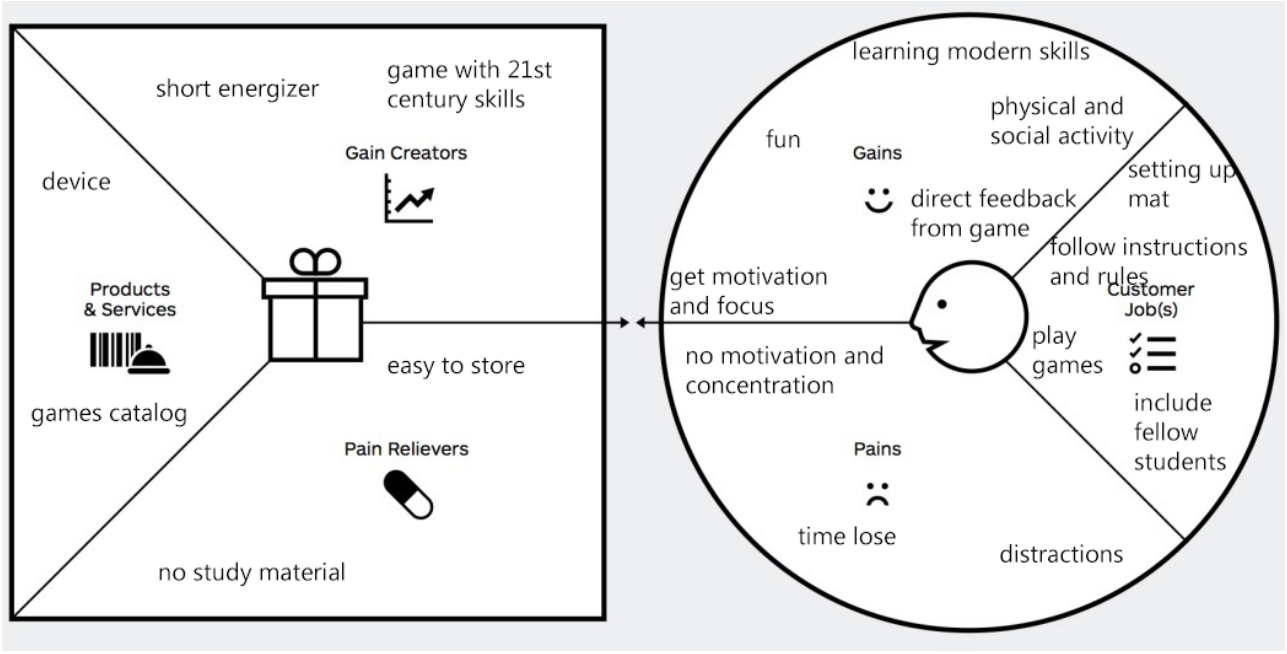
Playing these games will passively introduce them to some important 21st century education skills. Currently, students are free in their group choice and they only work together with their fixed group of friends or on their own. This is the reason why our games have their focus on improving especially collaboration, creativity and communication.

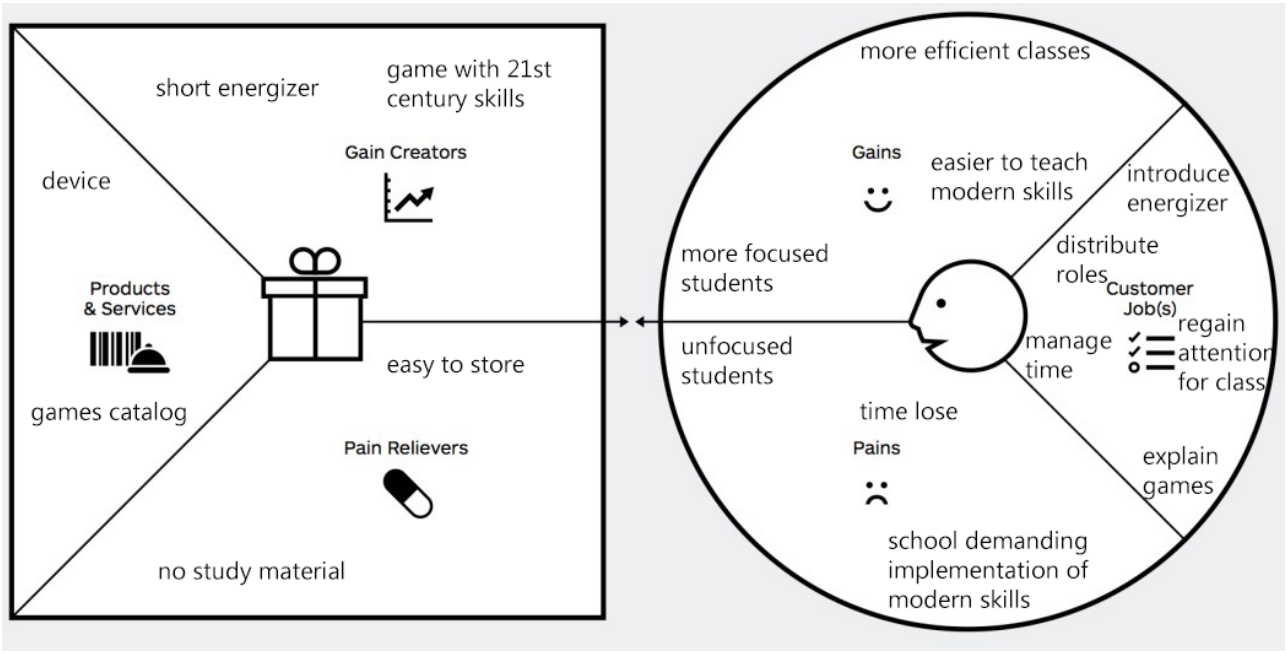
We have a smaller demo version of the mat here, and will demonstrate one of the games in a few moments.
In the next weeks, we want to do a user test with the children and possibly improve our design, games, possible interface. We hope to get some inspiration for this, so please feel free to write down your tips.

Attachment XI:
Board of innovation

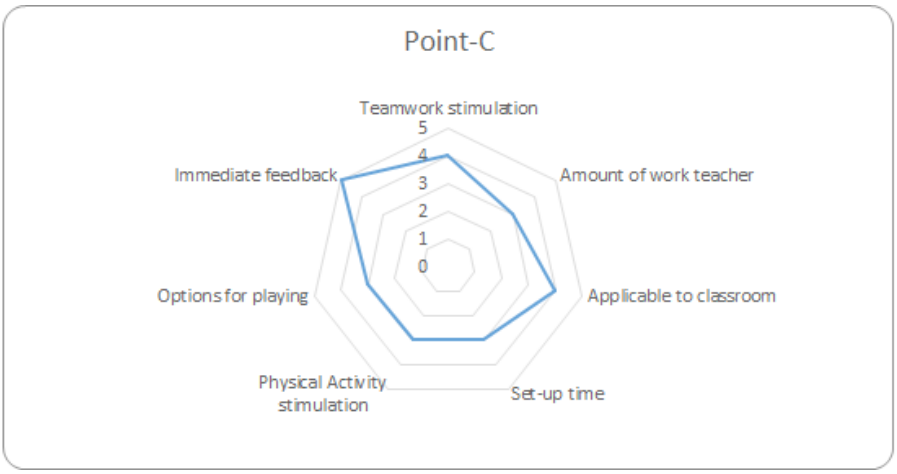


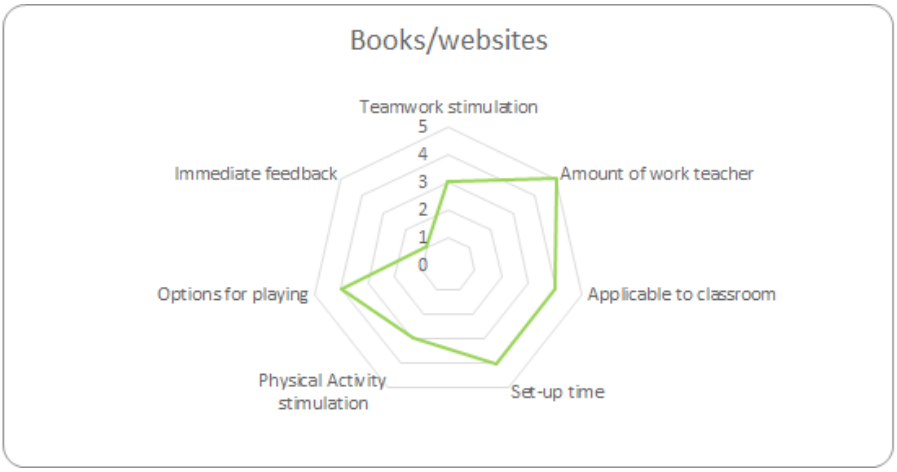
Attachment XII: Value proposition

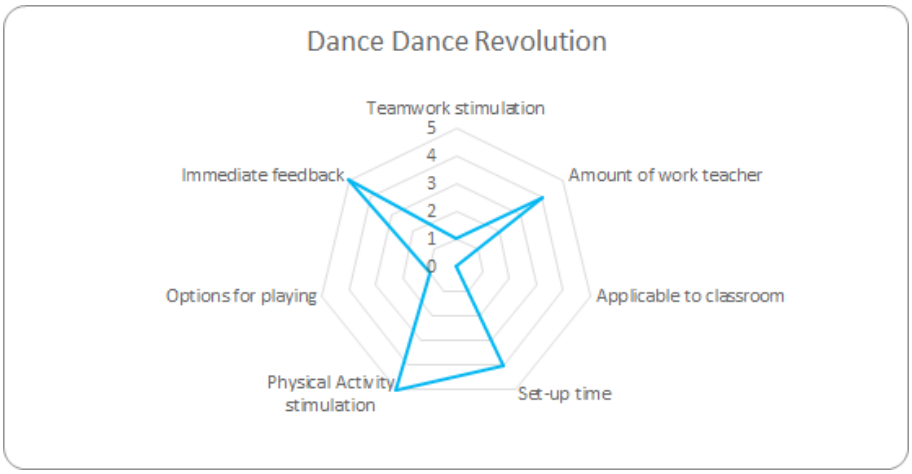


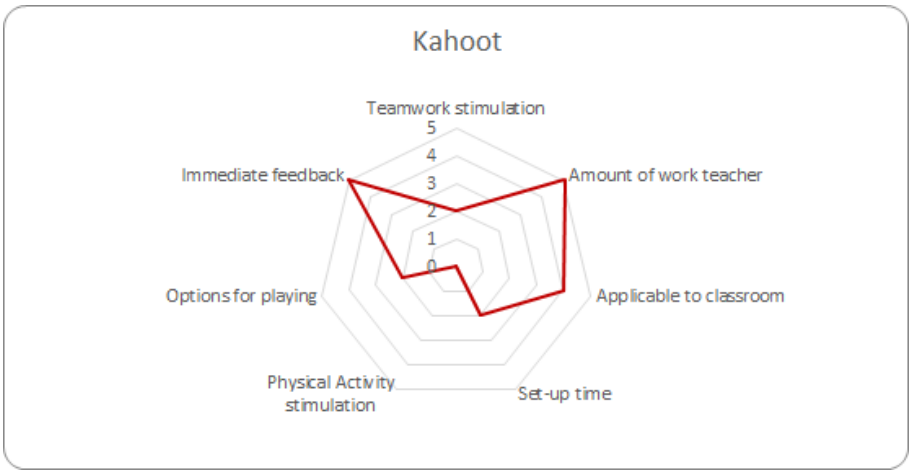


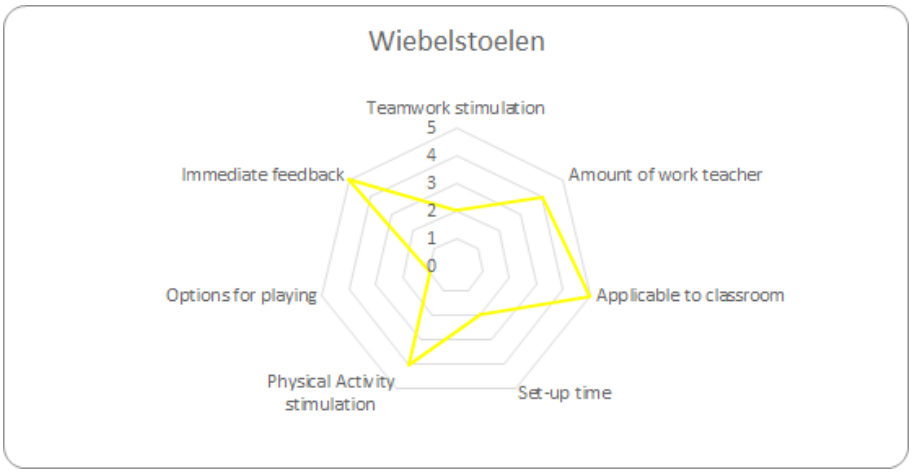
Attachment XIII:
Benchmarks webs competitors

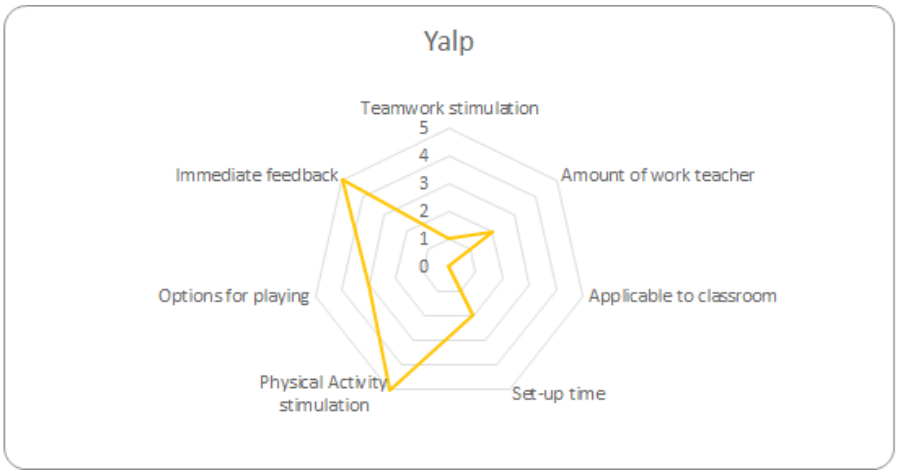







Kahoot
Teamwork stimulation
5
4
3
2
1
0
Amount of work teacher
Applicable to classroom
Set-up time
Physical Activity stimulation
Options for playing
Immediate feedback


Wiebelstoelen
Teamwork stimulation
5
4
3
2
1
0
Amount of work teacher
Applicable to classroom
Set-up time
Physical Activity stimulation
Options for playing
Immediate feedback


Yalp
Teamwork stimulation
5
4
3
2
1
0
Amount of work teacher
Applicable to classroom
Set-up time
Physical Activity stimulation
Options for playing
Immediate feedback

Attachment XIV: SWOT-Analysis

	Positive	**Negative**
Internal	Strengths: - Variable games - Easy to set up	Weaknesses - Lack of network - Costs
External	Opportunities - Special domain class - Breaks are already integrated in the class	Threats - Other energisers - Chaos - Unwilling teachers

Attachment XV: Business model canvas

Key partners:

Industrial Engineer: 4.000 euro/month

Industrial Designer I: 2.500 euro/month

Industrial Designer II: 2.500 euro/month

Marketing & communication employee: 2.200 euro/month

Key activities:

Installation

Programming

Assembling

Maintenance

Processing feedback

Key resources:

72m digital LED-strip (72,00 eur)

16 sq.mtr. fabric (40,00 eur)

Plastic coating (100,00 eur)

81 Piëzo pressure sensors (81,00 eur)

Case construction for rolling up (100,00 eur)

Value propositions:

See: 'Appendix XIII: Value proposition Point-C'.

Customer relation

Clear communication with the teachers should be made. For criticism and bug reports, but also for future game development.

Channels

See: 'Appendix XII: Board of Innovation Point-C' .

Customer segments:

All teachers in the domain education could benefit from our product.

Cost structure:

Upfront cost: Material (393 euro), Website (3.700 euro)

Recurring costs: Employee costs (11.200 euro/month), Advertising (216,67 euro/month)

Revenue streams:

Sale per unit: Point-C installation box with mat and interface with pre-made games (3,000 euro/unit)
Single sale of pre-made games
Single sale of custom-make games