CBL Project 1 Group Report

MOVE & IMPROVE

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Executive Summary

Over the last 5 months, our team has worked tirelessly to formulate, ideate, and create a physical–digital hybrid game that is both fun to play as well as educational. Having been thrown in the deep end, with our first ever university lecture being about this project, we embraced the challenge and did our best to come up with a great game that all of us would be proud of.

Our first brainstorming session yielded several viable ideas, including a city exploration game, a word solver, an introduction to endangered animals, and more. Following further discussions, we whittled over 50 suggestions down to two ideas, and within a few weeks, we had settled on one concept. As a team, we wanted to focus on designing a unique game that focused on an underrepresented niche of society – either through our user group, educational concept, or game idea.

Our initial idea for 'The Game' (title still pending) fulfilled all these criteria: A game designed for seniors in old age homes to keep their minds and bodies fit as they aged. Originally, we had planned on several 'game tiles' which players would step on when they had completed the exercise printed on it, with the winner being the player who completed their exercises the fastest.

We presented this idea to our coaches and fellow students, and after gaining some valuable insight, spoke to experts in the field about it as well. As this concept solidified itself, with most of the exercises and puzzles finalized, and the first prototype developed, some potential problems reared their ugly heads. Studies showed that competition and speed were not effective motivators for the elderly, and the cost of manufacturing a viable prototype for our game would have stretched well beyond our means.

It was at this moment that, almost halfway through the project time–frame, that we pivoted. After weeks of user testing, revisions, and new ideas, Team 12 had 'Move & Improve': A card–based interactive game for children aged 8–10 in schools, where teams of two compete to enhance both physical and mental fitness.
The benefits of this approach were clear: A small package, endless fun, infinite possibilities with over forty exercises to choose from, and a way to make boring PE classes in school fun and educational.

Move & Improve is a multi–faceted game: It not only activates one's body through physical activity, but also educates children on how these exercises help their bodies, teaches them the importance of teamwork, and imbibes in them how to follow instructions and clear steps to achieve a favorable result under time pressure.

With the possibility of large–scale implementation in the future, and multiple expansion packs, Move & Improve has the potential fundamentally alter the way we view fitness in schools, providing a fun way for our youth to be the best they can be.

Acknowledgement

Index

Introduction

"Design a physical–digital hybrid educational game.": This one concise sentence is what gave birth to several months of fruitful discussions, prototypes, and a valuable learning experience.

With an veritable plethora of potential concepts to choose from, and a group of eager students brimming with ideas, CBL Project 1 was going to be nothing short of an exciting journey.

Over the next few months, we went through several iterations, concepts, prototypes, and evaluations before we opened the door to the current version of 'Move & Improve'
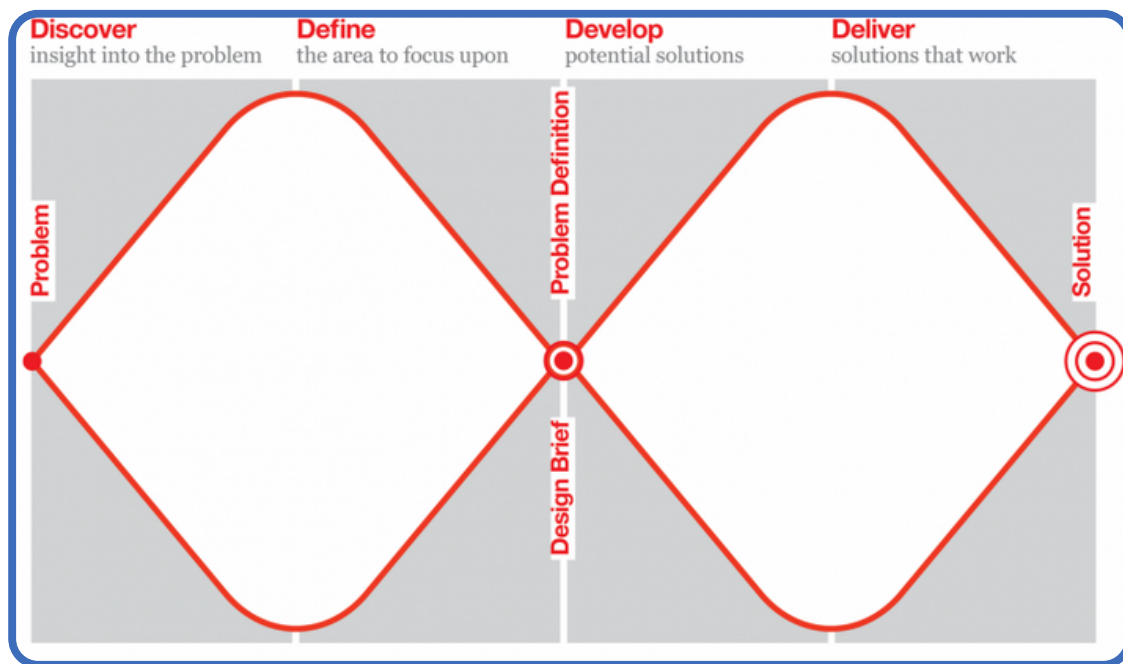
Fig. 1: The Double Diamond Design Process

Through the project, we stuck to an iterative design process, broadly following the tried and tested Double Diamond approach. After having been introduced to it in our Human Centered Design course, it stuck with all of us and we felt it would be a useful tool in helping us reach the finish line. Discover, Define, Develop, and Deliver has been our mantra since August, and we have done our best to apply it to every aspect of Move & Improve.

The three main phases of our development so far have been expanded upon later in the document, which we believe to be each full iteration of the double diamond. Phase 1 broadly encompassed our journey from the problem statement to the first prototype, while Phase 2 highlights the changes to our final idea, until the midterm deadline where we found ourselves with a crude version of what would grow to become 'Move & Improve'. Finally Phase 3 features our growth from an group with a cardboard box, a few cards, and a dream, to a fully-fledged prototype with everything from packaging to a working card reader for our NFC-enabled cards.

Every member of the group contributed significantly to the development of the final product, with a focus on equitable task distribution, precise planning, and thorough documentation to turn Move & Improve into the product it is today.
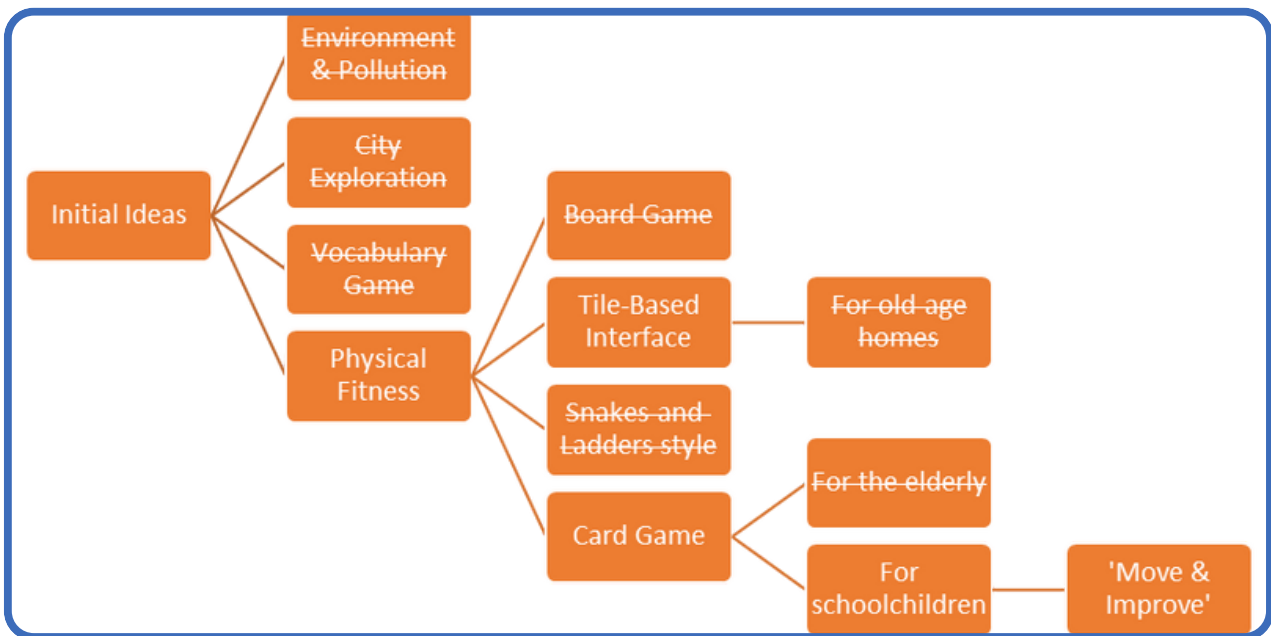

Fig. 2: The ideas

Competitor Analysis

Board games designed for primary student in class are not a new concept for the market. These games not only encourage children to stay active in class, but also encourage teamwork between student. Among them, board games related to physical activities are commonly used in P.E. classes, while others focusing on mental activities can be applied to any class. However, some of these games may involve only a single type of activity.
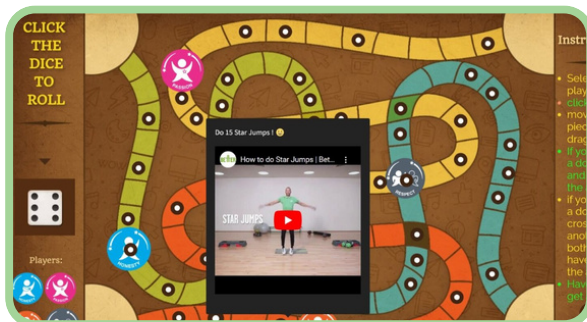
Fig. 3: Interactive game for 1 – 4 players (School Games Interactive Board Game, n.d.)

Fig. 4: Fitness tic tac toe (Learn Move Conmmect wit NXT, n.d.)

Fig. 5: Matchstick men(Lili Home, n.d.)

Fig. 6: P.E. Life-size board Game(Hillary Kiser, 2018)

After establishing our initial game framework, we conducted research on similar games in the market. Firstly, we believe that a game should be designed to be enjoyable, ensuring that repetition does not lead to boredom. Additionally, the game's difficulty should be moderate, providing small challenges for children without causing frustration. Team set up for 2 students also encourages teamwork and social interaction.

Our game focuses on both physical and mental health for young students. We have incorporated competitive elements to keep children active, setting the gameplay in a classroom and utilizing various school facilities, allowing us to design and integrate a wide range of different types of activities. With an abundance of activity cards surpassing the required number, users can freely combine and vary them during repeated gameplay, significantly enhancing replayability.

Project Goal

We all shared the same goal during this project which we all agreed on in the beginning. During our first weeks we found out what everyone's skills and strengths are.

Throughout the first few meetings we got to know each other better and learned that we all had different strengths and that we wanted to learn from each other during this project. For example Zyfn is very good with electronics, Eva is good at planning and Kitty and Zoë are good with creativity and aesthetics. With this we wanted to watch along with each other to expand our own knowledge about design in different aspects.

Another goal of the project was to create a working prototype and we all contributed to achieve this. We wanted to learn how to prototype and have different levels of prototypes. Together we also wanted to learn how to take part in a complete design process.

The Process: Phase 1

Discover

Our first meeting involved basic discussions and brainstorming; we each put forth our ideal game types, themes, and target audiences. We then quickly entered the brainstorming phase, gathered each team member's unique ideas on the game, and reviewed topics of individual interest. After a week of individual research, we ended up with four game concepts:

1. Race–based game for old–age homes designed to promote physical fitness.
2. Scavenger hunt around a city for new university students
3. Environment resource management board game for high school students
4. Scrabble–style vocabulary enhancing minigames for young children.

Through a few discussions and rule refinement, we invalidated two concepts we considered relatively unclear. This narrowed our selection to two concepts for further development. We believed both concepts had merits, and they all started taking shape, but the key to the decision–making process extended beyond the team. We decided to introduce an external perspective and seek the professional opinions of experts, our project coaches, and our fellow students.

Define

Through interviews, we examined each concept from a psychological standpoint, evaluating their potential for further investigation. This step provided us with professional guidance, we successfully locked in a game theme that underwent careful consideration and professional guidance.

The final concept we settled on was Concept One, an entertaining board game designed specifically for elderly. In this game, each board corresponded to different simple physical movements. Teams were to consist of 2 players each, and the game, with the whole game designed for 4–8 players.

Fig. 7: Original concept sketch

Each team chose one route, consisting of 8–10 tiles, with the goal of reaching the endpoint of the boards as quickly as possible. This board game incorporated a variety of simple physical movements, exercising different parts of the body. By performing specific actions on different tiles, players engaged in physical activity and enjoyed the game's interactivity.

Having kept in mind the elderly target audience, the game focused not only on physical activity but also integrated some simple mental activities. The planned product manuals and tutorial videos would be simple and clear, ensuring the elderly could easily set up the game themselves. The game offered different difficulty levels as well. Silicone lining was to be added underneath the tiles to prevent slipping. LED lighting effects add creativity and entertainment to the game. Each completed action (pressing button) triggered corresponding LED lights, enhancing the game experience.

Fig. 8: Brainstorming ideas

During the brainstorming phase for naming the game, options such as "Healthify Me," "Race to Health," "Step and Move," and "Training Tiles" were considered, reflecting the game's focus on a healthy life.

Develop

At this point, like any novice designer, we believed we had our final product concept – barring some small possible changes in the future. We were not ready for what was to come, and this was the first time we got a glimpse of what our future might hold.

It was in fact, during one uneventful Monday morning team meeting that we had our first Eureka moment. While discussing our game idea, we were talking about what we wanted our game tiles to look like. After we had a rough idea of what we wanted, it only took one trip to the nearest coffee machine to 'manufacture' our first physical prototype – a bunch of coffee stirrers on the floor.
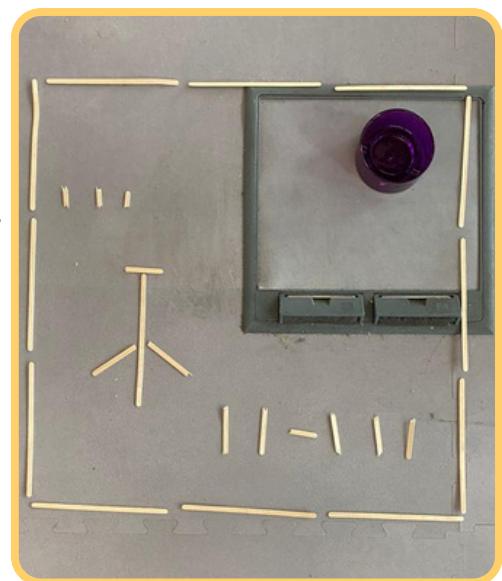

Fig. 9: Coffee stirrer prototype

Additionally, we held interviews with a few experts to help us finalize the details of our design and the exercises we should include in the game. Speaking with Dr. Ashwini Deoras, a doctor of physical therapy with a double masters in endocrinology and biotechnology who does extensive work with the elderly, we learnt a lot about what exercises would suit our target audience. She recommended including exercises that focused on five core areas of development: balance, reflexes, flexibility, breathing, and movement. Additionally, we were recommended to include various difficulty levels to ensure that it would be a fair game for everyone, no matter their abilities.

Dr. Priya Kher, an expert in behavioral psychology and learning, assisted us with the formulation of the mental fitness aspect of our game. She encouraged us to focus on memory-based games, mental calculations, and riddle-based questions to keep the minds of the elderly active.

Fig. 10: Testing the first prototype


Fig. 11: Conducting the interviews

Using this information, we got to work designing a more refined prototype of our game tiles, focusing on ease of readability for the elderly. This initial model theorized large, high contrast text printed on a soft foam square with a button that could be stepped on once the task had been completed. 10 of these tiles would make up the 'path' of the game, and the first team to finish their part would be adjudged the winner.

Unfortunately, as a team, we lacked the skills needed to actually build such a model, and so a workshop at the Wearable Senses lab to learn the basics of sewing, heat transfer printing, and leatherworking was in order.

Kitti and Zyfn then spent a day in the workshops bringing to live a model of one of the game tiles – a wood backed panel with a soft cloth exterior, LEDs in the corner to highlight opponents' progress, and a large button in the center.

Deliver

After creating our first low fidelity prototypes, we did some user testing to test if our game concept was fun, if the instructions were easy to follow and if the game was played as we imagined it would be. Due to the guidelines of the Minimal Risk Checklist and lack of time to organize visits to elderly homes, we could not test on our target user group. Instead we asked classmates of ours to test out the game.
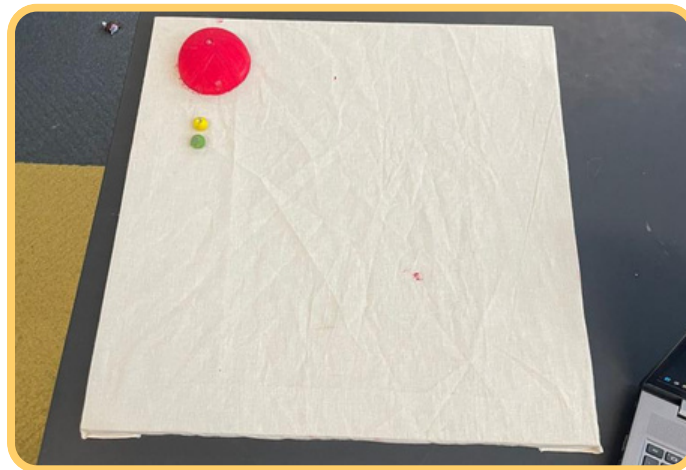
Fig. 12: Wood and textile prototype

Fig. 13 and 14: Initial playtesting

We gained a lot of insight into potential flaws in our game through this and despite our classmates thoroughly enjoying the game, we realized we might need to change some aspects of our game. Firstly, the game board itself was quite heavy and difficult to move which may pose issues to elderly people. Additionally, the timing factor may be difficult for elderly people as one group may need more time to understand instructions or might be demotivated by being timed. We, however, did also gain positive insights into our game as our classmates found it very fun and motivating to hit a button to indicate the end of an exercise. With this feedback in mind, we began a second interaction of the double diamond as we discovered potential solutions to this problem and began our second iteration.

The Process: Phase 2

Discover

As mentioned above, the feedback we received from user testing was that the board was difficult to maneuver and quite heavy and that the premise of the game, a time-based race game, may not be suitable for the nature of elderly people. We also got feedback from our group members that the creation of the board was quite expensive and the addition of electronics would further increase this making it difficult to mass-produce on the scale we had initially imagined. With further guidance from our coaches and feedback in hand, we decided to go back to the drawing board and began brainstorming potential solutions.

We came up with the idea of using cards with NFC chips to display the exercises instead of using the tiles. To accompany this we needed to include a card reader and screen to display the information stored on the chips. As we got a positive response from the button, we thought it would be good to keep a button in the game to indicate that an exercise is done. We alternatively thought we could create a snake-and-ladder type board with individual exercises on each tile which players have to do if they land on them.

When discussing what potential solutions we could find to the issue of motivation and timing for elderly people, we thought of the radical solution of changing the user group entirely. Initially we were quite opposed to this as we had based a lot of the game around our user group but as we explored advantages of changing the user group to children instead of elderly, we realized it would allow us to keep the core concept of the game, a time-based race game focused on physical activities, the same. Children are highly motivated by extrinsic factors such as competition and more active and mobile therefore we would mainly have to put our focus on changing the difficulty of the exercises. We also looked at potential cons to making children our key user group, mainly that we cannot interview or user test on them and that only a small group of children could play at one time which may make it hard to play in a school setting.

Define

Our first user group were elderly in a nursing home. Due to discussions and interviews and research we questioned ourselves if elderly would be motivated by winning or racing against each other. The conclusion was no and we found out that unlike elderly, children are way more driven by racing and being the fastest. We were sketching out a scenario board for our game and during this process we were talking with our coach if elderly would actually like this game. This way we changed our user group to children from six to twelve years old in PE class or at the beginning of a school day to stimulate them to exercise and also teach them about the human body. With our new user group being children we could not user test with them ourselves but with our old user group, elderly, we were also not able to test with them. We figured that we could collect enough knowledge by doing research online and interviewing PE teachers and parents and also testing with ourselves because we have all been children in our lives. The decision of changing our user group motivated us all to continue our project and having a new canvas to project our ideas onto. Further into our project we narrowed down our user group to children from eight to ten years old because we received feedback during coaching sessions that six to twelve is a big age group and that six year old children and their interests are very different that children of twelve years old. With our defined age group of eight to ten years we were able to guide ourselves in a more controlled direction and this helped us to select the exercises that are included in our game on the cards.

Fig. 15: A meeting discussion

Our first prototype of our original idea was one tile of our game board that would have the shape of a large mat on the ground. This idea seemed to work for us at first but when we began we found out that the tiles were quite heavy and that it might be difficult for elderly to set up a large mat as they are not flexible and often have a hard time bending or reaching for the ground. The cost of our final prototype would also be very high as the materials were expensive, especially the soft materials. To make our game more accessible for elderly and to reduce the cost of materials we decided to make a card game with large cards and a card reader. The new idea was to make A4 cards with NFC chips instead of the tiles.

The NFC chips were to indicate what exercise is selected and would provide for a connection to a screen to show additional information and an explanation video. Another idea that came to us was a snakes and ladders board where each tile is a unique exercise and any time a team lands on that tile they must do that exercise. The first team to get to the end wins. So this board would not be as big as our original board and would be cheaper than our initial choice. We decided to go with the card game as this seemed more unique and interactive than a regular board.

Our initial concept included both mental and physical exercises in the same game to play at the same time. Due to research and feedback from the coaching session we found out that mixing these activities would slow down the game. Simple mind puzzles in between physical exercise is not stimulating for children and we did not want that to demotivate them from playing the game. We then decided that the game could be played in two different ways. The first being played in a PE class for the physical exercises and the second could be played inside a classroom for a small break between lessons or the beginning or end of a day to make school more fun and interactive for children. This seemed to work way better but we still had some struggles with the division. Later on in the process of our game we decided to make the mental cards an expansion pack in a different box with just the cards because this seemed more fitting in our concept. This would ensure the game to be more clear and it is also nice for people to have a choice if they also want to play the mental exercise cards.

Develop

Cards

The first prototypes for the cards were A4 size and printed on weighted paper to make them more firm. We made the first cards before we decided upon what exercises to try and we just had a design for the front of the cards. In figure 16 and 17 is shown how these looked, the graphics were designed in Canva. The goal of these first prototypes was to combine the colours well and to create a playful design that fits with our age group. These prototypes were also useful to visualise where on the card we wanted our text and graphics.
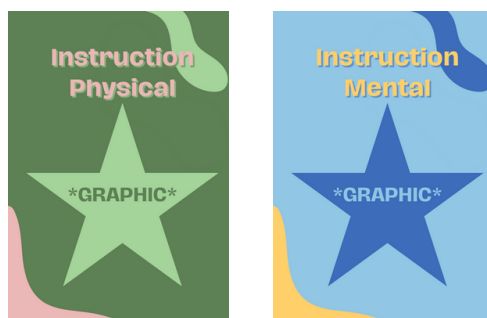

Fig. 16 & 17 Initial card designs

The second prototypes were made for the midterm video. We stuck with the weighted paper and printed them double sided. For the video we had selected five exercises for the physical exercises and also five exercises for the mental exercises. So for the video we created 10 different graphics and also a back for the card. In the following figures (Fig. 18 – 21) these graphics are portrayed.
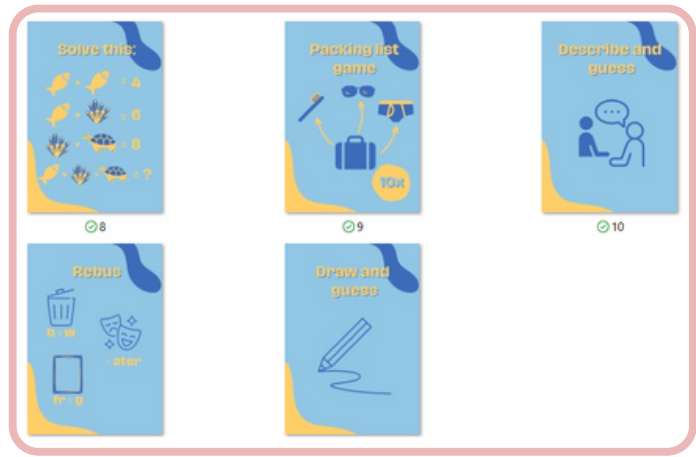

Fig. 18: Back of mental card

Fig. 19: Graphics of mental cards

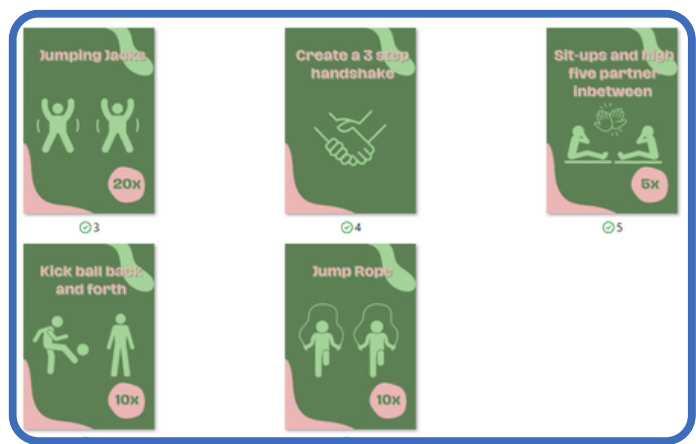**Fig. 20: Back of physical card**

Fig. 21: Graphics of physical cards

The only small problem with these cards was that there were some parts of the card cut off because they did not print very nicely double sided. We did not keep the white part in mind that goes around the page when something is printed and that the white part is slightly different on the front and the back of the page when it is printed double sided. To explain what went wrong here is a visual representation of the cards of how they looked in figure 22.
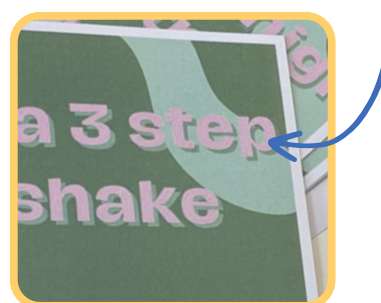

Fig. 22: Text too close to the edge

The white outline caused the text on the cards to be way too close to the edge on one side which made the first batch of cards messy and asymmetrical. For the next time that we printed it was nice to have this knowledge so we could do something about it and learn how to do it correctly.

Card Reader
To create the initial prototype for the card reader, we needed to ensure it would be the right size to allow the large cards to rest on top of it and be clear to the watchers of the video what its role is. As it was a low fidelity prototype it was made out of cardboard and painted black. First, the cards were measured to decide the measurements for the box and then the net of the box was drawn onto cardboard. Using scissors and a scoring machine, the shape of the box was cut out and then glued together. While there were no electronics or other features present, this simple cardboard box fulfilled its role as a proof-of-concept for the card reader and prop for the midterm video.

Fig. 23: Lo-fi card reader prototype as featured in midterm video

Developing PowerPoint Interface
To facilitate user testing and the filming of the mid-term video, we created a draft of the interface. We designed the cover page (Figure 24), two activity pages, and a ranking board page (Figure 25) with the primary goal of testing the required information and layout for each page. We decided to design two versions of the activity page, this decision stemmed from the necessity to include a tutorial video for the physical activity page, whereas the mental activity page did not require one. In the physical activity page, we employed green as the main color complemented by light pink, dividing the page into two distinct sections (Figure 27). The left side features the activity name, a text description, and prompts for the next steps after completing the exercise. On the right, we placed the tutorial videos we recorded.

For the mental activity page, we used blue as the main color complemented by bright yellow (Figure 26). The page is centered around the activity name, accompanied by a text description and prompts for the next steps after completing the exercise.
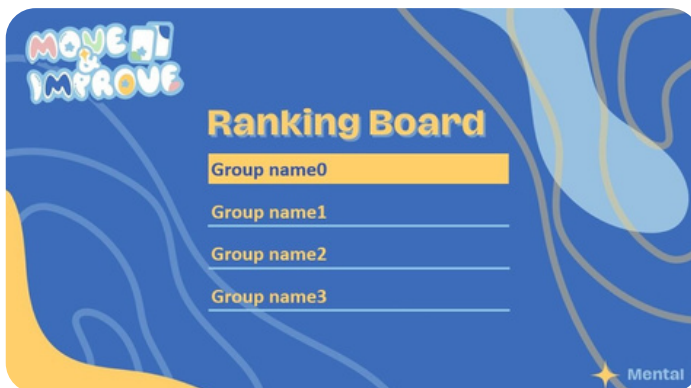

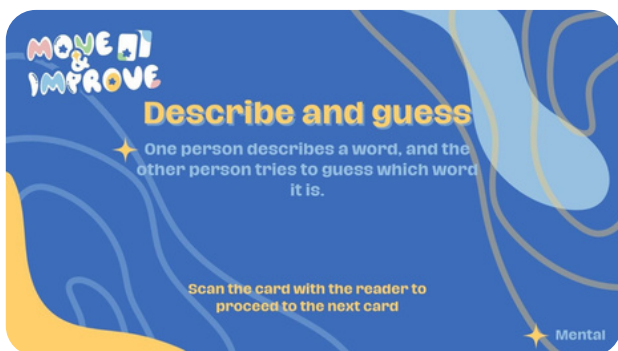**Fig. 24: Cover page**

Fig. 25: Ranking board
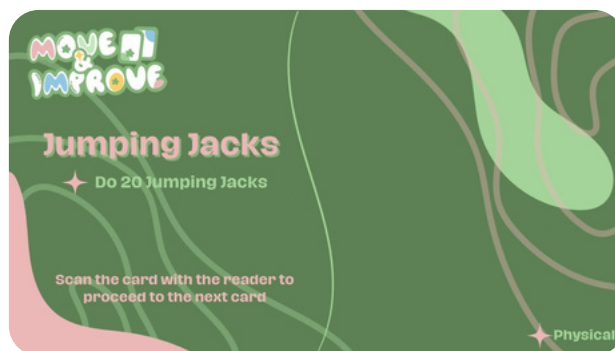

Fig. 26: Mental activity page

Fig. 27: Physical activity page

Storyboarding

For our second gameplay idea where we introduced the cards we created a storyboard during our coaching session with our coach. This was really helpful for us to create a clear view of how we wanted our game to work out. The storyboard is shown below in Fig. 28.
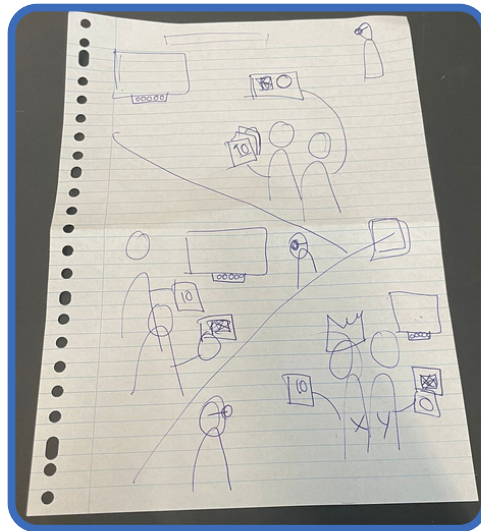

Fig. 28: Storyboard gameplay cards

There was also a storyboard created for our midterm video. This storyboard can be found in figure 29. We sat together with the group and discussed each scene we wanted to shoot and made a simple image with an easy description of what was supposed to happen during the scene. The storyboard was very useful for sharing our ideas of a more in depth gameplay than our first storyboard and also nice for us to have a storyboard to guide us during the shooting of the video. When we got distracted we could always fall back on our storyboard which was nice for us. The balance with the storyboard of the details that we included and also parts that we could be creative during the shooting was comfortable. The storyboard was there to guide us in our planned direction but also left space for creativity. For example our scene in the classroom where we acted out a card was not planned yet it was a good addition to the video and it made shooting the video more fun.
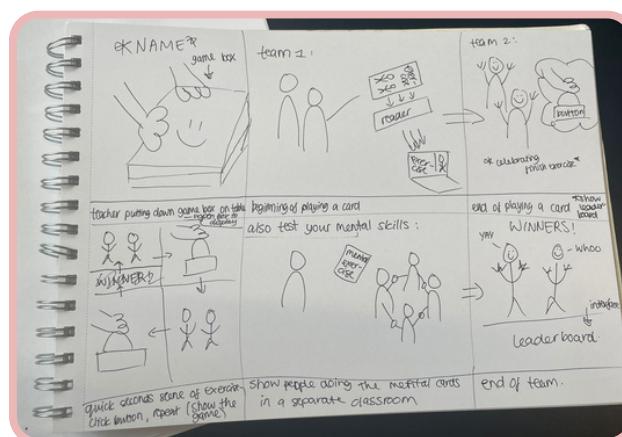

Fig. 29: Midterm video storyboard

Deliver

The beginning of the end of Phase 2 was marked by work on our Quartile 1 deliverables. The midterm video was an important part of our growth, as it gave us a chance to summarize all our progress thus far, and served as a yardstick by which we could measure our own development.

Work on the midterm video began with a review of the storyboard, and setting the scene for the actual filming. We chose the beautiful TU/e campus to be the set for our shoot, with a lecture room fulfilling the role of a classroom setting, and the gardens being used to film outdoor exercise scenes.

In our video, we tried to encompass the true essence of Move & Improve. With only 90 seconds to work with, it was important that everything from the cheery background music, to the colorful scene transitions lived and breathed our game. Unfortunately, due to the inability to recruit our target audience to act in our video, it was up to us to play the role of the happy children playing our game.

Fig. 30 and 31: Filming the midterm video

Additionally, with our midterm report, we delivered concise explanations on how our work so far has applied the double diamond design process, and demonstrated how our progress so far had been extremely user–centered, incorporating feedback and the needs of the user every step of the way. The report also showcased the consistent branding and theme for our game featuring five bold colors, a logo that screamed happiness, and playful containers for our text and images.

Having received largely positive albeit critical feedback on our video and midterm report, we felt we were ready to jump into Phase 3 of our design process – finalizing our model and getting ready for Demo Day.

Fig. 32: Set creation for the midterm video

The Process: Phase 3

Discover

We gained crucial peer feedback on our video, and insightful advice from our coaches about the video as well as our report. Following the tenets of User-Centered Design, we incorporated this into our plans for the following quartile, and set about finalizing the definition for our game.

Define

To define what exercises we should incorporate into our cards we conducted a variety of interviews and sent out a questionnaire. As we could not directly interview children, we chose to interview teachers as they have a good insight into what motivates children and what activities are suitable for their age group.

One of our interviewees was Marcus Dailly, a secondary school English and PE teacher and a coach to a children's football team. He had coached them from ages 6 to now, age 13, and in combination with his experience as a PE teacher, he was able to give us valuable insights into the capabilities and motivators for our target group. Below are some excerpts from the interview:

Is it important for children to stay active/incorporate being active into their daily routine?

"It is incredibly important, one of the most important things for a kid: both in terms of the physical perspective and for the mind."

**How many repetitions of different activities are ideal?**

"Not sure if I can put an exact figure on it ... keep it simple and do more repetitions. The more you overcomplicate it, the less they get from it. It takes too much time for them to get familiar with it. You're better keeping it relatively simple depending on their age (what they can do at that age group) and keep it simple. The most straightforward things are almost always the best"

Is a game/winning element an effective form of motivation for children?

"100%. You can't hide away from the fact that kids do like that sense of competition. They love it, it motivates them a lot. Whether it's football training or a school activity, kids are motivated by trying to do their best. Having a competitive element in it has to happen."

With this advice in mind, we made sure to keep the exercises to simple two-three step activities and were more assured that the competitive race aspect of our game would motivate children to play our game.
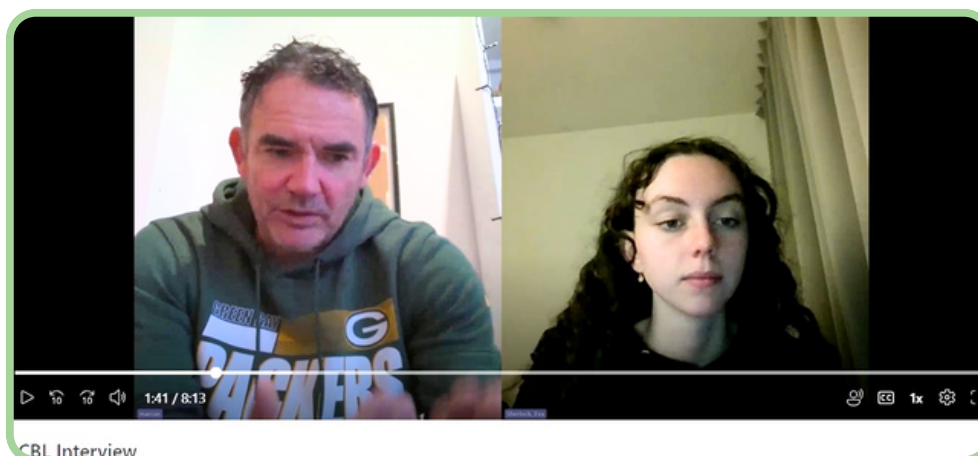
Fig. 33: **Interview with Marcus Dailly, held on Microsoft Teams**

For our new target group for children of the ages of eight to ten we wanted to take some interviews with experts and in our case these were PE teachers. We tried to contact multiple primary schools in Eindhoven by email and luckily we found contact with Marvin van Heeswijk. He is a PE teacher at primary school de Troubadour. He has a great history of experience with teaching sports and children. He was learning for seven years in which he also followed multiple internships and he is now working for 5 years. He was happy to do the interview and that made it a pleasant experience.

We met up through Teams and had a video call. The most important findings from the interview were that children like a nice twist to something such as a story behind an exercise or something different then normal and also that they can not keep concentrated for a long time if they have to do the same all the time. This means that with a longer exercise it helps if there are smaller exercises within that longer exercise to help them reach the goal instead of repeating something for a long time. Marvin agreed that our game has that similar structure so he thought that our game is well structured in the sense of maintaining concentration with the children.

Marvin also told us that children like being the fastest and the best at something so that is also good. He also stated that children also like having their own input for something so creative exercises where they have to come up with something on their own are also nice to include. Due to this knowledge we decided to include exercises for the children to come up with their own dance or handshake for example. Lastly he gave advice to include exercises that require movement in a certain direction and not just have exercises to move statically in place. So running to the other room for example. These things create a more diverse game and we are happy to include these components into our game. This will make the game more interesting for the children and maintain their concentration which will hopefully make it fun for them to play and make them want to play it over and over.

The interview was voice –recorded and after that a manuscript was typed out.

We distributed a questionnaire to a groupmate's high school classmate who is currently serving as music teacher and class teacher in a primary school. The questionnaire included all the questions we had planned to ask during the interview, he focused on answering the mental activity section. Due to time zone differences and language difficulties, we were unable to conduct an interview, so we asked him to fill out the questionnaire instead. In the questionnaire, he expressed his opinions in detail, stating that " The game should promote teamwork and communication, perhaps you can consider integrates it with the curriculum, and also, adding a rewarding system can motivate individual and collective achievement. "

With a clear vision in our minds for our final product, it was also time to start the technical development of the card reader and the smart cards. We decided to use NFC as our main communication protocol between the cards and the card reader, and a Bluetooth connection between the unit and the user's device. An Arduino Uno serves as the brains of our card reader, while a 20*4 LCD display allows the user to see a live stopwatch, basic exercise details, and more.

A list of materials was made, and work started on defining the electronics that would dip our toes into the water of the Technology and Realization expertise areas. This was one of the most time-consuming efforts of the entire project, tying together all the different facets of the electronics to function smoothly.
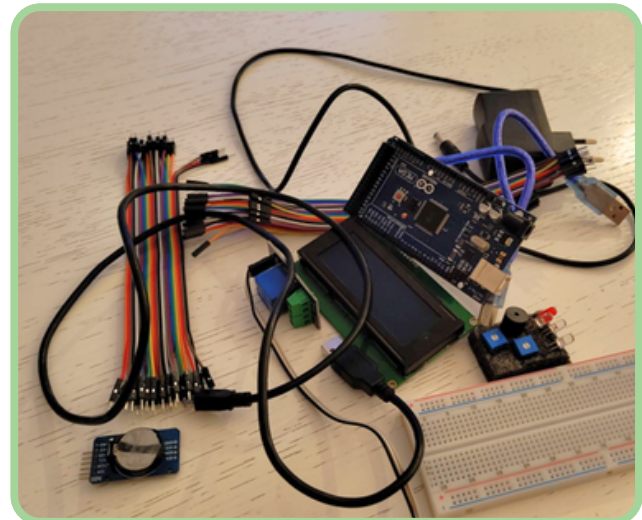
Fig. 34 and 35: Sourcing electronic components

Finalizing the Activities

For the final selected activities, we emphasized two key points :"using the simplest and readily available tools" and "replayability." We wrote down 26 physical activities and 21 mental activities, the props used are mostly common items found in schools, such as paper and pens. Our aim was to standardize the time required for each activity card, minimizing the chance of teams winning based on luck. For physical activities, w our goal was to encourage users to use different muscle groups with each exercise. As for mental activities, our focus was on ensuring replayability since puzzles can lose their appeal after being solved once. We ensured that each puzzle has a slight difference to offer a unique experience in subsequent plays.

Fig. 36: Finalizing the exercises

Develop

Card Reader

Our weapon of choice for the final material and manufacturing method for the card reader, card holders, and box supports was 3D printing using a Fused Deposition Molding process. We used Solidworks and Fusion 360 to design the models for our prototype, and went through design process iterations in the 3D modelling and printing alone.

Our first prototype for the card reader and card reader was large and bulky (as seen in figure 38), to get a rough idea of how we expected everything to fit into place inside it. With a better idea of what we needed, our second prototype was considerably smaller, stronger, and improved upon the required tolerances and space for internal components. Our next prototype was modelled after feedback we got during our Pre-Demo Day presentation. It featured the colors of our model boldly displayed across the front and top, an eye-catching logo on the front, and the required spacing for our internal components.

Fig. 37: Later card reader prototype

Fig. 38: Original card reader prototype

To complete the presentation of the box, we 3D modeled bases for the card readers to sit in and boxes for the cards to sit in. This ensures that everything in the box will be presented at the same height and will look more put together. To 3D model this we used the software SolidWorks which one team member had some previous experience in using. We took measurements of the base of the box and the card dimensions to ensure everything would fit and that the height of the card holder would be level with the height of the card reader. Initially, we planned to stack both sets of cards and place them in one tall card holder but after some brainstorming and rough sketches of the concept we decided it would be easier to separate the cards for both teams and make two separate card holders that would stack instead.
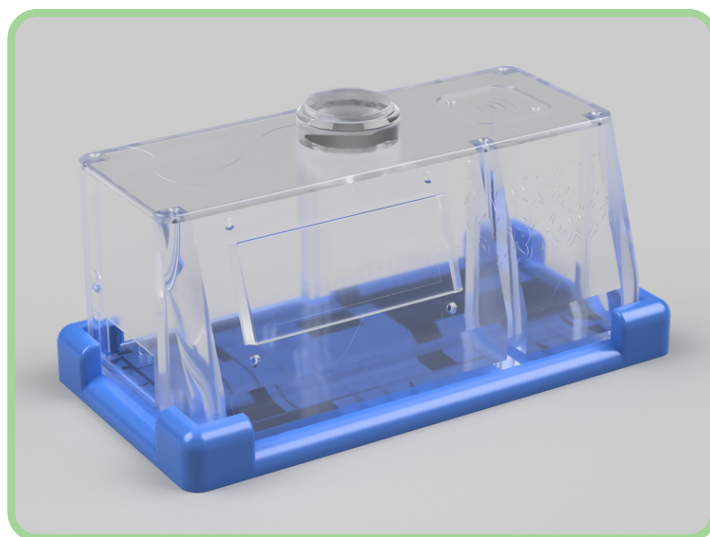
Fig. 39: Card reader supports

Cards

The last phase of prototyping the cards was focused on using the right material, the most comfortable size and having all of our graphics for all of our exercises done. For the materials we chose between the weighted paper with a slightly glossy finish or regular paper laminated. For the sizing we thought that A4 might not be the best size for the cards as they were not made for elderly anymore who can not see that well. We decided to also make the cards A5 format. For these two choices we made four types of cards. Type a (Fig. 40): A4 size and weighted paper. Type b (Fig. 41): A4 size and laminated paper. Type c (Fig. 42): A5 size and weighted paper. Type d (Fig. 43): A5 size and laminated paper. In Fig. 44 the size comparison is portrayed.
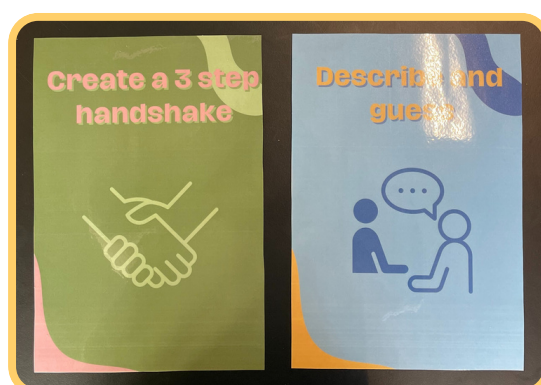

Fig. 40: Type a

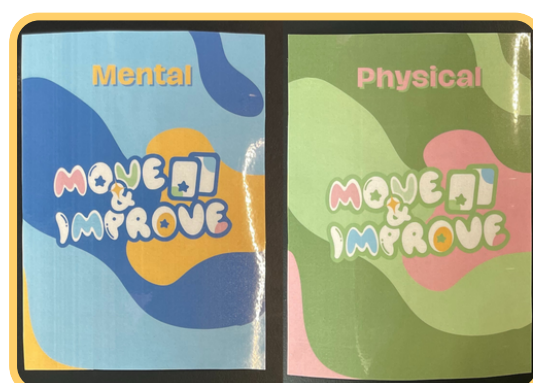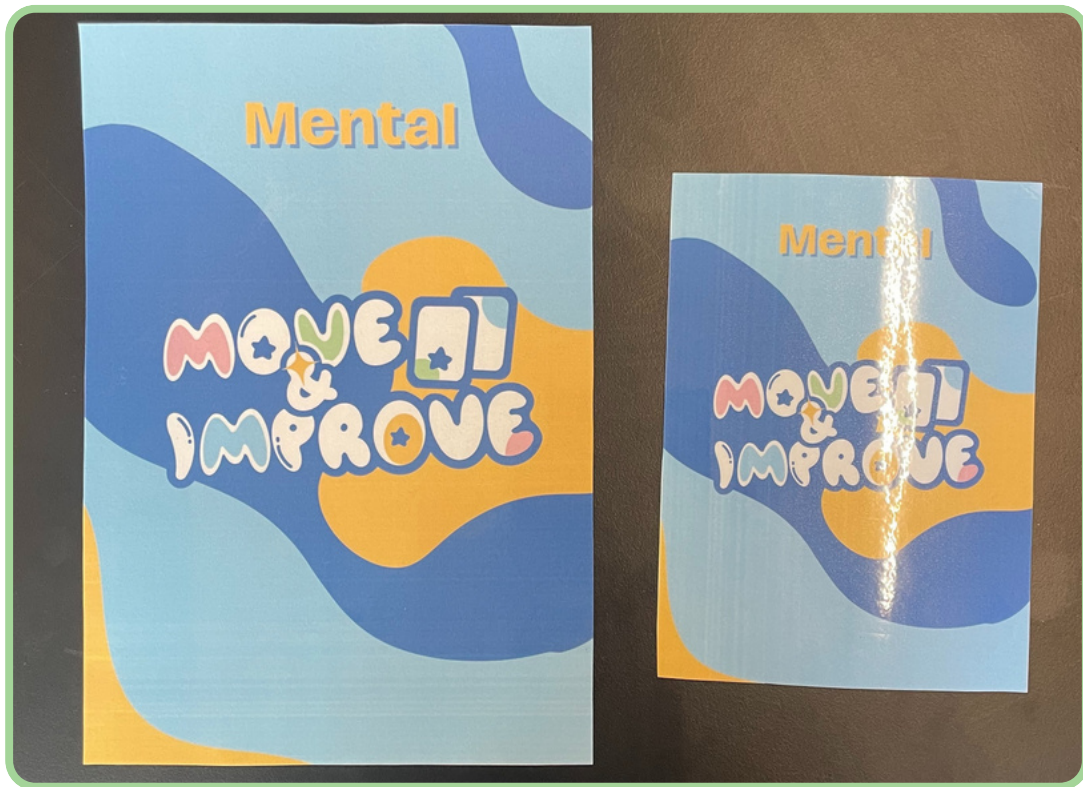**Fig. 41: Type b**

Fig. 42: Type c

Fig. 43: Type d

Fig. 44: Size comparison A4 and A5

We all agreed quickly on the laminated paper type ones. This choice was made because children can have dirty hands and are not as careful with playing cards so the weighted paper would be easily ruined. The laminated paper had our preference because it is more durable and easier to clean because you can clean them carefully with a wet cloth.

For the sizing we were not sure as fast. We asked for feedback during the coaching session and compared both the sizes to our card reader. The conclusion was that A5 format fitted better with our game concept as A4 size could be clumsy as they are too big and also a lot bigger than the card reader so the NFC tag will be harder to scan. So we chose type d (Fig. 43): A5 size and laminated paper for our final prototypes.

We had one small problem the first time printing the A5 sized cards as we printed two cards on one A4 paper sheet and we printed it double sided. The issue was that the backsides of the cards were flipped, so the cards were upside down. In figure 45 is shown how we printed this batch.

The next step was to get all the graphics done for the exercises that we had selected. We made all the graphics on Canva and used icons from their catalogue. Of course not all the desired icons were pre made and ready so some had some adjustments to be made and together with those icons we put together all the graphics. In total we have made 31 different graphics for the physical exercises, each in two colourways for different teams. And we made 21 different graphics for the mental cards, also in two colourways. Lastly also two start cards with front and back. So in total there were 108 graphics made.

For printing all these cards we made sure to have guidelines for the white outline that printers make around the page so no parts were to be cut off and also alternate the direction that the cards point to so that the cards would not be upside down due to double sided printing. How we did it it shown in figure 46.
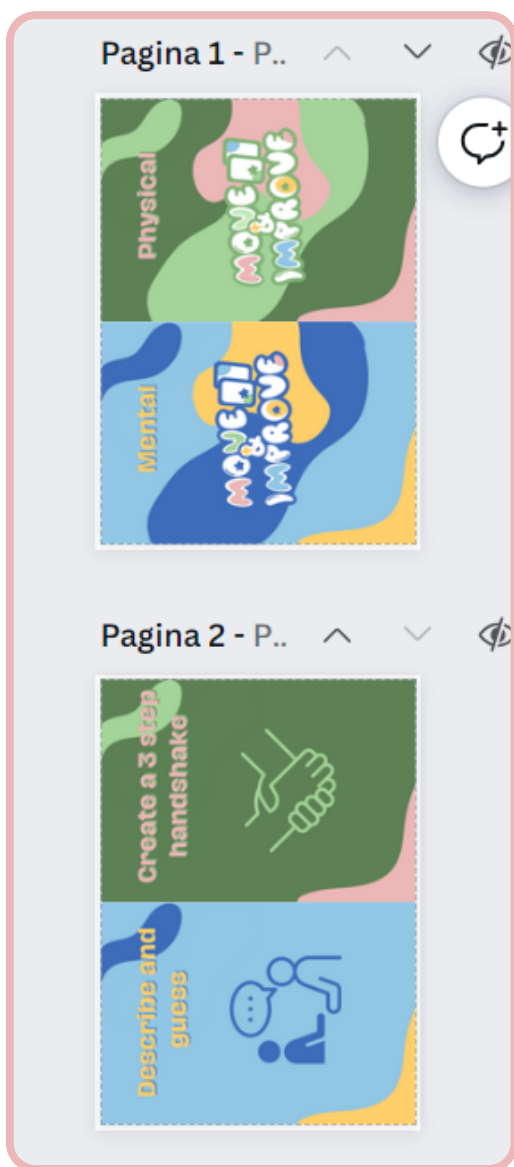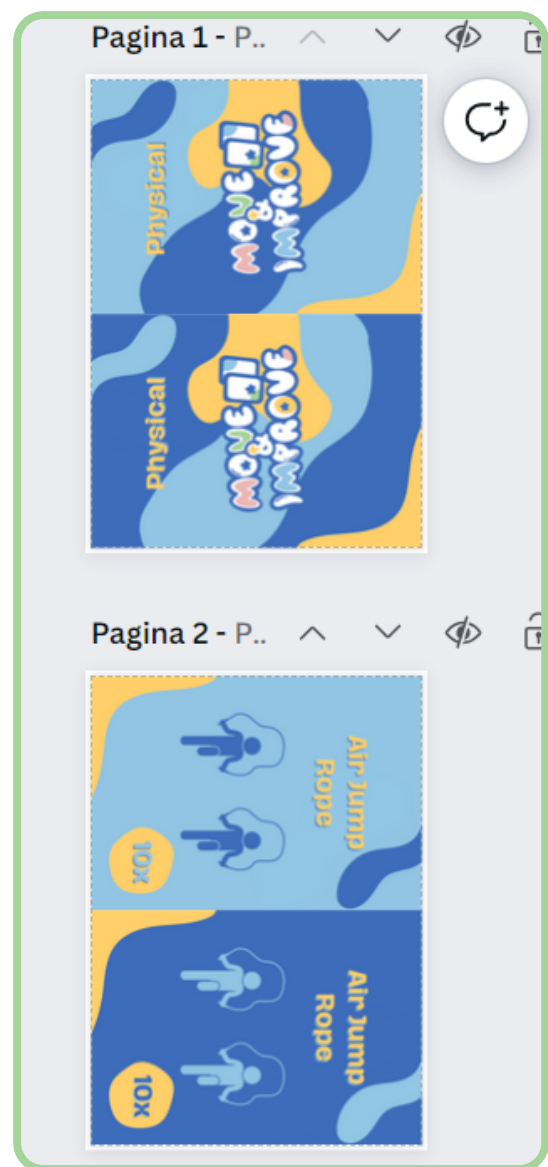

Fig. 45: Inverted card templates

Fig. 46: Final card templates

Box

The final item to be made is the box. After confirming the dimensions of all in-box contents (Figure 47), we began creating a folding corrugated box.

For the box's design, we aimed for consistency with the style and colour theme of other contents. The overall colour of the box is light blue, with streamlined colorful blocks as accents. The inside of the box is mainly blue, with the logo printed at the top. We chose corrugated cardboard for its lightness and ease of cutting. We wanted to avoid making the game box too heavy, considering the weight of the two card readers and two sets of cards inside. Additionally, corrugated cardboard is easy and quick to cut, with a high tolerance for errors and low time and money requirements compared to handling wood or using 3D printing, which is time-consuming.

We first created a scaled-down version using A4 paper (Figure 48) to test the design and colours. Then, we printed two A0 paper for the front and back. Since we couldn't get A0 corrugated cardboard at school's workshop, we glued two A1 cardboard together and glued the printed paper to both sides. By folding the cardboard , the box was completed (Figure 49 and Figure 50).

Fig. 47: Online mock-up of box design

Fig. 48: Small scale model of box

Fig. 49: Net of the box

Fig. 50: Final box

Interface

For the final interface, we added a guidance bar on the cover page(figure 53) to help users navigate features other than the game itself, this includes an online manual book and a link to the online expansion pack store; In the activity page, we added a timer and a human muscle model and there were no changes to the leaderboard page. Additionally, we added a team pairing page and an activity type prompt page (Figure 51 & 52). The pairing page allows players to name their teams and add new teams if they exceed two. The activity type prompt page informs players of the type of activity they are currently playing, this is because we removed the color distinction between different activity pages
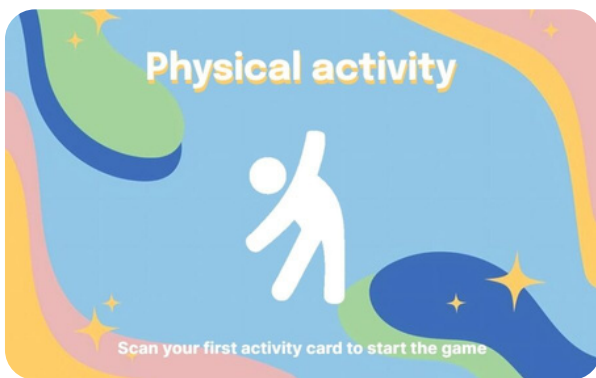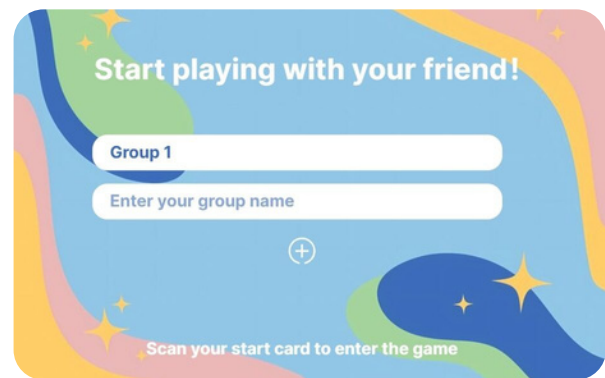

Fig. 51: Physical activity start page
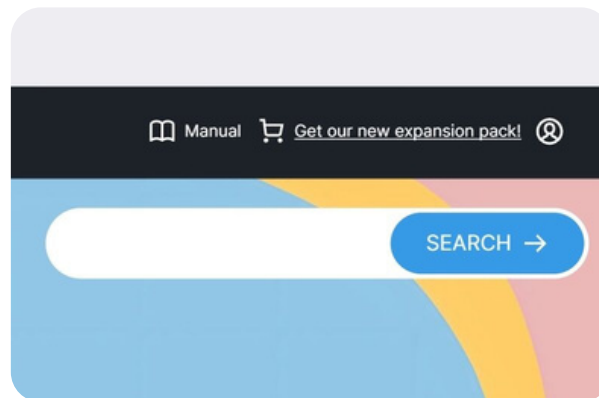

Fig. 52: Team pairing page

Fig. 53: Guidance bar on cover page

Box Inserts

To complete the presentation of the box, we 3D modeled bases for the card readers to sit in and boxes for the cards to sit in. This ensures that everything in the box will be presented at the same height and will look more put together. To 3D model this we used the software SolidWorks which one team member had some previous experience in using. We took measurements of the base of the box and the card dimensions to ensure everything would fit and that the height of the card holder would be level with the height of the card reader. Initially, we planned to stack both sets of cards and place them in one tall card holder but after some brainstorming and rough sketches of the concept we decided it would be easier to separate the cards for both teams and make two separate card holders that would stack instead.
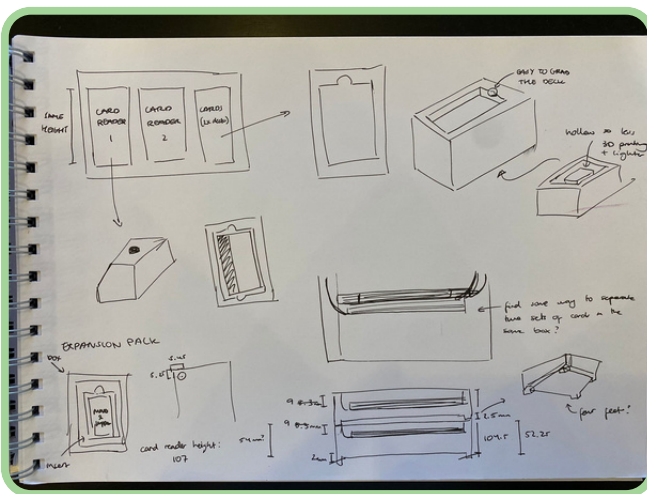

Fig. 54: Exploratory sketching of box inserts
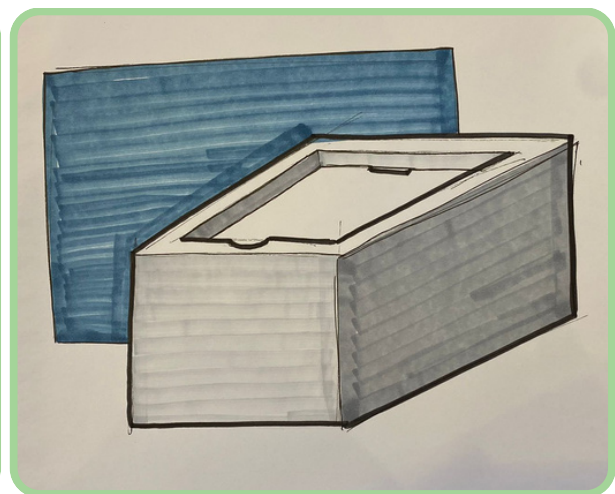

Fig. 55: Sketch of card holder

Additionally, we considered engraving swirls into the top surface of the card holders, however after some experimentation we decided the sleeker minimalistic top would fit the aesthetics of the game more.
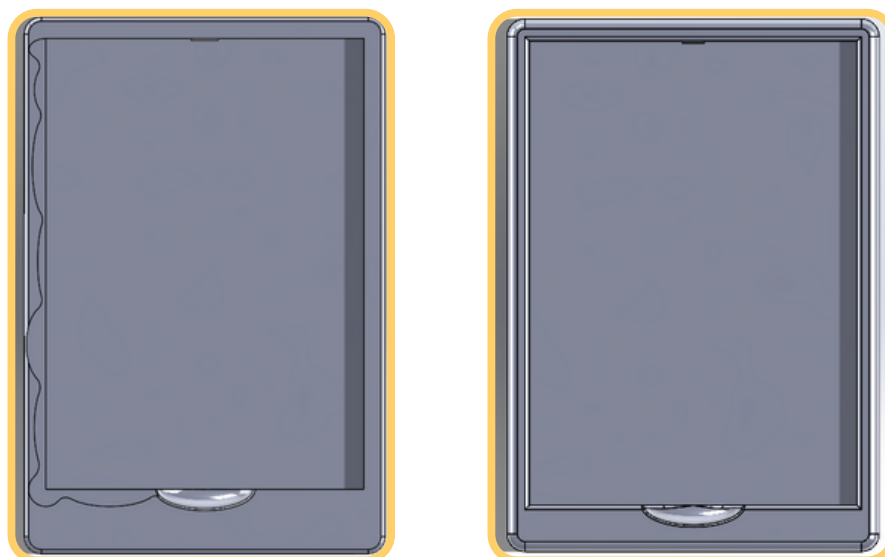

Fig. 56: Experimenting with engraving curves (left) versus leaving it plain (right)

Manual

We also created a physical manual to include in the box that we later linked electronically on the interface. We utilized the same graphic background designed by one of the group members for the midterm portfolio that incorporated the color scheme of our game. It was vital to think about the audience of the game, namely children, when designing this manual as the instructions had to be clear, use simple language and be visually appealing. To achieve this we used short sentences, included large graphic numbers and utilized white text bubbles around the text to break it up.

We also wanted the manual to be large in size to make it easy to read and experimented with different sizes. We decided to make it A5 size as that also matched the A5 dimensions of the cards. We also experimented with different thickness of paper from regular printer paper and 60 g/m2 paper as well as printing it double sided vs. gluing pages together. We finally decided on printing it on thicker paper and gluing pages together which allows us to hide the back of the staple in the middle of the booklet.
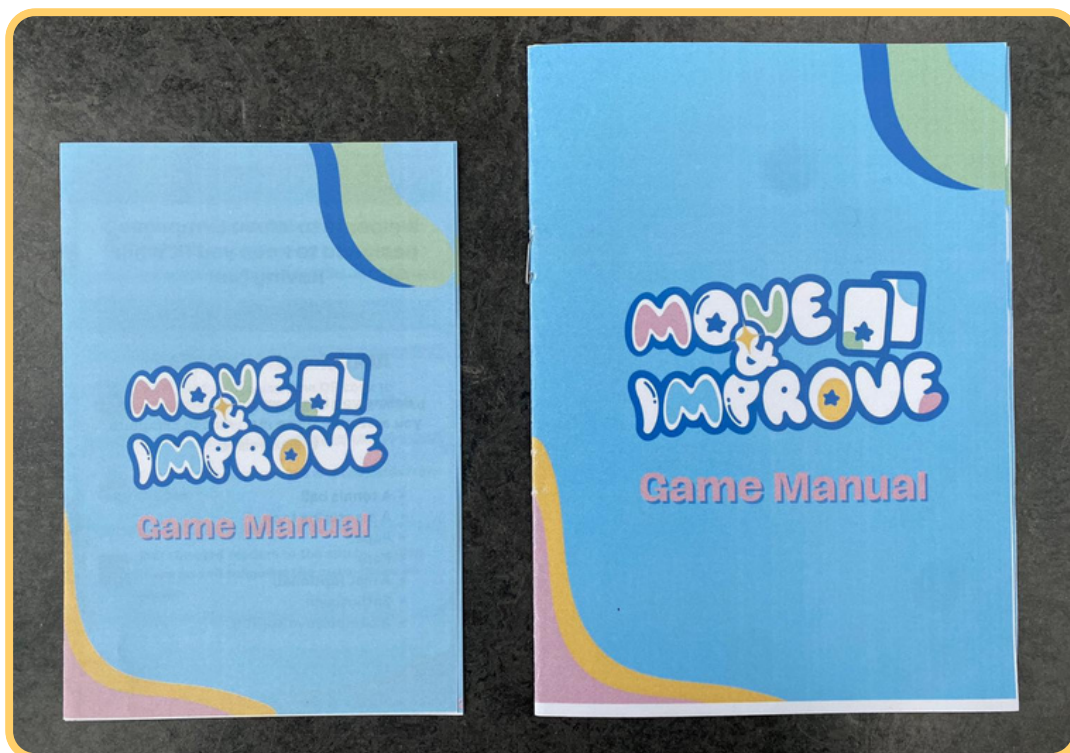

Fig. 57: Experimenting with different sizes and materials for the manual

Deliver

The practice demo day took place in the eighth week, where we showcased our nearly finished game. We presented the packaging, manual, some activity cards, interface, and an almost completed card reader. (Figure 58 & 59) Our coaches expressed approval and proud for our work. Classmates and two coaches provided valuable feedback, pointing out some small errors in the text. We considered and adopted many of their suggestions, such as distributing small items like name cards or stickers on the final demo day, creating additional manuals for the expansion pack, and adjusting the order of the presentation structure.

Fig. 58 and 59: Photos from the practice demo day

Final Concept

Fig. 60: 3D render of card readers and box inserts

Fig. 61: Game manual

Fig. 62: Game box

Fig. 63: Cards

Our game box consists of two card readers and two sets of cards. In order to set up the game, these two card readers are paired to the interface (an app displayed on a laptop/iPad/phone) and the cards shuffled and set down next to the card readers. Children work in pairs and find an open space to play in. They begin by naming their team and scanning the introduction card which is included in the deck of cards. They then select a card and scan it on their team's card reader. On the interface they see an image of the human body on which they need to select what part of the body the activity works. If they get it wrong they must wait 5 seconds before selecting another. Once they have chosen the right part, they can optionally watch an instructional video on how the exercise is done and then must complete it. After completing the exercise, they hit the button on the card reader to stop the time and indicate they are done. They repeat this for eight exercises and when they're done with all eight they can see their final time on a leaderboard in comparison to the other team. If both teams played simultaneously the winner is announced immediately, however if the other team plays at a different time, in a different location, they may have to wait for them to be done to finalize a winner. To play again, they just scan the introduction card again.

Overall Results

Aesthetics

The Colors

In the beginning of our project we designed a colour palette together during a coaching session. We sat down together and looked at what worked the best together. We quickly agreed that we wanted to use green as green stands for health and our game encourages a healthy and fit life. Together with that we thought that blue also stands for productivity which also fits well in our game and it goes well with green so these were the main colours. Engaging in physical activities within green and blue environments offers advantages for both physical and mental well-being. Lastly we chose yellow and pink as these are happy and positive colours to make the game playful and positive. Our colour palette is displayed below in figure 64.
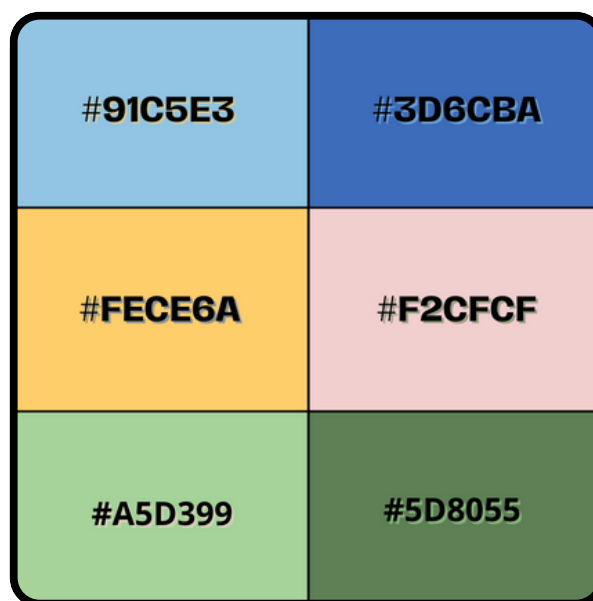

Fig. 64: The 'Move & Improve' color palette

In the last phase of designing our card prototypes we decided to switch the colours around for the categories so mental exercises became green with pink instead of blue with yellow and physical exercises became blue with yellow instead of green with pink. This was because blue and yellow are more active colours and together they create a brighter palette and stimulate activity. While green and pink look more calm together and green reduces stress, improves mood and increases creativity which is beneficial for our mental exercises.

The Logo

The design concept for the logo was " energetic and cute." We used the rounded "Airfool" font, which is more playful compared to traditional fonts, fitting the cute theme. We used five different colors with lower saturation and high brightness, including light sky blue as the main color and corresponding colors for physical and mental activities.

The logo has three different design versions: We primarily use the second version (Figure 66), which incorporates card elements and maintaining an overall neat appearance for readability. The first version (Figure 65) is a more impactful and complex logo, applied only to the packaging. It uses more lines for impact and rounded edges to maintain the cuteness. However, due to its complexity, its readability is lower. The third version (Figure 67) is the simplest, mainly used when we want to fill the screen with the logo without drawing immediate attention.
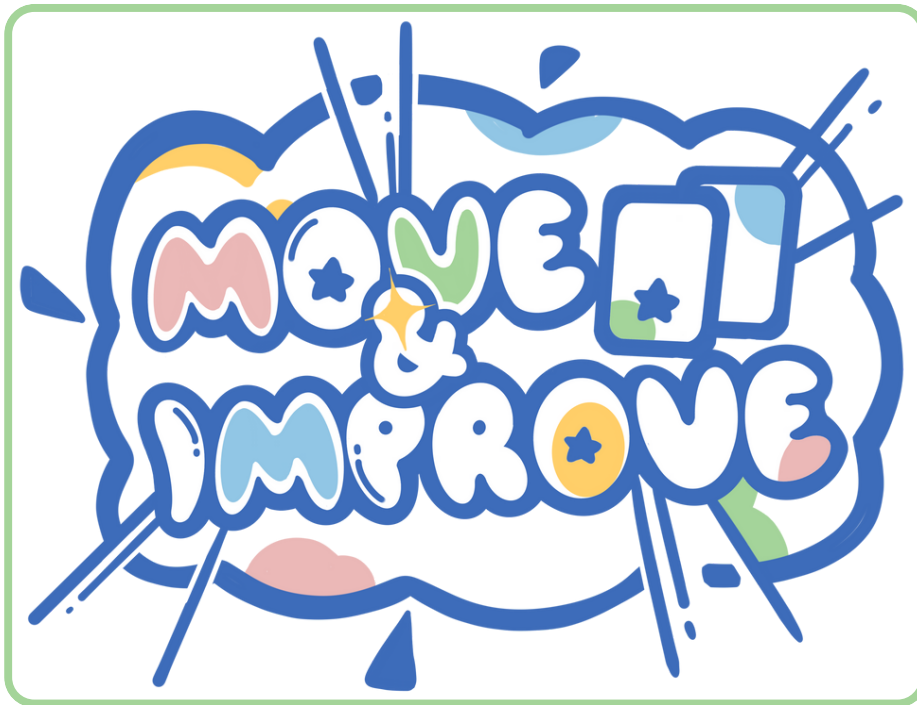

Fig. 65: Logo Version 1
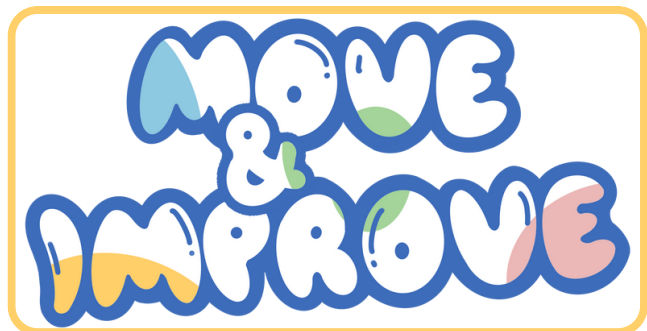

Fig. 66: Logo Version 2

Fig. 67: Logo Version 3

The Box

The box adopts an all-in-one design (Figure 68), considering its primary use in elementary classrooms.

The color scheme remains consistent with the main color being light blue, covering a large area, and the remaining four colors as accents. We applied this design to all products, ensuring clear and recognizable brand identification.
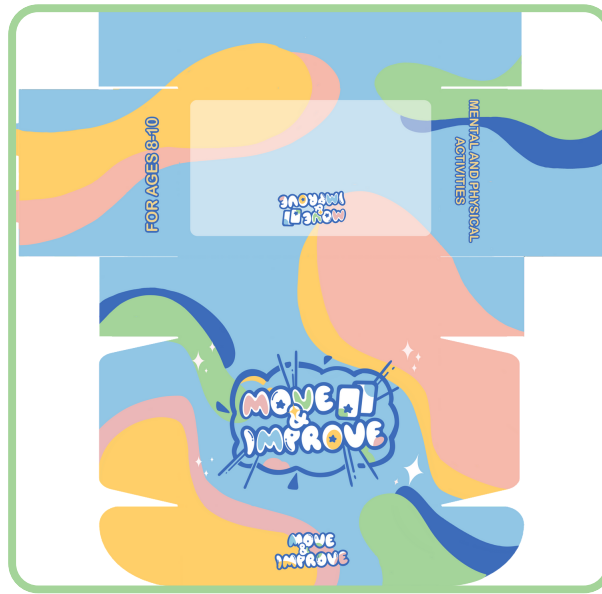

Fig. 68: Box layout

Fig. 69 and 70: Box prototype

Features

The Tech

All the electronics are cleverly hidden away inside our control unit. We have utilized an Arduino Uno microcontroller for all our processing needs; a 20*4 LCD display using a parallel interface to display all the required information; a PN532 NFC and RFID reader to scan the cards; and Mifare S50 NFC stickers on the cards themselves; in addition to a large 40mm pushbutton on the top of the control unit. Everything isconnected to a breadboard inside the card reader, along with the required buttons, potentiometers, and resistors.
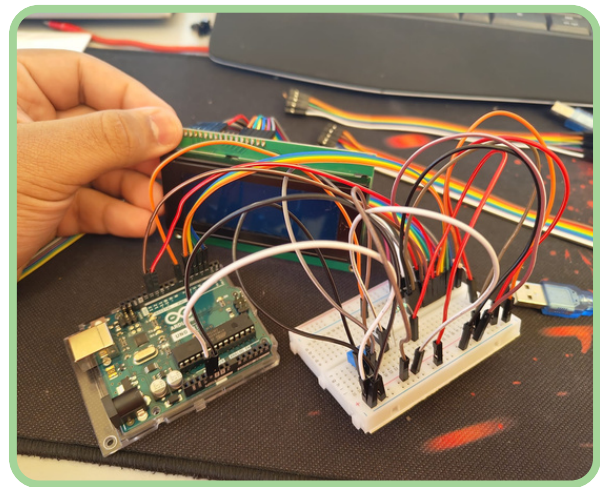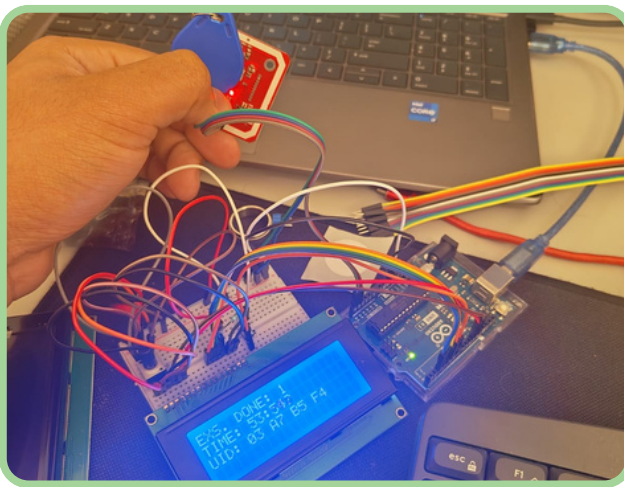

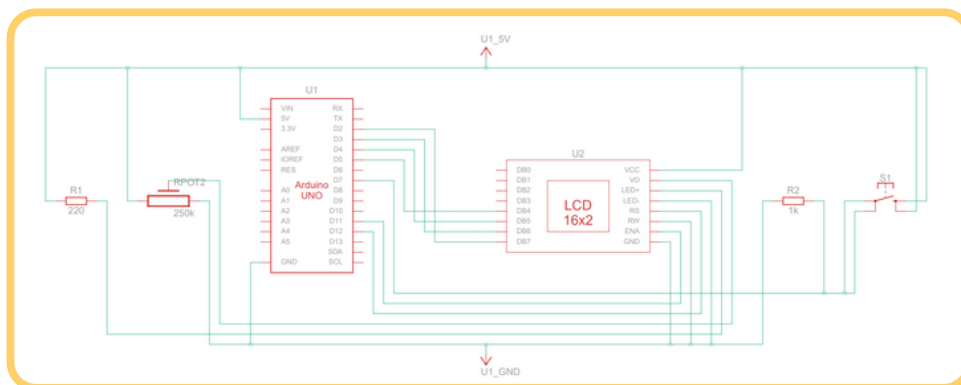**Fig. 71 & 72: Testing the electronics**

Fig. 73: Basic schematics

The Card Reader

This sleek 3D-printed control unit houses all the components that Move & Improve needs to be the interactive card game we envision. With a sturdy PLA construction, this control unit can handle all the use and abuse expected from a school gym. The ergonomic angled front panel allows the LCD screen to be viewed easily from any angle, while the logo to its side helps in brand recognition. On the left face of the base, there is a cutout for power and communication with the Arduino microcontroller, as well as the reset button once the game has ended.

The top of the box is affixed to the base using flathead M3 screws, ensuring a secure fit. The top features a large, satisfying to click blue button that the players hit after completing each exercise. User testing showed that the tactile feeling of a large button was one of their favorite aspects of the original tiled prototype, and the feeling we wanted to incorporate that feeling into the final model as well. To the right of the button is the NFC reader, where users place their cards to begin the exercise. It features an engraved logo to signal its purpose to the user, and is a crucial element of our game design.

The entire control unit box is adorned with the colors of our game and our signature swirls that one can find everywhere on our branding.

Fig. 74: 3D render of the final card reader

The Box Inserts

The box also comes with 3D printed inserts to house the card reader and cards. Two bases hold the card readers in place while the cards are placed in two boxes which stack on top of each other. Both have a number engraved in it to indicate which group each set of cards belongs to. They also have a ribbon that lies below the stack of cards so they can be lifted out of the box easily.
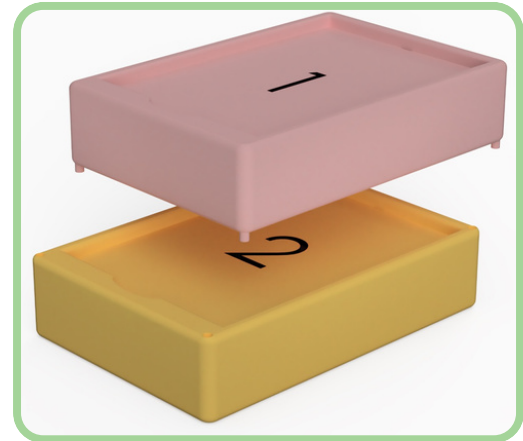

Fig. 75: 3D render of card holder inserts

The Game Manual

A physical manual is also provided, made of thick paper and illustrated in the colors and graphics of the game. It includes information about additional materials, how to set up the game and instructions on how to play. On the back is a NFC chip which leads to a webpage where one can download an online version of the manual, download the app and buy the expansion pack 'Move & Improve: Brain Games'.
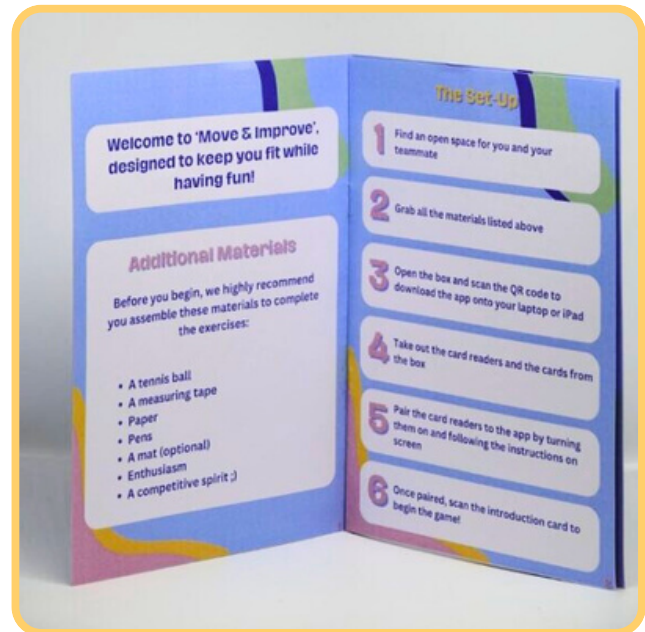

Fig. 76: Game manual on game cards

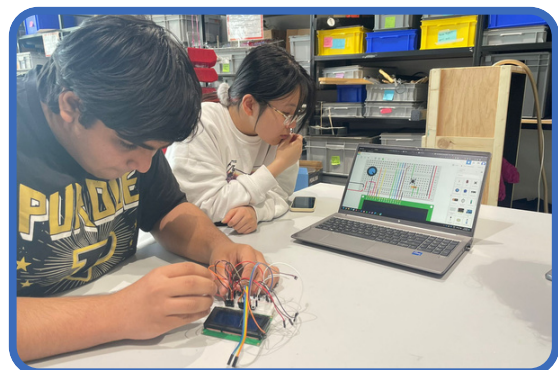**Fig. 77: Game manual opening page**

Task Division

Collaboration is vital to success in this project and we had to work efficiently and constructively to achieve our goal. Each session began by reviewing the progress each member had made on their individual task delegated to them from the session before and discussing this with the other members in the group. Notes were taken by one group member to document the design progress and any key conclusions we had come to or decisions we had made. We then discussed what we planned for the current session and the coming week in line with the project timeline we set for Q1 and Q2 respectively. We then delegated tasks based on our individual strengths and prior skills and began working on them. Key to this was trust in each other and each group member being reliable contributors to the project's progress. We ensured the workload was spread evenly over all four members overall and that no one felt they were taking on any additional work.

We also took on responsibility for learning new skills as a team. For our initial idea we needed to sew a mat and therefore took part in a sewing workshop to gain access to the sewing workspace in Atlas and learn the basic skills needed to bring our vision to a reality. Even when one person already had the skills to carry out a specific task, we took the time to explain specialized skills such as using an Arduino board to the rest of the group to ensure we all developed our professional skills and could give input on every part of the process.

Fig. 79: Explaining the Arduino structure

Fig. 78: Taking part in sewing workshop
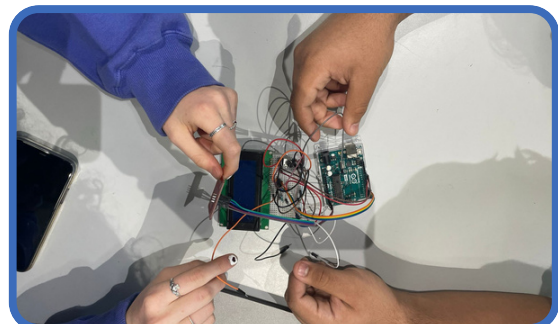
Fig. 80: Collaboratively setting up the Arduino

Zyfn

- Brainstorming
- Research
- Sketching
- Writing interview questions
- Conducting interviews
- Sewing workshop
- User testing
- Lo–fi Prototyping
  - Wooden prototype construction
- Midterm Video
  - Filming
  - Video & Audio Editing
  - Color Grading
- Midterm report
  - Individual work
- Hi–fi prototype
  - Card Reader
  - Soldering and electronics work
  - Arduino Coding

Lu Jinlin

- Brainstorm
- Research
- Sketching
- Writing interview questions
- Writing a questionnaire
- Sewing workshop
- User testing
- Lo–fi prototype
  - Powerpoint interface
- Creating storyboard for midterm video
- Midterm report
  - Latter phases of our process
  - Individual work
- Finalizing exercises
- Hi–fi prototype
  - Box
  - Visily interface

Eva

- Brainstorm
- Research
- Sketching
- Note–taking during sessions
- Lo–fi prototyping
  - Card Reader
- Writing interview questions
- Conducting interviews
- Sewing workshop
- User testing
- Storyboard for midterm video
- Midterm report
  - Goals for Q2
  - Individual work
- Finalizing exercises
- Hi–fi prototyping
  - Box Inserts
  - Manual

Zoë

- Brainstorm
- Research
- Sketching
- Lo–fi prototyping
  - Card
- Card graphics
- User testing
- Writing interview questions
- Conducting interviews
- Sewing workshop
- Storyboard for midterm video
- Midterm report
  - Initial phases of our process
  - Individual work
- Hi–fi prototyping
  - Cards

Conclusion

Design Process

Throughout this project we utilized the double diamond design process and went through it multiple times as we made different iterations of our game. This process can be defined in four steps: 'Discover', 'Define', 'Develop' and 'Deliver'. We can further split our process into three phases, each of which goes through the double diamond process themselves. In the first phase, we explored the design space, narrowed down our concepts to one final concept, conducted expert interviews and delivered a low–fidelity prototype for user testing. Using this feedback, we moved into phase two, where we explored alternative physical aspects to the game and user groups, decided on using cards and changing our user group, made new prototypes and delivered a midterm video to illustrate our concept. In phase three we continued to define our concept by conducting interviews and doing research. We created our first high fidelity prototypes using a variety of materials and presented them in a practice demo day.

Outcome

The outcome of this project is more than just the elements of the game we will present at demo day. While we are proudly able to show off the evidence of our hard work: a 3D printed card reader, stack of carefully considered physical activity cards, a coherent manual and an aesthetic box to house it all, we also reflect on the personal and professional skills we have gained from this project. An equally important outcome is that our group of four students have learned how to collaborate effectively, delegate tasks, take responsibility for learning new skills, and become familiar with the iterative design process all practiced professional designers are experienced with.

Fulfillment of Project Goals

We can all say that this project has been very educational for all of us. We learned how to work well together and use our strengths and combine them all together. We all sat in Innovation Space with Zyfn where he showed us the electronics and Arduino and explained some things about it and what he was doing. This was nice for the rest of us to have an insight of how this works.

Zoë explained what she did for the graphics in Canva to us and for the Portfolio in quartile one and the report she made a template in Canva where we could all work together and also practise with getting every component in the same branding so our project has the same style in everything that we have. Kitti showed us how she made the box and explained how she did it and also drew the logo when we were all sitting around the table. Lastly Eva was very good at planning everything and keeping track of what had to be done for the week and she made sure that everyone knew what they had to do and always discussed directly how we were going to do it. This was very nice for the communication in our group and throughout the process this became a routine so everyone knew that we were going to discuss our tasks at the beginning and ending of our meetings. Eva and Zyfn worked together for the 3D modelling and practised that together to get the best result. During the project we all learned note taking skills during our meetings to document our process and agreements and we also learned to improve our presentation skills to speak enthusiastically and clearly about our project.

We all learned these different skills from each other and used them to combine everything into our project. We created a prototype and a branding which we are all proud of so for our goal of creating prototypes and practising with that we think that we definitely succeeded. In terms of taking part in a full design process we think we also reached that goal because we were all very involved in the project and everyone wanted to help and learn with every part of the process. We are all happy to have done this project and have learned to improve our future design processes that will take place.

Group Reflection

As a group we have learned a lot through this process. We faced challenges in abandoning many aspects of our initial idea after user testing and ensuring we got everything done in the time frame given to us. We learned new skills such as the basics of sewing, 3D modeling, graphic design and most importantly how to collaborate as a team. We had to delegate tasks, take responsibility and communicate effectively and plan accordingly to ensure we succeeded in reaching our project goal.

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Appendix

Interview with Marvin van Heeswijk

Z: Ja, dus weet u nog een beetje wat ons spel inhoudt of zou ik nog even een korte uitleg geven?

M: Ja, leg die nog maar even kort uit, dan weet ik het zeker.

Z: Ja

M: Ja

Z: Nou we hebben dus een groepsproject waarbij we een leerzaam spel moesten ontwerpen. Dus dit wordt een leerzaam spel over beweging voor kinderen. En we doen het voor kinderen van 8 tot 10 jaar en ja. We hebben een race element eraan toegevoegd zodat het een beetje competitief is en de kinderen spelen dan in teams van 2. En het is eigenlijk een soort ja kaartspel je hebt soortvan kaarten die ongeveer zo groot zijn ik heb die kaarten nu even niet bij me. En dan staat er een een oefening op en die moeten ze dan uitvoeren en die kunnen ze dan, nouja die kaarten kunnen ze dan scannen op een scanner en dan krijgen ze op een scherm meer uitleg over die kaart en kunnen ze ook kijken naar het menselijk lichaam en de delen aanwijzen die zij denken dat ze aan het trainen zijn. Maar ja wij hebben zelf natuurlijk niet heel veel verstand van oefeningen die kinderen leuk vinden om te doen en een beetje helpen dus daarbij wilden we een beetje uw hulp. Is dat een beetje duidelijk zo?

M: Ja ja het is wel een hele grote lijn en wel duidelijk.

Z: Oh ja nou wel mooi.

M: Ja.

Z: Zou u jezelf misschien eventjes willen voorstellen, uw naam en beroep en ja wat u doet.

M: Ja ik ben Marvin van Heeswijk. Ik ben vakdocent gym. Ik geef les op de basisschool Troubadour, 4 dagen. En heb ik eigenlijk elke klas dus van groep 1 tot en met groep 8 twee keer in de week die ik les geef.

Z: Oh ja nou heel erg bedankt. En hoe lang heeft u al ervaring met kinderen en beweging en sporten?

M: Ik heb 3 jaar lang MBo sport en beweging gedaan waarin ik stages heb gelopen op basisscholen. Toen de ALO heb ik 4 jaar stage gelopen en dat heeft gevarieerd van basisonderwijs, middelbaar onderwijs en MBO. En nu werk ik ondertussen is dit denk ik mijn 5e jaar ongeveer of 4/5e jaar dat ik echt werk. Daarin heb ik ook vooral gewerkt in basisonderwijs en een beetje of ja 1 dag in de week een jaar lang op middelbaar onderwijs en daarbinnen ook veel nog dertussen op SBO heb gewerkt dat is speciaal basisonderwijs.

Z: Oh ja, en heeft u dan vooral dus veel ervaring met nouja sowieso met de jeugd maar vooral ervaring met jongere kinderen? Want u zei ook op de middelbare school?

M: Ja op de middelbare school heb ik ook dan een jaartje 1 dag in de week gewerkt. Maar het meerendeel heb ik eigenlijk vooral op de basisschool gewerkt.

Z: Ohja, en verschilt dat veel van elkaar qua hoe die een beetje aangepakt moeten worden?

M: Ja het is natuurlijk wel een hele andere belevenis gebeurte. Dus ook de manier van aanspreken is nogal een groot verschil. Bij jongere kinderen doe je oefeningetjes met in hun belevingswereld dus probeer een verhaaltje omheen te verzinnen.

Z: Oh ja dus een verhaaltje eromheen is wel leuk voor hun.

M: Ja dat daagt ze wel meer uit dus stel je doet een oefeningetje waarbij je een bedreigd gebied pionnetjes ofzo moet pakken dat de boeren die gaan de wortels verdedigen en de kinderen die ze gaan pakken dat zijn dan de konijnen en die eten die graag en dat zijn echt de jongere kinderen die vinden dat helemaal mooi. Dan zit je rond een jaar of 8 jaar 10 jaar is dat wel wat minder natuurlijk maar vaak als er zo'n verhaaltje achter zit of iets in een mooi jasje wordt gegoten dan kan je ze daarin wel makkelijk meekrijgen zeg maar makkelijk pakken.

Z: Ja dat is wel goed om te weten in ieder geval. En is het naar uw mening en uw belevenis belangrijk voor kinderen om dagelijks te sporten of beweging te krijgen?

M: Ja, ik denk wel dat het belangrijk is en dat kan natuurlijk zijn buiten gymlessen, ja dat is natuurlijk lastig om dat altijd zo te geven op scholen. Maar ik vind zeker dat ook buiten school om echt wel gebaat is bij wat beweging. En daarin komt natuurlijk ook naar boven sociaal emotioneel hoe ze met elkaar omgaan, de regels aan kunnen of ja regels af kunnen spelen maar ook zichzelf daaraan kunnen houden dus ook echt omgang met elkaar. Dat helpt er natuurlijk ook bij en een gezonde leefstijl is natuurlijk ook wel flink om met sport.

Z: Ja klopt inderdaad, nou bedankt voor uw antwoord. En even kijken hoor wat ik nog had staan. En wat voor soort oefeningen zijn vooral goed voor kinderen van 8 tot 10 jaar. Zijn dat wat meer uitgebreide oefeningen, wat korter? Ja, hoe ziet u dit een beetje?

M: Ja de leerlingen dat varieert wel heb je een wat langere opdracht, zorg er dan wel voor dat ze niet te lang hetzelfde zijn zegmaar want dan vinden ze het wel leuk in het begin alleen hoe langer het duurt hoe minder de concentratie wordt. Dus je hebt langere opdracht met daarbinnen wat kleine facetten die ze kunnen doen dus dan is dit een oefeningetje, dan dat, en die achter elkaar die zorgen voor 1 grote opdracht dan kunnen ze dat wel makkelijk aan dan kunnen ze dat op zich wel dan blijft de concentratie ook wel makkelijker erbij. Duurt een opdracht echt te lang, dan zie je best wel vaak dat de concentratie echt wel weg zakt.

Z: Dat ze er wel een beetje klaar mee zijn?

M: Ja dat je ze echt moet motiveren om door te blijven gaan of wat dan ook dus dat is, daar moet je inderdaad wel een beetje op letten dat het niet te lang duurt voor de kinderen.

Z: Ja oke, nou dus inderdaad dan ons spel zou dan een beetje gezien kunnen worden als een wat langere opdracht en die kaarten dus elk oefeningetje dat ze doen is dan een beetje een wat korter iets dus dat werkt denkt u wel?

M: Ja, ja dat werkt denk ik wel als je het inderdaad pakt op een groot onderdeel eigenlijk met daarbinnen gewoon kleine opdrachtjes dat ze uiteindelijk komen tot een bepaald doel. Dat zal ze denk ik wel motiveren.

Z: Ja oke. En per kaartje gaan we dus oefeningen maken en daar moeten ze dus bepaalde bewegingen wel een paar keer herhalen maar hoe vaak herhaling is een beetje gemiddeld om een oefening te doen of verschilt dat heel erg? Of wat is een beetje het minimum en het maximum?

M: Ja dat ligt natuurlijk ook wel weer per kind anders. De ene doet wat opdrachten beter dan de ander. Zijn de opdrachten meer fitness-achtig?

Z: Ja, ik kan ze er ook wel even bij halen. Ik denk dat ze wel het meest fitnessachtig zijn want we hebben hier zo nu bijvoorbeeld dat je touwtje moet springen en verder hebben we ook een soort reactiespel dus dat staat hierzo met licht en schaduw. Dus we moeten op een scherm krijg je dan meerdere nou ja patronen en dan moeten ze daarop reageren dus dan staat er bijvoorbeeld een klap of een spring ofzo en dan moeten ze dat zo snel mogelijk nadoen. En we hebben ook bijvoorbeeld iets met een bal gooien, we hebben jumping jacks, squats, sit ups en we hebben ja ook nog wat andere dingen even kijken. Ook dingen met balans hebben we. En dat je dingen samen moet doen dus bijvoorbeeld zo'n kruiwagentje dat soort dingetjes. Dus ik denk dat het wel meer ja fitness achtig is.

M: Ja zijn inderdaad wel wat meer van die kracht en dingen kleine oefeningetjes. Ja het ligt er natuurlijk best wel aan ook met wie ze samenwerken want stel ze werken samen dan zit er toch altijd bij de kinderen wel een dingetje in van oh die kan het zo vaak of oh die kan het zo lang, ik wil dat ook kunnen of ik wil verder of ik wil er overheen gaan. Dus binnen het geheel zegmaar maken ze ook soms zelf wel een wedstrijdje van of willen ze meer. Dus dat is best wel kijk ik had pas naschoolse sport gegeven waarin ze ook fitnes opdrachtjes gingen doen en dan deed ik eigenlijk de opdrachtjes 1 minuut lang en dan moesten ze bijvoorbeeld zoveel mogelijk push ups maken of die dingetjes. Dat is goed te doen. Zouden ze misschien nog wel wat langer vol kunnen houden. Dus ik denk dat ze twee minuten echt zo'n opdracht of 2,5 minuut nog wel vol kunnen houden.

Z: Ja oke dat kunnen ze wel.

M: Ja.

Z: Ja want waar wij een beetje mee zitten is dat wij daar ook aan dachten om dan een tijd te geven van hoe lang ze het moeten doen maar het is natuurlijk een soort wie het het snelste kan. Dus denkt u dat het meer helpt van oke je moet dit 10 x doen en wie dan het snelste kan of je moet het binnen een bepaalde tijd doen en wie het het vaakste kan?

M: Ja dat zijn wel twee wedstrijdelementen waarbij ze best wel makkelijk kunnen gaan zegmaar dat ze graag willen, goed willen presteren of beter willen presteren. Dus dan maakt in principe niet zo veel uit. Wel moet je opletten dat als je doet van doe het bijvoorbeeld 10x dat het niet te kort zal zijn dus dat ze bijvoorbeeld nog met een opdrachtje bezig zijn en dat het dan eigenlijk te kort is als dat ze eigenlijk zelf graag zouden willen want dan werkt het voor de kinderen misschien ook wel weer demotiverend.

Z: Oke dat is heel goed dat u dat zegt. Ik schrijf het heel even op hoor. Dus die oefeningen moeten niet t4e kort zijn denk ook omdat je dan de actie hebt met de kaarten scannen als dat langer duurt dan de oefening zelf is dat ook niet ideaal denk ik.

M: Nee.

Z: Maar u zegt dus dat een race element of een beetje dat competitieve dat wel een beetje de kinderen motiveert om het spel te gaan spelen?

M: Ja vaak wel, vaak zijn ze wel competitief der zitten er vaak wel in. voor kinderen waarbij dat niet is of kinderen waarbij dat maar vaak zit er met competitieve onderdelen willen ze toch wel vaak proberen om de beste te zijn of om zichzelf echt te laten zien. Dus ik denk wel dat dat werkt. Wel moet je natuurlijk opletten dat de kinderen die dat minder hebben daar juist niet tegen afkeren zegmaar.

Z: Ohja want dat kan dan misschien juist inderdaad demotiveren als mensen denken van ja ik ben hier toch niet zo goed in ofzo.

M: Ja ik win toch niet of wat dan ook dus ja dan hoef ik het eigenlijk ook niet te proberen. Voor de fanatieke kinderen helpt het zeker die willen gewoon graag winnen. Voor de kinderen die dat minder hebben kan het soms zijn dat ze niet mee gaan doen.

Z: Oke, nou dat is ook heel goed om te weten in ieder geval. Nou heb ik nog een laatste vraag als u een beetje onze oefeningen die ik al heb opgenoemd hoort heeft u daar nog iets van een toevoeging voor of een opmerking van dit werkt of dit werkt niet? Of ik heb nog wel een leuk idee?

M: Oeh das een goeie. Ja ze kunnen in principe al die opdrachtjes wel met dat planken of zo lang mogelijk of heel lang kunnen ze allemaal wel en dat vinden ze ook best wel leuk om te doen. Dus als je in die hoek graag door zou willen gaan dan kun je best wel veel kijken naar fitness opdrachtjes die je erbij kan doen die geen materialen kosten of weinig materialen of wat dan ook. En daarin kun je natuurlijk ook makkelijk variëren door eventueel dagelijkse materialen te gebruiken die iedereen thuis heeft, dus gewoon een gewichtje met een fles bijvoorbeeld of wat dan ook.

Dan gebruik je dat toch wel wat meer materialen bij dat kan soms ook wel wat bevorderen. En als je wat meer spelelementen zou willen doen dan zou je bijvoorbeeld een klein parcourtje dat je wel kunt verbinden met fitness opdrachtjes. Parcourtje daarbij dat ze ook nog een beetje vooruit bewegen en niet alleen statisch de oefeningen aan het doen zijn. Dus die afwisseling is denk soms wel belangrijk dat ze en beweging doen in de ruimte maar ook dat ze soms gewoon statisch op een plek de oefening kunnen doen.

Z: Ja oke. Dat vind ik wel een hele goeie. En zouden we bijvoorbeeld oefeningen zoals nou bedenk nu een handshake van 5 stappen ofzo zouden ze dat ook ertussen leuk vinden of is dat juist een beetje dat je denkt van nou laat dat maar weg zulk soort dingen? Dat ze een beetje iets moeten bedenken dus bijvoorbeeld een dansje van een aantal stappen of een ja een handklap weetjewel dat je met elkaar gaat snapt u wat ik bedoel?

M: Ik snap het ik denk wel dat ze dat leuk vinden het is natuurlijk ook best wel fijn voor kinderen als ze zelf ook een beetje de regie hebben dus ook het idee hebben dat ze wat in mogen brengen of wat mogen verzinnen. Dus zo'n opdracht om die er tussendoor te doen is denk ik wel leuk om wat toe te voegen ja.

Z: Oke nou heel erg bedankt voor uw antwoorden ik denk dat we dan nu een beetje ales hebben besproken. Heeft u zelf nog iets van vragen ofzo of een opmerking?

M: Nee op dit moment niet. Mocht je zelf nog wat hebben of vragen hebben dan mag je dat altijd vragen stellen.

Z: Heel erg bedankt in iedergeval ik ben blij dat u tijd kon maken om even te bellen was wel heel erg fijn en dan wens ik u nog een hele fijne dag.

M: Ja graag gedaan, zelfde.

Z: Dank u wel! doei

M: Doei

Interview with Marcus Dailly

What is your name and occupation?
Marcus Dailly. My occupation is a secondary school teacher of English and occasionally PE.

What is your experience with working with children, particularly children and sports?
Teacher for 20 years so experiences with children ages 12–18. Also, coach of a kid's football team from when they were age 6–13 (and have helped coaching with teams of other ages).

Is it important for children to stay active/incorporate being active into their daily routine?
It is incredibly important, one of the most important things for a kid: both in terms of the physical perspective and for the mind.

What activities in particular are important to keep children fit? Or what parts of the body are important for children to exercise?
Most important thing for kids that age is to make that activity fun. So, whatever that activity is, it should be based around fun and enjoyment. Also, an activity that they feel a sense of achievement from. During the process from start to finish they should feel like they achieved something, and they feel part of it. Can't think specifically but two most important things are let them have fun, all are participating, and they feel a sense of achievement from it.
Important to exercise all parts of the body.

What sort of activities are suitable for children ages 8–10?
Physical activities like throwing and catching a ball and running, these are all good things for kids. Jumping jacks, simple throwing and catching games are good, like races (with evenly balanced teams) with relatively straightforward in terms of their understanding of what they have to do.

How many repetitions of different activities are ideal?
Not sure if I can put an exact figure on it. Like a specific time is important like 30s. Hard to quantify a number of repetitions for a certain activity. The time scale is very important and how many you can do in that amount of time.
keep it simple and do more repetitions. The more you overcomplicate it, the less they get from it. It takes too much time for them to get familiar with it. You're better keeping it relatively simple depending on their age (what they can do at that age group) and keep it simple. The most straightforward things are almost always the best

Is a game/winning element an effective form of motivation for children?

How many repetitions of different activities are ideal?
"Not sure if I can put an exact figure on it … keep it simple and do more repetitions. The more you overcomplicate it, the less they get from it. It takes too much time for them to get familiar with it. You're better keeping it relatively simple depending on their age (what they can do at that age group) and keep it simple. The most straightforward things are almost always the best"

Is a game/winning element an effective form of motivation for children?
"100%. You can't hide away from the fact that kids do like that sense of competition. They love it, it motivates them a lot. Whether it's football training or a school activity, kids are motivated by trying to do their best. Having a competitive element in it has to happen."

Interview with Ashwini Deoras

Team: Hi, Ashwini. Let's start by introducing you to the team.
Thanks for joining us today. Could you share your qualifications and experience?

Ashwini: Certainly. I'm a Doctor of Physical Therapy and a qualified personal fitness trainer. I work with a broad demographic, focusing on the elderly and addressing aging issues and debilitating conditions. My approach integrates the outdoors with physical activity to enhance overall quality of life.

Great. Now, let's discuss the project. Given your experience, how have you worked with the elderly?

Ashwini: Mainly one-on-one and in group homes or care facilities. Group sessions, despite varying needs, foster camaraderie among participants.

Now that you've heard about the game, what exercises would you suggest for the elderly?

Ashwini: It's crucial to group them based on similar abilities, avoiding contrasting debilitating issues. Assign someone from the team best equipped to handle each subgroup.

With three difficulty levels, should we opt for completely different exercises or variations of the same exercise?

Ashwini: It depends on the focus. For balance, consider variations like moving hands above the head. For strength, progress from sitting on a chair to standing up and eventually incorporating weights.

Any feedback on our game, particularly regarding interactions with the elderly?

Ashwini: Regular engagement is key. The game setup should be simple for caregivers, and we need to acknowledge that not everyone may participate. Medical clearance is vital for each patient, ensuring the game is safe. Additionally, we could ask for specific do's and don'ts for each patient per game, addressing individual health concerns.

Interview with Priya Kher

Hi, Priya. Let's start with introducing our team. Thanks for being here today. Could you share your name?

Priya Kher: Certainly. I'm Priya Kher.

Team: Great. Now, could you tell us about your background and qualifications?

Priya Kher: I have a background in psychology and learning in development, with a focus on learning and learning experiences, as well as behavioral sciences and psychology.

Team: Wonderful. How about your experience?

Priya Kher: Currently, I don't have direct experience working with elderly people in my current role. However, as a counseling psychologist, I have worked with the elderly.

Team: Now, let's introduce the project. We'll describe the game, show pictures and sketches, and answer any questions about gameplay.

Team: Given your experience, could you tell us about your work with elderly people?

Priya Kher: In my current role, I haven't worked with the elderly, but I have volunteered as a counseling psychologist in old age homes.

Team: Now that you've heard about the game, what mental puzzles and games do you think we could include for the elderly?

Priya Kher: We could include puzzles that allow them to progress, such as picture puzzles, word puzzles (like a word jumble game), and interactive and entertaining activities like riddles and mental calculations (like counting backwards from 100 with gaps of 7). Having different sets of riddle cards would provide variety in mental activities. I'll send you a list of different games.

Team: With three different difficulty levels, is it better to have completely different exercises, variations of the same exercise, a different number of repetitions of each exercise, or something completely different?

Team: Is there any feedback you have on our game, especially with the interaction with the elderly?

Priya Kher: It's important to keep safety and mobility in mind, offering options that don't create roadblocks to the game and cause frustration. Just because they're elderly doesn't mean they don't need incentives or motivation to play. Can they sit next to the tile and still play the game? What about people with a cane or wheelchair users?

Priya Kher: As for improvements, consider how many rules the game has, and make sure they're clear and concise. Any challenges should be addressed with alternatives or options. Removing anything should be based on whether it adds unnecessary complexity or confusion.

Priya Kher: Additionally, think about the number of rules for the game and whether they might overwhelm the players, especially the elderly participants.

Exercise Cards

Start Move & Improve	**Start** Move & Improve	**Start** Move & Improve	**Start** Move & Improve
Mental Move & Improve	**Mental** Move & Improve	**Physical** Move & Improve	**Physical** Move & Improve
Air Jump Rope 10x	**Air Jump Rope** 10x	**Elastic Jumping** 4x	**Elastic Jumping** 4x
Light and Shadow Game	**Light and Shadow Game**	**Sound Signal Game**	**Sound Signal Game**

Toss Ball Back and Forth Above head 10x	**Toss Ball Back and Forth** Above head 10x	**Toss Ball Back and Forth** Behind back 5X	**Toss Ball Back and Forth** Behind back 5x
Toss Ball to Partner 1 person lays on ground 5X	**Toss Ball to Partner** 1 person lays on ground 5X	**Toss Ball to Partner** While jumping 5X	**Toss Ball to Partner** While jumping 5X
Toss Ball Back and Forth Clap 3 times inbetween 5X	**Toss Ball Back and Forth** Clap 3 times inbetween 5X	**Jumping Jacks** 15X	**Jumping Jacks** 15X
Jumping Jacks Together 8X	**Jumping Jacks Together** 8X	**Jumping Jacks** Rotate 180° after each one 8X	**Jumping Jacks** Rotate 180° after each one 15X

Squats
Touch the ground
10x

Squats
Touch the ground
10x

Squats
Hold partner
10x

Squats
Hold partner
10x

Sit-ups
10x

Sit-ups
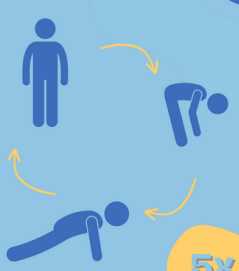8x

Sit-ups
High five in between
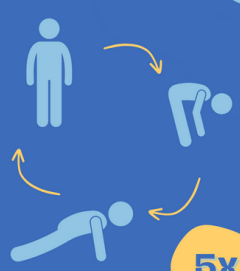10x

Sit-ups
High five in between
8x

Inchworm
5x

Inchworm
5x

High Knee
Rotate in a circle
5x

High knee
Rotate in a circle
5x

Pair Standing
Hold for at least 15 seconds

Pair Standing
Hold for at least 15 seconds

Card Balance
Walk 5 meters
5m

Card Balance
Walk 5 meters
5m

Balance

Rotate in place 10 times and walk 2 meters

2m

Balance

Rotate in place 10 times and walk 2 meters

2m

Hopping

Swap legs after 5

10x

Hopping

Swap legs after 5

10x

Wheelbarrow

Walk 5 meters, swap and walk back

5m x2

Wheelbarrow

Walk 5 meters, swap and walk back

5m x2

Frog Hop

Hop over your partner alternately

8x

Frog Hop

Hop over your partner alternately

8x

Handshake

Create a 5 step handshake

Handshake

Create a 5 step handshake

Dance

Create a 3 step dance

Dance

Create a 3 step dance

Sprint

to the other side of room and back

Sprint

To the other side of room and back

Hop

To the other side of room and back

Hop

To the other side of room and back

Count to 24

for every number with a 3 in it or a multiple of 3 you have to say "oink" instead of saying the number

Count to 24

for every number with a 3 in it or a multiple of 3 you have to say "oink" instead of saying the number

Count to 45

for every number with a 5 in it or a multiple of 5 you have to say "oink" instead of saying the number

Count to 45

for every number with a 5 in it or a multiple of 5 you have to say "oink" instead of saying the number

Count to 30

for every number with a 7 in it or a multiple of 7 you have to say "oink" instead of saying the number

Count to 30

for every number with a 7 in it or a multiple of 7 you have to say "oink" instead of saying the number

Game Count 21

alternate counting, you can count 1-3 numbers in one go, the goal is to force the other person to say the number 21

21

Game Count 21

alternate counting, you can count 1-3 numbers in one go, the goal is to force the other person to say the number 21

21

Draw and Guess

School items

Draw and Guess

School items

Draw and Guess

Vacation items

Draw and Guess

Vacation items

Draw and Guess

Animals

Draw and Guess

Animals

Draw and Guess

Kitchen items

Draw and Guess

Kitchen items

Rhyme

Come up with 5 words that rhyme, (choose one): Disgrace, Amaze, Parade, Shake, Remote, Snail

Rhyme

Come up with 5 words that rhyme, (choose one): Disgrace, Amaze, Parade, Shake, Remote, Snail

Rhyme

Come up with 5 words that rhyme, (choose one): Brawl, Age, Knee, Extend, Reign, Alone, Airway

Rhyme

Come up with 5 words that rhyme, (choose one): Brawl, Age, Knee, Extend, Reign, Alone, Airway

Rhyme

Come up with 5 words that rhyme, (choose one): Brawl, Age, Knee, Extend, Reign, Alone, Airway

Rhyme

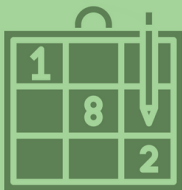Come up with 5 words that rhyme, (choose one): Brawl, Age, Knee, Extend, Reign, Alone, Airway

Describe and Guess

Describe and Guess

Sudoku

1 8 2

Sudoku

1 8 2

Word Ladder

2 words and get from one to the other by replacing one letter at a time (words must be real in between)

BULL ⟶ BEAR

Word Ladder

2 words and get from one to the other by replacing one letter at a time (words must be real in between)

BULL ⟶ BEAR

Word Ladder

2 words and get from one to the other by replacing one letter at a time (words must be real in between)

BELT ⟶ BUST

Word Ladder

2 words and get from one to the other by replacing one letter at a time (words must be real in between)

BELT ⟶ BUST

Word Ladder

2 words and get from one to the other by replacing one letter at a time (words must be real in between)
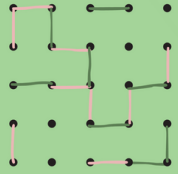
ROLE ⟶ MOOD

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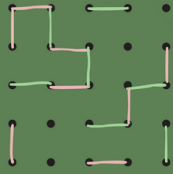
ROLE ⟶ MOOD

Dots and Boxes

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Pattern Game

Shape sequences: identify the shapes in the different patterns

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Describe

Describe a room in your home as detailed as possible

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Describe a classmate, your partner should guess who

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Arduino Code (WiP)

```cpp
#include <Wire.h>
#include <LiquidCrystal.h>
#include <PN532.h>
#include <PN532_I2C.h>
#include <NfcAdapter.h>

PN532_I2C pn532i2c(Wire);
PN532 nfc(pn532i2c);

LiquidCrystal lcd(12, 11, 5, 4, 3, 2); // Pins for RS, Enable, D4, D5, D6, D7

const int buttonPin = 7;
int buttonState = 0;
int lastButtonState = 0;

unsigned long long startTime = 0;
unsigned long long stopTime = 0;
int tasksCompleted = 0;

bool gameStart = false;
bool gameOver = false;

bool uidDisplayed = false;


NfcAdapter nfc = NfcAdapter(pn532_i2c);
String tagId = "None";
byte nuidPICC[4];

void setup()
{
 Serial.begin(115200);
 lcd.begin(20, 4); // Adjust the size based on your LCD

 pinMode(buttonPin, INPUT);
 lcd.setCursor(0, 0);
 lcd.print("  Welcome to  ");
 lcd.print(" MOVE AND IMPROVE ");

 nfc.begin();
 nfc.SAMConfig();

 delay (2000);
}
```

```
void loop()
{
 buttonState = digitalRead(buttonPin);

 // compare the buttonState to its previous state
 if ((buttonState != lastButtonState) && (!gameOver))
 {
 // if the state has changed, increment the counter
 if (buttonState == HIGH)
 {
 if(!gameStart)
 {
 startTime = millis();
 updateLCD(startTime, millis());
 gameStart = true;
 }
 else
 {
 updateLCD(startTime, millis());
 tasksCompleted++;
 uidDisplayed = false;

 if(tasksCompleted >= 10)
 {
 gameOver = true;
 stopTime = millis() - startTime;
 displayResult(startTime, stopTime);
 }
 }
 }
 }

 else if((tasksCompleted > 0) && (!gameOver))
 {
 uint8_t uidBuffer [7];
 uint8_t uidLength;

 updateLCD(startTime, millis());
 //readNFC();
 if(!uidDisplayed)
 {
 if (nfc.readPassiveTargetID(PN532_MIFARE_ISO14443A, uidBuffer, &uidLength))
 {
 displayUID(uidBuffer, uidLength);
 uidDisplayed == true;
 }
 }
 }
```

```
   delay(100);
   lastButtonState = buttonState;
}


void updateLCD(unsigned long start, unsigned long end)
{
 lcd.clear();
 lcd.setCursor(0, 0);
 lcd.print("EXS. DONE: ");
 lcd.print(tasksCompleted);
 lcd.setCursor(0, 1);
 lcd.print("TIME: ");
 displayTime(start, end);
}

void displayResult(unsigned long start, unsigned long end)
{
 lcd.clear();
 lcd.setCursor(0, 0);
 lcd.print("GAME OVER!");
 lcd.setCursor(0, 1);
 lcd.print("TIME TAKEN: ");
 displayTime(start, end);

}

void displayTime(unsigned long start, unsigned long end)
{
 lcd.print((end - start) / 1000); // Convert to seconds
 lcd.print(":");
 lcd.print((end - start) % 1000);
}

void readNFC()
{
 uint8_t success;
 uint8_t uid[] = { 0, 0, 0, 0, 0, 0, 0 };
 uint8_t uidLength;

 success = nfc.readPassiveTargetID(PN532_MIFARE_ISO14443A, uid, &uidLength);

 if (success)
 {
 printNfcLcd(uid, uidLength);
 }
}
```

```
void printNfcLcd(uint8_t *data, uint32_t numBytes)
{
 lcd.setCursor(0, 2);
 lcd.print("UID: ");

 for (uint32_t i = 0; i < numBytes; i++)
 {
 if (data[i] < 0x10)
 {
 lcd.print("0");
 }
 lcd.print(data[i], HEX);
 lcd.print(" ");
 }
 lcd.println();
}

void displayUID(uint8_t *uid, uint8_t uidLength)
{
 lcd.setCursor(0, 2);
 lcd.print("UID: ");
 for (uint8_t i = 0; i < uidLength; i++)
 {
 if (uid[i] < 0x10)
 {
 lcd.print("0");
 }
 lcd.print(uid[i], HEX);
 lcd.print(" ");
 }
}
```

Game Manual

Welcome to 'Move & Improve', designed to keep you fit while having fun!

Additional Materials

Before you begin, we highly recommend you assemble these materials to complete the exercises:

- A tennis ball
- A measuring tape
- Paper
- Pens
- A mat (optional)
- Enthusiasm
- A competitive spirit ;)

The Set-Up

1 Find an open space for you and your teammate

2 Grab all the materials listed above

3 Open the box and scan the QR code to download the app onto your laptop or iPad

4 Take out the card readers and the cards from the box

5 Pair the card readers to the app by turning them on and following the instructions on screen

6 Once paired, scan the introduction card to begin the game!

How to Play

1 Begin by scanning the introduction card

2 Shuffle the deck of cards and place them next to the card reader

3 Pick a card off the top of the deck and place it onto the card reader

4 On screen a picture of the human body appears, select which part of the body the exercise works

If you don't get it right the first time, wait 5 seconds and try again!

How to Play

5 Click the video to see how the exercise is done (optional)

6 Do the activity with your partner as fast as you can

7 Once you're done, click the button on top of the card reader to move on to the next exercise

8 Repeat steps 3-7 until you've done 8 exercises

9 You're finished!! Did you beat the opposing team?

4

Scan here to explore Expansion packs!