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KEY ELEMENTS IN THE DEVELOPMENT OF A DIGITAL PROTOTYPE OF AN EDUCATIONAL VIDEO GAME

Memory Match Finnish

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ABSTRACT

This thesis covers the development of a digital prototype of an educational game to start learning the Finnish language, using the information retrieved from the development process and game tests to identify the key elements in the development of an educational game.

The research methods include a literature review of previous studies on the topic, market and competitors' analysis, tests with users, and users' feedback. The findings of this research include the identification of iterative tests both on paper and digital, as the most crucial aspect of the development process, as well as a balance of the game mechanics with the educational objectives of the game. Other elements that showed to be important are the usability of the prototype, the use of spaced repetition, and the combination of images and sound to enhance the recollection of vocabulary.

This thesis consolidates the already existing literature on the topic, as well as contributes to showing a step-by-step development process that can be useful for developers interested in delving into the field of educational game design.

Keywords: educational games, game design, language learning, prototype, test

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1 INTRODUCTION

Gamification of educational activities has been used for years in an attempt to make the learning process more engaging to students. Over time, gamification techniques have evolved according to the technological tools available and the needs of students, bringing new possibilities for educators and developers for the design of a variety of gamified experiences that aim to keep students motivated to learn. In addition, the study of a new language is a challenging activity that more often than not can feel overwhelming, leading to frustration, stress, and the initial motivation to learn fading away in the face of the complexity of the learning process.

Gamified apps to learn languages have addressed this problem, providing students and enthusiasts of languages with easier and more engaging ways to take a first dive into the desired language to learn, compared to the traditional language courses, which can at times feel like a dull and heavy chore. In light of this, a better understanding of the key elements in the design and development of an educational game is of high value for both the games industry and the education industry, and this thesis is an attempt to answer the question: which are the key elements in the development of an educational game? This question will be addressed not only from a theoretical framework but also by developing and testing an educational game to start learning the Finnish language.

This research is based on the hypothesis that gamification makes learning a new language easy and fun, with the balance between gamified features and educational content a key element in accomplishing the learning objectives. This thesis includes a summary of previous studies on the matter, a literature review, an analysis of three of the most used gamified apps to learn languages, documentation of the development process of the prototype of a video game to start learning the Finnish language, and tests of the prototype. The prototype developed for this thesis project has a higher level of gamification than already existing language learning apps, it aims to be a game with educational content rather than an educational app with gamified features, to make it more fun and engage than its competitors. During the test phase of the project, it will be

evaluated if this objective is accomplished, or if less gamification is necessary to meet the learning objectives.

This thesis aims to be a contribution for game developers interested in designing educational or other serious games, by providing a comprehensive guide on the key elements necessary to achieve the required balance between fun and educational content, but leaning more towards the game experience than most of the already existing products on the field.

2   LANGUAGE LEARNING

2.1   Spaced repetition

For the purpose of this research, the focus is on the language learning methodology known as spaced repetition. Spaced repetition is a methodology that consists of distributing the exposition of the study material into multiple sessions over a period of time, and it is widely used in word learning (Hanson & Brown, 2020).

Two important aspects of spaced repetition are the repetition pattern and the repetition method. The repetition pattern has a strong influence on word learning, and it refers to how learning sessions are spaced during the learning period. The repetition pattern involves the measurement and analysis of three indicators: 1) number of learning sessions, 2) interval between learning sessions, and 3) the time between the first and the last learning sessions (Rogers & Cheung, 2020). Researchers differ about how many repetitions are necessary to learn a new word, being the range suggested between five and ten, extended up to 20 for words considered more difficult (Zhang, Zou & Xie, 2021).

Regarding the interval, it is suggested that it should be as long as possible, although this theory is not completely accurate, since the optimal interval can differ depending on the learners and contexts. For the time between the first and the last session, a 15-day learning period is considered optimal, and a 30-day

learning period would accomplish better acquisition and retention (Zhang, Zou & Xie, 2021).

The repetition method consists of how to present to the learners each session. When the use of learning apps is involved, the presentation of the learning material often includes text, images, audio, and sometimes video.

2.2 Imagery in Language Learning

Researcher Allan Paivio suggests a dual coding theory for language learning, which includes the participation of two cognitive systems, a non-verbal coding process for imagery, and a verbal coding process for linguistic information. Paivio identifies two kinds of concepts in the process of language learning, concrete concepts, and abstract concepts. According to him, concrete concepts can be represented in non-verbal cognitive systems as well as in verbal cognitive systems, because they have clear referents that can be represented with images. Abstract concepts, on the other hand, can only be represented in the cognitive verbal system, since their nature makes it difficult to be represented with visual imagery (Paivio, 1971).

Paivio also mentions that the association of words with images can enhance understanding and retention in the language learning process, and the combination of both verbal and non-verbal systems for coding processing of the language information facilitates better memory and later recall of the material to which the learner was exposed. According to this approach, the incorporation of both verbal and non-verbal systems in educational activities can result in better learning outcomes.

An additional advantage of using imagery in the language learning process is that facilitates to the learner the acquisition of the skill of thinking in the target language, rather than translating from their mother tongue, which helps with fluency (WordDive, 2016).

his chapter introduces the layout of text produced with the template. Appendix 1 provides more information on the technical details of this template.

3 GAME DESIGN

Game design can be defined as the area of game development that consists of the creation of the mechanics, rules, and content of the game. The job of a game designer is to create these elements in a way that provides an engaging experience for the player. Game design encompasses several sub-disciplines such as systems design, user interface design, game balancing, art design, audio design, player engagement, and monetization design, among others.

There is a wide variety of game genres, most of them aiming at the goal of providing entertainment. There is, however, an area of game design that focuses on creating games that go beyond just entertainment, but aim to teach something to the user, known as serious games or educational games.

Developing games is by itself a challenging task, one that comes with extra challenges when these games aim to serve an educational purpose. This review shows how different authors have approached the matter of game design, focusing on educational or serious games.

Schell (2020), states that a game is a problem-solving activity approached with a playful attitude. This definition applies to all games, not just educational games, but it already sets the basis for experiences that are in itself, somehow educational, since all games allow for the players to solve problems, activities that are stimulating from a cognitive point of view, even without having an educational goal in mind.

This idea is aligned with Kalmapourtzis (2019), it might be possible to say that any game virtually has educational potential, because by playing games, any games, players get exposed to and engaged in experiences within the game world, which can lead players to learn an array of skills and concepts. That being considered,

it becomes necessary to establish a clear differentiation between games and educational games.

From Kalmapourtzis' view (2019), a game is considered educational when the learning objectives are the starting point and purpose of the development, and when the topic is relevant in real life instead of in the game world only. These two characteristics are a good starting point for defining educational games, providing the basis for a development framework. This framework, however, might differ depending on the game and the context. First, it is important to define if the game is going to be used in a formal, informal, or non-formal learning context. A formal context is well structured and guided, an informal context is when the learning process happens spontaneously, and a non-formal context is a mix between the two. A non-formal context has structure, but its focus is on the interests of the participants rather than following the structure strictly, and it allows for spontaneity to occur. In addition, other aspects to consider when designing an educational game are keeping in mind the student's needs, having a deep understanding of the topic the game addresses, balancing the difficulty curve of the game, concentrating on few learning objectives, limiting gameplay features, making sure that the game gives real-time feedback to the players on the learning objectives, and keeping in mind the resources and limitations of the developers.

Besides the previous, the probably most important thing to consider is to achieve the right balance between the educational aspects of the game and the fun aspects of the game. If it is too educational and not gamified enough, it is not a game but an educational activity; and if it is too fun without enough attention to the educational aspects, then it is a game that fails at the educational objectives. According to Ahmad (2019), it is of great importance to align the learning objectives with the game mechanics, the learning goals with the gameplay goals, as well as real-time feedback on the learning objectives, Ahmad (2019), Karkaanranta & Neittaanmäki (2009).

Another aspect widely mentioned by the previous authors is engagement. Engagement is crucial to incite and sustain the motivation of players to play the educational game (Ahmad 2019), (Karkaanranta & Neittaanmäki 2009). Williams (2015) also mentions that the incorporation of cognitive challenges can motivate engagement and create a more immersive game experience. Keeping players engaged through the game experience comes from a strategic balance in the progression of the game mechanics, the difficulty curve should be designed keeping in mind the players' capacity. Leppanen (2019) also highlights the importance of balancing and the creation of progressive challenges for an engaging experience. Authors also coincide in considering the iterative process a key element to designing an effective and engaging game, giving high importance to test sessions and player's feedback (Ahmad 2019), (Karkaanranta & Neittaanmäki 2009), (Leppanen 2019). From the previous summary of literature on the topic, it is possible to outline a preliminary framework for the design of educational games, as shown in Table 1.

Table 1. Framework for the development of an educational game (Apache 2023).

DESIGN OF EDUCATIONAL GAMES
1. Defining the educational content of the game. This is defining the topic and learning objectives.
2. Brainstorming ideas, always with those objectives in mind.
3. Evaluating the different ideas in terms of the resources available, difficulty of development, time constraints, and how much/well it addresses the learners needs.
4. Defining the game concept. Game genre and core mechanics, secondary mechanics if exist, but not many. Keep it simple. Other game elements such as aesthetics, UI, music etc.
5. Building a prototype.
6. Defining the game concept. Game genre and core mechanics, secondary mechanics if exist, but not many. Keep it simple. Other game elements such as aesthetics, UI, music etc.
7. Testing and evaluating the prototype.
8. Iterating on steps 4-5-6 until have a finished good educational game, that is: it is fun enough to engage players and it accomplishes its learning objectives.

4 DEVELOPMENT

4.1 Initial game concept

The initial concept for the game was born from the frustration about how difficult it is for most non-Finnish people to start learning the Finnish language. Even though some language learning apps include the Finnish language among their offered languages, the majority of them are not gamified enough to make them fun, being Duolingo and the Digitaldialects website probably the only exceptions. Based on that, the concept of a game with very simple and fun mechanics that would serve as an introduction to the Finnish language was a perceived need in the market of language learning apps.

The first iteration of this concept consisted of creating the main mechanics of matching pairs of cards. The cards would include an illustration of an object and the corresponding Finnish name of that object alongside an audio with the pronunciation of the word. The game would also include a character that plays the role of helping the player by revealing cards and would provide a reward in the form of game currency every time the player matches a pair correctly. The game currency could be later used to level up the character, and the higher the level of the character, the more valuable help will be provided to the player.

Another feature intended for this first game concept was monetization through rewarded ads. The number of flips per level was limited to three, and the player would have the option of receiving extra movements by watching rewarded ads. The option would be triggered only by the game over phase, that is when the player runs out of movements within a given level.

This initial game concept was thought for mobile devices only, and it has had several changes during its development, as will be explained in detail in further sub-chapters. An infographic of this first concept can be found in the appendices.

4.2   Market research

Market research is a process of gathering data about products and services to determine if a product or service meets the needs of the targeted audience (Ewing Marion Kauffman Foundation 2007).

When conducting a market research, it is of great importance to establish a clear research objective, to ensure that the data gathered is relevant. Market research can be conducted using an array of methodologies, which might vary depending on the product or service. These methods can be primary or secondary, which are commonly used in combination during different stages of the research. Primary methods are those in which the data is gathered directly from consumers, and secondary methods are based on the analysis of already existing data from several sources (Bryter Global 2023).

In the games industry, five general steps to market research can be identified: 1) identify the target audience 2) analyse the competitors 3) test the game concept 4) study industry trends 5) use surveys and focus groups (Hassanzadeh 2023).

The market research for the game concept of the Memory Match Finnish game used primary methods of interviews, surveys, and game tests; and secondary methods of analysis such as SWOT, trends, and design analysis.

4.2.1   First analysis of trends and market potential

The goal of Memory Match Finnish is to solve the problem of feeling overwhelmed when starting to study the Finnish language, whether because of its difficulty or due to limited time to study. There are already several language learning applications that aim to solve the same problem, which serves as a starting point to verify that there is already an existing market for similar products, however, the market research objective was to determine if there is demand for a language learning application to start learning the Finnish language in the form of a game with casual mechanics, which is more gamified than the majority of already existing applications on its field. To approach this research had as a

starting point the categorization of the hypotheses related to it using the Assumption Matrix. The Assumption Matrix is a tool in the form of a simple diagram where the vertical axis shows the relevance of the hypothesis to validate the concept of a product or service, and the horizontal axis shows the level of difficulty of testing the hypothesis (Bland 2017).

The initial hypotheses tested through the Assumption Matrix served to refine the market research question: is there a viable market for a language application for studying the Finnish language in the form of a casual mobile game? This question was the topic of the previous research Memory Match Finnish Market Research. As stated in such document, an article published in Helsinki Times (2020) reveals that the number of people who signed up for the Finnish course in the languages learning app Duolingo was 50,000 during the first four days of its launch. In another article published in Yle News (2020), Duolingo's marketing manager said that Finnish was their most requested course, and the Duolingo Language Report for the year 2021 (Duolingo 2021) shows that Finnish is their second most popular language course in Finland. Study, family, and friends are the most common reasons for people to study the language in the application, only after those comes work-related interest. Besides this data about Duolingo, the leader in language learning apps and the main competitor of Memory Match Finnish, Google Play Store shows that other apps to learn Finnish from amount to more than 150,000 installs (Apache et. all 2022).

In addition, a chart published by PopulationU, shown in Table 2, provides data from the years 2017 to 2020 showing that Finnish is not the native language of more than 400,000 people living in Finland.

Table 2. Languages spoken in Finland (PopulationU 2020).

Languages	2017	2018	2019	2020	%
Total Speakers	5,139,805	5,126,173	5,112,648	5,100,946	92.0
Finnish	4,848,761	4,835,778	4,822,690	4,811,067	86.9
Swedish	289,052	288,400	287,954	287,871	5.2
Sami	1,992	1,995	2,004	2,008	0.0
Foreign languages, total	373,325	391,746	412,644	432,847	7.8
Russian	77,177	79,225	81,606	84,190	1.5
Estonian	49,590	49,691	49,427	49,551	0.9
Arabic	26,467	29,462	31,920	34,282	0.6
English	19,626	20,713	22,052	23,433	0.4
Somali	20,007	20,944	21,920	22,794	0.4
Kurdish	13,327	14,054	14,803	15,368	0.3
Persian, Farsi	12,090	13,017	14,118	15,105	0.3
Chinese	11,825	12,407	13,064	13,778	0.2
Albanian	10,391	10,990	11,806	12,664	0.2
Vietnamese	9,872	10,440	11,094	11,562	0.2
Total	5,513,130	5,517,919	5,525,292	5,533,793	100

As a conclusion from this first stage of market research, it is possible to say that there is a viable market for a game like Memory Match Finnish.

4.2.2 Identifying the target audience

The target audience was defined through a process of open interviews which were conducted as part of the Memory Match Finnish Market Research work in the year 2022. As explained in such document, the interviewees consisted of six people ages 25 to 40, all with academic backgrounds and who were planning to move to Finland or already live in Finland. Another group targeted is refugees in Finland, who were not possible to interview but were included as part of the target audience in the construction of personas, shown in the appendices.

As presented in the results of Memory Match Finnish Market Research, none of the interviewees consider learning Finnish a priority in their life, showing interest in learning it only to a basic level or actually losing interest in studying it. The

reasons expressed for it were the difficulty of the language and being too time-consuming to learn. However, the interviewees already living in Finland mentioned that they wish to learn enough to better adapt to the culture, socializing with Finnish people, and daily interactions.

All interviewees had had experience using language applications. Duolingo had been used by all five of them, other applications mentioned were Italki, Tandem, and Mondly Finnish. Further discussion about the positive and negative features and possibilities of the language applications is provided on Table 3.

Table 3. Interviewees' opinions about language learning apps (Apache 2023).

POSITIVE	NEGATIVE
Repetition helps to remember already studied topics and words	Some of the vocabulary is not useful in real life
Entertainment helps with user retention	Paid options of apps do not offer enough to be worth paying for, interviewees have only used free options
Ranking provides challenge and intrigue	Limited educationally, good only to start learning the language but useless for more advanced students
Interaction with other students and native speakers in the application	
Pronunciation, except if the voice sounds too robotic	

Other learning methods that some of the interviewees used were watching television and movies in the target language, mostly children's media because of the clearer pronunciation and easier grammar, listening to music, watching news, and reading children's books. The interviewees showed stronger interest in the informal language rather than the formal, as they would mostly need language skills in daily life informal situations. The interviewees also considered academic

courses too difficult for beginners and lacked the vocabulary they would need and use. They also considered it important to take into account the context of where and when the language is used and considered that getting grammar correct as something secondary to getting oneself understood. (Apache et. all 2022).

4.2.3 SWOT Analysis of Memory Match Finnish

A SWOT analysis evaluates the strengths, weaknesses, opportunities, and threats of a project or business. A SWOT analysis is useful to help make better-informed decisions and plans, as well as accelerate goal achievement. The objective of a SWOT analysis is to give clarity about the possibilities of using the strengths of the business to stand out from competitors, address the weaknesses beforehand, find new opportunities, and prepare for potential threats (Lindley 2023).

Next it is presented a SWOT analysis for the game concept Memory Match Finnish.

Strengths

Language apps vary in their monetization model but can be broadly categorized into free and paid. Free ones are the most popular, although they have the downside of limited content, not offering much immersion, a translation-based methodology, and limited gamification. Paid apps offer more complete and more gamified features that allow a deeper immersion and more engaging experience, facilitating the learning process even more. Memory Match Finnish aims to offer features found on paid apps in an F2P model. Higher gamification is another strength of the game concept. The more gamified and engaging the experience is the bigger retention potential and a higher percentage of learning process can be achieved. The more fun and engaging, the more retention potential and the higher percentage of learning progress. Memory Match Finnish gamification is higher than other free products of its kind.

Memory Match Finnish' methodology is based on association, repetition, and emotional impact. The association of words and sentences with images and sounds when the user matches pairs is the main method to help memorize vocabulary. The repetition of this loop-over facilitates the retention, and emotional impact by providing an engaging learning context with memorable characters and RPG mini-quests, which can set the players into a positive mood that is beneficial for the learning process. Even though the game itself will offer just basic vocabulary, it will include links to other sources that users can check for a deeper study of the language outside the game. This unique learning method contributes to a *quick learning process* and *deeper immersion* than other language apps. The fact that the method is not based on translation is a huge advantage, is not recommended to rely on the assumption that the player already knows a base language, such as English for example, which is the base language of almost all already existing language apps.

Weaknesses

The developer's team was a team of three people for a period of three months, but the rest of the time it has been a solo developer. Besides, Memory Match Finnish is a project with a limited budget, which makes impossible to dedicate full time to its development. It is also the first commercial project of the developer, who is still in learning process with no previous experience in the field. These situations make the development progress very slow.

The project received some funds but very limited compared to how much the production of a game of this scope actually costs. That implies that the developer and the team members who joined for a short period of time do not receive a salary for the job in the game, but the limited budget has to be used to cover other costs, and even that in a cheap way.

Finnish is not widely spoken worldwide, that means that even though there is demand for the product, it is not large demand if compared to other more popular languages to learn like English, Spanish, German or French, for example. In

addition, Duolingo, which represents the main competitor of Memory Match Finnish, has been the leader on the field of free language learning apps for years. It recently included Finnish in their services and has been very well received by users.

Opportunities

Memory Match Finnish is the prototype that is being developed with Finnish as a target language, but the concept can be applied to any language. If the prototype proves to be successful a larger scope of the project is to develop games for different target languages, which would reach larger target groups.
Since the COVID-19 pandemic, the audience for online products and services has been increasing, and language apps have been one of the fields gaining users.

The game characteristics are a good fit to have presence is other media, such as social networks or language schools' networks with which partnership could be possible in the future.

Threats

Due to the huge variety of mobile devices, each with their specifications, it is virtually impossible to make sure that a mobile app would work in the best way possible on absolutely all devices. This can lead to a high rate of failures in some devices and ultimately may cause the removal of the app from those devices in which it keeps crashing.

Because of a combination of the factors mentioned in the Weaknesses section, the game may end up having a low retention rate. Also, keeping a mobile app updated and optimized enough over time can generate costs that a small team could not be able to afford.

The SWOT analysis charts differentiated in the categories of market, resources, and features can be found in the appendices.

4.2.4 Competitor analysis

Duolingo

Duolingo is an educational app for learning languages. It is available to learn 43 languages, Finnish included. It is the language app with more gamified features in the market. It is available for mobile devices and desktops/browsers. It is the most gamified app to learn languages available in the market right now. Its learning method is through translation and repetition. It includes exercises such as fill-in-the-blanks, accommodating the words in the right order to form a sentence, and choosing the right word between given options. It has a ranking system and a rewards system for studying daily lessons without missing days.

Duolingo's target audience is people who want to learn a secondary language in an accessible way. The wider age range of Duolingo's target audience is teenagers and young adults. Duolingo's marketing strategies include a strong brand presence, social media marketing, email marketing, ads, and YouTube series. Its monetization model is freemium (ads, in-app purchases) with a Premium option (monthly subscription $6,99); and its distribution channels are the Google Play Store, the Apple Store, and the app's website (browser/desktop version).

Lingoplay

Lingoplay is an educational app for learning languages. It is available to learn 70 languages, Finnish included. It has gamification features for some exercises. It is available for mobile devices and desktops/browsers. Lingplay also has several native languages to choose from, not only English. It includes a variety of exercises, some with gamification features, including flashcards. It offers a certificate of completion. Its target audience is people who want to learn a secondary language.

Lingoplay's marketing strategy consists of ads and a strong branding, its monetization model is Freemium (ads) and a Premium option (monthly subscription $19,99), and its distribution channels are the Google Play Store, the Apple Store, and the app's website (browser/desktop version).

Digital dialects

Digitaldialects is a website with games to learn languages. It offers 80 languages, Finnish included, as well as some minority and endangered languages, and educational games on the topic of geography. The learning method is a combination of translation (from English to the target language) and visuals, in a variety of games with different mechanics. Digitaldialects' target audience is people who want to learn a secondary language.

Digitaldialects' marketing strategy is SEO. It is easy to find through Google search on games to learn Finnish. The games are available to play on the website only, and the website's monetization is through banner ads. All the content is free to access and it doesn't have paid options.

Tables 4 and 5 show an analysis of the main competitors in relation to Memory Match Finnish.

Table 4. Competitors' analysis table 1 (Apache 2023).

		MEMORY MATCH FINNISH	DUOLINGO	LINGOPLAY	DIGITALDIALECTS
PROFILE	**OVERVIEW**	Educational Games with casual mechanics to learn languages in beginners level. The MVP is being developed to learn the Finnish language.	Educational app to learn languages. It is available to learn 43 languages, Finnish included. It is the language app with more gamified features in the market. It is available for mobile devices and desktop/browser.	Educational app to learn languages. It is available to learn 70 languages, Finnish included. It has gamification features for some exercises. It is available for mobile devices and desktop/browser.	Website with games to learn languages. Includes 80 languages, Finnish included.
	COMPETITIVE ADVANTAGE What value do you offer customers?	It is a game with educational content, instead of a learning app with gamified features. This makes it more fun and engaging, since the users can focus on playing instead of trying to consciously learn the vocabulary presented. Over repetition and association with images and sound, the user absorbs the vocabulary in a subconscious level at first, that easily comes conscious over time, with minimum effort from the user.	The most gamified app to learn languages available in the market right now. Its learning method is through translation and repetition. It includes exercises such as fill-in-the-blanks, accomodate the words in the right order to form a sentence, and choose the right word between given options. It has a ranking system and a rewards system for study daily lessons without missing days.	Many languages available, and several native languages to chose from, not only English. It includes a variety of exercises, some with gamification features, including flashcards. It offers certificate of completion.	It offers many different languages, including minority and endangered languages. The learning method is a combination of translation (from English to the target language) and visuals, in a variety of games with different mechanics.
MARKETING PROFILE	**TARGET MARKET**	Young adults who currently live in Finland or want to move to live in Finland, and want to start learning the Finnish language or are already learning but are still at beginners' level, and want a way to study the language that it is easy and does not take much time.	People who want to learn a secondary language in an accessible way. The wider age range of Duolingo's target audience are teenagers and young adults.	People who want to learn a secondary language.	People who want to learn a secondary language.
	MARKETING STRATEGIES	• Lead magnets → email marketing • Social media marketing • Influencers (YouTube, Instagram) • Google Ads campaigns	• Strong branding • Social media marketing • Email marketing • Ads • YouTube series	• Ads • Strong branding	• SEO. I found it doing google search on games to learn Finnish, so I conclude that SEO is their main marketing strategy. I have never seen the website advertised anywhere.

Table 5. Competitors' analysis table 2 (Apache 2023).

		MEMORY MATCH FINNISH	DUOLINGO	LINGOPLAY	DIGITALDIALECTS
PRODUCT PROFILE	PRODUCTS & SERVICES	• Educational game to start learning a new language (Finnish) • For mobile devices • Possibility to develop for PC and browser.	• App to learn languages (includes 43 languages) • Available for mobile devices and to play in browser.	• App to learn languages (includes 70 languages) • Available for mobile devices and to play in browser.	Games to learn languages and geography. Available to play only on the website.
	PRICING & COSTS	• Freemium (with rewarded ads as monetization model) • Subscription option • Premium option	• Freemium (ads, in-app purchases) • Premium option (monthly subscription $6,99)	• Freemium (ads) • Premium option (monthly subscription $19,99)	• Free (banner ads in the website, but no video ads like the others). All the content is free, it doesn't have paid options.
	DISTRIBUTION CHANNELS	• Google Play Store • Apple Store • The game's website • itch • Steam (possibly through Amazon)	• Google play Store • Apple Store • The app's website (browser/desktop version)	• Google play Store • Apple Store • The app's website (browser/desktop version)	• The website only.
SWOT ANALYSIS	STRENGTHS	•Higher gamification than others • Free to play • Paid options (subscription/premium) • Unique learning method (not based on translation) • Familiarity of the target audience with similar products	• Higher gamification than others • Free to play • Paid option (monthly subscription) • Strong branding • From beginner to intermediate level • 43 languages available	• Variety of exercises • Free to play • Paid option (monthly subscription) • From beginner to intermediate level • 70 languages available • Several native languages (not only English) • Grammar lessons (paid version only) • Radio	• Free to play (banner ads) • The most gamified of all, the entire methodology is through games. • The illustrations in the games are very well done, pleasant to the sight • The mechanics of the games are simple and engaging. • Basic information and clear instructions in the introduction page of each language. • Up to 80 languages
	WEAKNESSES	• No voice recognition • Only for beginner's level • No ranking • Possible low retention rates	• Learning method based on translation (most courses translate from English) • Only until intermediate level (not advanced) • No grammatical explanations • No voice recognition	• Learning method based on translation • Only until intermediate level (not advanced) • No voice recognition • More expensive than the main competitor (Duolingo)	• Not very strong brand • To play in browser only • Suitable only for English speakers • Even though the illustrations are beautiful, the overall website looks cluttered with text and disorganized.
	OPPORTUNITIES	• PC and browser versions possible • Scalable to other languages (with bigger audience)	• Scalable to other languages • Scalable to other native languages (for the translation learning model) • Could aim for higher levels of language competence	• Scalable to even more languages • Could aim for higher levels of language competence	• Could expand to be a downloadable app for mobile • Could upgrade to a paid version
	THREATS	• Similar products with more content (for higher levels, not only beginners) • Main competitor dominates the market • (for the Finnish language) small audience, and possibly decreasing due to the political changes in Finland regarding immigration.	• New emerging competitors • Changes in technology • Changes in users' preferences	• Competitors, current and new • Changes in technology • Changes in users' preferences	• Language learning apps (downloadable for mobile, not only to use in browser) • New emerging competitors • Changes in users' preferences

4.3   Paper prototype

An initial paper prototype was conducted using 25 words in the Finnish language. These words were categorized by difficulty according to the number of syllables. The cards were hand-drawn in a very simple style, just enough to represent the image in a readable way. The cards were distributed over a table starting with a layout displaying four cards (two pairs), and increasing by two cards (1 pair) as the levels would progress.

There would be several characters, one by default at zero cost of game currency at the initial stage of the game, and others available to unlock and buy with in-game currency through progress in the game. Each character would have different skills to help the player. Besides having multiple characters, two new elements were introduced that hadn't been considered in the initial concept: food and gems. Both food and gems would act as different kinds of currency, in addition to coins, the main currency. Coins would be used to buy food, which would be used to feed the characters. The initial loop for levelling up the characters consisted in feeding the characters several times and having a level

bar that would fill progressively each time a character was fed, then once the character was leveled up, they would start providing help to the player.

During the tests with the paper prototype, it was observed that this system would make the pace of the game very slow and not very engaging, so the character level progression was changed to be achieved with gems currency, and feeding a character would provide help to the player immediately every time is fed. The number of times that the player can feed a character per level is limited and depends on the level of the character, the higher the level of the character, the more times can be fed, and the maximum level of characters would be level 3.

Gems are used to unlock new characters or level up already unlocked characters. Coins are earned by matching pairs of cards correctly, whereas gems are earned by playing mini-games, watching ads, or buying coins. Food to feed the character is bought with coins. During the paper prototype, it was observed that the players would want to acquire more in-game items such as food, coins, gems, and lives; so micro-transactions were included in the gameplay design.

Other features introduced for this first paper prototype were mini-games, badges, and trophies. The badges would be earned by unlocking words, and the trophies would be earned by playing mini-games. The mini-games are unlocked to be played after the player has unlocked a certain amount of words.

Four versions of this paper prototype were tested, using different combinations of features, after which, the one selected as the most engaging gameplay and with better balance was the one using the following features:

• Flip 1 card for the duration of the level
• Flip 2 cards for the duration of the level
• Flip all cards for 2, 3, or 4 seconds; depending on the number of cards in the screen at the beginning of the level.
• Give an extra life

The iterations and tests on the paper prototype was very useful to have more clarity in the design of the core loop and other game loops, as shown in the following chapter. Photos of the paper prototype can be found in the appendices.

4.3.1 Game loops and monetization from the paper prototype

The main loop is to match pairs of cards correctly, which will reveal vocabulary. Once the cards are paired correctly, the player receives a reward (coins), and once all the cards in the layout are paired correctly, the player will move to the next level of the game.

The words revealed by matching pairs correctly are saved in an inventory where the player can see the cards at any time during the play state. An additional loop happens when the player wants to use the character's abilities to provide help during the game. Once a character is given by default at the beginning of the game, for free, the player can opt to feed that one to use their ability to help or unlock new characters with different abilities. The food for the characters is bought with coins and unlocking new characters is done with gems, which are also bought with coins.

The main monetization strategy is rewarded ads, although in-game purchases are also included in this version of the concept. Both rewarded ads and micro-transactions are possible to access when the player runs out of currency or lives. However, this is optional, since the player can also decide to not watch an ad or make a purchase. That being the case, and if the player is out of lives, the default 3 lives would automatically be respawned after a waiting time of 30 minutes.

The learning loop is one of the most important in the game, the gameplay has to support the learning process through engaging loops. The main loop by itself aims to accomplish this goal, but secondary loops are in place to reinforce the learning. The learning process in Memory Match Finnish consists of two stages, 1) unlock new vocabulary, and 2) review already unlocked vocabulary. These goals are achieved through game mechanics that provide the opportunity for association, repetition, and immersion.

Unlocking new vocabulary happens during the main game loop, reviewing unlocked vocabulary can be done through playing mini-games, or checking the inventory.

The mini-games reinforce the learning and reward the player with in-game currency. A general view of all the game loops is represented in Figure 1, and more documentation on loops can be found in the appendices.
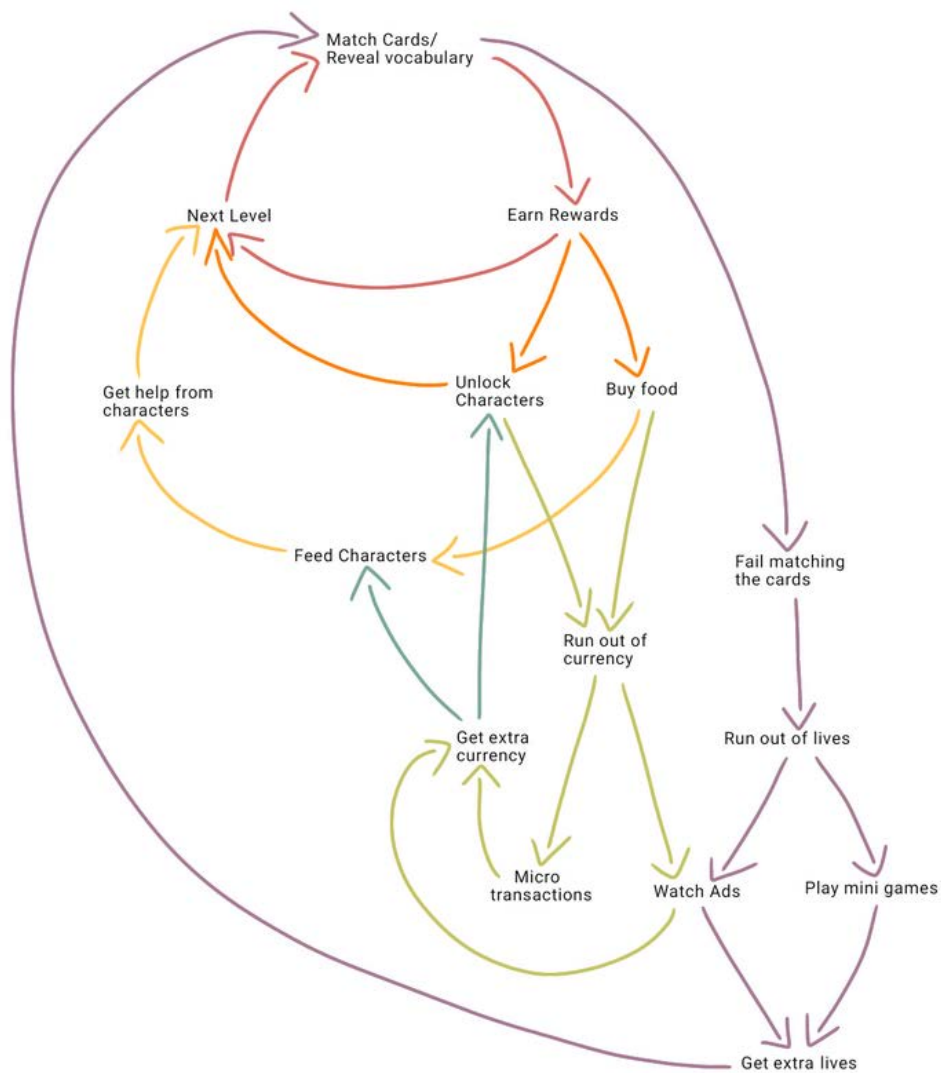
Figure 1. Memory Match Finnish prototype game loops, first iteration for paper prototype (Apache 2021).

4.4   Development of the digital prototype

4.4.1   Scope

The initial concept of the game, as tested in the paper prototype, would take a considerable amount of time and resources that were out of the scope of this research. To accomplish the complete development of a minimum viable product that could be playable and tested, the initial concept went through an analysis process to define which features are essential, and which others should be put aside for the time being. To have more clarity about what elements the MVP should include, the MoSCoW framework was used.

The MoSCoW framework is an approach of categorization that helps prioritize tasks in the development process of a product. The acronym stands for must, should, could, and would or (or "won't"). The must requirements are essential to the success of a project and cannot be negotiable, whereas the should requirements are important but not strictly necessary for the project's functionality, and can be delivered in a second phase. The could requirements are desirable but it is possible to leave them out, and the would (or "won't") are also desirable but most likely would not be included, these are the first ones being left out when scoping down a project (Mind Tools Content Team 2023).

The first MoSCoW framework for the MVP of Memory Match Finnish focused on the main gameplay as the most important element, designed keeping in mind the use of rewarded ads as a monetization strategy, and an inventory to showcase the cards previously matched correctly by the player. The elements necessary to have the game work with those features are shown in Figure 2, together with other elements in the categories should, could, and won't.

MUST HAVE

· Cards (image and text)
· Audio (pronunciation)
· Lives
· Help (flip/reveal cards)
· One form of in game currency
· Cards inventory
· Ads
· Background image

SHOULD HAVE

MUST HAVE elements, plus:
· 1 Character (that provide the help)
· Food (to feed the character)
· Badges
· One mini game (hyper-casual)
· Second mini game (mini RPG quests)

COULD HAVE

MUST HAVE and SHOULD HAVE elements, plus:
· Several characters (characters inventory)
· Second in game currency
· Food inventory
· Trophies
· Outfits for the characters (outfits inventory)
· In game purchases
· Timer
· Links to more in depth language study sources
· More than one background image to select
· User avatar

WON'T HAVE

Would be nice, but out of scope:

· RPG open world mode
· Online Multiplayer mode
· Chat
· Assignments
· Associated language teachers for mini in game lessons

Figure 2. First MoSCoW analysis for the Memory Match Finnish prototype (Apache 2021).

Due to time constraints and changes of the game engine, it was necessary to scope down even more. A second and final MoSCoW framework for the MVP included only the main game mechanic of matching cards, and the character to provide visual feedback to the player, as well as a congratulations sign to indicate the successful completion of a level.

The game loops for the digital prototype changed through more iterations. For the first prototype, the main change was to eliminate the feature of feeding the character to get help during the gameplay. This was replaced by having a shop where the player can directly buy flips of cards with coins, which are earned by matching pairs of cards correctly. The character was kept in the design as a way to provide visual feedback to the player's actions, and to make the game more visually appealing.

Another change was the addition of a combo counter and a level counter. The level counter would inform the player of the current level as well as the total number of levels that should be completed, giving feedback about the player's progress. The combo counter would show how many pairs the player has matched correctly in a row. Matching pairs of cards in a row would also give extra coins. The micro-transactions were eliminated and rewarded ads were kept as the only monetization strategy.

For the second and final MVP developed, due to time constraints, the only game loop included was the core loop of matching pairs of cards. Monetization was eliminated, as well as in-game currency, limited lives, and combos. This final version has unlimited lives and there is no game-over condition, the player can keep playing the game until matches all the pairs of cards in the layout correctly. An inventory was included for review of the words corresponding to the first level only, it is a feature in development that did not play a significant role in this prototype.

4.4.2 Usability design

The first UX/UI design was based on the first MoSCoW framework, and it included six different game states, as shown in the figure below, start screen, play screen, settings screen, menu screen, cards inventory screen, and mini games screen. The user navigates through the screens as shown in the flow chart corresponding to Figure 3. Depending on the user's decisions, pop-up sub-screens appear with feedback to the player, as shown in the Flow Chart in Figure 3.

FLOW CHART (For the MUST HAVE)
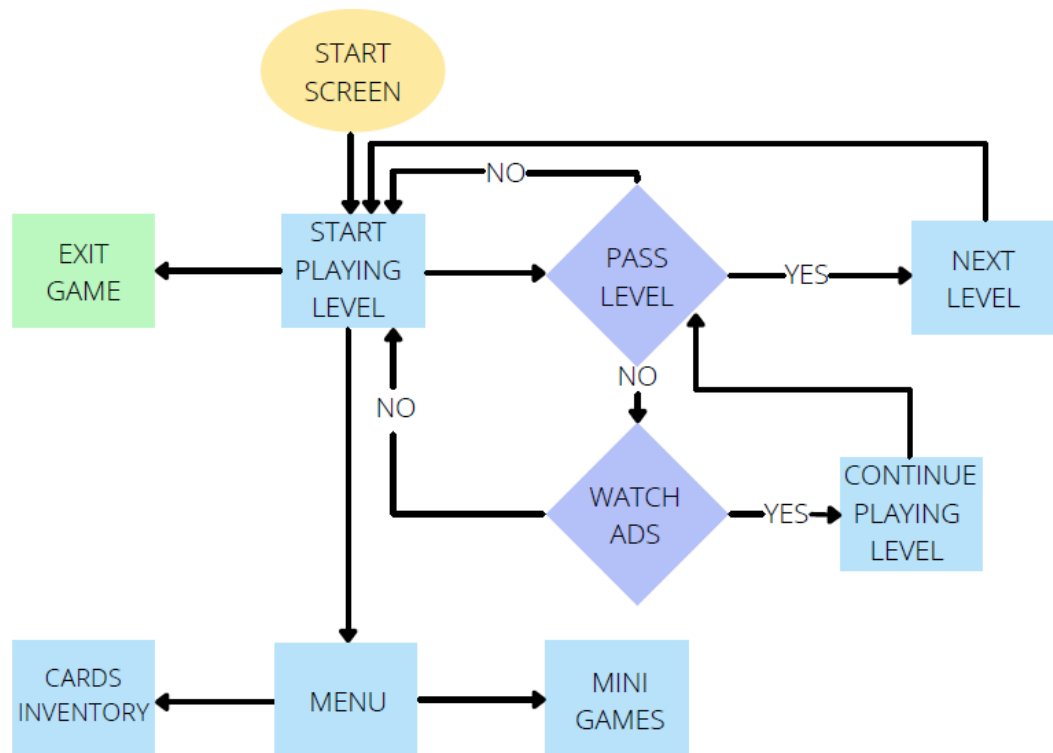
Figure 3. Flow Chart for the must-have features of the Memory Match Finnish prototype, first iteration (Apache 2021).

Usability test

Usability tests were conducted with two participants, to analyze the user interaction during the game state playing, in the play screen, not yet completed or failed level. The tests were made using a Lo-fi prototype, which can be seen in Figure 4.
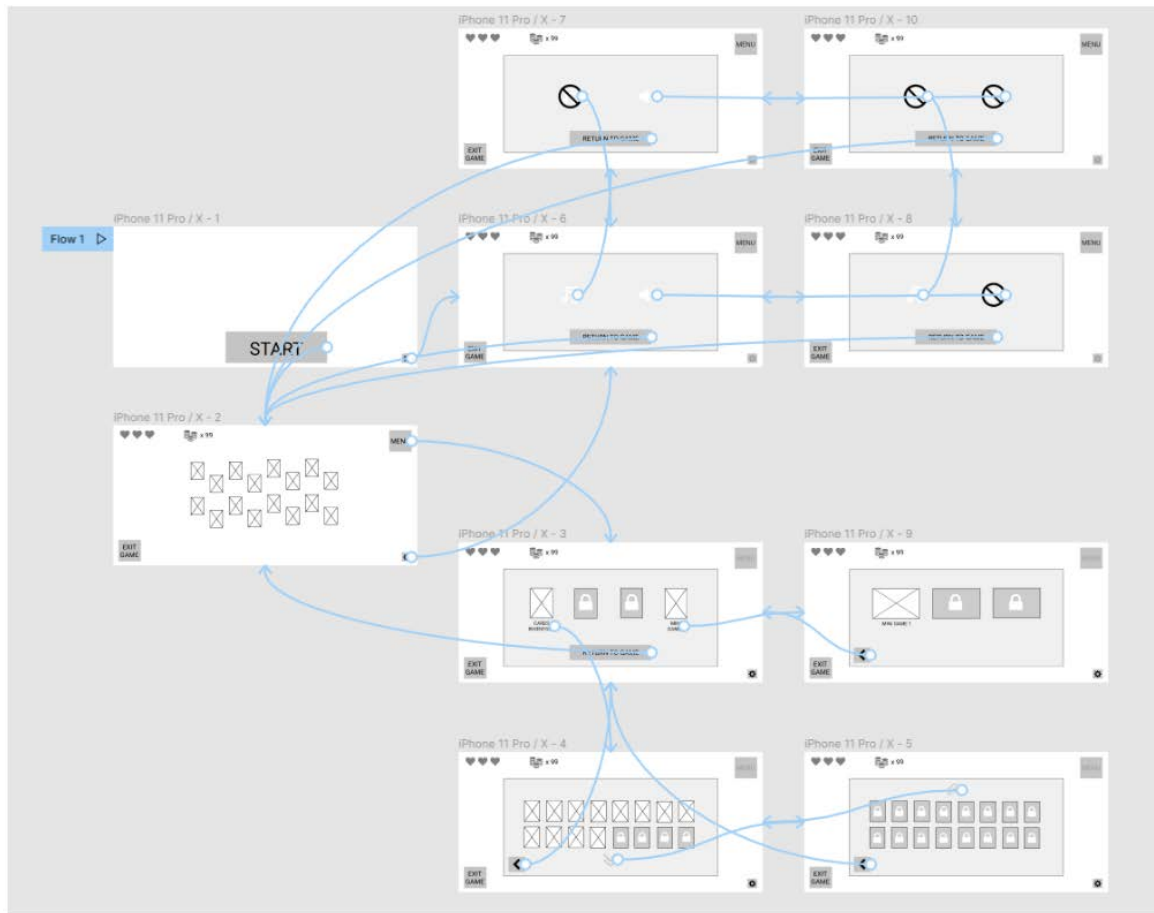
Figure 4. Wireframe and usability test for the Memory Match Finnish prototype, first iteration (Apache 2021).

A link to this interactive prototype can be found in the list of references, and the complete usability test report has been included in the appendices section.

The results provided the following data:

• The text in the button was key for the participants to know what to do.
• The settings icon and the arrows were familiar, the participants knew what actions would be triggered by pressing them.
• Inside the menu screen and the settings screen it was not clear to the participants what to do.
• One participant did not remember where to find the card inventory from the play screen.

The conclusion from these tests was that the usability has problems due to a lack of clarity on some screens, as well as too many clicks needed to access some content. Based on this feedback, the following changes were later implemented for the development of the prototype:

• Fewer clicks to access content.
• Clearly defined buttons and icons.

A wireframe with these changes implemented and using the final in-game assets can be seen in the image below. An even simpler wireframe, which corresponds to the adjusted scope for the final MVP used for this research. These new approaches did not have usability tests separated from the game tests. A further chapter presents detailed information about the visual design of the user interface.

4.4.3   The visuals

After the adjustments were made on the tests with the paper prototype, the development of the digital prototype started with the creation of the graphic assets. For this, it was necessary to decide on an art style and color palette that would match the theme and fit the mechanics. Being a game with casual mechanics thought to be played on mobile devices, the art should be simpler and easier to read than it would for a game that is played only on a big screen. That can be accomplished through the use of basic shapes for very clear silhouettes, well-defined colors, and contrast.

The overall style of the game art was thought, since the beginning, to be 2D stylized; and the game levels are static, a layout of cards showing on screen, therefore, the background could be whether a plain color, a seamless pattern, or an illustration. The option chosen was a winter landscape, which fits the theme of the Finnish language since it is a landscape associated with Finland. The first illustration for the background included the sun shining through the branches of trees, but after testing this image and receiving feedback, it was noticeable that the bright sun catches too much attention on the screen and can interfere with

the game elements, thus, the sun was removed from the illustration, having as a result a very subtle background that gives context and does not disturb the game experience.

The cards

The original design of the cards ideated during the pre-production phase consisted of a triangular vertical shape, using light colors for the background and dark blue for details. The back of the cards used one background color and the front of the cards was divided into two sections, the section showing the picture and the section showing the written word. These two sections had different colors. The color of the background would also change depending on what kind of vocabulary the card is showing, in the example below, light blue for nature (a card showing a tree) and ivory for buildings (a card showing a house); whereas the color of the card's section showing the written word would remain the same in all cards, for consistency in the design. The corners of the cards had a slightly rounded design.

The cards were completely redesigned during the production phase. The main change was the decision to use the colors white and blue resembling the Finnish flag, for both the back and the front of the cards, being the only difference that the front of the cards includes the illustration of an object and the corresponding word in Finnish. The first iteration of this concept had cards with sharp edges and a light-colored background in the section where the word is written. The word is written in lower case and bold type, and the cards also had a representation of casted shadow in the right and bottom edges, to give the illusion of depth when displayed on the screen.

In a second iteration of the design, the corners were changed to be rounded again, for a softer look, and the ratio changed slightly to make them less elongated. Other changes were the elimination of the light background for the section, keeping only a white background for the entire card, and switching the type from lower case to upper case. The chosen font for the vocabulary in the cards was the Montserrat Font in semi-bold form.

These design decisions were made considering easier readability of the cards, and a better fit with the theme, including a representation of the Finnish flag for cards showing words in the Finnish language. The evolution of the card design can be found in the appendices.

The character

For the digital prototype, it was decided that there would be only one character. The first design of the character was ideated during the preproduction phase and it was a moose in a sitting position, with two variants, normal and leveled up. The leveled-up moose would be wearing a scarf of colors white and blue, referencing the Finnish flag, as a visual cue indicating that the character has been leveled up.

This design was later changed to have an anthropomorphic shape and position, standing on two legs. This decision was made for a technical reason, the character needed to be animated, and the animation cycle of the character sitting was too complex for the developer's current 2D animation skills, whereas simple animation cycles for an anthropomorphic character were easy to handle. For the prototype, the character would not be leveled up, so the scarf accessory was not included in this version of the character.

During this phase, six different animation cycles were designed for the character, as shown below; idle, showing pairs of cards, accommodating glasses, sad, celebration, and peltors on.

The animations were intended to be used during different game states to give visual feedback to the player. The evolution of the character design and animation cycles can be found in the appendices.

The UI art

The main colors for the UI are brown, green, blue, and white; varying in shades. Other colors are included in lesser amounts for certain elements when needed. The color palette slightly changed during the development. In the first iteration of

the UI design, the boards were designed to look like wood panels with rough edges, but this design was later changed into more polished boards with straight edges and rounded corners.

For the buttons, the first iteration was a very simple design, with the corners slightly rounded and a faint shade of a warmer hue when the button is clicked. This design changed later on as well. The final version of the buttons was designed with a brown frame around and below them, to convey the idea of wood. The buttons that are placed over the game's background have an extra outer frame resembling a lighter wood texture, the same as used in the boards, to communicate that the buttons are placed over a wood surface; whereas the buttons that are placed over boards have only the dark brown frame. When the buttons are clicked, the size reduces slightly and the dark brown frame appears bigger, this gives the effect that the buttons are being pressed or pushed down (Apache 2023).

The button for exit the game and the arrows to move through the inventory board changed from the first design to the final one, as shown in the figure. Other UI elements such as hearts to represent lives, coins and gems to represent currency, and a video icon were also designed and changed during development.

The fonts chosen for the UI are Digitalt Font and Montserrat Font. The Digital Font was chosen because it has a bold look, is thick, and has sharp angles, which makes it a good fit for the wooden boards. It is also easy to read and catches the eye's attention (Apache 2023). For the numbers used in stats, it was chosen the font Montserrat, which is the same one chosen for the vocabulary in the cards.

For the title it was used the Digitalt Font in two different colors. The first part of the title has the same wood texture as the boards, and the second part of the title uses the same blue as the Finnish flag in the cards, with a yellowish white on the top of each letter to resemble snow (Apache 2023). A congratulations text that

shows when the player completes a level was also designed using the Digitalt Font with wood texture.

The UI elements were combined in different ways to provide feedback to the player in the different game states, some samples can be seen in the figure. However, due to time constraints, the final MVP did not include the majority of the UI elements. Complete documentation about the UI design can be found in the appendices and the list of references.

4.4.4 The educational content

The original concept of the game aimed to include commonly used nouns in the Finnish language regarding different topics. For the paper prototype, a variety of vocabulary was included within the same levels. However, for further development, it was decided that the vocabulary would be distributed in nine different categories, each with a given number of levels. It was also decided that in addition to nouns, the game would also include simple sentences of daily use in each category, although due to time constraints, it was not possible to include full sentences in the MVP developed for this research.

The nine categories of vocabulary are numbers, days and months, food, travel, study and work, home and family, hobbies, health and body parts, and nature. An extra category, clothing, was considered at this stage. For the selection of a category, it would be shown a map screen in which the player can freely move the character to select the desired category. Each category would include several levels with nouns and sentences exclusive to that category. A sketch of the map ideated for this game state is included in the appendices.

The MVP developed for this research consisted of 20 playable levels within the food category. The vocabulary included consisted of 36 words of difficulty levels from 1 to 3. The difficulty levels of the words are decided upon the number of syllables, being one and two syllables difficulty level 1, three syllables difficulty level 2, four syllables difficulty level 3, and five or more syllables difficulty level 4.

The following table shows the distribution of the words within the 20 playable levels.

The distribution of the words within the levels is designed so the difficulty curve of the levels matches the difficulty level of the words, being the words of level one more often presented in the first levels of the game, and the most difficult words introduced later on further levels. The distribution also uses spaced repetition in the design, mixing in each given level words that have been presented before, as well as new words. As shown in the figures, the two first levels of the game are the only ones that present completely new words, not repeating words from level one in level two of the game.

The audio as an educational aid

The main audio feature is the voice-over for the Finnish vocabulary, this feature is necessary for the core loop and the educational objective of the game. When a pair of cards are correctly matched, the voice-over corresponding to the word would play automatically. When the player accesses the inventory to review previously unlocked vocabulary, there is an option to listen to the audio again by clicking a button, as many times as the player desires. However, for the current prototype, the inventory is working only for the words unlocked in the first level of the game.

Other audio features, although not directly related to the educational content, are the sound effects and the background music. The background music was an arrangement of a classic Finnish tune, to fit the theme of the game; and sound effects were added to the actions of flipping cards, matching pairs of cards correctly, clicking buttons, and completing a level. The sound effects are important to provide feedback to the player about the current game state and actions performed.

4.4.5 Development challenges

The development of the project presented several challenges along the way, such as resources and time constraints, as well as limited skills and a small team

(1-3 people). The most relevant challenges were scope, vocabulary readability, UI readability, language knowledge, and technical issues when using the chosen game engines. Details about these specific challenges are detailed next.

The scope, as explained earlier, was reduced progressively until finally decided on a very minimalistic version of the MVP, which was the one used for this research. This was a result of other challenges such as a small team, time constraints, and limited skills and experience with the game engines. The game engine used for the prototype was Unity, but the final version used for this research was developed in Construct 3. This change happened because the Unity developer left the team, so it was necessary to choose a new engine that the one-person team could use at least to a level enough to put the game together.

In the first iteration of the MVP with the final design of the cards, the typography was on a size big enough to be perfectly readable on big screens, but not on mobile devices screens. For this reason, it was necessary to resize until the word was easy to read without being inconvenient on mobile device screens. However, no matter how big the typography, the word was easy to read when the cards showed on the screen on a big size, which happens when cards are paired correctly and in the inventory, but not when the cards are displayed in the layout, where they have a much smaller size. To solve this problem, as shown in Figure 5, it was decided that the cards when appear in the layout would not display the word, but dots representing the number of syllables, and the word is only visible when the cards are paired correctly.

Figure 5. Sample of the cards' modification for better vocabulary readability (Apache 2023).

Since the first UX test, it was clear that the UI needed to be very clear with visual cues only, so the player would not have to rely on the text to understand the information presented and the available options to do next. Finding a solution to this problem was the base for the UI design, which has been already explained in a previous chapter. In the first iteration of the MVP, however, the screen in some game states would look cluttered, which creates a lot of visual noise. For this reason, a main change was made in the development of the final MVP, which was removing the layout board during the play state, and having the cards layout displayed directly over the background of the screen, which is a winter scenery in very light colors. The result of this change can be seen in Figure 6.

Figure 6. Sample of the changes made to the UI for the final Memory Match Finnish prototype (Apache 2023).

Other UI elements were eliminated from the final MVP due to time constraints to implement the features that had been designed for the previous prototype.
The main developer of the game is not a native Finnish speaker, which caused some delays in the development, and typos, later fixed by another member of the team who is a native Finnish speaker. Design documents and material produced during the development can be found in the appendices, and the link to the playable MVP can be found in the list of references.

5 PLAYTESTS

5.1 First tests

The first tests of the digital prototype were done with five players ages 6, 8, 11, 66, and 71 who had not had any previous contact with the Finnish language. The prototype at this stage of the development consisted of ten playable levels that included a total of 22 cards representing 22 nouns in the Finnish language. The levels were designed with a difficulty curve that increases both the difficulty of gameplay by increasing the number of cards in the layout, and the difficulty of the words portrayed in the cards.

For this test, the participants played the ten levels consecutively, only one time, while the developer was observing. After playing the ten levels, the players were asked to answer a questionnaire that consisted of matching the images from the cards in the game with their corresponding nouns, from an array of three different word options. Later, another test was conducted, increasing the difficulty by not providing any written options, but asking the players to type next to a given image the corresponding word.

Being this a test in which the developer was physically present with the participants, there was an opportunity to observe their behavior rather than just rely on a questionnaire. This approach was very valuable in gathering data otherwise more difficult to obtain, such as partial memory of vocabulary and confusion with some of the cards. This is explained in the first test results chapter next.

5.1.1 First tests results

The results of the test showed that players remember over 90% of words when asked to choose the right word corresponding to an image from three-word options, but that percentage decreases when they are not given any option, but asked to type the correct name of the image showed. The results also showed that the younger participants take less time in completing the levels, and remember a considerably higher percentage of words than the older participants.

The tests also showed that for most of the words that the players do not remember, they do remember partial syllables or letters conforming to that word. This was typically observed in words that include double letters, whether consonants or vowels. The sound was also crucial in the memory, several times the participants did not remember how to write a word, but had a close enough recollection of how it was pronounced.

It was also noticeable that the participants remembered more easily and faster words that were similar to their native language (Spanish). This happens whether the meaning of the word is also the same as in their native language, or the

similarity is only in the sound but refers to a different word than the one sounding similar in their native language. The participants used this mental resource of familiarity to remember the vocabulary with resemblance. In addition, for some of the words remembered, the participants remembered how they were written but they pronounced the letters according to their native language pronunciation.

In a different association with another language, one of the participants during the test wrote the English word instead of the Finnish word for one of the images presented. The word was correct for the image, but not in the Finnish language. This participant has a very basic level of the English language. There was also confusion between words, which happened because they were written similar, or sounded similar, or various cards looked similar, as shown example in Figure 7.

The images presented below are some of the cards that are confused because of visual similarities.
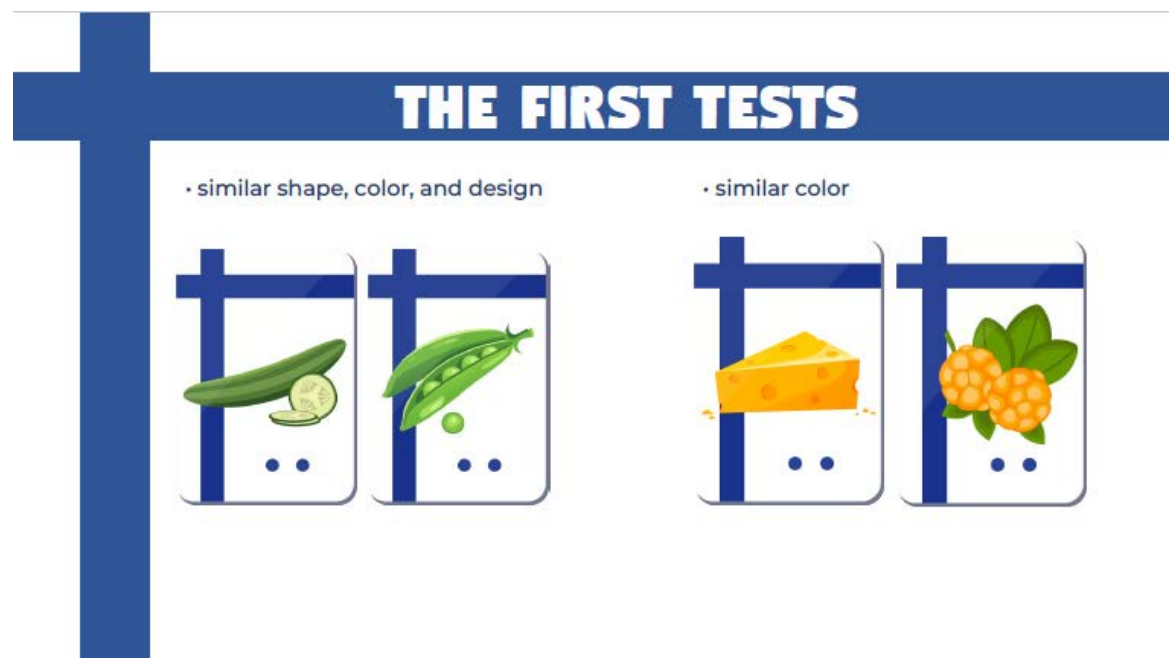
Figure 7. Sample of cards with similar visuals in the Memory Match Finnish prototype (Apache 2023).

5.2 Final tests

The final tests were conducted online with participants from different demographic backgrounds, locations, and levels of knowledge of the Finnish language. The test consisted of asking the participants to play the final version of the prototype, which includes 20 playable levels and 36 words, then, fill in a questionnaire aimed to measure the recollection of vocabulary after playing the game, as well as general feedback about the playing experience.

The questionnaire included optional questions to gather demographic information about the participants, 13 questions about vocabulary recollection from given images, 7 questions about vocabulary recollection from voiceovers, 6 required feedback questions, and 6 optional feedback questions. A total of 13 participants tested the game and answered the questionnaire.

Some of the participants are XAMK students, others do not have any affiliation to XAMK. The playable prototype and the test were sent to possible participants starting from October 30 to November 9 and gathering answers until November 15. A link to the questionnaire can be found in the appendices.

5.2.1 Final test results

As the results of the first tests had shown already, the final tests also presented a high recollection of vocabulary after one game session in the questions of multiple choice where the participants are shown one card and three different words to choose from the corresponding word they consider correct for the given card, and a decrease in the percentage of recollection when they are shown a card but not words, but asked to type the word from their memory instead. The percentages graphic can be seen in Table 6.

Table 6. Percentage of correct answers in the final tests of the memory Match Finnish prototype (Apache 2023).

METHOD OF VOCABULARY RETRIEVAL	PERCENTAGE OF CORRECT ANSWERS
Show an image and give three words to choose from, one correct and two incorrect	86,8%
Show an image and ask to type the corresponding word	29%
Ask to listen to the pronuntiation of a word and type the corresponding word	30,7%

Confusion of some words was also observed, as in the first tests, seemingly due to images looking similar or to similar sounds. An example of this, as seen in Figures 8 and 9, is the word lime, presented in a card illustration and given the options limu, which is pronounced and written similarly but looks very different on the card, lime, which was the correct answer, and sitruuna, which looks similar in the card but is pronounced very differently. For this particular word, 76,9% of the answers were the correct option, 15,4% of the answers were the word sitruuna, and 7,7% of the answers were the word limu.

Figure 8. Vocabulary question 1 of the memory Match Finnish prototype (Apache 2023).
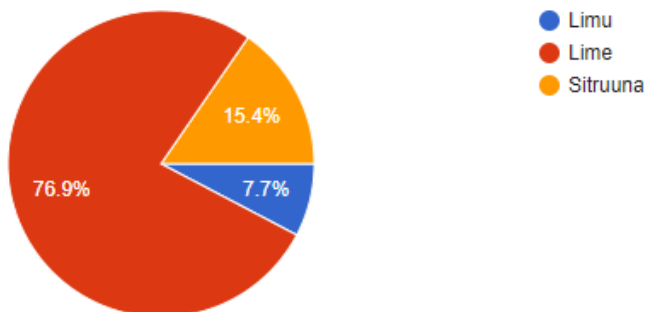
Figure 9. Percentage of answers for the vocabulary question 1 (Apache 2023).

For the card showing the kinkku image, 69,2% of the answers were the correct word and 30,8% were the word kurkku; which shows clear confusion from how similar the words sound. The word lakka could be associated with a confusion in audio as well since there was 7.7% of answers corresponding to the word liha when shown an image of lakka. Both these graphs can be seen in Figures 10, 11, and 12.
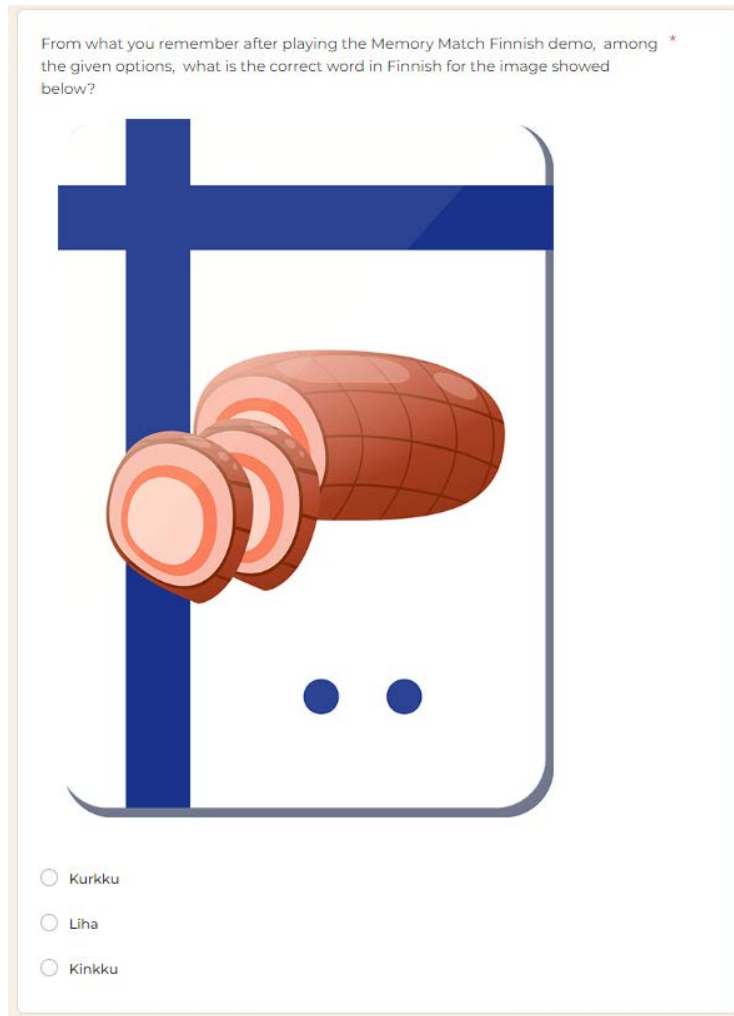
Figure 10. Vocabulary question 2 of the memory Match Finnish prototype (Apache 2023).

From what you remember after playing the Memory Match Finnish demo, among the given options, what is the correct word in Finnish for the image showed below?
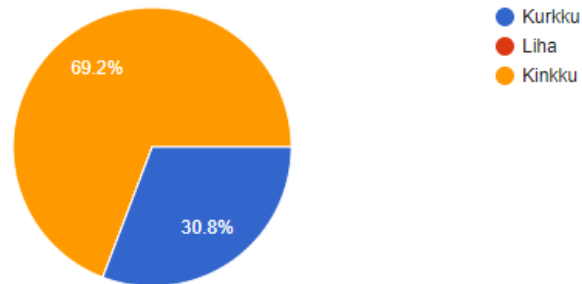
13 respuestas

Figure 11. Percentage of answers for the vocabulary question 2 (Apache 2023).

From what you remember after playing the Memory Match Finnish demo, among the given options, what is the correct word in Finnish for the image showed below?

13 respuestas
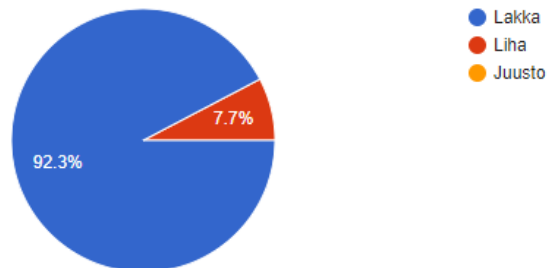
Figure 12. Percentage of answers for the vocabulary question 3 (Apache 2023).

Another confusion happened with the card showing the hodari image, which had 84,6% of correct answers, and 15,4% of incorrect answers, being 7,7% makkara and 7.7% porkkana. This could indicate confusion due to the visuals, since the layout and colors of the cards showing the hodari, makkara, and porkkana images are similar, as seen in Figures 13 and 14.
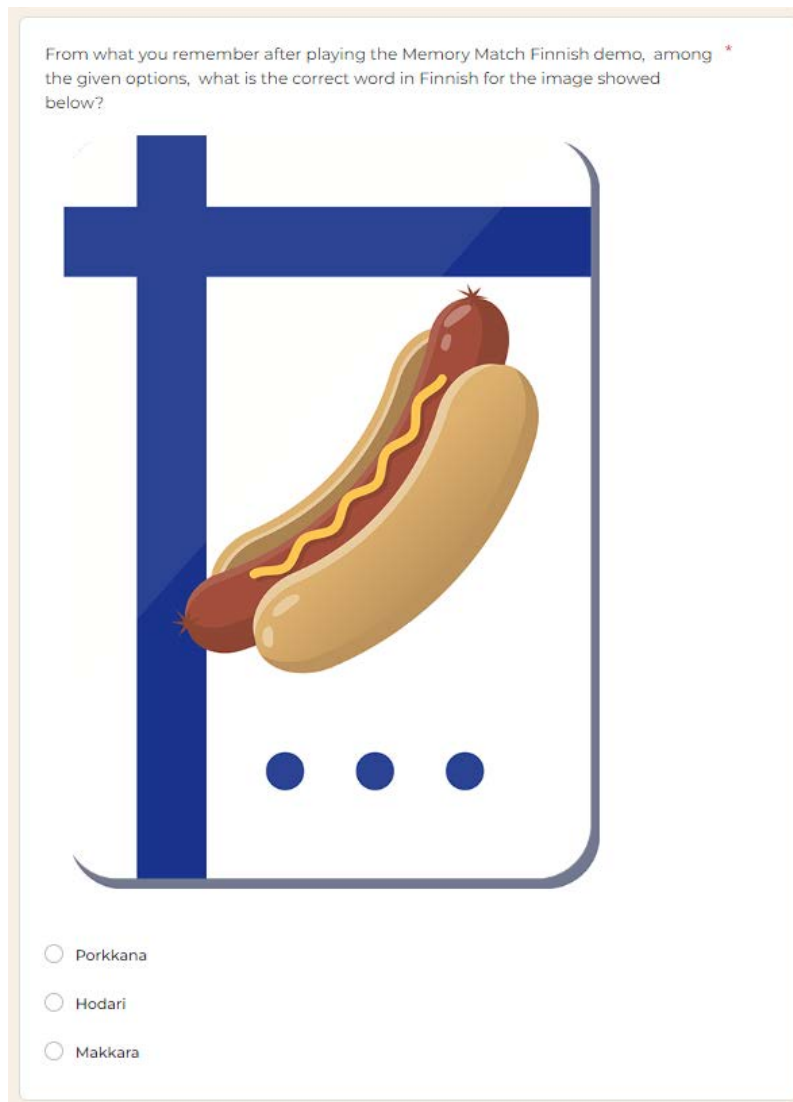
Figure 13. Vocabulary question 6 of the memory Match Finnish prototype (Apache 2023).
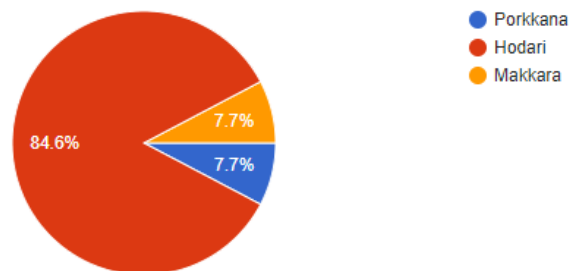
Figure 14. Percentage of answers for the vocabulary question 6 (Apache 2023).

The word jäätelö, when showing the card and given three word options, despite being misspelled in the prototype (o instead of ö), did not have any incorrect answer. It was the only word with 100% of correct answers, other words, in all the three different kinds of memory evaluation, showed some percentage of error in the answers. The fact that it was the only question correctly answered by all the participants, despite having an error, can be an indication that correct grammar might not be a decisive factor in the memorization process and understanding of the meaning of the word. An error like this can be technically a mistake, but it is arguable if it is of high importance for the purpose of learning a language to a conversational level, which is simply to understand and be understood. However, that is not the topic of this research.

As for the questions in which it was required from the participants to type the word corresponding to the given image, it was found that the majority of incorrect answers are actually partially correct, the errors show some missing letters or partial recollection or syllables. A sample of this result can be seen in Figures 15 and 16.
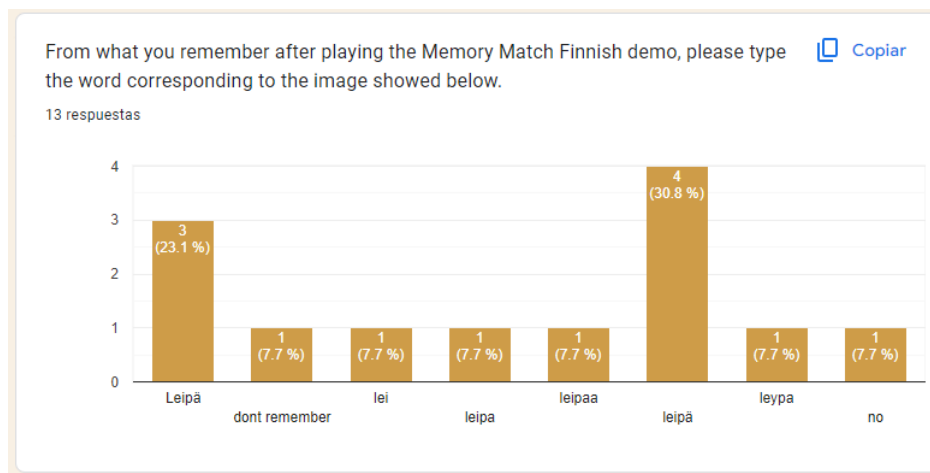
Figure 15. Percentage of answers for the vocabulary question 9 (Apache 2023).
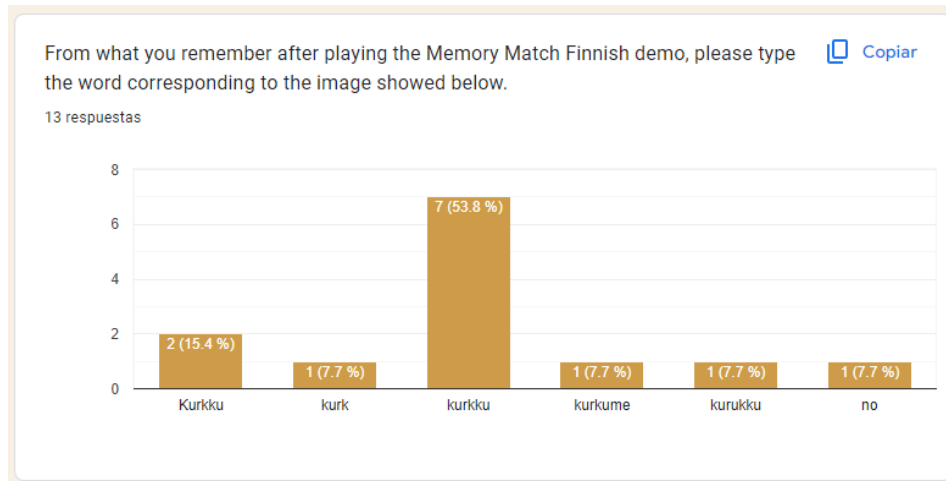
Figure 16. Percentage of answers for the vocabulary question 10 (Apache 2023).

This is consistent with the results of the first tests. The same behavior occurred when the participants to type the word from listening to the pronunciation, but not seeing any image. A sample of this can be seen in Figures 17 and 18.
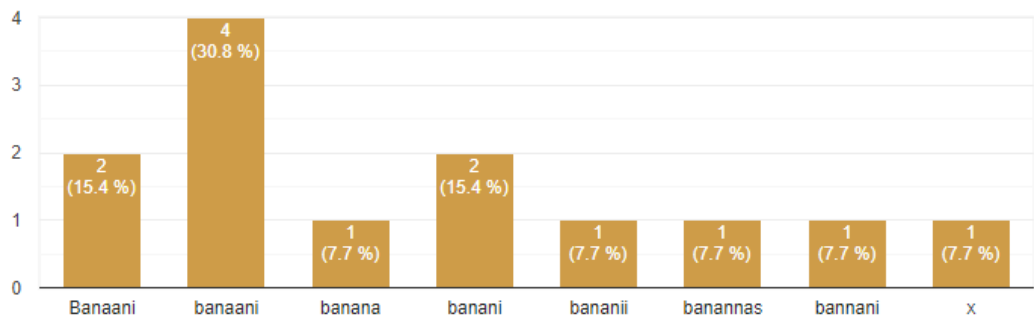
Figure 17. Percentage of answers for the vocabulary question 13 (Apache 2023).
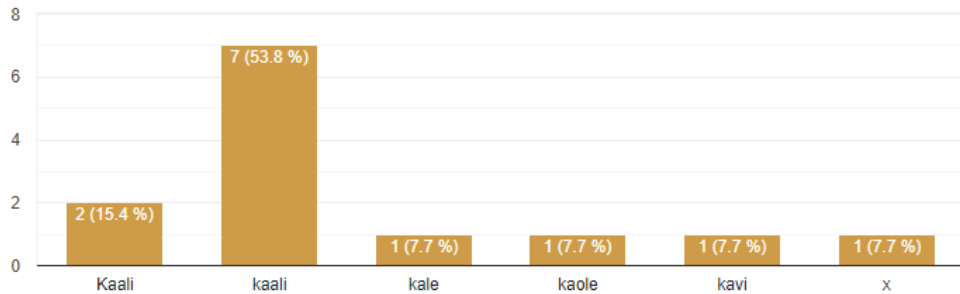
Figure 18. Percentage of answers for the vocabulary question 14 (Apache 2023).

General feedback

The participants were asked to evaluate the prototype in the categories of fun, ease to understand how to play it, and usefulness in helping to memorize vocabulary. The punctuation given can be found in Table 7.

Table 7. Punctuation was given to the Memory Match Finnish prototype in the feedback questionnaire (Apache 2023).

ASPECT EVALUATED FROM 1 TO 5	PUNCTUATION
FUN TO PLAY	3,6
EASE TO UNDERSTAND	4,6
USEFULNESS IN MEMORIZING VOCABULARY	4,0

The reasons some of the participants mentioned to find the game fun included stress relief, enjoyable experience, interesting to play, and being educational. Other participants gave reasons for not find the prototype fun enough, such as a repetitive soundtrack, too easy, the controls not being responsive enough, and a

slow pace. For the ease of understanding how to play, the most common reason why the participants found it easy to understand how to play was the familiarity they had with similar mechanics. Other reasons are easy interaction with the game, clear rules, and being just a matter of concentration.

The most common reason that some participants mentioned to find the game useful to memorize vocabulary was the combination of images and sound. Other reasons are repetition and gamification. One participant rated the game with a low grade in this matter, their reason was that the images in the cards are sometimes confusing.

The elements of the game mentioned as the most likeable were the animal character, the design of the cards (resembling the Finnish flag), and the pronunciation. Among elements disliked, the most mentioned was the background music, for being repetitive and interfering with the gameplay. Other elements mentioned were the bugs. The list of bugs corresponds to technical issues, so is not being analyzed in depth in this research. The full report of bugs found by the participants is however included in the appendices with the rest of the questionnaire. Suggestions for further development mentioned by the participants included adding more content, words and sentences, also content that would be more practical. Other suggestions included to have a pause feature, use more than one soundtrack, and improve the transition time when cards are matched.

6   CONCLUSION

The purpose of this thesis research was to identify the key elements that take part in the development of a digital prototype of an educational video game, more exactly, a video game to memorize vocabulary in the Finnish language. This report includes a review of previous research about language learning, in particular, the concept of spaced repetition and the use of imagery in learning a new language, and the development process of a prototype of an educational game to memorize Finnish vocabulary, using matching pairs of cards as the main mechanic.

The development of the prototype passed through different stages, starting with ideation of the concept, market research, and paper prototype. After the tests with the paper prototype, the initial concept had many changes until ultimately became the concept for the digital prototype developed and tested. Upon analysis of the results, as well as previous literature on the topic and the main competitor language learning apps, it is possible to identify as key elements in an educational video game, the following.

Spaced repetition

The methodology of spaced repetition is already widely used by educational apps and games, including the ones reviewed during the market research, and it was also the main concept utilized for the development of the prototype Memory Match Finnish. The results and the feedback from the participants in the tests confirmed that being exposed to repetition of the vocabulary enhances the recollection of it after playing the game.

Use of images

The use of images representing the words was also a crucial factor, especially when combined with sound. The overall aesthetics of the game was something that the participants of the tests mentioned to like, so having a generally appealing look in all the game elements, even if not directly related to the learning process, might also be beneficial for an enjoyable experience.

Easy interaction

How easy or difficult the interaction with the game is also plays a crucial role. In the first usability test, there was some confusion, which was later eliminated with the changes made in the UX and the UI design for the two versions of digital prototypes created. For the final prototype, used in the tests, the UI was reduced to the minimum, and the feedback from participants in the test was favorable

when it comes to usability. An easy interaction allows the participants to focus on playing the game without distractions or extra effort about how to play it.

On the downside, the game had some bugs regarding the response of the controls, which had a negative impact on the overall experience, possibly affecting the learning outcome.

Sound

As mentioned above, the use of voiceovers with the pronunciation of the vocabulary was a key element in allowing the participants to remember vocabulary after a game session. Other sounds however, proved to be distracting and interfere with the experience. This is the case of the background music, which according to feedback from the participants, becomes repetitive and annoying after playing several levels in a row, as well as some sound effects not performing nicely.

Educational content

In an educational game, what educational content to include is a key element. The decision of what content to include depends on the mechanics of the game, the target audience, and expected learning outcomes. The feedback received from participants in the test included suggestions such as including more and more practical vocabulary, as well as practical sentences of daily use. This is a feature already considered for further development, that was not included in the current prototype due to time constraints.

Gamification

Gamification is what makes an educational game different from any other educational activity. Although gamification is not an important aspect of education, necessarily, it is a matter of high importance when designing an educational game. As reviewed in the literature, the balance between fun and

educational content has to be optimal for an educational game to be entertaining as well as achieve the learning outcomes intended. In the design of the Memory Match Finnish prototype, aligning the difficulty curve of the complexity of gameplay and the complexity of vocabulary presented to the player was the approach to create this balance.

Considering the previous elements as the most important in an educational game as a final product, it can be concluded that the same elements are important in the development of a prototype. For the development process however, there are other elements to consider, such as the scope, which might be defined by constraints in time and resources, as well as the team size, previous research of similar products and target audience, understanding of the topic (in this case, the Finnish language), paper prototype, and testing both paper and digital prototypes.

From the experience developing the prototype of Memory Match Finnish, it is possible to conclude that the most important element during the development process was prototyping and iteration according to feedback. The changes made to the original concept of the game based on the paper prototype proved to be very useful for the ideation of features for further development, as well as adjustment of pace and balancing. Unfortunately, the digital prototype developed for the final tests had to be reduced in scope, the reason for which some features that had proved to enhance the fun of the game during the paper prototype had to be left out in this iteration.

These changes affected the fun of the prototype, as can be seen in the evaluation of the fun aspect in a previous chapter, however, more tests would have to be made to determine if less fun has an impact on the learning process. A preliminary conclusion could be that it plays a role, since one of the participants in the test of the digital prototype also participated in the test of the paper prototype, and the recollection of vocabulary during the paper prototype was higher than when playing the digital prototype. Only one participant is not enough to determine a conclusion, but it is a good hypothesis for further tests.

All in all, the development of an educational game showed not to be very different than the development of an entertainment game, in most stages of the process.

The educational aspect however it is the differentiating point, and in this regard, the most important element that can be concluded is that it is necessary the participation in the team of a person with broad knowledge of the topic, in this case, the Finnish language. Lack of a person with such knowledge can lead to mistakes, such as one made in the misspelling of the word jäätelö in the game, in which the ö was wrongly spelled as o.

To conclude, this research has confirmed some of the conclusions achieved by previous authors on the topic of educational games and language learning through gamified elements, mostly on the use of spaced repetition and imagery to facilitate the learning process. It has also shed some light on the development process, helping understand from first-hand experience the elements that are key in the development, highlighting the importance of testing and iterating according to feedback.

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LIST OF FIGURES

LIST OF FIGURES

INFOGRAPHIC OF THE GAME CONCEPT

ASSUMPTION MATRIX FIRST ITERATION

MEMORY MATCH FINNISH
ASSUMPTION MATRIX

Increasing Importance

If this assumption is not true, the concept might fail

There is a group of people who want to learn Finnish as a second language

Some people who want to learn Finnish as a second language want to have an easy and fun way to help them learn it

The concept is still viable without this assumption being true

Some people who want to learn Finnish as a second language have taken or are taking academic courses of Finnish language

Some people who want to learn Finnish as a second language are also hard core gamers

It is easy and quick to test

It takes time and resources to test

Increasing Difficulty to test

PAPER PROTOTYPE

GAME LOOPS

Run out of
lives/currency

Watch Ads

Get extra
lives/currency

Match Pairs/
Unlock vocabulary

Next Level

Play
mini-games

Review
vocabulary

Match cards/
Reveal vocabulary

Next Level

Earn Rewards

Unlock
characters

Get help from
Characters

Feed
Characters

SWOT ANALYSIS

MEMORY MATCH FINNISH
SWOT ANALYSIS - GAME FEATURES

STRENGTHS

• Free to play
• Higher gamification than others
• Unique learning method (not based on translation)
• Quick learning progress
• Deeper immersion than others
• Linked to other learning resources
• Iconic character

WEAKNESSES

• Limited content
• No voice recognition feature
• No ranking/leaderboard

OPPORTUNITIES

• PC/Web version possible
• Presence in other media
• Scalable to other languages

THREATS

• Similar apps with more/better content

MEMORY MATCH FINNISH
SWOT ANALYSIS - RESOURCES

STRENGTHS

• Knowledge on game design and development
• Knowledge on pedagogy for teaching languages
• Passion and dedication

WEAKNESSES

• Small team
• Limited budget
• Little experience in the field

OPPORTUNITIES

• Networking

THREATS

• Sustainability over time

MEMORY MATCH FINNISH
SWOT ANALYSIS - MARKET

STRENGTHS

• A high percentage of the audience is familiar with language learning apps
• Mylly organization is interested in the game (as a tool to help immigrants learn the Finnish language)

WEAKNESSES

• Possible low retention rate

OPPORTUNITIES

• Increasing audience
• Presence in other media

THREATS

• Small target audience
• Main competitor dominates the market

MEMORY MATCH FINNISH
SWOT ANALYSIS - MAIN COMPETITOR

STRENGTHS

• Gamified features
• Iconic character
• Professionals in language teaching design the app chapters/lessons
• Over 40 million active monthly users worldwide
• Basic content free
• PC/Web version available

WEAKNESSES

• Some mistakes in the language (spotted and reported by native speakers)
• Limited content
• Learning method based on translation

OPPORTUNITIES

• Increasing audience
• Finnish is the second most studied language in the app in Finland
• The app has many languages not only Finnish

THREATS

• Mobile devices technical issues
• Mobile version doesn't display all the information easily

PERSONAS

NAME: Anun Mal
GENDER: Female
AGE: 27
LOCATION: Finland
STATUS: Single
OCCUPATION: Master's Student

BACKGROUND
Born and lived most her life in Bahrain. Moved to Finland to study a Master in International Business.

GOALS
• Graduate from the Master.
• Find a job in Finland.
• Stay living in Finland.
• Learn Finnish language.

ABOUT STUDY THE FINNISH LANGUAGE:

MOTIVATIONS
• To have better job and further studies opportunities in Finland.
• Socialize with Finnish people better.
• Build strong friendships with Finnish people and probably establish a romantic relationship with a Finnish man.

FRUSTRATIONS
• The Finnish language has too complicated grammar for her.
• The academic courses on Finnish language are overwhelming and complicated to follow.
• The Finnish language taught in academic courses is too formal and is barely useful in real daily life.

PREVIOUS EXPERIENCE
• She has used Duo-lingo and other language apps for short time, she has found them helpful but become boring after a while.
• Plays casual mobile games every now and then. Mostly Match-3 puzzles.

EXPECTATIONS
• Learning the Finnish language in a way that doesn't make it feel so difficult and frustrating.
• Learning real daily-life use of Finnish language, not only the formal she studies in academic courses.
• Progress within a time-frame that makes her feel she is actually learning instead of taking too long to actually see some progress.

HOBBIES
• Going out to social events
• Take walks around the city, visit new places
• Take pictures of the city/lifestyle with her phone

PERSONALITY TRAITS
• Charming
• Outgoing
• Likes to socialize, attend to events and meet new people.
• Enjoys studying but dedicates weekends to friends and hobbies.

TECHNOLOGY
• Laptop
• iPhone

SOCIAL MEDIA
• Facebook
• Instagram
• LinkedIn

GAME MOTIVATION MODEL

• Social (Competition, ranking)
• Achievement (Completion)

NAME: Sandra García
GENDER: Female
AGE: 38
LOCATION: Finland
STATUS: Single
OCCUPATION: Spanish Language Teacher

BACKGROUND
Born and lived most her life in Spain. Moved to Finland to work as a Spanish teacher in a language's institute.

GOALS
• Continue in her current job and stay living in Finland.
• Socialize more with native Finns.
• Establish a romantic relationship with a Finnish man.
• Learn Finnish language.

ABOUT STUDY THE FINNISH LANGUAGE:

MOTIVATIONS
• Establish a romantic relationship with a Finnish man.
• Socialize with Finnish people better.
• Build strong friendships with Finnish people.

FRUSTRATIONS
• Doesn't have much time to study the Finnish language.
• Is very shy to attempt to communicate in Finnish.

PREVIOUS EXPERIENCE
• She has used Duo-lingo and other language apps to study English and French.
• She is a Spanish language teacher, so she is familiar with language learning processes.
• Doesn't play video games, only uses language learning, habits tracking and dating apps.

EXPECTATIONS
• Learning the Finnish language in a way that doesn't take much time of her busy schedule.
• To gain confidence to practice what she learns in real daily-life.

HOBBIES
• Connect with people online.
• Watch tv series.
• Read novels.

PERSONALITY TRAITS
• Introvert
• Hard-working
• Focused

TECHNOLOGY
• Laptop
• Android Phone

SOCIAL MEDIA
• Facebook
• LinkedIn

GAME MOTIVATION MODEL

• Mastery (Challenge)
• Achievement (Completion)
• Immersion (Story)

NAME: Hakim Abara
GENDER: Male
AGE: 32
LOCATION: Finland
STATUS: Married
OCCUPATION: Currently Unemployed

BACKGROUND
Professional Chef from Africa. Recently married to a Finnish woman and moved to live in Finland with her.

GOALS
• Find a job in Finland, preferably on his field.
• Establish a closer connection with his wife's parents, who don't speak English.
• Learn Finnish language.

ABOUT STUDY THE FINNISH LANGUAGE:

MOTIVATIONS
• Find a job in Finland, preferably on his field.
• Establish a closer connection with his wife's parents, who don't speak English.
• Socialize with Finnish people better.

FRUSTRATIONS
• He finds the Finnish language too complicated.
• He finds frustrating not being able to communicate better with his political family.

PREVIOUS EXPERIENCE
• Has used Duo-lingo briefly in the past to study English, but he mostly studied it traditionally.
• Currently studying the Finnish language in a languages Institue, beginners level.
• He plays FPS games every now and then.

EXPECTATIONS
• An app that supports his learning of the Finnish language.
• To make progress quickly.

HOBBIES
• Exercise.
• Cooking.
• Goes out for a run every morning.

PERSONALITY TRAITS
• Sociable
• Relaxed
• Disciplined

TECHNOLOGY   **SOCIAL MEDIA**
• Desktop   • LinkedIn
• Laptop
• iPhone

GAME MOTIVATION MODEL

• Action (Excitement)   • Achievement (Completion, Power)
• Social (Competition)   • Mastery (Challenge, Strategy)

NAME: Faadi Ebeid
GENDER: Male
AGE: 28
LOCATION: Finland
STATUS: Married
OCCUPATION: Currently Unemployed, Refugee.

BACKGROUND
Construction worker. Arrived to Finland as a refugee with his family (wife and three kids).

GOALS
• Find a job in Finland.
• Take care of his family.
• Learn Finnish language.

ABOUT STUDY THE FINNISH LANGUAGE:

MOTIVATIONS
• Find a job in Finland.
• Understand and adapt to Finnish culture.
• Socialize with Finnish people better.

FRUSTRATIONS
• He finds the Finnish language too complicated.
• He doesn't know English.
• He doesn't know how to read and write (not even his own language).

PREVIOUS EXPERIENCE
• Has never used any app or played video games.
• Just recently has an Android phone.

EXPECTATIONS
• An app to learn Finnish that is easy to use and does not require previous knowledge of English or any other language.
• To make progress quickly.

HOBBIES
• Watch tv.
• Playing with his kids.

PERSONALITY TRAITS
• Introvert
• Responsible
• Hard working

TECHNOLOGY
• Cell phone with Android.

SOCIAL MEDIA
• None

GAME MOTIVATION MODEL

• Action (Excitement, Destruction)
• Social (Competition)
• Achievement (Completion, Power)

SITEMAP

UI AND ART STYLE

BOARDS

The boards were designed to resemble wood boards, using two shades of light brown for the boards, and darker brown for the accent details and texture. The headers and other text on the boards are dark brown as well, to give the visual look of being carved in the wood board.

EMPTY BOARD

ASETUKSET

- ÄÄNET
- ÄÄNITEHOSTEET
- MUSIIKKI

SETTINGS BOARD

The texture details' opacity is dimished to 30% for a softer look. As with the buttons that include a light frame with wood texture, the buttons designed only with a dark brown frame create the visual effect of being pushed down when clicked, by making the button shape smaller so the brown frame looks wider.

INVENTORY BOARD

KORTTIKOKOELMA

KAHVI | MANSIKKA

The inventory shows the collection of cards that the player has matched correctly throrough the levels played. Each card has an audio option to listen to the word's pronuntiation. The AUDIO buttons in this board have a light wood texture frame in addition to the dark brown frame for better contrast with the card colors, over which they are partially placed. The inventory board has ARROW buttons on the bottom corners for horizontal navigation throrough the inventory.

SHOP BOARD

KAUPPA

X 20 | X 35 | X 60

OSTA | OSTA | OSTA

The shop shows the card-flips available to purchase during gameplay. The card-flips can be bought as long as the player has enough coins in the coin-counter. When the player doesn't have enough coins in the coins counter to make a purchase, the BUY button appears inactive, to visually communicate to the player that they cannot buy that card-flip at the moment.

PURCHASE CONFIRMATION BOARDS

When the player clicks the BUY button under a card-flip in the SHOP, a notification board appears to confirm the purchase, with the NO and YES buttons for the player to choose if continue with the purchase or not. When the purchase is to flip multiple cards, the number of the cards to flip appears in the same yellow color than the coins, as visual communication by association indicating that by confirming the purchase, the player is spending coins. These boards do not have a CLOSE button, the are closed automatically once the player clicks whether the NO or YES buttons.

VAHVISTUS | **VAHVISTUS** | **VAHVISTUS**

PALJASTA KORTTI ? | PALJASTA KORTTIA ? | PALJASTA KORTTIA ?

EI | 300 | EI | 300 | EI | 300

REVEAL 1 CARD CONFIRMATION | REVEAL 2 CARDS CONFIRMATION | REVEAL 4 CARDS CONFIRMATION

NOTIFICATION BOARDS

When the player clicks on a BUY INACTIVE button, or enters the SHOP without having enough coins to make a purchase, the NOT ENOUGH COINS notification shows up, with an offer to watch an ad in echange for 10 extra coins. A forbidden sign appears over a group of coins for visual communication showing that the coins are not available before watching the ad, also, the number of coins offered appears in the same yellow color than the coins indicating that the text refers to coins. The video offer is also communicated visually with the video icon attached to a group of coins next to the WATCH button. The CLOSE button gives the player the option to not accept the offer of watching am ad and return to the game.

EI TARPEEKSI KOLIKOITA OSTOKSEEN ! | KIITOS MAINOKSEN KATSOMISESTA !

KATSO | KIVA !

NOT ENOUGH COINS NOTIFICATION WATCH AD TO GET EXTRA COINS OFFER | THANKS FOR WATCHING MESSAGE GOT EXTRA COINS NOTIFICATION

If the player watches an ad, after the ad ends a notification shows informing the player that they have received 10 coins. In this notification the group of coins appears without the forbidden sign to indicate that the coins are now available. The NICE ! button appears for the player to accept the coins and return to the game. The CLOSE button will also close the notification and return to the game with the coins earned.

NOTIFICATION BOARDS

When the player loses all the lives, the GAME OVER notification shows, offering to watch an ad to get 3 extra lives. The offer is not communicated through words, but with visuals only, showing a heart that represents the game lives with the text X3, indicating the number of lives to earn, attached to a video icon, and the WATCH button underneath. The CLOSE button gives the player the option of not watching an ad, but close the notification and return to the game screen.

PELI LOPPUI

KATSO

GAME OVER NOTIFICATION
WATCH AD TO GET EXTRA LIVES OFFER

KIITOS MAINOKSEN KATSOMISESTA !

X3

KIVA !

THANKS FOR WATCHING MESSAGE
GOT EXTRA LIVES NOTIFICATION

If the player watches the ad, after the ad ends a notification appears informing the player that they have earned 3 extra lives. This notification has text but it is also communicated visually by showing the heart icon with X3 on it. In the text, the number 3 appears in a shade of pink corresponding to the heart, as a color code to indicate visually that the text is referring to the lives earned.

EXIT GAME CONFIRMATION BOARD

The board that appears when the player clicks the EXIT GAME button, asking confirmation to close the game, with buttons for NO and YES options.

LOPETA PELI ?

EI

JOO

LEVEL BOARD

A small board informing the current level and total number of levels to play shows on screen all the time.

TASO 13/40

GAME TITLE

The game title uses Digitalt Font. The first part of the title: MEMORY MATCH, is designed with stylized wood texture, and the second part: FINNISH, uses blue color with a snow effect on the top of each letter.

MEMORY MATCH
FINNISH

WIN LEVEL NOTIFICATION TEXT

The EXCELLENT! text appears every time the player matches all card pairs in a level correctly, clearing the level. This text has the same typography and wood texture style that the title text.

HIENOA !

SCREEN MOCKUP SAMPLES

MEMORY MATCH FINNISH
PELAA
START SCREEN

PLAY SCREEN

MANSIKKA
PLAY SCREEN

KORTTIKOKOELMA
KAHVI **MANSIKKA**
INVENTORY SCREEN

COLOR BLINDNESS SAMPLES

PROTANOPIA TYPE

DEUTERANOPIA TYPE

TABLE OF LEVELS

MEMORY MATCH
FINNISH

The number in between () indicates the difficulty group of the cards.

LEVEL	# OF TOTAL WORDS/CARDS	# OF REPEATED WORDS/CARDS	# OF NEW WORDS/CARDS
LEVEL 1	2/4 (1)	0	2/4 (1)
LEVEL 2	3/6 (1)	0/2 (1)	3/6 (1)
LEVEL 3	4/8 (1)	2/4 (1)	2/4 (1)
LEVEL 4	4/8 (1)	2/4 (1)	2/4 (2)
LEVEL 5	4/8 (1)	3/6 (1)	1/2 (1)
LEVEL 6	5/10 (1)	3/6 (1)	2/4 (1)
LEVEL 7	3/6 (1) - 2/4 (2)	2/4 (1) - 0 (2)	1/2 (1) - 2/4 (2)
LEVEL 8	3/6 (1) - 2/4 (2)	2/4 (1) - 1/2 (2)	1/2 (1) - 1/2 (2)
LEVEL 9	3/6 (1) - 2/4 (2)	2/4 (1) - 1/2 (2)	1/2 (1) - 1/2 (2)
LEVEL 10	3/6 (1) - 3/6 (2)	1/2 (1) - 2/4 (2)	2/4 (1) - 1/2 (2)
LEVEL 11	3/6 (1) - 3/6 (2)	2/4 (1) - 2/4 (2)	1/2 (1) - 1/2 (2)
LEVEL 12	2/4 (1) - 4/8 (2)	0 (1) - 2/4 (2)	2/4 (1) - 2/4 (2)
LEVEL 13	2/4 (1) - 4/8 (2)	1/2 (1) - 3/6 (2)	1/2 (1) - 1/2 (2)
LEVEL 14	3/6 (1) - 4/8 (2)	2/4 (1) - 2/4 (2)	1/2 (1) - 2/4 (2)
LEVEL 15	2/4 (1) - 5/10 (2)	2/4 (1) - 2/4 (2)	0 (1) - 3/6 (2)
LEVEL 16	2/4 (1) - 5/10 (2)	1/2 (1) - 4/8 (2)	1/2 (1) - 1/2 (2)
LEVEL 17	2/4 (1) - 4/8 (2) - 1/2 (3)	1/2 (1) - 3/6 (2) - 0 (3)	1/2 (1) - 1/2 (2) - 1/2 (3)
LEVEL 18	1/2 (1) - 4/8 (2) - 2/4 (3)	1/2 (1) - 3/6 (2) - 1/2 (3)	0 (1) - 1/2 (2) - 1/2 (3)
LEVEL 19	1/2 (1) - 5/10 (2) - 2/4 (3)	1/2 (1) - 4/8 (2) - 1/2 (3)	0 (1) - 1/2 (2) - 1/2 (3)
LEVEL 20	1/2 (1) - 4/8 (2) - 2/4 (3)	0 (1) - 4/8 (2) - 1/2 (3)	1/2 (1) - 0 (2) - 1/2 (3)
LEVEL 21	2/4 (1) - 4/8 (2) - 2/4 (3)	1/2 (1) - 3/6 (2) - 2/4 (3)	1/2 (1) - 1/2 (2) - 0 (3)
LEVEL 22	1/2 (1) - 4/8 (2) - 3/6 (3)	1/2 (1) - 2/4 (2) - 3/6 (3)	0 (1) - 2/4 (2) - 0 (3)
LEVEL 23	1/2 (1) - 5/10 (2) - 3/6 (3)	0 (1) - 3/6 (2) - 2/4 (3)	1/2 (1) - 2/4 (2) - 1/2 (3)

LEVEL	TOTAL WORDS/CARDS	REPEATED WORDS/CARDS	NEW WORDS/CARDS
LEVEL 1	kahvi, voi (1)	0	kahvi, voi (1)
LEVEL 2	kaali, juusto, limu (1)	0	kaali, juusto, limu (1)
LEVEL 3	maito, juusto, vesi, kahvi(1)	juusto,kahvi (1)	maito,vesi (1)
LEVEL 4	kaali,voi,olut,liha (1)	kaali,voi (1)	olut,liha (2)
LEVEL 5	Olut,Limu,Maito,Kurkku (1)	Olut,Limu,Maito (1)	Kurkku (1)
LEVEL 6	vesi,liha,kahvi,lime,mehu(1)	vesi,liha,kahvi (1)	lime,mehu (1)
LEVEL 7	voi,juusto,lakka (1) - ananas,peruna (2)	voi,juusto(1) - 0 (2)	lakka (1) - ananas,peruna(2)
LEVEL 8	leipä,mehu,lime (1) - hodari,peruna (2)	mehu,lime (1) - peruna (2)	leipä (1) - hodari (2)
LEVEL 9	lakka,limu,kinkku (1) - ananas,banaani,porkkana(2)	lakka,limu(1) - ananas(2)	kinkku(1) - banaani,porkkana (2)
LEVEL 10	maito,herneet,riisi (1) - hodari,banaani,omena (2)	Maito (1) - hodari,banaani (2)	herneet,riisi(1) - omena (2)
LEVEL 11	leipä,kinkku,mehu (1) - omena,peruna,porkkana (2)	leipä,kinkku,mehu (1) - omena,peruna,porkkana (2)	0(1) - 0(2)
LEVEL 12	olut,voi (1) - ananas,porkkana,mansikka,sitruuna(2)	Olut,voi (1) - ananas,porkkana (2)	0 (1) - mansikka,sitruuna (2)
LEVEL 13	kahvi,vesi (1) - banaani,hodari,sitruuna,tomaatti (2)	kahvi,vesi (1) - banaani,hodari, sitruuna (2)	0 (1) - tomaatti(2)
LEVEL 14	leipä,liha,lakka (1) - mansikka,omena,jäätelo,puolukka(2)	leipä,liha,lakka (1) - mansikka,omena(2)	0 (1) - jäätelo,puolukka (2)
LEVEL 15	herneet,kinkku (1) - jäätelo,sitruuna,ketsuppi,makkara,lakritsi(2)	herneet,kinkku(1) - jäätelo,sitruuna(2)	0 (1) - ketsuppi,makkara,lakritsi (2)
LEVEL 16	kaali,kurkku (1) - porkkana,hodari,tomaatti,mansikka,puolukka (2)	kaali,kurkku (1) - porkkana,hodari,tomaatti,mansikka(2)	0 (1) - 0 (2)
LEVEL 17	maito,mehu, (1) - jäätelo,porkkana,makkara,jaakutiot (2) - majoneesi(3)	maito,mehu, (1) - jäätelo,porkkana,makkara (2) - 0 (3)	0 (1) - jaakutiot (2) - majoneesi (3)
LEVEL 18	lakka (1) - omena,jäätelo,avokado,puolukka(2) - majoneesi,kananmuna (3)	lakka (1) - omena,jäätelo,avokado,puolukka (2) - majoneesi (3)	0 (1) - 0 (2) - kananmuna (3)
LEVEL 20	juusto(1) - puolukka,banaani,omena,peruna,makkara (2) - vesilasi,rankalaiset(3)	juusto(1) - puolukka,banaani,omena,peruna,makkara (2) - vesilasi (3)	0 (1) - 0(2) - rankalaiset (3)
LEVEL 19	lime (1) - makkara,hodari,mansikka,sitruuna(2) - vesilasi,kananmuna(3)	lime (1) - makkara,hodari,mansikka,sitruuna (2) - kananmuna(3)	0 (1) - 0 (2) - vesilasi (3)
LEVEL 21	2/4 (1) - 4/8 (2) - 2/4 (3)	1/2 (1) - 3/6 (2) - 2/4 (3)	1/2 (1) - 1/2 (2) - 0 (3)
LEVEL 22	1/2 (1) - 4/8 (2) - 3/6 (3)	1/2 (1) - 2/4 (2) - 3/6 (3)	0 (1) - 2/4 (2) - 0 (3)
LEVEL 23	1/2 (1) - 5/10 (2) - 3/6 (3)	0 (1) - 3/6 (2) - 2/4 (3)	1/2 (1) - 2/4 (2) - 1/2 (3)
LEVEL 24	2/4 (1) - 4/8 (2) - 3/6 (3)	1/2 (1) - 4/8 (2) - 2/4 (3)	1/2 (0) - 0 (2) - 1/2 (3)
LEVEL 25	1/2 (1) - 5/10 (2) - 3/6 (3)	1/2 (1) - 5/10 (2) - 3/6 (3)	0 (1) - 0 (2) - 0 (3)
LEVEL 26	1/2 (1) - 4/8 (2) - 3/6 (3)	1/2 (1) - 4/8 (2) - 3/6 (3)	0 (1) - 0 (2) - 1/2 (3)
LEVEL 27	1/2 (1) - 4/8 (2) - 4/8 (3)	0 (1) - 3/6 (2) - 4/8 (3)	1/2 (1) - 1/2 (2) - 0 (3)
LEVEL 28	2/4 (1) - 4/8 (2) - 3/6 (3) - 1/2 (4)	2/4 (1) - 4/8 (2) - 3/6 (3) - 0 (4)	0 (1) - 0 (2) - 0 (3) - 1/2 (4)
LEVEL 29	1/2 (1) - 4/8 (2) - 4/8 (3) - 1/2 (4)	0 (1) - 4/8 (2) - 4/8 (2) - 1/2 (4)	1/2 (1) - 0 (2) - 0 (3) - 0 (4)
LEVEL 30	1/2 (1) - 3/6 (2) - 4/8 (3) - 2/4 (4)	1/2 (2) - 2/4 (2) - 4/8 (3) - 0 (4)	0 (1) - 1/2 (2) - 0 (3) - 2/4 (4)
LEVEL 31	1/2 (1) - 3/6 (2) - 4/8 (3) - 2/4 (4)	1/2 (1) - 2/4 (2) - 4/8 (3) - 1/2 (4)	0 (1) - 1/2 (2) - 0 (3) - 1/2 (4)
LEVEL 32	1/2 (1) - 4/8 (2) - 4/8 (3) - 1/2 (4)	1/2 (1) - 3/6 (2) - 4/8 (3) - 0 (4)	0 (1) - 1/2 (2) - 0 (3) - 1/2 (4)
LEVEL 33	2/4 (1) - 3/6 (2) - 4/8 (3) - 2/4 (4)	1/2 (1) - 2/4 (2) - 4/8 (3) - 1/2 (4)	1/2 (1) - 1/2 (2) - 0 (3) - 1/2 (4)
LEVEL 34	1/2 (1) - 4/8 (2) - 4/8 (3) - 2/4 (4)	1/2 (1) - 4/8 (2) - 4/8 (3) - 2/4 (4)	1/2 (1) - 0 (2) - 0 (3) - 0 (4)
LEVEL 35	1/2 (1) - 3/6 (2) - 4/8 (3) - 2/4 (4)	1/2 (1) - 3/6 (2) - 4/8 (3) - 2/4 (4)	0 (1) - 0 (2) - 0 (3) - 0 (4)
LEVEL 36	1/2 (1) - 3/6 (2) - 3/6 (3) - 4/8 (4)	1/2 (1) - 3/6 (2) - 3/6 (3) - 4/8 (4)	0 (1) - 0 (2) - 0 (3) - 0 (4)
LEVEL 37	1/2 (1) - 3/6 (2) - 3/6 (3) - 4/8 (4)	1/2 (1) - 3/6 (2) - 3/6 (3) - 4/8 (4)	0 (1) - 0 (2) - 0 (3) - 0 (4)
LEVEL 38	2/4 (1) - 4/8 (2) - 3/6 (3) - 2/4(4)	2/4 (1) - 4/8 (2) - 3/6 (3) - 2/4 (4)	0 (1) - 0 (2) - 0 (3) - 0 (4)
LEVEL 39	1/2 (1) - 5/10 (2) - 3/6 (3) - 3/6 (4)	1/2 (1) - 5/10 (2) - 3/6 (3) - 3/6 (4)	0 (1) - 0 (2) - 0 (3) - 0 (4)
LEVEL 40	1/2 (1) - 4/8 (2) - 3/6 (3) - 4/8 (4)	1/2 (1) - 4/8 (2) - 3/6 (3) - 4/8 (4)	0 (1) - 0 (2) - 0 (3) - 0 (4)

GAME DESIGN DOCUMENT

Project Design Document

GAME'S NAME: Memory Match Finnish
GENRE: Casual/Educational
STYLE: 2D cartoonish art style
ENGINE: Unity
CONSOLE: Android
PROTOTYPE VERSION: 3.01
GOAL OF THIS PROTOTYPE: Try out in digital Version
1.0 form the version 3.0 of the paper prototype
(that's why version is 3.01). With the exceptions
of collectible items, outfits, timer and in-game
purchases; the other features included in this
document have been tested in paper prototype. Is
paper prototype version 3.0 because of 6 versions I
tried out combining features differently, this is
the one that felt more balanced and entertaining.
*(the blue parts are optional, only if enough time,
the first demo can go without them)*

06/20/2022
Angélica Apache
Franco (GD)
Annele Kuusisainen
(Code, Finnish
Vocabulary)
Phi Khanh Tran (Art)

Project Concept

1 Player Control	You control a	in this	game
	Cards with pictures and words of nouns in Finnish.	Front view/side view (like Meow Match).	
	where	makes the player	
	Tap screen/card (left click to test in pc)	Select/flip a card	

2 Basic Gameplay	During the game,		from
	The player will flip 2 cards in each turn to match a pair.	appear	All cards appear at start of layout, briefly showing the images, then showing their back face.
	and the goal of the game is to		
	Pair all the cards correctly		

3 Sound & Effects	There will be sound effects	and particle effects
	S1: when the player flips a card. S2: when the player matches wrong cards. S3: when the player matches correct cards. S4: when the player finishes a level. S4: when is game over. S5: when the player clicks on the audio icon to listen to the word revealed on the card. S6: When the player clicks on a button. S7: when the player earns a coin.	P1: when the player finishes a level (like fireworks to celebrate).

There will also be

*Visual effects when clicking buttons. Progression bar.
Cards and coins move to their respective place in the
screen when collected.
The character changes expression depending how the player
is doing in the game. Example, sad if loses, happy if
wins.
WON screen and LOST screen with respective sound and
visual effects.*

4 Gameplay Mechanics	As the game progresses,	making it
	More cards appear. Some cards are the same than in previous levels, some are new. The player has 3 lives to make correct matches. The lives do not reduce if the player matches correctly. The player loses one life for each incorrect match. If the player loses all lives in one level, is game over and has to start the level again. Every time the player finishes a level (matches all the cards), the next stage starts with all 3	Matching cards wrongly or correctly.

Activ.

lives.

There will also be

*The vocabulary in the cards will be chosen by themes. The
background will match the theme of the vocabulary and
will change every time the theme changes.

An animal character appears on the left side of the
screen, is the character that helps the player.

Helpers. The player can buy food for the character with
coins earned. The character when fed helps the player. In
the final game will be different characters, but for this
demo we try this mechanic with only one character, like
this: with 15 coins can buy food type 1, which when given
to the character helps flipping one card. With 25 coins
can buy food type 2, which when given to the character
flips two cards. With 60 coins can buy food type 3, which
when given to the character stay flipped until the end of
the level or until are matched correctly by the player.
Animals can help a limited number of times within 24
hours (get tired).

Achievements. There are badges and trophies. Badges are
earned by unlocking words like this:
Badge LV 1, 4 words
Badge LV 2, 8 words
Badge LV 3, 12 words
Badge LV 4, 16 words
Badge LV 5, 20 words... and so on.

Trophies are earned by completing thematic groups of
words (kitchen, bedroom, school, etc). When a trophy is
earned it can also include 1 gem.

NOTE: Match the badges and trophies with leveling up in
the progression bar! If there is no progression bar, there
should be a button that indicates the number of the
level.

Mini-games. There are three kinds of mini games, but for
this demo we can use only one. The player is shown one
picture and three options of words and has to match the
picture with the correct word. The mini game screen
appears automatically when the player is playing the main
game and loses all lives; the player then has the option
of refuse playing and quit the game (because is game
over) or play the mini game and if they match correctly,
gets one extra life to continue playing the main game.*

*This reward of an extra life after playing a mini game is
limited to once every 12 hours. The mini games can also
be accessed through the menu whenever the player wants,
in this case the player receives 1 coin for matching the
word and image correctly.

Coins. The main currency of the game, is earned by
matching cards correctly and is used to buy food for the
characters who will help when fed. It can also be used to
buy outfits and accessories.

Gems. Another currency of the game. Is earned by watching
a daily ad, winning trophies or buying in-game packages.
Is used to unlock new characters that give better help
when fed.

Ads. Ads will always be rewarded. The most common
rewarded ad is watching an ad every time the player loses
all lives, and get one extra life in reward. The player
can also watch 1 daily ad to earn 3 coins. When including
various characters which will be unlocked with gems, then
the player can watch a second ad every day to get a
reward of 1 gem that can be used to unlock new
characters.

In-game purchases. The player can buy packages of gems
and coins with real money. If added in the demo, first
package would be: 10 coins + 1 food type 1 + 1 life x
1euro.

RPG/dialogues. After finishing all the levels of an area,
the player unlocks RPG mode which allows have short
conversations with NPCs using the vocabulary learned. For
each conversation completed successfully the player gets
one heart/life piece. In the demo, include 4
conversations. The conversations are completed through
the method of choosing given words in the correct order.
They include audio.

Quests. In the RPG mode, NPCs give to the character some
quests to complete for which they have to use the
vocabulary learned. Example: buy x item in the shop, or
ask X question to X other NPC, etc. Rewards for
completing quests still to decide. In the demo, include
only 1 quest.

Special cards/collectibles. Cards themselves are placed
in the cards inventory, where the player can see them and
play the audio whenever they want; but some cards contain
as well collectible items that the player can keep in an
inventory and/or place in the different map locations
(example: a blueberry in the kitchen). Collectible items*

Activ.

are those most related to Finnish culture. These
collectibles can later be used in RPG quests.

Outfits/accessories. For character customization, the
player can buy outfits or accessories for the characters
in each chapter. The outfits fit the theme of the level.

Timer. There can be a timer, although I am not sure if
the rush of a timer might interfere with the learning
process. We have to try it out and see how it goes.

Notifications. Reminder to play every day (like the
duolingo owl)
Additional learning material. For some content such as
verbs, sentences, and typical/cultural finnish stuff;
there will be a link to a website (can be wikipedia or
any other free website with information about the finnish
language and culture) where the player can go deeper into
the study of them.

5 User Interface	The	will	whenever
	Coins	increase	The player matches 2 cards correctly.
	XP	increases	Every time the player completes a level.
	lives	decrease	Every time the player makes an incorrect match.
	Coins	decrease	Every time the player uses coins to buy something.

At the start of the game, the title		and the game will end when
Memory Match Finnish	will appear	The player loses all the lives.

There will also be

Start screen: Play button

Main Game Screen: Coins, XP, Lives, Cards Inventory, Mini-games,
Achievements, Characters, Food, Outfits, Settings, Exit Icon, Watch
a rewarded ad Icon, Inbox, Shop.
Mini Games screen: Match Image-word button, RPG mode button.
RPG: Heart container, dialogue boxes.
Shop. Packages available to buy, with buy button. After buying,
confirm the purchase button.
Cards Inventory: the cards, audio icon. Empty slots for cards
pendent.
Achievements: Badges button, Trophies button, each with the
Inventory of achievement accomplished and empty slots for
achievements pendent. The trophies button for the demo is locked but
visible.
Characters: different characters (locked and unlocked) with select
button.
Food: Different types of food (buy button)
Inbox: Msgs to the player from the devs.
Outfits: different outfits (locked and unlocked) with select button.
Close button in the right upper corner of each menu when opened.
+ notification in the right upper corner of a menu button each time
a new action is possible to take inside it.
When buttons require titles, these are in Finnish.
Map of the different areas. The player can move freely and play
whatever area they want. (for the demo, only area playable is the
food area, the rest will remain locked but visible in the map). The
names of the areas are In Finnish.

6 Cards Distribution	Cards will be distributed by theme, each theme can appear in different levels. Other distribution of the cards is difficulty. Classified like...

this:

Group 1 words: 1 or 2 syllables
Group 2 words: 3 syllables
Group 3 words: more than 4 syllables and verbs
sentences

Levels 1-4: Words of group 1
Levels 5-8: Words of group 1 and 2
Levels 9-15: Words of group 1-2-3
Levels 15-ahead: words of groups 1-2-3 and sentences.

Levels:
LV 1: 4 cards (2 words)
LV 2: 6 cards (3 words)
LV 3-4-5: 8 cards (4 words)
LV 6-7-8-9: 10 cards (5 words)
LV 10-11-12-13: 12 cards (6 words)
LV 14-15-16-17: 14 cards (7 words)
LV 18-19-20-21-22: 16 cards (8 words)
LV 23-24-25-26-27: 18 cards (9 words)
LV 28-29-30-31-32: 20 cards (10 words)
LV 33-34-35-36-37-38: 22 cards (11 words)
LV 39-40-41-42-43-44: 24 cards (12 words)
LV 45-46-47-48-49-50: 26 cards (13 words)

7
Settings

• The game auto-saves every time the player completes a level, or
gains experience (If experience bar included) or gets a reward/item
for correctly complete a game activity, watching ads or makes In-
game purchases.
• Enable/disable the automatic finnish audios when player matches a
pair correctly.
• Enable/disable Sound FX and music.
• Control volume of Finnish audios, sound FX and music.

Project Timeline

Milestone	Description	Due
#1	– Functional feature(s) by milestone #1	mm/dd
#2	– Functional feature(s) by milestone #2	mm/dd
#3	– Functional feature(s) by milestone #3	mm/dd
#4	– Functional feature(s) by milestone #4	mm/dd
#5	– Functional feature(s) by milestone #5	mm/dd
Backlog	All features included are subject to change depending on test and feedback… or simply adapting features to fit scope to get a demo ready by the end of august! Include in the demo a survey for the player to complete in exchange for a reward, more or less when the player has completed 50% of the demo.	08/27
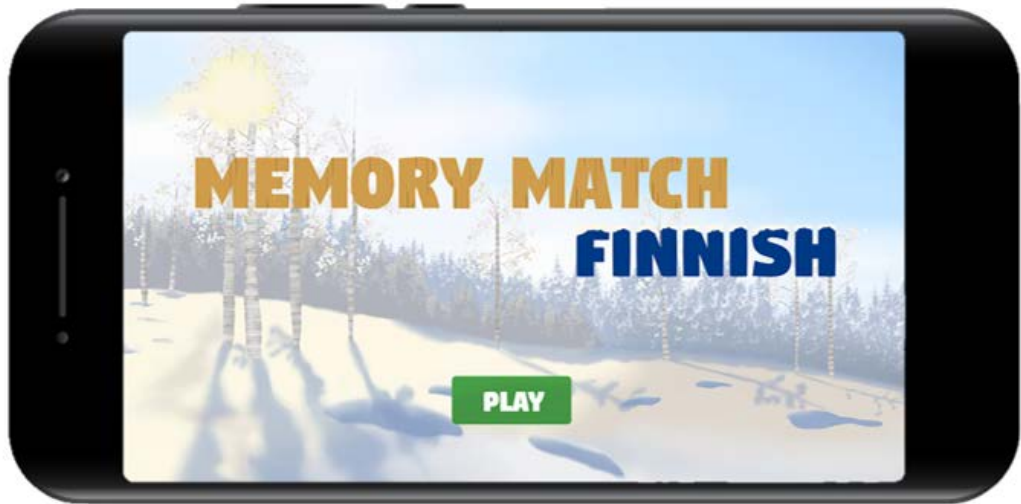
QUESTIONNAIRE

MEMORY MATCH FINNISH
Demo Test Form

Sección 1 de 7

Thesis research: Key elements in the development of a digital prototype for an educational game

This form gathers feedback data from your play session of the demo of the game Memory Match Finnish, which is being developed as part of the thesis research *Key Elements in the Development of a Digital Prototype of an Educational Game* (South-Eastern Finland University of Applied Sciences, Bachelor of Culture and Arts, Game Design).

The purpose of the research is to measure the efficiency of a digital prototype of a videogame designed with the objective of helping beginner students of the Finnish language to memorize Finnish vocabulary, and identify the elements of the game design that play a role in the vocabulary acquisition process.

The test will take place from October 30 to November 15.

After playing the game, you will be asked to answer a questionnaire consisting on background information and Memory match Finnish demo related questions.

Participation in this test is voluntary, all personal data will be anonymized, accessible only to the creator of the test and questionnaire, not made public or disclosed to any third party, and used only for the purpose of the research.

If you have any questions about this research, or want to cancel your participation in this test, please contact the researcher through the email below before November 5 2023. If you desire to receive a copy of the results of this research, please contact the researcher through the email below before December 31 2023.

Angélica Apache Franco

Email: banap002@xamk.edu.fi

Sección 2 de 7

Consent Form   ✕   ⋮

By filling in this form, you agree to participate or agree to participation of my child participant name in the research project titled *Thesis Research - Key Elements in the Development of the Prototype of an Educational Game* conducted by Angélica Apache Franco, Game Design Student at XAMK – South Eastern Finland University of Applied Sciences; who has informed all the characteristics of the research project in this form.

You confirm that you have received, read and had the chance to keep a copy of the information statement. You confirm that you have had the opportunity to ask questions about this research, and you understand the general purposes and methods of this research.

You consent to participate in the research project and the following has been explained to you:

·   Your participation is completely voluntary

·   Your right to withdraw from the study at any time without any implications to you

·   What you are expected and required to do

·   Your able to request a copy of the research findings and reports

·   Security and confidentiality of your personal information.

In addition, you consent to:

·   Publication of results from this study on the condition that your identify will not be revealed.

I confirm that I have read and understood the consent form and the purpose   *
of the research.

☐   Yes

Sección 3 de 7

Background Information

Descripción (opcional)

What is your mother tongue? *

Texto de respuesta breve

What is your age range?

○ younger than 12 years old

○ 12 - 18 years old

○ 19 - 25 years old

○ 26 - 30 years old

○ 31 - 40 years old

○ 41 - 50 years old

○ older than 51 years old

What gender you identify with?

○ Male

○ Female

○ Non-binary

○ Prefer not to say

Do you live in Finland? *

○ I do not live in Finland

○ I have lived in Finland for less than 1 year

○ I have lived in Finland for 1 - 3 years

○ I have lived in Finland for 3 - 5 years

○ I have lived in Finland for more than 5 years

What contact had you had with the Finnish language before playing the Memory *
Match Finnish demo?

☐ Playing Memory Match Finnish was my first contact with the Finnish language

☐ I had played other games or used other apps to learn the Finnish language

☐ I had taken online or in person courses of the Finnish language

☐ I am or have been in contact with the Finnish language through interaction with Finnish p...

☐ I listen to music in the Finnish language

☐ Otra...

Following up with the previous question, how often has been your contact with the *
Finnish language previous to playing the Memory Match Finnish demo?

☐ No contact at all

☐ A few times in the year

☐ A few times per month

☐ A few times per week

☐ Daily contact

Please briefly describe if and why you are interested in learning the Finnish language

Texto de respuesta largo

From what you remember after playing the Memory Match Finnish demo, among *
the given options, what is the correct word in Finnish for the image showed below?

○ Limu

○ Lime

○ Sitruuna

From what you remember after playing the Memory Match Finnish demo, among *
the given options, what is the correct word in Finnish for the image showed
below?
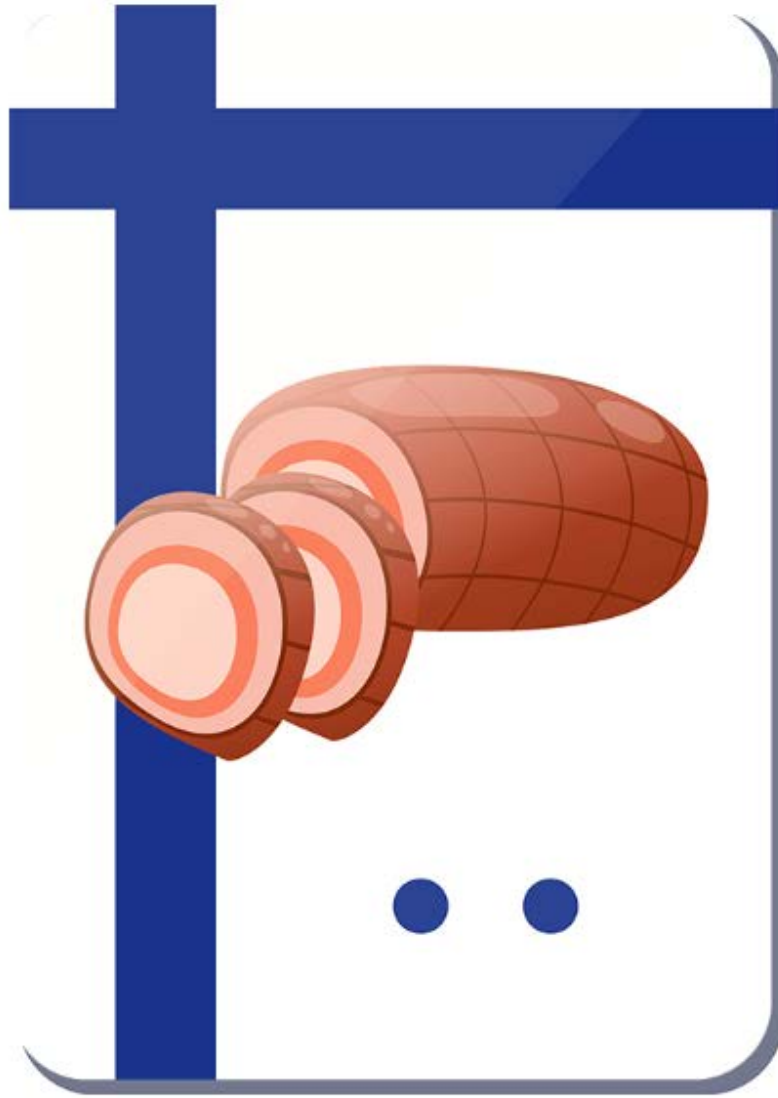
○ Kurkku

○ Liha

○ Kinkku

From what you remember after playing the Memory Match Finnish demo, among the given options, what is the correct word in Finnish for the image showed below?
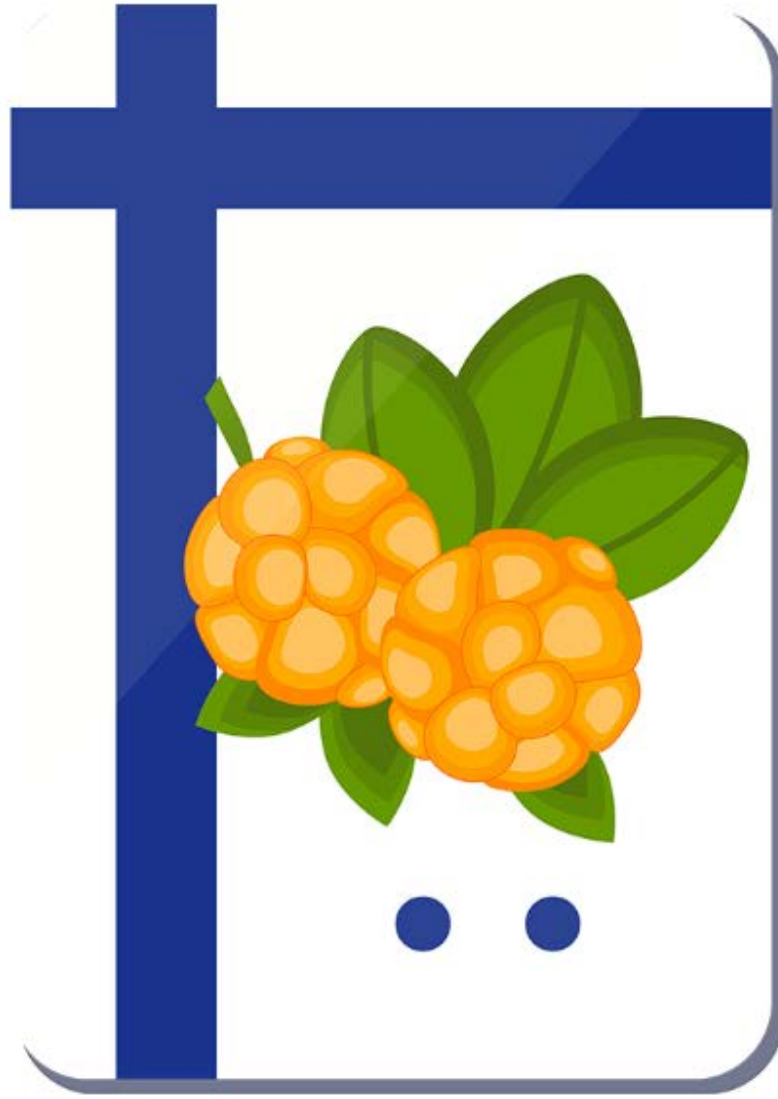
○ Lakka

○ Liha

○ Juusto

From what you remember after playing the Memory Match Finnish demo, among the given options, what is the correct word in Finnish for the image showed below? *

○ Kurkku

○ Omena

○ Herneet

From what you remember after playing the Memory Match Finnish demo, among the given options, what is the correct word in Finnish for the image showed below? *

○ Jääkuutiot

○ Jäätelo

○ Juusto

From what you remember after playing the Memory Match Finnish demo, among the given options, what is the correct word in Finnish for the image showed below? *
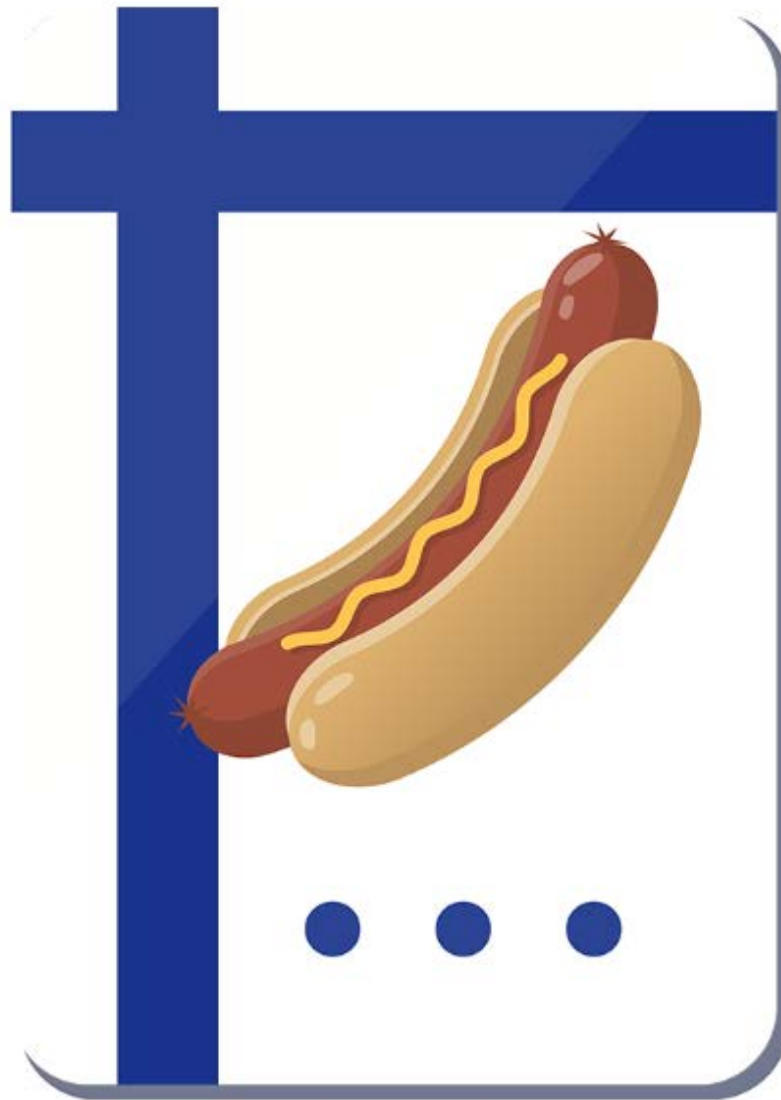
○ Porkkana

○ Hodari

○ Makkara

From what you remember after playing the Memory Match Finnish demo, among the given options, what is the correct word in Finnish for the image showed below?

○ Peruna

○ Lakritsi

○ Vesilasi

From what you remember after playing the Memory Match Finnish demo, please type the word corresponding to the image showed below. *

Texto de respuesta breve

From what you remember after playing the Memory Match Finnish demo, please *
type the word corresponding to the image showed below.

Texto de respuesta breve

From what you remember after playing the Memory Match Finnish demo, please type the word corresponding to the image showed below. *

Texto de respuesta breve

From what you remember after playing the Memory Match Finnish demo, please type the word corresponding to the image showed below.

Texto de respuesta breve

From what you remember after playing the Memory Match Finnish demo, please type the word corresponding to the image showed below.

Texto de respuesta breve

From what you remember after playing the Memory Match Finnish demo, please type the word corresponding to the image showed below. *

Texto de respuesta breve

USABILITY TEST REPORT

2.   DESCRIPTION OF THE TEST

2.1   Outline

This is the first usability test conducted.
The present report is about the test conducted on only one user for now (because of the deadline for the assignment, I didn't have time to schedule more tests with other possible users), but will be conducted on more users within the following weeks.

2.2   Test Tasks

It is intended to observe how users perform the following tasks:

• Go to the play game screen (easy)
• Change settings configuration (medium)
• Navigate the Menu and its options (hard)

The time used for each task per participant in minutes
First test:

Participant	1st task	2nd task	3rd task	Overall
1	3 sec	16 sec	5 min	5,19 min

Second test:

Participant	1st task	2nd task	3rd task	Overall
1	1 sec	7 sec	2 min	2,08 min

3.   RESULTS

3.1   Usability Test Results

The participant is a casual player and language apps user who is familiarized only with two language apps and one not educational game.

FIRST TEST

Task 1: Go to the play game screen (easy)
The participant was able to go to the paly game screen immediately in both iterations.

Task 2: Change settings configuration (medium)
The participant was able to find the SETTINGS button quickly, but once inside the settings window, didn't know what to do. She tried to click other buttons outside the settings window. After failed attempts to click other buttons, she clicked the icons inside the windows various times (turning on and off the music and sound icons).

Task 3: Navigate the MENU and its options (hard)
The participant located the MENU button immediately. Once inside the menu window, she tried to click over the icons, returned to the game, then went back to menu, and she asked me how to do next. I told her enter the options unlocked and she tried clicking the icons again, until she finally clicked on the text below the icons. In the CARDS INVENTORY section, she was able to navigate through both screens easily using the double arrow icon; she was also able to go back to menu quickly using the left arrow button. Once in the MENU she easily accessed the MINI GAMES screen by clicking on the text below the icon, then went back to MENU and went back to the game screen using the RETURN TO GAME button effortlessly.

SECOND TEST

Task 1: Go to the play game screen (easy)
The participant was able to go to the paly game screen immediately in both iterations.

Task 2: Change settings configuration (medium)
The participant was able to find the SETTINGS button quickly and turned off and on the sound and music quickly, then returned to the game screen.

Task 3: Navigate the MENU and its options (hard)
The participant was asked to go to the CARDS INVENTORY. She thought for 9 seconds "where is the cards inventory", then clicked the SETTINGS button; noticed it wasn't there and quickly went back

clicking the RETURN TO GAME button. Then clicked the MENU button, and once inside the MENU window she quickly found the CARDS INVENTORY and navigated through it, went back to the MENU window and then returned to the game screen effortlessly

3.2   Evaluation

The results do not provide enough information because the test was conducted with one person only. However, I will conduct another test with more possible users.

According to the results of the test, I can conclude that:
• The text in the buttons was key for the participant to know what to do.
• The settings icon was familiar so the participant knew that was the settings option. Same familiarity applies to the arrow buttons.
• Inside the MENU window, it wasn't clear where to click. I think this happened because I didn't frame the text that was supposed to be clicked, so it doesn't look like a button. The same problem was found inside the SETTINGS window, where the music and sound icons are not framed.
• The participant didn't remember where to find the CARDS INVENTORY from the game screen. This makes me think that maybe too many clicks are on the way. MENU → CARDS INVENTORY. Maybe would be better to have the CARDS INVENTORY visible on the game screen.

UI STYLE FIRST ITERATION

2

MEMORY MATCH FINNISH
Educational Game for Mobile
UI Style Samples

TYPE

Digitalt Font.
Used for the title, headers and buttons

**ABCDEFGHIJKLMNOPQRSTUVWXYZ ABCDEFGHIJKLMNOPQRSTUVWXYZ
1234567890.:,; ' " (!?) +-*/=**

Monserrat Font. (semi-bold)
Used for the vocabulary cards.

abcdefghijklmnopqrstuvwxyz ABCDEFGHIJKLMNOPQRSTUVWXYZ
1234567890.:,; ' " (!?) +-*/=

COLOR

Boards &Title

Title

Buttons

Cards

Hearts
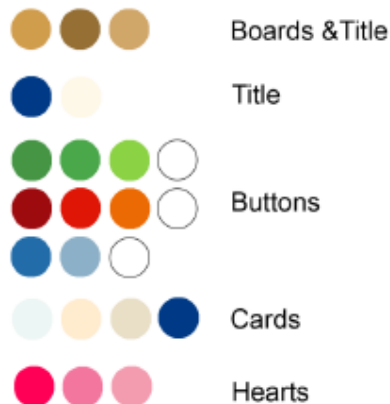
The boards were designed to resemble wood panels, and the title uses this
same wood texture together with dark blue assiciated with the Finnish flag,
and the same yellowish white that is used in the winter background, simulating
snow.

The buttons and headers were designed following a very commonly used
color palette for buttons color in casual mobile games, which consists mostly
in the use of greens and reds for buttons and a variation of colors for headers,
from which I chose blue to make it match with the overall visuals of the game.

3

The colors of the cards include dark blue (again making reference to the Finnish flag), and very light colors in the background. The beige in the background of the vocabulary is the same in all cards keeps the design consistent, whereas the different background color for the picture in the card serves as color code to distinguish the different kind of word groups that is possible to find in the game (the example used in the samples: light blue for nature, cream color for buildings).

The color and shape of the lives/hearts, as well as the currency, use well known conventions in casual a visually simple games.

ICONS & BUTTONS SAMPLES

untapped

tapped

currency

cards

boards

INVENTORY

MAP SKETCH

Areas map / themes:
- Numbers / monts / days.
- Food
- Travel / tourism.
- Study / work
- Shoping
- home / family
- hobbies / friends.
- health - body parts.
- Nature
(clothes)

Nature   hobbies   Numbers / hours / months / days

health

Food

shoping   travel

study / work   home / family

DEVELOPMENT PROGRESS PRESENTATION

Video demo here.
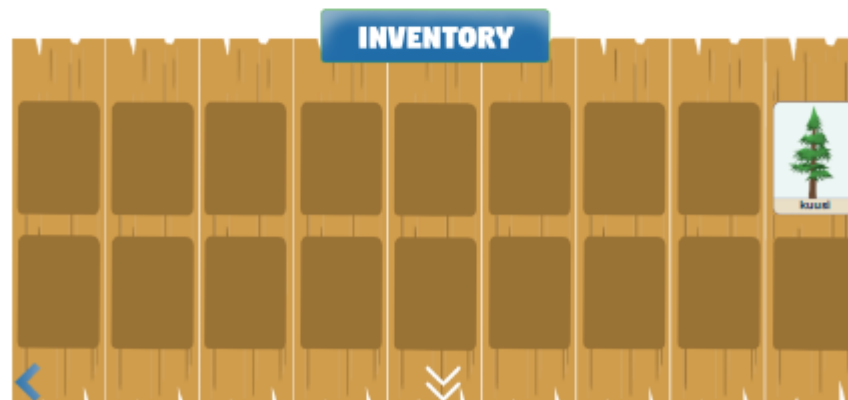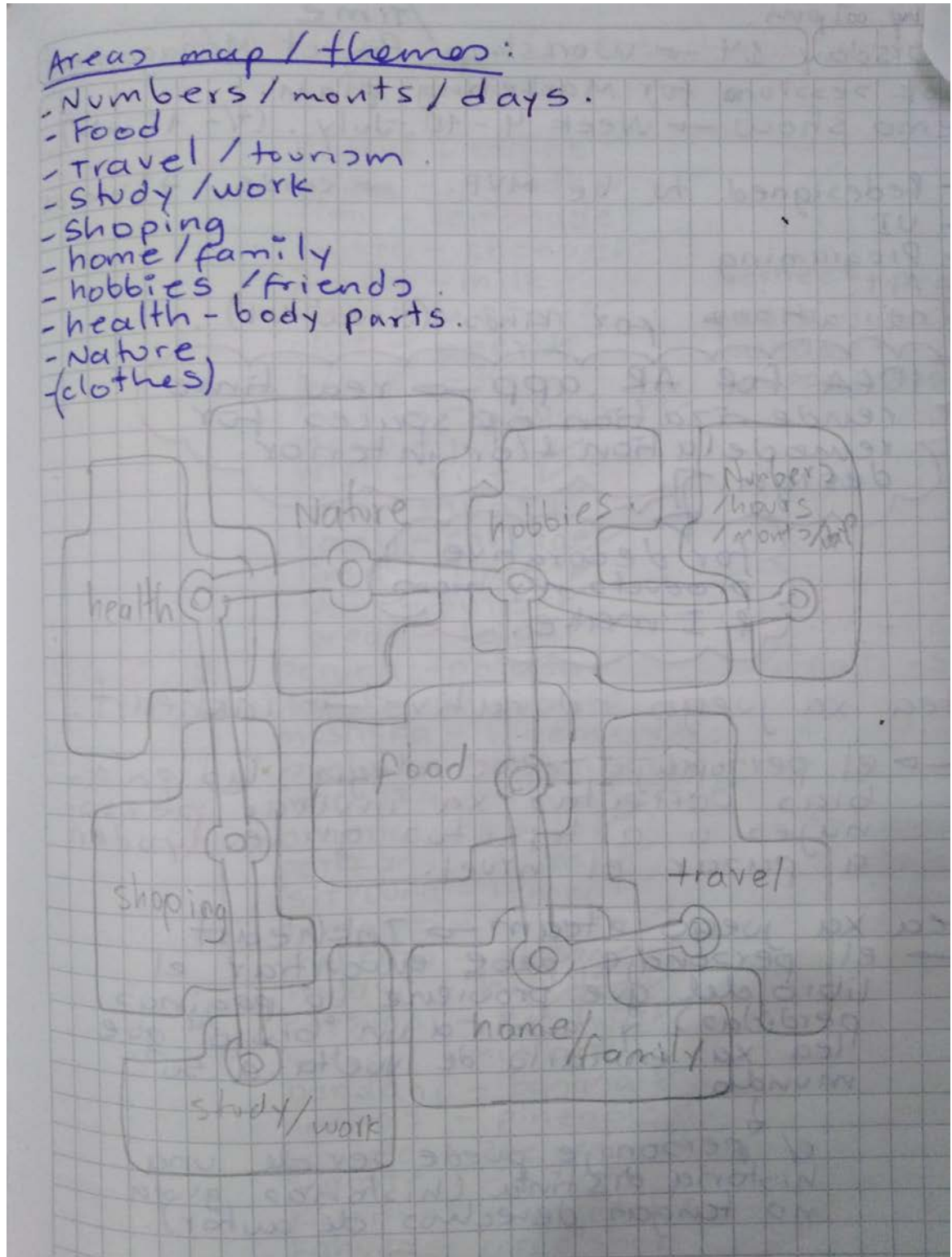
MEMORY MATCH FINNISH

Angélica Apache Franco

Xamk / Työharjoittelu Yrittäjänä Project
2023

THE GAME CONCEPT

- F2P Educational Game for mobile
- Finnish Language for beginners

KAHVI

PREVIOUS WORK - 2021

- Market research
- Paper prototypes
- Sketches
- Background
- UI test

talo

kuusi
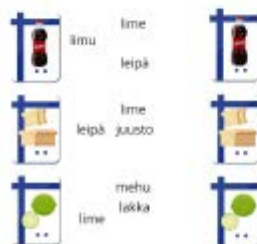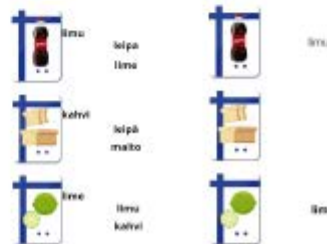
THE FIRST TESTS

· similar shape, color, and design
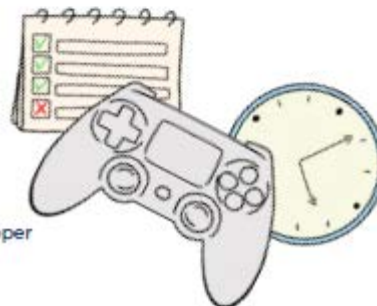
· similar color

THE FIRST PUBLISHED DEMO

MY ROLES & DUTIES

· Producer

· Game Designer

· Level Designer

· Artist

· Construct 3 Developer

· Schedule

· Scope

· Design iterations

· 2D Art

· Development & debug

· Documentation

· Test with users