Technology-Assisted Language Learning Strategies: A Multiple Longitudinal Qualitative Case Study on the Lessons that Can Be Learned from Experienced Language Learners' Duolingo Usage

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Abstract

Although much research has been conducted into language learning strategies for the four different skills, i.e., reading, listening, writing, and speaking, no research on this topic has investigated the effect of technology on the language learning process. This thesis examines the language learning strategies that are employed by experienced language learners using a technology-assisted language learning application in order to fill this gap. Data was collected by asking four participants to fill in diary entries related to their language learning behavior for 30 days, while using Duolingo. Two of the participants were then invited to participate in a follow-up interview, which was aimed at uncovering more about what the participants did and why they decided to do so. The data collected in the diary entries and interview transcriptions were analyzed using Grounded Theory. The results showed that the experienced language learners who participated in this experiment employed five different types of technology-assisted language learning strategies, namely (a) internal motivation, (b) external motivation, (c) meta-cognitive, (d) time management, and (e) cognitive. These types can be further subdivided into more specific language learning strategies, such as motivation management and resource selection. Based on these findings a new taxonomy of technology-assisted language learning was proposed and implications for autonomous and classroom-based language learners as well as language educators were concluded.

Contents

Chapter 1: Introduction

The technological innovations and advancements of the past decades have had an immense influence on many different parts of society, such as education. Among others, the language learning landscapes have changed drastically (Zhou and Wei, 2018). One part of the landscape that has rapidly developed is that of online language learning software. There are many different brands, like Duolingo, Rosetta Stone, and Babbel, that aim to provide language learners with affordable, accessible, and fast online language learning applications. Especially Duolingo, which is the application of focus in this thesis, has gained a lot of popularity (Martinelli, 2016; Mogavi et al., 2022). Particularly its stand-out content (Duolingo, n.d.), i.e., the unnatural sentences like the Japanese sentence ”We got divorced, because my cat was too cute.”, has become very popular online and several twitter accounts have been dedicated to sharing these ”weird” sentences. These new technology-assisted language learning applications offer the unique option of studying remotely without loss of immediate feedback and they allow learners to make autonomous decisions on what, when, where, and, arguably most importantly, how to learn a language (Reinders and Benson, 2017). This provides learners of different levels with a personalized learning opportunity and permits them to take control of their own language learning path and their personal development. Thus, the results of the technological improvements call for a change in the way that language learning was traditionally approached and raise several questions. How should language learners approach language learning with these new types of technology? What is the most efficient way of studying a language using technology? Are there specific learning strategies that should be used when learning a language with technology?

It is important to address these currently unanswered questions and to gain a better understanding of the language learning strategies that can be utilized by language learners who are using technology to learn a new language. Traditional language learning strategies have been shown to increase language learning success, language proficiency, and successful course outcomes (Almusharraf and Bailey, 2021). Finding out what learning strategies autonomous language learners who assist their language learning with technology should use to increase

learning efficacy and enjoyability could, therefore, lead to an increase in their language learning success. Furthermore, educators who have already implemented technology into their curriculum may use this knowledge to increase students' language learning efficiency even further. Moreover, this knowledge would provide educators who do not feel confident about implementing technology into their lessons with the necessary tools to start employing technology. It is also important to fill this gap in the literature as this knowledge may influence the design of future technology-assisted language learning applications and inform future research into technology-assisted language learning applications and strategies.

The remaining chapters of this thesis are organized to provide this thesis's research background in the form of a literature review, research design, experiment results, results discussion, implications, limitations, and conclusion. Chapter two discusses the previous research that has been conducted in the field of technology-assisted language learning, Duolingo and language learning strategies, and will discuss the present research and its central question. Chapter three provides a methodological explanation about the experiment that was conducted. In this chapter, the qualitative research design that was employed, the data collection tools, i.e., diary entries and semi-structured interviews, and the data analysis are detailed. Chapter four outlines the results of the data analysis. The data that was collected from the diary entries are presented first, followed by the data from the interview. Then, a thorough discussion of the results is given in chapter five. The results of the experiment are synthesized and analyzed in this chapter. An overview of the limitations and the recommendations for future research are also provided in this chapter. Finally, chapter six summarizes the findings and provides an answer to the research question at the center of this thesis, which is outlined is section two.

Chapter 2: Literature review

2.1 Introduction

This chapter provides an overview of the relevant theoretical and empirical literature in the fields of technology-assisted language learning, Duolingo, and language learning strategies. First, technology-assisted language learning, its general usage, and its usage in educational settings (e.g., technology enhanced tasks, learners, and its role in teacher training) will be introduced. This will be followed by a discussion of the existing literature on Duolingo and, specifically, its design and pedagogical approach. Then, the several different theoretical frameworks of language learning strategies that have previously been proposed will be discussed and one framework will be chosen as the focus of this thesis. Finally, this chapter outlines the present research and its central research question.

2.2 Technology-assisted language learning

The technological innovations and advancements of the past decades have had an immense influence on different parts of society, among others the educational and language learning landscapes (Zhou and Wei, 2018). Many people born in or after these decades have grown up with the results of these developments from a young age. These learners are sometimes called ”digital natives” (Prensky, 2001, p.2) and are argued to process information fundamentally differently due to a particular blend of cognitive skills caused by their early interaction with technology. As a result, these learners are distinctly proficient at utilizing and adapting to these newly developed technologies. Loewen et al. (2019) and Kukulska-Hulme et al. (2017) add to this by claiming that the ubiquitous usage of technology has led this new generation to adopt a new language learning approach that is more suitable for language learning assisted by a form of technology. Furthermore, Benson (2011) created a framework of language learning beyond the classroom that is used to explain that technology offers the unique option of studying remotely without loss of feedback and that it allows learners to make autonomous decisions about the location (e.g., out-of-class, out-of-school, or extra-curricular), the formality (e.g., informal or formal), the

pedagogy (e.g., non-instructed or self-instructed), and the locus of control (e.g., autonomous, self-directed, or independent). Reinders and Benson (2017) claim that this provides learners of different levels with a personalized learning opportunity and permits them to take control of their own language learning path and their personal development. Thus, the results of the technological improvements call for a change in the way that language learning was traditionally approached.

The evolved language learning approach of young learners requires educators to adapt their traditional curricula to include the previously unused technological and digital aspects in a way that aligns with the contemporary educational needs of students. Zengin and Meral (2017) note that educators, and, indeed, education as a whole, have not remained oblivious to these developments. Warschauer (2004) predicted that there would be an increased demand for personalized, affordable, and mobile technology. We can now observe that this prediction has come true. It is now recognized that the implementation of technology is a tremendous asset to (language) learning and educators have become aware of the importance of employing educational technology like YouTube, PowerPoint, and other digital media in the classroom (Fauzi et al., 2017; Galvis, 2012). Funding and resources have been made available to ensure the successful implementation of technology into the (language learning) classroom (Kartchava and Chung, 2015). Abundant technological equipment has now become available to learners and teachers alike. Technological equipment such as digital projectors and school-issued computers have become increasingly standard. As Zhou and Wei (2018) note, the use of ”computer technology ... has become ecological and normalized ... in the language learning classroom” (p.417). As a result of this development, there has been an increased research interest in the impact of technology on learning (DuBravac, 2013; Hubbard, 2008) and how to convince educators to implement technology into their curricula (Kartchava and Chung, 2015).

The field of computer-assisted language learning, also known as mobile-assisted or technology-assisted language learning, has made the investigation of technology used to assist language learning its primary focus of investigation. Technology-assisted language learning has been defined in many different academic works under different names and with widely varying

definitions. Davies and Steel (1981) are considered to be the people who coined the term computer-assisted language learning, though a clear definition of the phenomenon was not present in their work. Consequently, different terms appeared in the literature that combined technology and pedagogy (Tafazoli et al., 2019). DuBravac (2013) formulated definitions for the most used terms in the field, e.g., computer-assisted language learning and technology-enhanced language learning. The first term, computer-assisted language learning, is used to refer to ”the use of any computer hardware, and software that helps learners to develop their language skills.” (p.2). In opposition to this term, the term technology-enhanced language learning refers to any technological equipment that is not related to computers, such as projectors, recorders, cameras, and phones. Several publications have used the term technology-assisted language learning to refer to a combination of these two (e.g., Ahmad, 2016; Ko, 2017). Technology-assisted language learning, thus, can be defined as any language learning progress made by a language learner as a result of the use of any type of technology. Following this, technology-assisted language learning will be operationalized as any type of technological equipment (e.g., phones, laptops, computers, word processing, presentation applications, and internet-based applications) used for any type of language learning, i.e., classroom-based or autonomous, throughout this thesis.

Research in the field of technology-assisted language learning has been dedicated to the investigation of technology from four main angles, namely technology, technology-assisted tasks, language learners, and language educators (Hubbard, 2013). Research from these angles has been used to argue that the use of technology has a positive influence on a learners’ language learning outcome. The first angle, technology, has led to the investigation and identification of technologies that can be utilized to effectively teach and learn a language and increase proficiency in the four main language skills, i.e., reading, listening, writing, and speaking (Levy, 2012). For reading, for example, Toland (2010) showed that English second language learners in high-tech schools outperform those from low-tech schools by comparing the Texas state reading test results of multiple classes over multiple years. For listening, Al Qasim and Al Fadda (2013) argued that a learner’s listening comprehension should increase more when presented with authentic material,

i.e., materials that have not been manufactured specifically for educational purposes and represents the language that a language learner would encounter outside of the classroom more closely (Namaziandost et al., 2022). In line with earlier findings (see Kavaliauskienė and Anusienė, 2011; Lu, 2007), Al Qasim and Al Fadda (2013) conclude that the use of podcasts increased the listening comprehension and the motivation to continue using podcasts of 25 learners compared to the control group. For speaking, Gromik (2012) showed that the speaking rate of nine Japanese learners of English increased over the span of 13 weeks by recording videos using their cell phone. Moreover, Martinelli (2016) showed that the pronunciation of Italian geminate sounds produced by learners of Italian became more native-like after using Duolingo for four weeks. Lastly, for writing, the special functions, i.e., spell check, grammar check, and online dictionaries, of word-processing applications such as Word have been shown to increase writing proficiency and vocabulary acquisition (Levy, 2012; Warschauer, 2004). Hur and Suh (2012), for example, tested the vocabulary acquisition of 11 learners during a summer course using digital storytelling and podcasts, and found that learners' results increased significantly. Thus, the use of technology to assist language learning has been shown to benefit from the authentic and communicative opportunities that technology offers.

The communicative opportunities that technology offers have also led to an increased scientific interest in the benefits of the types of tasks that can be assisted with technology, the second angle mentioned above. DuBravac (2013) and Tomlinson (2012) claim that authentic materials with native speakers of the target language encourage student involvement. According to them, the authenticity of the materials should result in meaningful engagement with the target language and authentic linguistic output. While these types of tasks were limited to the classroom before, technology allows learners to engage with the task, and, therefore, the target language, at any time and place. Furthermore, learners are able to monitor their language learning progress with easily accessible resources outside of the classroom. This provides a fertile environment for learners to act autonomously and take charge of their learning process based on individual needs (Garrett, 2009; Reinders and Benson, 2017; Tomlinson, 2012).

Although today's learners have grown up with technology and technological proficiency is exceedingly common nowadays, researchers have realized that language learners, the third angle of research into technology-assisted language learning, need to be trained in order to effectively be able to use technology-assisted language learning programs. Bax (2003) noted that the role of the educator in the classroom has changed from a "sage on the stage" to a "guide on the side" (Morrison, 2014). With this method of teaching, learners have become active agents and contributors in their own learning, whereas educators were the focal point in the classroom before. In order to effectively and successfully continue their language learning, these learners need to be made aware of the fact that technology can be used to assist their language learning, and, perhaps more importantly, how this technology can be used to do so. This aspect of technology-assisted language learning is the focus of this thesis. Since the need to implement technology into the classroom has been widely recognized and technology has become more accessible and affordable, the demand for the knowledge required to successfully use technology has also grown.

In order to be able to give these language learners the necessary tools to increase their technology-assisted language learning, educators, the fourth and final aspect, must be made aware of the fact that language learning can be assisted by technology and how this can be done. Hubbard (2013) advises that teacher training programs should train future teachers in the use of technology and that these teacher trainer programs should emphasize that the use of technology has been shown to increase effectiveness of teaching as well. In addition to the focus on the third aspect of technology-assisted language learning, this thesis also explores this aspect by looking at the implications of the experiment's findings and the ways that the findings suggest that technology can be used by educators to provide language learners with the tools they need to successfully learn a language both in and outside of the classroom.

2.3 Language learning applications

As mentioned in the previous section of this thesis there are many different language learning applications available online. These language learning applications offer different paid

subscriptions, applications, and packages that provide language learners with various online tools in the form of lessons, tutorials, videos, forums, and (practice) tests that can be used to learn, practice, and gain proficiency in a language that is available on the application. Although there are hundreds of different language learning application available, applications like Duolingo, Rosetta Stone, and Babbel are consistently among the most used and downloaded ones (Martinelli, 2016; Mogavi et al., 2022) These applications all bring something unique to the table in terms of the content that they publish.

Rosetta Stone is one of the language learning applications that utilizes the target language to teach the language of choice. It uses images, texts, and sounds in the target language to help language learners acquire both the vocabulary and the grammar of the target language. Other apps that use the same approach, like Berlitz, employ the target language to help language learners acquire the grammar implicitly, i.e., they do not offer any explicit grammar teaching and, instead, provide the learner with sufficient input for them to work out the grammar themselves. The approach taken by these apps is modeled after the ideas put forward in the Natural Approach to language learning (Terrell, 1977). This has been contentious since it has been shown that there is a fundamental difference between the acquisition of a first language and a second language (Bley-Vroman et al., 1990; Bley-Vroman, 2009).

Babbel, however, utilizes what has been dubbed ”leverage”, i.e., it leverages the prior knowledge of the language learner over the immersion that is used by Rosetta Stone and Berlitz in order to help language learners create connections between the language(s) they already know and the new language that they are trying to acquire. To achieve this, Babbel offers themed lessons which aim to address relevant content that would allow for learners to start communicating immediately. One of the downsides of Babbel that has been pointed out is that it is almost entirely in the language that the learner already knows, i.e., the source language (Nushi and Eqbali, 2018).

Duolingo stands out from the other language learning applications due to its use of gamification. The underlying goal of this approach is to empower the language learner in ways that a non-gamified approach cannot. Duolingo also employs real-life communication, stand-out

content, implicit learning, personalization, and supplementary materials like events, podcasts, and interactive stories as a part of their approach (Duolingo, n.d.). These components will be discussed further in section 2.3.2. Due to this particular combination of approaches that sets it apart from the other language learning application discussed above, Duolingo was selected as the application of focus in this study.

2.3.1 Duolingo app description

Duolingo is a free language learning application that has additional paid options and can be accessed on any browser or downloaded for free on the App Store or on the Google Play Store. Speakers of different languages can then choose to learn a variety of different languages dependent on the source language. For example, speakers of English can choose from 38 different language that include conlanguages like High Valyrian and Esperanto, while speakers of Spanish can choose from 10 different languages including languages unavailable to English speakers such as Catalan or Guarani. Speakers of almost all languages have the option of learning English, Spanish, French, and German. Due to the platform that Duolingo has offered its users, a wide variety of languages are available compared to other language learning applications such as Babbel and the number of available languages continuously grows larger.

After the target language has been selected, Duolingo allows the learner to set different goals. The first goal is called the daily goal. The daily goal indicates the number of minutes a learner wants to spend learning a language with Duolingo. There are four goals: casual, regular, serious, and intense, consisting of 5, 10, 15, and 20 minutes, respectively (see figure 1).

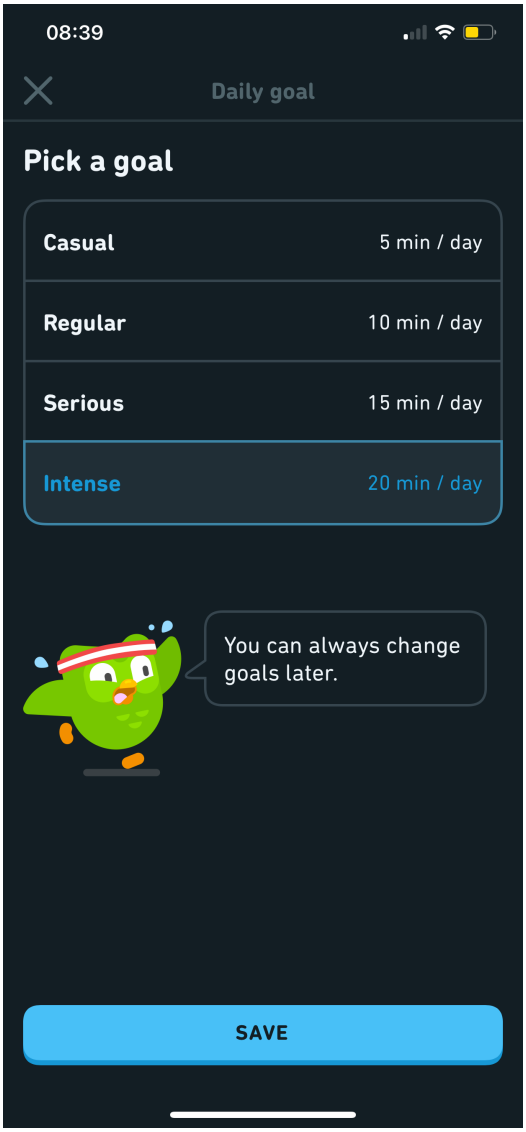

Figure 1
A screenshot of the daily goal choices learners can choose from.

Duolingo will then ask the learner to select a streak goal. This goal denotes the number of consecutive days that a learner uses Duolingo to study the selected target language. There are four different goals here as well: baby steps, strong start, clearly committed, and unstoppable streak, consisting of 3, 7, 14, and 30 days, respectively (see figure 2). The learner will receive a notification from Duolingo to remind them to complete a lesson in order to achieve their daily and streak goals. The time Duolingo sends a reminder can be changed by the learner to fit their schedule.

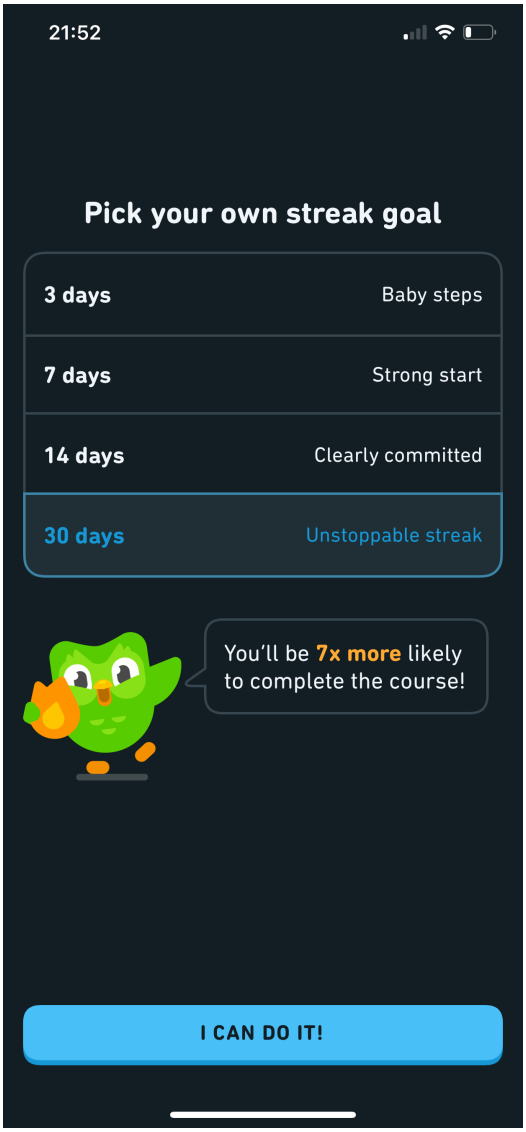

Figure 2
A screenshot of the streak goal choices learners can choose from.

When a learner starts a new course, Duolingo will attempt to find the right level for the learner. This is done by asking the learner if they are starting from scratch or if they have any prior learning experience (see figure 3). If learner chooses the former option, the first lesson of the curriculum is started. If a learner chooses the second option, a test that helps Duolingo determine what the learner already knows will be started and, upon completion, the learner will unlock all lessons in the curriculum prior to the lesson Duolingo deems to be closest to the current level of the learner.

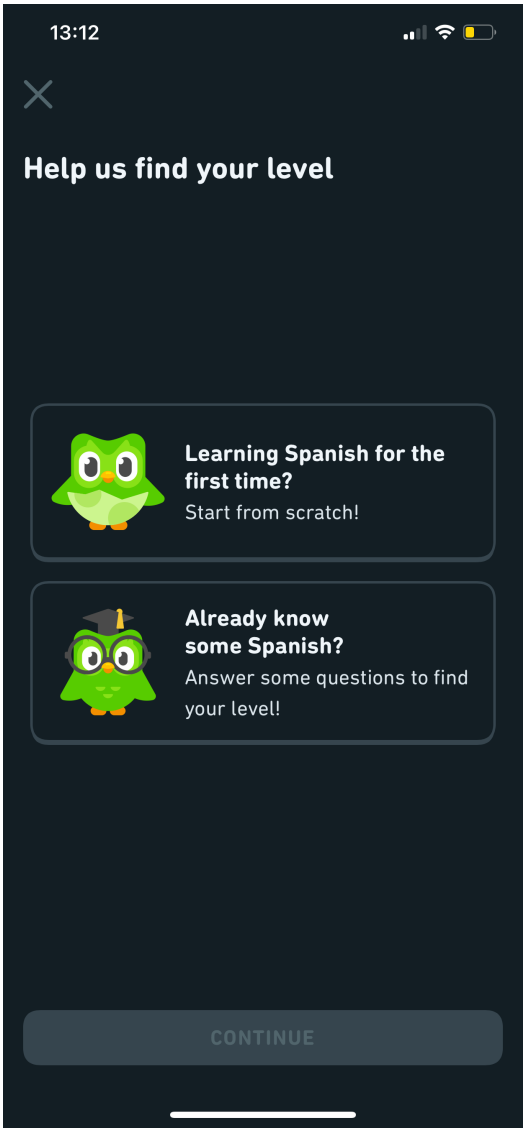

Figure 3
A screenshot of the placement test choices learners can choose from.

While the learner is going through the first lesson or through the placement test, they will run into five different kinds of exercises, as described by Nushi and Eqbali (2017).

1. **Translation exercise:** The learner is asked to translate a sentence from either the source language or the target language to the other language. This exercise can be done using the keyboard or by using the words that duolingo provides and putting these into the correct order (see figure 4).

Figure 4
A screenshot of a translation exercise.

2. **Matching exercise:** the learner is asked to identify a picture or audio fragment and match this with the words that are given (see figure 5). Sometimes these exercises will permit you to make a mistake once before marking the answer as incorrect, e.g., if the learner accidentally clicks ”I am” instead of ”man” in the exercise in figure 5, Duolingo will allow the learner to correct the mistake once.

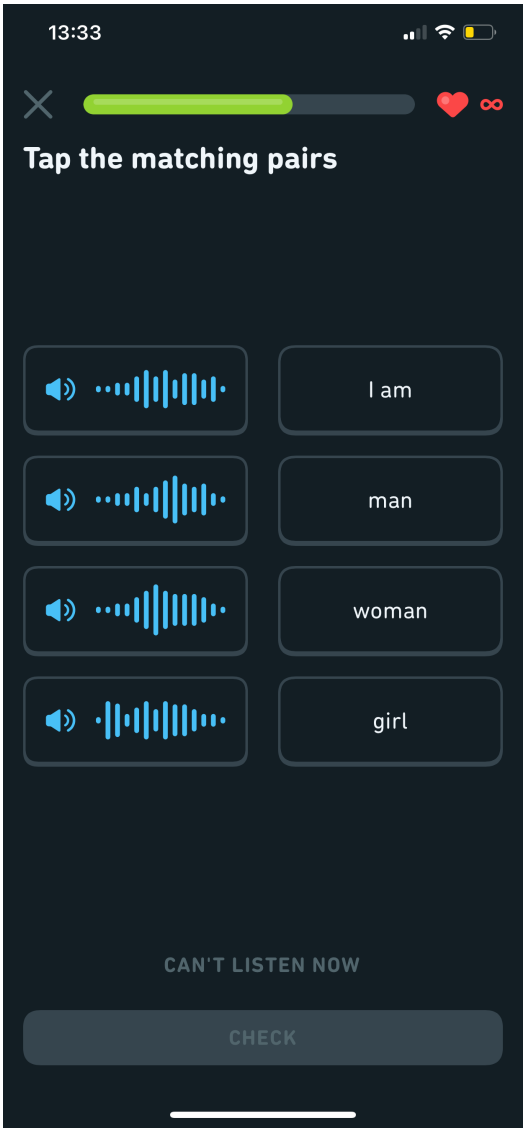

Figure 5
A screenshot of a matching exercise.

3. **Pairing exercise:** the learner is asked to pair the words in one language to the translation in the other language (see figure 6). Similarly to matching exercises, Duolingo allows learners to correct a mistake once before marking the exercise as incorrect.

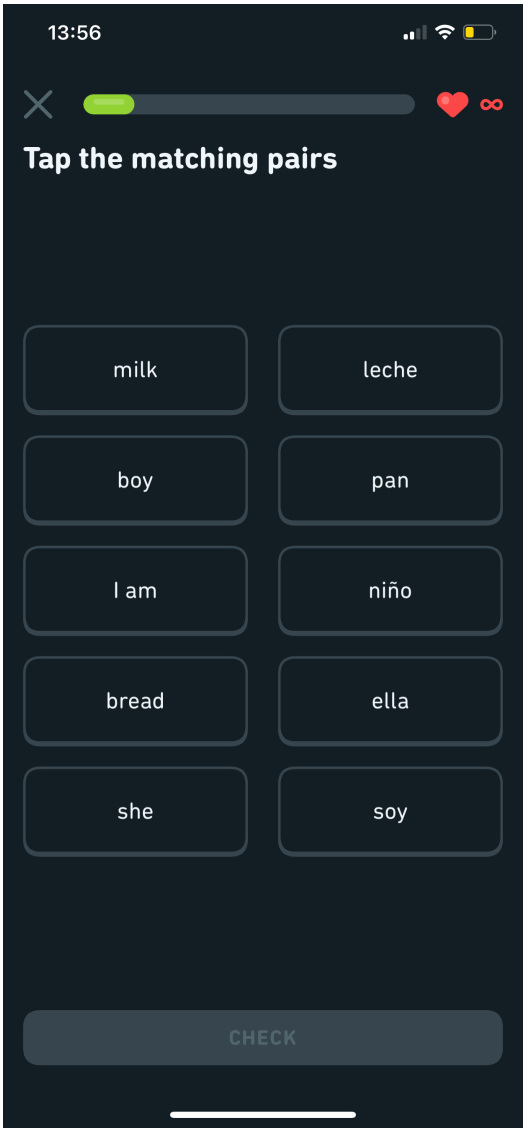

Figure 6
A screenshot of a pairing exercise.

4. **Listening exercise:** the learner is asked to listen to a short phrase spoken in the target language and to provide a transcription of what is said in the target language (see figure 7). The learner is given the option of listening to the fragment at a normal speed (the microphone button) and a slower speed (the tortoise button). Similarly to the translation exercise, This exercise can be done using the keyboard or by using the words that Duolingo provides and putting these into the correct order.

Figure 7
A screenshot of a listening exercise.

5. **Speaking exercise:** the learner is asked to read a short phrase in the target language and to repeat that phrase to the best of their abilities (see figure 8). This type of exercise can be skipped by selecting that the learner is unable to speak at that moment in time.

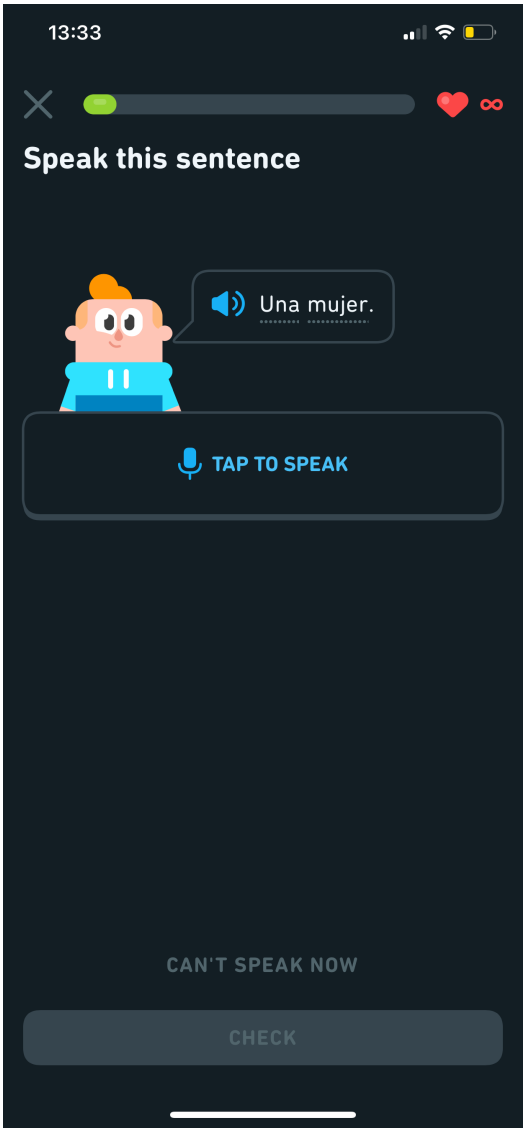

Figure 8
A screenshot of a speaking exercise.

Every lesson contains approximately 10 to 15 exercises consisting of various combinations of the types of exercises mentioned above. The learner can monitor their progression through the progress bar at the top of the screen. Every time a correct answer is given, this bar will move forward. The bar will not progress when an incorrect answer is given and, instead, the mistake will be pointed out and the exercise will be revised at the end of the lesson. If a learner answers all questions in the lesson correctly, the last three questions will be ”hard questions” where the learner has to translate sentences from the source language to the target language (see figure 9).

Figure 9
A screenshot of a translation exercise.

Besides the regular lessons Duolingo also offers learners of certain languages the option of completing additional Duolingo stories and audio lessons. Duolingo stories allows learners to listen to a story in the target language. During the story, learners will be asked to answer various questions, like true and false questions or questions that are similar to the listening exercises mentioned above (see figure 10).

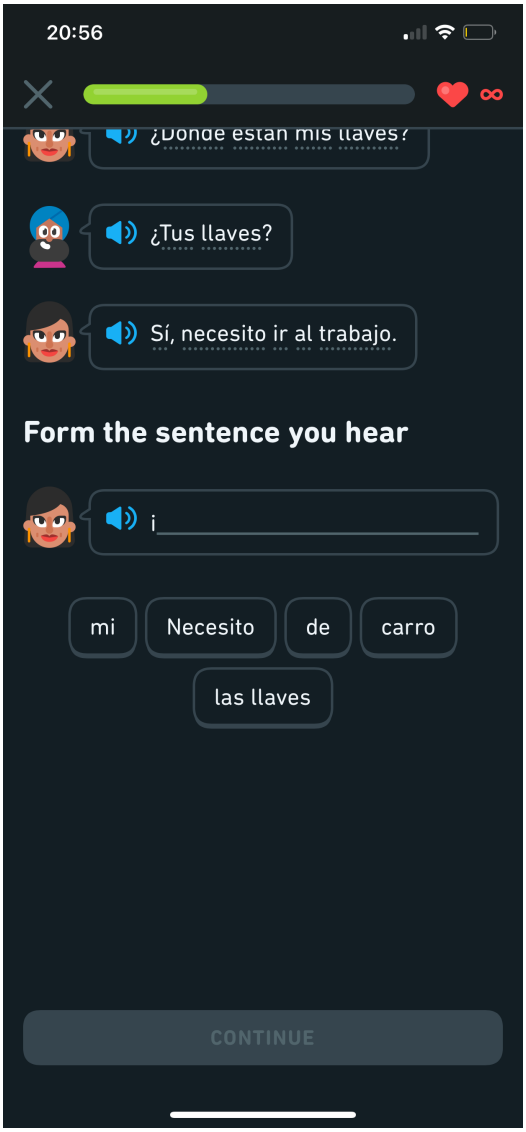

Figure 10
A screenshot of a listening exercise.

In the podcast lessons, which are audio-based lessons that combine the target language and the source language to give additional context to the words that learners are learning, learners are also asked to repeat and translate several core phrases (see figure 11).

At the end of every lesson, learners will gain experience points that contribute to their challenge goal. Completing these challenges will earn learners a special badge and move them up in the Duolingo league. The more experience points a learner gains, the higher their ranking will be in their current league. After a certain amount of time, the top 10 people in the league will

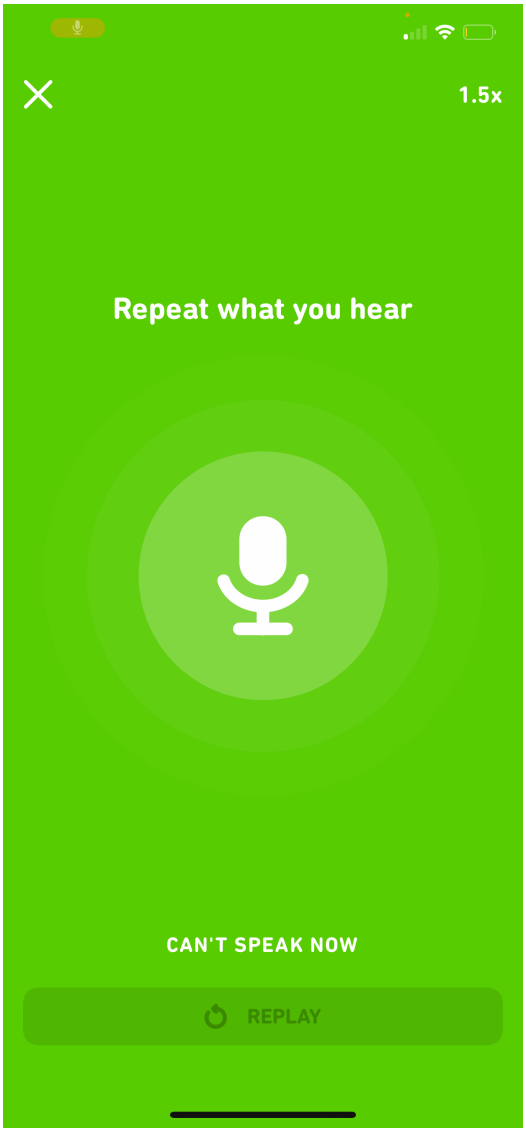

Figure 11
A screenshot of a podcast exercise.

move on to the next league. There are 10 different leagues ranging from bronze to diamond. Furthermore, completing a lesson will also earn the learner diamonds. These diamonds can be used to purchase special offers, power-ups, heart refills, and bonus skills in the shop. Besides streak freezes and timer boosts, certain language curricula also have additional skills available for purchase. The Spanish course, for example, offers idioms and proverbs, and flirting as additional skills.

Duolingo discriminates between different types of mistakes. While grammatical errors or

errors that hamper the correct understanding of the sentence are marked as incorrect, spelling mistakes that do not hamper the understanding of the intended meaning are not marked as incorrect. For example, writing ”muger” for the word ”woman” in the Spanish course is not marked as incorrect, while ”niña” for the word ”boy” is. Duolingo recognizes that the g in the word ”muger” is a typo and not a mistake. The learner will, however, be reminded of the correct spelling of the word and the spelling mistake made by the learner is pointed out. Whenever a learner provides an answer that is similar in meaning but not Duolingo’s intended translation, Duolingo will offer the learner an alternative answer.

Important to note is that Duolingo does not offer learners any grammatical explanations in any of the lessons. Learners are assumed to pick up on certain grammatical features like agreement by deducing the principle through trial and error, similar to the way that newborns pick up on language. Some of the grammatical aspects of the language are presented in the tips tab that is attached to a lesson. In the Spanish course for example, the conjugations of verbs are never mentioned in a lesson, but can be found in the attached tips. This allows learners to choose between discerning a rule themselves or looking at an explicit grammar explanation.

2.3.2 Duolingo’s language learning approach

According to Duolingo (n.d.), their approach is ”based on a methodology proven to foster long-term retention, and a curriculum aligned to an international standard.” According to their website, Duolingo’s approach consists of several components, namely ”real-life communication”, ”stand-out content”, ”implicit learning”, ”personalization”, and ”supplementary materials” like events, podcasts, and interactive stories. This section will explore these components of Duolingo’s approach more in depth.

The first part of Duolingo’s approach is their real-life communication. Duolingo (n.d.) argues that their app takes a ”functional approach” to this topic. They argue that they focus on what a learner will actually need to know in a real-life conversation. Duolingo claims it aids the development of vocabulary and grammar needed to hold a conversation with a native speaker on a

variety of topics. They explain that this is done through ”varied practice in reading, writing, listening, and speaking” (Duolingo, n.d.). Furthermore, the lessons that learners go through are typically themed around topics that learners will discuss in daily conversations such as animals, clothing, education, jobs, and feelings.

The second part of Duolingo’s approach is their standout content. Duolingo (n.d.) explains that this content consist of unnatural sentences such as ”The bear gave birth to a duck” and that these sentences keep learners on their toes. They claim that these sentences are more memorable and as a result the content of the sentence will be easier to remember. They also explain that these sentences challenge learners to think about the language and its structure in a more in-depth manner.

The third part of Duolingo’s approach is their balanced approach to grammar instruction. Duolingo (n.d.) states that it allows learners to figure out grammar rules by themselves through the concept of implicit learning. They argue that this implicit learning approach mimics the way a child learns their first language. They also argue that this approach is ”ideal for developing a strong foundational knowledge of a language and its rules”(Duolingo, n.d.) However, Duolingo (n.d.) recognizes that explicit grammatical instruction brings some benefits with it and offers learners the opportunity to access explicit instruction on the grammar, pronunciation, and helpful phrases in the target language before and during their lessons.

The fourth part of Duolingo’s approach is their personalization. Duolingo (n.d.) claims that they are able to analyze the answers that have been given by learners. Duolingo states that they are able to accurately assess the current level of the learner by using machine learning algorithms. Furthermore, this same machine learning algorithm is constantly at work to find new and improved data on the level of different learners. This, in turn, helps Duolingo find the right exercise at the right level for the learner and helps them improve the courses to better fit the needs of new learners of a certain language.

The fifth part of Duolingo’s approach is their many different ways of learning. As explained in the app description above, there are many different paths that learners can take to get

to their goal. Although the order of the lessons is rigid, there are many different options that give learners more freedom, e.g., unlocking lessons faster by skipping to a level and using the other methods of language exposure. Duolingo (n.d.) believes that a varied exposure to language is the best way to attain proficiency. To facilitate this, Duolingo offers interactive stories, podcasts, and even interactive in-person events.

The sixth part of Duolingo's approach is their continuous effort to improve the courses. Duolingo has embedded test questions in lessons that they use to analyze how learners are progressing through the course. By analyzing this data, Duolingo is able to see where the course can be improved and may improve on that front. This data is also used to update existing materials and to develop new and better courses.

Finally, the last part of Duolingo's approach is the gamification of learning. gamification is the use of game-like mechanics, aesthetics, and game thinking to engage and motivate people and activate them to learn actively (Deterding et al., 2011; Kapp, 2012). Research has shown that gamification results in an increased commitment (Marczewski, 2013), and motivation, engagement, and enjoyment (Dehghanzadeh et al., 2021). There are two principles that underlay gamification and its subsequent usage by Duolingo. One of these principles is the *Well-ordered problems principle* (Gee, 2007). This principle states that the problems that learners encounter early on cannot be too free-form or too complex since learners will then form creative hypotheses on how to solve a problem that may not work later on. Therefore, problems that learners face at the beginning of the learning process are paramount to their success and should be designed in such a way that they lead the learner to a hypothesis that works well on both the current problem that needs to be solved and aspects of more advanced problems. Duolingo applies this by providing learners with small and to-the-point phrases or sentences that focus on one particular problem, i.e., an unknown word or a grammatical structure, when a learner just started learning that language. Another principle is the *Information on demand* or *just in time principle* (Gee, 2007). This principle states that learners should have the necessary information available to them just in time for them to use it or on demand, i.e., whenever the learner feels they need it, since

learners are able to utilize verbal information the best when it is given to them in context and when they can see how it applies in actual situations. Duolingo applies this by providing learners with on demand translations of words during lessons and by providing learners with grammar tips when they make mistakes during lessons and outside of them. Overall, Martinelli (2016) argues that Duolingo's use of gamification mechanics, design aspects, and principles allows them to create an environment that fosters high engagement and empowerment levels.

Duolingo's approach has been on the receiving end of critique. Nushi and Eqbali (2017) note that the unnaturalness of the stand-out content that is used by Duolingo, like "their elephants drink milk", may leave learners confused and that the computerized voice that is used in many courses prevents the learners from interacting with the way a native speaker of the target language sounds. They further argue that the unnatural sentences that occur in Duolingo's courses may take away the attention of the learner instead of redirecting it to the structure Duolingo wants them to notice and may, instead, be distracting. The result of this could be that the learner does not retain the information as well because their attention is drawn away from the relevant content of the sentence and is, instead, drawn only towards its unnaturalness. Another downside that is mentioned by them is that learners need to know a specific language to learn another one, since Duolingo uses the source language to teach the target language. However, if a learner does not natively speak English, it can be hard to learn another language as it may not been available in the learner's source language. As Carreres (2006) notes, learning a new language through a second or additional language may prevent a learner from gaining full proficiency. Additionally, due to the design of the exercises, sometimes a new word is presented to a learner without the support of spoken pronunciations (Martinelli, 2016). Nushi and Eqbali (2017) have also noted that there is no real-time feedback for the most relevant skills here, which are reading and writing. Finally, the most impactful shortcoming is that there is no actual interaction and, therefore, no real communication between the learner and a proficient speaker of the target language (Nushi and Eqbali, 2017; Teske, 2017). Learners, therefore, have no way to get feedback on the way that they pronounce certain words or the grammar that they use in real time. These downsides imply that it

is not that technology is used but, rather, how it is used that affects the language learning process.

2.4 Language learning strategies

During any learning process, a specific way of learning, i.e., a strategy, needs to be adopted in order to efficiently learn something new (Hardan, 2013). It is important to consider what can be used to learn and how to use this to make learning as efficient and enjoyable as possible. These questions are also important when considering how to learn a new language. However, language learning strategies have become a contentious topic with much controversy since their original introduction (Griffiths et al., 2015). One of the many contentious aspects of learning strategies are their nature and their definition. The term ”learning strategies” has been defined differently by many different researchers (Hardan, 2013). The term was first defined by Rubin (1975) as “the techniques or devices which a learner may use to acquire knowledge” (p. 43). In the following decades this rather broad definition was interpreted and operationalized in many different and sometimes conflicting ways (e.g., Bialystok, 1981; Cohen and Aphek, 1980; Naiman, 1996). Rigney (1978), for example, defined ”language learning strategies as the often-conscious steps or behaviours used by language learners to enhance the acquisition, storage, retention, recall, and use of new information” (Hardan, 2013, p.1715). Wenden (1987) argued learning strategies should be defined as ”the various operations that learners use in order to make sense of their learning.” (p. 7-8). Oxford et al. (1990) defined learning strategies as a ”specific action taken by the learner to make learning easier, faster, more enjoyable, more self-directed, more effective, and more transferable to new situations.” (p. 8).

Griffiths (2008, 2013) and Griffiths et al. (2015) argued that a more precise definition was needed and distilled several different characteristics of learning strategies into six essential elements specifically for language learning strategies:

1. Learning strategies are active (Rubin, 1975).

2. Learning strategies are conscious and deliberate (Wenden, 1991).

3. Learning strategies are chosen from a large repertoire of possible strategies to best fit the situation (Bialystok, 1981; Cohen, 2014).

4. Learning strategies are goal-oriented which sets them apart from skills (Oxford, 2016).

5. Language learning strategies only contain those strategies that are related to learning a language and not a related but irrelevant strategies such a communication strategies.

Griffiths et al. (2015) argued based on the above characteristics of language learning strategies should be defined as ”actions chosen (either deliberately or automatically) for the purpose of learning or regulating the learning of language.” (p. 476). Based on these definitions, language learning strategies will be defined and operationalized as specific and deliberate or automatic actions taken by the learner to make the learning and regulating of a language easier, faster, more enjoyable, more self-directed, more effective, and more transferable to new situations.

2.4.1 The taxonomy of language learning strategies

Despite the many different definition of language learning strategies (cf., O’Malley et al., 1985; Oxford et al., 1990; Stern and Allen, 1992; Wenden, 1987), Hismanoglu (2000) argues that there is only a minimal difference between many of the different categorizations and that differences that are present do not radically change one categorization from the other. In this section of this thesis, I will, therefore, only discuss the categorization put forth by O’Malley et al. (1985), Oxford et al. (1990), Rubin (1975), and Stern and Allen (1992).

Rubin (1975), as a pioneer in the field of language learning strategies, distinguishes between two different types of strategies: those that contribute to language learning directly and those that contribute to it indirectly. There are three types of language learning strategies according to Rubin (1975): learning strategies, communication strategies, and social strategies. Learning strategies are strategies that contribute directly to the acquisition of language and can be subdivided into two separate categories: cognitive learning strategies and meta-cognitive learning strategies. Cognitive learning strategies refer to the strategies used to aid direct analysis,

transformation, and synthesis of materials. Examples of learning strategies include clarification, inductive inferencing, and deductive reasoning. Meta-cognitive learning strategies refer to the strategies that aid in the regulation and self-direction of language learning and include strategies such as planning and goal setting. Besides learning strategies, Rubin (1975) also defines communication strategies. These strategies indirectly have an influence on language learning as they are geared towards a speaker's ability to express themselves clearly and are meant to help speakers when there is a communicative breakdown and when their communication ends outrun their communication means. Finally, there are also social strategies. These strategies also contribute indirectly to the language learning process as they do not directly lead to the acquisition of language.

Unlike Rubin (1975), Oxford et al. (1990) argues that there are two types of strategies, direct and indirect, which are subdivided into three sub-strategies each. Direct strategies are subdivided into cognitive strategies which are mental strategies used to make sense of learning like practicing and analyzing, memory strategies which are used to store information like creating mental links and reviewing material, and compensation strategies which help learners overcome knowledge gaps like making educated guesses about the meaning of a word based on the context. The indirect strategies are divided into meta-cognitive strategies which help the learner regulate their learning like planning and evaluating learning, affective strategies which address the emotional requirement of learners like encouraging yourself and lowering anxiety, and social strategies which lead to increased communication between people like asking question and empathizing with others.

O'Malley et al. (1985) divided language learning strategies into three different subcategories, namely meta-cognitive strategies, cognitive strategies, and socio-affective strategies. Meta-cognitive strategies relate to the executive functioning of the learner and reflecting on the learning that has been done. It concerns monitoring the production of a learner's own speech or the comprehension of a text or conversation. Cognitive strategies are limited to direct manipulation of the material like translation or deduction. Finally, socio-affective strategies

relate to the mediation of social activity like cooperation or asking clarifying questions.

The last taxonomy that has been proposed is by Stern and Allen (1992). According to this taxonomy, there are five sub-strategies: management and planning strategies, cognitive strategies, communicative-Experiential Strategies, interpersonal strategies, and affective strategies. The management and planning strategies concern the learners' intention to direct their own learning and include strategies like setting reasonable goals and selecting appropriate resources. Cognitive learning strategies refer to the strategies used to aid direct analysis, transformation, and synthesis of materials. Examples of learning strategies include clarification, inductive inferencing, and deductive reasoning. Communicative-experiential Strategies are meant to avoid a communicative breakdown and include strategies like circumlocution and paraphrasing. Interpersonal strategies include knowledge of the target culture and strategies like cooperating with native speakers. Finally, affective strategies concern the monitoring of emotional feelings towards the target language and people associated with that language.

Although these taxonomies all have different components, their classification of language learning strategies are more or less the same (Hismanoglu, 2000). In fact, the different taxonomies seem to build on the taxonomies proposed before them. Stern and Allen's (1992) taxonomy seems to be the most diverged taxonomy here. Whereas the other taxonomies primarily mentioned similar categorizations, e.g., cognitive, meta-cognitive, and affective, Stern and Allen's (1992) taxonomy also includes management and planning strategies and communicative-experiential components. As this is the most extensive and elaborate taxonomy, I will adhere to the taxonomy as put forward by Stern and Allen (1992) throughout the rest of this thesis.

2.4.2 The proficient language learner

Many scholars (e.g., Griffiths et al., 2015; Hardan, 2013; Rose et al., 2018) mark the beginning of research into language learning strategies with the work by Rubin (1975). Rubin (1975) used what she called "good language learners" (p. 41) to determine what made some learners better and more efficient at learning a language than other learners. As Hardan (2013) notes, these good

learners ”represent [learners who make] use of good and proper strategies that lead to accurate acquisition [of a language]” (p.1723). By looking at the behavior that these ”good learners” exhibited while attempting to learn a language, the language learning strategies that they employed could be isolated and researched. The strategies used by these good language learners could then be taught to less successful language learners to help their learning become more efficient. In a study with almost 100 participants, Nadif and Benattabou (2021) looked for a correlation between ”good language learners” and test scores. Indeed, they concluded that ”there is a significant correlation between GLLs’ characteristics and academic achievement” (p.71). They also note that “research into the characteristics and strategies of good language learners provides us with further evidence that successful language learners share a plethora of learning traits which make their learning easier, enjoyable and worthwhile” (p. 71).

Who qualifies as a good language learner has shifted over time, however. Rubin (1975) does not clearly define what a good language learner is beyond claiming that good language learning depends on the variables aptitude, motivation, and opportunity. By this logic, a good language learner is a learner who has an aptitude for learning language, who is motivated, and who has the opportunity to learn and practice the language. In contrast, Hardan (2013) notes that there is no one profile for all good language learners. Since all learners are different and use a variety of resources to accomplish the same goal, it is impossible to limit the group of ”good language learners” based on a prescriptive set of criteria. Instead a broader, more inclusive view of who qualifies as a ”good language learner” should be taken that holds into account the individual differences between learners. Following this, a ”good language learner” will instead be referred to as an experienced language learner. An experienced language learner, then, is any learner who has successfully acquired proficiency in any additional language over the course of a longer period of time. These learners have not only become proficient in the language itself, but have also become proficient in how they are best able to learn a new language.

2.5 The present research

As mentioned before, there is still a pressing need for more research into language learning strategies that can be used with technology-assisted language learning. As outlined in the previous section, research into language strategies has received much attention and several taxonomies of language learning strategies have been proposed (O'Malley et al., 1985; Oxford et al., 1990; Stern and Allen, 1992; Wenden, 1987). None of these taxonomies took into account the technology that is now available and how this technology has changed the way that learners can approach learning a language. These taxonomies did not take into account the different language learning applications that are available to us now either. In order to fill the gap in the knowledge base in a satisfactory manner, this thesis aims to find the language learning strategies that may be used by language learners while using technology assisted language learning applications. To find the answer to this question the language learning strategies that may be used by language learners while studying a language using Duolingo will be researched. In order to achieve this, I have formulated the following research question:

1. What language learning strategies can be derived from experienced language learners' Duolingo use?

Chapter 3: Method

3.1 Introduction

In order to answer the research question laid out above, I collected data using a diary-based research design and by conducting semi-structured interviews based on the results of the diary entries filled out by the participants. Once data collection had started, the diary entries were analyzed after the first week of data collection was completed and coded for similarities and differences. The data was recoded once a week as data collection continued. Once participants had filled out the diary entries for four weeks, the data was analyzed one final time and the participants were invited to participate in an interview. The data from the diary entries was supplemented with the results of the interview and a conclusion was drawn about the language learning strategies that the experienced language learners employed while learning a language with Duolingo.

3.2 Data collection

3.2.1 Participants

In order to answer the research question outlined in the previous section, four experienced language learners were recruited to participate in the study. These people were chosen based on convenient sampling, a language background questionnaire (see Appendix A), and a consent form (see appendix A). In the end, four people were able to participate in the study. Participants were allowed to participate in the study if they had achieved at least B2 level of proficiency (see council of Europe, 2020) in a language beside their mother language that was acquired successively. The minimum required proficiency level was chosen based on previous research (e.g., Rivers, 2001) who used interagency language roundtable scale level 2 speakers, which is approximately equal to B1 level in (council of Europe, 2020) and in order to ensure participants had the necessary experience learning and studying the language. The participants who met this criterion consisted of four experienced language learners.

The four participants were all proficient language learners based on the criteria laid out above. Three of the participants identify as female and the remaining participant identified as male. The ages of the participants ranged from 21 to 50. All four participants differed in educational level (associate degree to university) and the level of exposure to their second language. The first participant immigrated to the Netherlands at 18 and learned to speak Dutch. The second participant has previously studied Japanese and lived in Japan for half a year. The third participant learned Somali to be able to reconnect with family. Finally, the fourth participant learned French for professional purposes. All participants speak their second languages at B2 level and have mostly learned their second language in a classroom, i.e., not through immersion. While none of the participants chose to learn a language they already considered themselves proficient in, Participant 1 and 4 did choose to learn a language they had some previous experience with, i.e., they indicated they knew some words and simple sentences of these languages already.

3.2.2 Materials

Language learning experience and proficiency questionnaire. As mentioned above, participants were chosen based on the results of a language background questionnaire. The participants' language learning experience was determined through a language background questionnaire based on the language experience and proficiency questionnaire (Marian et al., 2007). The language experience and proficiency questionnaire includes questions about language dominance, (age of) acquisition, level, and use of all a speaker's languages. The layout of this questionnaire was modified to ensure that filling it out online would be more user friendly and for the questionnaire to better align with the current research, which is recommended by Kaushanskaya et al. (2020).

Consent form. As mentioned above, participants were asked to sign a consent form. This consent form is based on the consent form template used by Leiden University and was modified to align with the current research.

Diary entry. In order to find out what the participants did while learning a language, i.e., what strategies they employed, their behavior needed to be analyzed. Diary entries can be used in order to achieve this. Diaries are ”pre-existing or solicited documents made up of sequential dated entries that purport to provide a record of the diarists’ observations and reflections” (Alaszewski, 2021, p.205). Alaszewski (2021) also notes that ”[diary entries] are a valuable source of information on phenomena that may be intrinsically difficult to observe, such as everyday [...] practices” (p.205). Bartlett and Milligan (2020) further note that diary entries provide ”a more in-depth understanding of people’s interpretation of their worlds [...] as they can provide a useful tool for developing realistic pictures of an individual’s everyday life” (p.14).

A diary entry form was created to investigate the participants’ self-reported behaviors and their motivation for taking these steps (see appendix B). The form consists of nine questions related to the participants’ use of Duolingo and their reasoning for taking those specific actions. The form was divided into three sections. The first section consisted of the first question. The first question was created in order to identify the participant. This was done so the participant could be linked to the data. The data was later used as a basis for the interview questions. The second section consisted of the second to fifth question. These questions were created based on earlier research by Isbell et al. (2017), who researched the efficacy of Duolingo through narrative writing. These questions were created to elicit what the participants did to learn their chosen language, why they chose to do so, and how long it took them to do it. The questions in the last section of the form were based on earlier research by Halbach (2000) and Isbell et al. (2017), who both used reflective questions in order to gain a better understanding of the participants’ experience learning a language. Finally, the last question was included to ensure that participants had a place to express any feelings or behaviors that they had exhibited during the language learning that they felt they had not been able to express before that moment. Many have noted that this is important, e.g., Magnusson and Marecek (2015), as this can provide some interesting and unexpected results. Therefore, the questions in this section were created to allow the participants to reflect on their language learning and to elicit what they thought were their own good practices and what they

would do differently. Although the participants are assumed to be experienced language learners and, therefore, to exhibit good language learning practices, they may realize that the approach that they have taken to language learning over the course of the experiment was not optimal for them. Hence, the questions in this section were also created to provide a deeper insight into what the participants considered their stronger and weaker language learning practices.

Interview. To gain a more in depth understanding of the participants learning strategies, one interview was conducted with each participant. Interviews are said to be ”more powerful in eliciting narrative data that allows researchers to investigate people’s views in greater depth” (Alshenqeeti, 2014, p.39). Interviews also have a higher return rate, produce more complete answers, and are flexible (Alshenqeeti, 2014) as they ”provide very rich information and it offers the opportunity to ask follow-up questions, probe additional information, justify previous answers, and establish a connection between several topics.” (Queirós et al., 2017, p.378). Furthermore, Magnusson and Marecek (2015) say that good interview questions ”elicit full, rich, and personalized stories from participants, and encourage them to volunteer their reflections on their experiences” and that they ”provide material directly related to the interview topics” (p.52). With these characteristics in mind, a semi-structured interview guide was created.

Based on the results of the diary entries described above, an interview guide was created (see appendix C). The interview guide was created based on the work of Magnusson and Marecek (2015). They note that semi-structured interviews have a conversational tone and that, as such, an effort should be made to help participants feel at ease. The first part of the interview guide was created with this goal in mind. Then, Magnusson and Marecek (2015) explain what the main body of the interview should contain. The questions should be easy to understand, relate directly to the topic, it should be an open-ended question, that does not lead participants to a certain answer. With this in mind, questions about two main topics related to the research question, namely the diary entries and what the participants think new language learners should do with Duolingo, were created. Finally, Magnusson and Marecek (2015) note that the interview should be ended by giving participants the opportunity to reflect on the interview and by giving them the

opportunity to add or amend anything. With this in mind, the final three questions were created.

The interview guide was piloted three times with three different people who were not participants in the study and who regularly, i.e., at least four times a week, use Duolingo. The interview guide was updated based on the answers given by the participants after each interview. This was done in order to ensure that the questions would be result in data that would help answer the research question.

3.2.3 Procedure

Language learning experience and proficiency questionnaire and consent form. A message aimed at recruiting participants was sent out to several people familiar with the researcher. After indicating a willingness to participate, potential participants were sent the language learning experience and proficiency questionnaire and consent form in one package. Participants were asked to fill out the questionnaire and sign the consent form. Participants were given a short explanation on both. Participants were also instructed to contact me if any questions or uncertainties arose while filling out the questionnaire or the consent form. After the potential participants returned the questionnaire and the consent form, both were checked for any missing information and the participants were chosen.

Diary entries. After the participants were chosen, the participants were asked to start filling in diary entries. A link to a Qualtrics survey, which contained all the diary entry questions in survey form, was sent to the participants. This was done to ensure the privacy of the participants, as Qualtrics prevents access to private information. Participants were sent information about the experiment and what was expected of them. Participants were given instructions on how to fill out the survey and its different sections as described above. Every day, at the discretion of the participants, the survey would be filled in. Participants were free to choose the order in which they wanted to answer the questions and were able to move back and forth between questions freely. The participants were also free to choose whether to fill out the second part of the survey more than once a week.

interview. Two of the participants agreed to be interviewed about the experiment. One of the participants was interviewed in real life, while the other participants was interviewed over zoom. During the interview the questions in the interview guide were used to probe for further information regarding the results found in the diary study. The interviews were recorded using a MacBook laptop for the in-person and zoom for the online interview and, after the interviews had been conducted, the data was transcribed and analyzed as described below.

3.3 Data analysis

Diary entries. The diary entries were analyzed using Grounded Theory. This method was first proposed by Glaser and Strauss (1967) and can be described as a constant comparative method. Chun Tie et al. (2019) explain that it "is appropriate when little is known about a phenomenon; the aim being to produce or construct an explanatory theory that uncovers a process inherent to the substantive area of inquiry. One of the defining characteristics of GT is that it aims to generate theory that is grounded in the data" (p.1-2). This method was chosen as there are no theories or taxonomies about technology-assisted language learning strategies yet. Although research has been done into language learning strategies in traditional settings, these do not provide sufficient basis for the selection of a priori codes since the introduction of technology may significantly alter the strategies employed by learners. The process of analyzing data with Grounded Theory can be found in figure 12. As Chun Tie et al. (2019) note, there are multiple stages to analyzing data according to this methodology. In the initial coding stage, "the purpose [...] is to start the process of fracturing the data to compare incident to incident and to look for similarities and differences in beginning patterns in the data" (p.5). The initial coding of the collected data was started after the first week of data collection. The collected data was analyzed for similarities and differences in the answers of the participants, and this led to the creation of three different codes.

Then, in the second round of coding, the "coding begins to transform basic data into more abstract concepts allowing the theory to emerge from the data" (Chun Tie et al., 2019, p.6). This

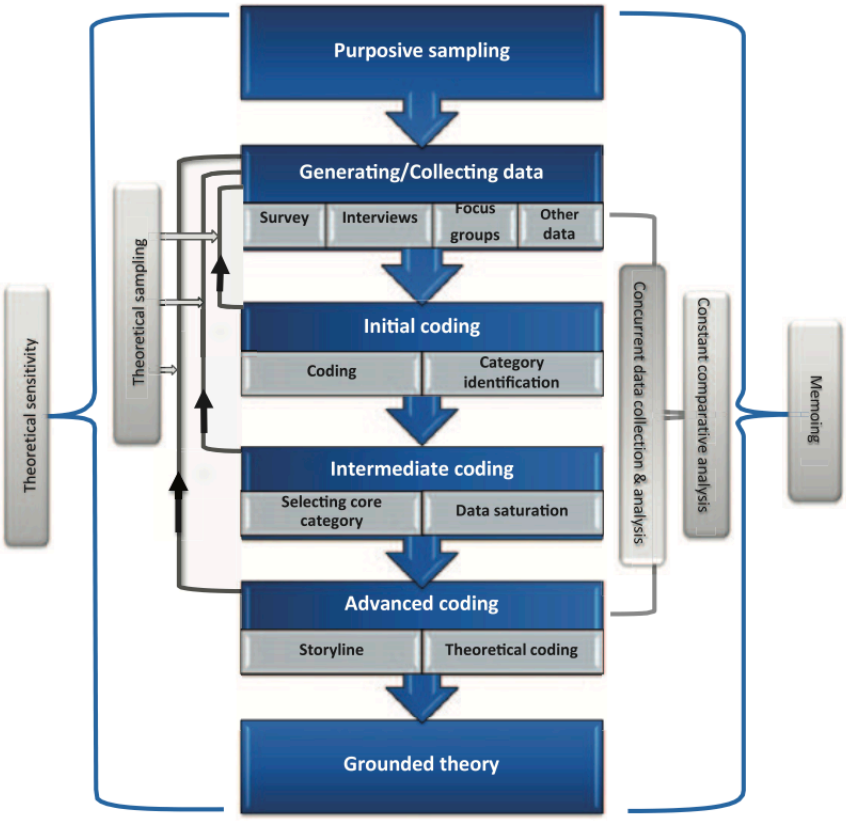

Figure 12

The process of gathering and analyzing data using Grounded Theory methods. Reprinted from Chun Tie et al. (2019).

round of coding took place after the second week of data collection had finished. During this coding round the data were still compared for similarities and difference and the three codes found during the first round of coding were further divided into 6 different codes. This was then further reassessed during the third round of coding, which took place after the third week of data collection had finished. During this round of coding the data points were further compared for similarities and differences and the six codes mentioned above were condensed into five.

After the final week of data collection, the final round of analysis took place. This round was the last and final round of coding and the aim was to ”[integrate and synthesize] the categories derived from coding and analysis to now create a theory” (Saldaña, 2021, p.224). During this round of analysis, the existing theory, i.e., the taxonomy proposed by Stern and Allen (1992), was used to determine whether the codes that had been found up until then needed to be

updated. The five codes were updated and further divided and combined to six different codes that will be discussed in the results section below. The final resulting taxonomy will be discussed in the discussion section.

To ensure inter-rater reliability, the data was coded every week and then sent to two other raters. The raters were chosen based on their familiarity with language learning strategies, both are modern foreign language teachers, and their educational level, both hold a master's degree. The raters were instructed to analyze the data for similarities within and across participants. They were also instructed to examine the codes proposed by me and compare those with the codes they proposed themselves. The raters would go through the data and check if they would code the data the same way. Memos were used in order to keep track of all the ideas and codes that were proposed. Chun Tie et al. (2019) note that "memos are reflective interpretive pieces that build a historic audit trail to document ideas, events and the thought processes inherent in "the research process and developing thinking of the analyst" (p. 4). These memos were used to share our thoughts, critiques, and questions about the data. An excerpt of the coding and the memos can be found in figure 13.

Interview. After the interviews had been conducted and transcribed, the data were analyzed in the same manner as the diary entries, i.e., using the methods described in Grounded Theory (Glaser and Strauss, 1967) and above. The transcriptions were coded using the same codes found in the diary entries and also analyzed for possible new codes. The transcriptions were also analyzed to see if the codes found in the diary entries needed to be updated. Similarly to the analysis of the diary entries, the transcriptions were sent to the two other raters mentioned above to ensure inter-rater reliability.

1 ASO	In my Spanish Duolingo course, I learned about schools. Specifically, the nouns that are associated with schools, such as pens, university, libraries, and classes. I also learned about the differences between this and that, such as saying this book, or that book.	No, I did not use the review function because I felt that I had learned enough from the lessons themselves.	No, I did not use any resources outside of Duolingo.	I spent a total of 15 minutes on language learning today. I stopped when I did because the lessons felt repetitive and that I was able to understand what the lessons were about, without going further.	That I was focused on learning and felt inspired to do so, which I do not always feel.	Sometimes I do not feel like taking the time to learn, although it is only 15 minutes of my day. However, I have been inspired to do so, so far this week.	I would maybe spend more time on paying attention and trying to really understand what it is I am learning, and how I can apply that to a conversation or a certain situation.	So far, I find the language learning fun and love using Duolingo. I believe that I will take it further and spend time using other resources as well to enhance the language learning experience.		
1 ENY	I completed 4 levels of Hiragana 1 in Japanese, I have been missing Japan and wanted to improve my Japanese skills.	I did not, mainly because it is my first day conducting it and I was not aware of the function.	No, did not feel the need today.	I would estimate one hour		Tot nu toe gevonden codes: - interne motivatie --> lichtoranje - externe motivatie --> donkeroranje - leerplanning. --> donkerblauw - tijdsmanagement --> lichtblauw - cognitief --> groen Potentieel nieuwe code --> rood.				
1 IGI	Ik heb vandaag de eerste levels van de eerst drie skills gedaan (basics, basic 2, phrases).	Sinds ik net pas ben begonnen met deze course en nog geen skills heb voltooid, heb ik deze optie nog niet kunnen gebruiken.	Nee.	Ongeveer 20 minuten, want toen had ik geen zin meer.						
1 DAB	ik ben vandaag begonnen met basics van italiaans. Level 1 en 2 heb ik afgerond.	Nee, maar dat kan ook nog niet.	Nee, maar er is ook nog niet zoveel dat ik op hoef te zoeken ofzo.	25 minuten.		Ik zie de volgende dingen terugkomen in week 1: - de participanten zijn allemaal gemotiveerd om aan de slag te gaan. Dit kan zijn vanwege omdat het allemaal nieuw is of omdat het experiment een "stok achter de deur zet", oftewel motivatie komt van een externe bron. - de gemiddelde gebruiksduur is ongeveer 10 - 15 minuten, daarna stoppen de participanten omdat ze genoeg geleerd hebben. Hoe zouden ze dit inschatten? - de review functie, voor zover die in dit stadium al gebruik kan worden door de participanten, wordt niet gebruikt als zij het gevoel hebben dit nog niet nodig te hebben (ze weten nog genoeg). Hoe zouden ze dit inschatten? - soms blijkt het plannen en tijd maken voor duolingo moeilijk in combinatie met het leven. dit leidt tot minder lange gebruiksduur. Voorstel coderen: - motivatie - tijdsmanagement en planning.	KMA: Ik kan me vinden in de voorstellen die je hebt gedaan. Ik denk wel dat je er 1 over het hoofd hebt gezien en dat is dat participanten klaarblijkelijk niet het nut inzien van externe resources. Ze hebben er geen van allen een gebruikt! Wellicht goed om erover na te denken waarom dat dat is. Daarnaast zie ik het woord "understand" vaak terugkomen en dat participanten genoeg hadden geleerd, wellicht dat je daar ook nog iets mee moet in de komende analyze rondes. Voorstel coderen: - motivatie - tijdsmanagement en planning. - cognitief (?)		
2 ASO	Today I finished two levels of People 2 in the Spanish course. I chose to complete these levels because once completed, I would have mastered this level of People 2.	No, I did not use the review function. After making very few mistakes in the lesson, I thought I had sufficiently studied enough that I would not have to review.	No.	I spent a total of 15 minutes on language learning today. I finished when I did because I felt that I had adequately understood the lesson and felt that I was ready to move on.						
2 ENY	So today I found that the Dualingo app for Japanese has a function where you can focus on just practicing the hiragana (or katakana) so I only focused on learning my hiragana today as this is the area of Japanese I need the most work for my fundamental skills.	I know what it is, I did not use it today. I didn't feel like I needed it.	I did not.	Somewhere around 30 min to 45 min I would guesstimate.						

Figure 13

An excerpt from the coded data and from the memos taken during data analysis.

Chapter 4: Results

4.1 Introduction

In this chapter, I will discuss the results of the experiment that was conducted. The results chapter is divided into two sections. The results of the diary entries, i.e., the codes that were found during the Grounded Theory analysis and quotes from the diaries themselves will be provided. Then, the noteworthy results from the interview with the participants will be outlined.

4.2 Diary entries

Data collection resulted in approximately 100 diary entries. The data analysis using Grounded Theory as described above resulted in five codes, namely (a) internal motivation, (b) external motivation, (c) meta-cognitive, (d) time management, and (e) cognitive. Some of the codes that were found occurred in the same entry, i.e., the same entry contained examples of more than one code. Participants indicated behavior related to internal motivation strategies 35 times, to external motivation strategies 8 times, to meta-cognitive strategies 46 times, to time management strategies 15 times, and to cognitive strategies 10 times. The results of the diary entries, the codes, and their related behavior are discussed below. For each code, a summary of the behaviors that were found in the diary entries is provided and then a specification of the behavior with examples is supplied.

Internal motivation. The internal motivation code was found after analyzing the behaviors indicated by the participants. The behaviors found in this code consist of a range of personal reasons and attributes that support or inhibit the language learning process of the participants. Participants indicated that they are able to recognize those factor that either supported or inhibited their language learning.

More specifically, participants reported a feeling of repetitiveness, which also lead to boredom in some cases, that inhibited their language learning. They also indicated a feeling of general unwillingness or tiredness. According to the participants, these feelings were the reason they stopped language learning with Duolingo that day.

> ”I spent a total of 15 minutes on language learning today. I stopped when I did because the lessons felt repetitive.” (participant 1)
>
> ”I stopped when I did because I did two different skills, and I did not want to overdue to the practice as I find it repetitive and boring.” (participant 1)
>
> ”Today, I spent about a total of 10 minutes on language learning. This was a personal reason because I am very tired.” (participant 1)
>
> ”Ongeveer 20 minuten, want toen had ik geen zin meer”, *about 20 minutes, because I did not feel like continuing afterwards.* (participant 4)
>
> ”I was tired this morning, I only did one class.” (participant 2)

Participants also reported a feeling of excitement and bouts of language learning inspiration in the diary entries. Participants indicated that these feelings and bouts were the reason that they continued to learn using Duolingo.

> ”I was focused on learning and felt inspired to do so.” (participant 1)
>
> ”Ben wel erg gemotiveerd om aan Duolingo te werken.” *I am very motivated to work with Duolingo* (participant 3)
>
> ”I have been missing Japan and wanted to improve my Japanese skills.” (participant 2)
>
> ”I find the language learning fun and love using Duolingo.” (participant 1)
>
> ”ik was vandaag gemotiveerd om pron. Obj. af te maken.”, *I was motivated today to finish pron. Obj.* (participant 4)
>
> ”I have been working on the Peoples skill for the past few days and wanted to continue to improve efficiency and master the lessons.” (participant 1)

External motivation. The external motivation code consists of a variety of reasons and feelings brought on by ”external” sources, i.e., not the learners themselves, that motivate language

learning using Duolingo. The participants indicated that they experienced these thoughts and feelings, but provided no evidence that they were able to regulate these feelings themselves.

In the diary entries, participants reported that the build-in gamification mechanics of Duolingo contributed to their willingness to use Duolingo to learn a language.

> ”I wanted to not loose my streak.” (participant 2)

> ”dat ik nu een streak heb die ik bij kan houden en dat ik lessen afmaak me motiveert om te blijven leren tot ik er genoeg van heb.”, *that I have a streak to maintain now motivates me to keep learning until I have had enough.* (participant 4)

> ”Ja, want ik kon basics herhalen en dat is goed voor m’n exp!”, *Yes, because I was able to repeat basics and that is good for my exp!* (participant 3)

> ”the streak function keeps you coming back at least once a day sometimes two or three times a day.” (participant 2)

Participants also indicated that feeling a self-imposed obligation towards me, the researcher, to fill in the diary entries helped motivate them to continue learning.

> ”Ik denk dat meedoen met dit experiment bijdraagt aan het succes van deze week. Het zet een stok achter de deur.”, *I think participanting in the experiment contributes to this week’s success. It is an incentive.* (participant 4)

> ”Ben wel erg gemotiveerd om aan Duolingo te werken en het gewoon te doen (ook omdat ik dit in moet vullen).”, *I am very motivated to work with Duolingo and just do the work (also because I have to fill this in).* (participant 3)

Meta-cognitive. The meta-cognitive code consists of a variety of processes that help the learner evaluate and recognize where they currently are in their language learning process and what steps they need to take to progress. Participants indicated that sometimes they felt certain steps were needed to progress, while, at other times, participant indicated not taking certain steps was better for their learning process.

Participants highlighted that they were able to recognize when they had learned enough and were able to move on to the next step in their diary entries.

> ”I had learned enough from the lessons themselves.” (participant 1)
>
> ”I only focused on learning my hiragana today as this is the area of Japanese I need the most work.” (participant 2)
>
> ” Ik heb de skip optie gebruikt omdat ik voelde dat ik alles in deze les goed genoeg kende en omdat ik minder tijd had vandaag.”, *I used the skip option today because I felt I know everything in this lesson well enough and because I did not have as much time today.* (participant 3)
>
> ”I felt I had studied enough and passed the quizzes with very good results.” (participant 1)

The diary entries showed that participants also reported the ability to recognize what steps to take next, or what steps to take next time, in order to progress most efficiently.

> ”Ik denk dat ik de skills wat verder af zou maken dan alleen het eerste level.”, *I think I should finish the skills beyond just the first level.* (participant 4)
>
> ”I did not use the review function today because I did not feel it was sufficient enough for me. However I plan to do so tomorrow.” (participant 1)
>
> ”ik ga de volgende keer wat sneller de skip functie gebruiken. Zo rond les 3 weet ik de inhoud al wel., *I am going to use the skip function more next time. I know the content around lesson 3.* (participant 3)
>
> ”the first time I did consider [using the review function] today.” (participant 2)

Time management. The time management code consists of the ability to dedicate time to language learning. Participants indicated that setting a specific time for their language learning helped them pay attention to what they were learning and helped them prevent having to learn when they were tired.

In their dairy entries, participants highlighted that being tired and having to stop due to poor planning and time constraints were among the main reasons that hindered their language learning.

> ”I stopped when I did because I did not have time to continue further.” (participant 1)

> ”I should try to plan a specific time every day where I can dedicate this time to doing the Duolingo, rather than doing it whenever is convenient during the day. For me, this helps me to be more punctual and organized.” (participant 1)

> ”when I get busy making time for duolingo becomes harder.” (participant 2)

> ”had niet zoveel zin of tijd vandaag.”, *I did not really feel like learning or have much time today* (participant 4)

One participant also emphasized that remembering to do Duolingo and to include it into their daily routine was hard and a hindering factor in their language learning process.

> ”Remembering to do [a Duolingo lesson is something I want to improve]” (participant 2)

Another participant also noted that having more time for Duolingo allows a learner to continue learning for longer.

> ”en nog wat extra lessen gedaan, want ik had wat meer tijd en energie vandaag”, *and I completed some extra lesson, because I had more time and energy today* (participant 3)

Cognitive. The cognitive code consists of the approaches and processes that aid a learner in solving and analyzing problems, and synthesizing learning materials. Participants reported that practice in particular skills and monitoring progression helps with their understanding of the content.

Participants indicated that finishing a full skill and reviewing helps with the memorization of a lesson’s content and that finishing grammar skills in a particular order results in a better understanding of grammar.

> ”Omdat ik [definites and plurals] nog niet zo goed beheers gebruik ik nu de skip optie niet maar ga ik ze allebei om en om door. Aangezien de twee in het zweeds ook gelinkd zijn, helpt dit wel met mijn begrip ervan.”, *because I have not mastered definites and plurals I am not using the skip option but finishing them by alternating between them. As the two are linked in Swedish, it is aiding in my understanding of them.* (participant 4)

> ”Yes, today I chose to use the review function because it would help me to have one last overview of everything I learned.” (participant 1)

> ”Dat ik alle skills probeer helemaal af te maken (naar goud) heel erg helpt bij het onthounden en kunnen toepassen van de woorden in een zin.”, *That I am trying to finish all skills (to gold) is helping a lot in remembering and applying words in a sentence.* (participant 1)

4.3 Interviews

The analysis of the interview data did not result in the addition or amendment of the coding outlined above. However, the interviews did provide valuable additions to the data gathered in the diary entries. The first question asked about the process of finishing a skill. Both participants indicated that they felt Duolingo was designed in such a way that it motivated them to finish a skill, to gold for one participant and to level four for the other, before moving on to the next skill. One participant also indicated feeling that a lesson was not completely finished until it had been completed to gold (the highest level), even if the previous levels of that particular skill had been passed. This participant also indicated that they finished skill entirely in order to prevent themselves from starting too many skills at the same time. The other participant expressed similar sentiments, but felt comfortable moving on when the skill hit level four. This participant would also move on to the next skill when they felt they had mastered a skill enough. This was measured through the number of mistakes made during a lesson, where they would move on if they made nearly no mistakes.

The second question was composed to find out how the participants knew when they were ready to stop learning. One participant indicated that they only used Duolingo for one quick lesson to maintain their streak some days. On those days, they would stop after that one lesson, as they would not have more time for another. Other days, however, the participant would continue learning until they ran out of Duolingo lives. The other participant indicated that the timing and the setting played a big part in deciding when to stop. The participant explained that the time they spent learning a language on Duolingo would be shorter when they did it on their way to work or later at night when they were tired. This participant also indicated that they sometimes spent more time learning because they wanted to finish at least two lessons a day.

The third question investigated why none of the participants decided to use outside resources during the experiment. The first participant indicated that they did not use outside resources, because they felt it was unnatural to use both Duolingo, and leave it running in the background, and outside resources at the same time. They also indicated that, at the level that the participant was at, Duolingo was sufficient enough that no outside resources were needed in order to help them become more proficient in the language of their choice. The other participant added that they felt they did not know what other resource to use and that they felt they lacked the time in order to use outside resource, as both finding and using outside resources is time consuming.

The fourth question asked participants to reflect on their language learning and what they would do differently next time. The first participant indicated that they would plan their language learning more. They indicated that using Duolingo at a set time of the day, e.g., during breakfast or lunch, would motivate them to do it more. They also indicated that this would prevent them from failing to complete a lesson, since they could plan and make sure they had enough energy when using Duolingo. The other participant indicated that they would use external resources next time. They explained that, at the level they were at, using outside resources was more important as they felt Duolingo was falling short in providing them with the right resources to progress.

Finally, the fifth question elicited what the participants would recommend to a less experienced language learner who wants to use Duolingo to learn a language. The first participant

indicated they thought some of the most important aspects that can contribute to successfully learning a language with Duolingo are creating a planning for yourself and creating a routine with a dedicated time slot for Duolingo and to ensure there is enough input by, for example, watching tv shows in the target language. The other participant agreed with both points that were made by the first participant and added to this by pointing out that consistency is an incredibly important aspect of language learning success and that, although Duolingo is a great application for language learning, it only offers a limited number of resources and that new learners should seek out other resources like books as well.

Chapter 5: Discussion

5.1 Introduction

In this chapter, I will summarize, synthesize and discuss the finding of the data that was gathered during the experiment, and answer the research question at the center of this thesis, namely what language learning strategies can be derived from experienced language learners' Duolingo use? to address this question, I compare the learning strategies found in the data, examples of which are given in section 4.2, to the those found in the taxonomies outlined in the section 2.4.1 of the literature review and discuss what language learning strategies can be derived from the data.

5.2 Technology-assisted language learning strategies

The results of the experiment led to the finding of five different codes that have been deduced from the behavior that participants indicated in the diary entries. These codes can be further subdivided into more specific language learning strategies employed by experienced language learners while using Duolingo. Below, each code found in the analysis of the diary entries is discussed based on the quotes that can be found in the result section and they are compared with previously proposed taxonomies of language learning strategies and subdivided into technology-assisted language learning strategies.

The results of the analysis show that the language learning strategies in the first code, internal motivation, facilitate or inhibit the language learning process from within the learner. As can be seen in the examples in the result section, participants indicated feelings of repetitiveness, boredom, tiredness, and a general unwillingness to learn at times. Participants wrote that these feelings stopped them from continuing their learning for the moment or for that day. Participants knew how to act when they recognized these feelings and would choose to stop for the moment or for the day. Participant 1, for example, noted that they "spent a total of 15 minutes on language learning today. [They] stopped when [they] did because the lessons felt repetitive". However, participants also indicated feeling motivated, excited, and experienced bouts of inspiration that allowed them to continue learning for a longer period of time. Participant 2, for example, noted

that they ”have been missing Japan and wanted to improve [their] Japanese skills”. This shows that participants are able to recognize and act on their feelings. This aligns with the finding of previous research by Stern and Allen (1992), whose taxonomy of language learning strategies is outlined in the literature review, and who note that, in what they call the affective strategies, ”good language learners” are able to take their emotional temperature. Hence, the results of both this research and previous research into language learning strategies agree that participants are able to monitor their feelings towards their language learning and know how to act on those feelings. By combining the results found in the experiment with the results of Stern and Allen (1992), the internal motivation code can be further subdivided into two strategies used by experienced language learners while using Duolingo:

1. A learner is able to recognize positive feelings towards language learning and knows how to act on those feeling.

2. A learner is able to recognize negative feelings towards language learning and knows how to act on those feeling.

The language learning strategies in the second code, the external motivation, facilitate or inhibit the language learning from outside of the learner. In the results of the diary entries, the participants wrote that they were motivated to learn by various outside sources such as the build-in gamification of Duolingo, but also by the knowledge that they were participating in an experiment and that they were helping me, the researcher, by doing so. Participant 2 noted that they ”wanted to not loose [their] streak” and participant 3 noted that they were ”very motivated to work with Duolingo and just do the work (also because I have to fill this [diary entry] in)”. This shows that participants are able to utilize outside resources to motivate themselves. Although this has not been previously found in taxonomies of language learning strategies (cf. Hismanoglu, 2000; O’Malley et al., 1985; Oxford et al., 1990; Rubin, 1975; Stern and Allen, 1992; Wenden, 1987), Stern and Allen (1992) do suggest a very similar learning strategy in their affective strategies, which is that ”good language learners” are able to encourage themselves. Based on

this, I suggest here that experienced language learners are able to recognize where their motivation comes from, i.e., what external factor is motivating them, and are able to use that to motivate and encourage themselves. By comparing the results found in the experiment with the results of Stern and Allen (1992), the external motivation code contains one strategy:

1. A learner is able to recognize the external factors that motivate them and is able to encourage themselves (to continue) to learn.

the language learning strategies in the third code, the meta-cognitive, help a learner recognize where they are in the learning process and what they need to do in order to progress. In the results, the participants highlighted that they were able to recognize where they were in their learning progress, i.e., what they already knew, what they did not know yet, and what they needed to do in order to progress in their language learning, in essence learners seem to provide themselves with feedback (e.g., Hattie and Timperley, 2007). In the diary entries, participant 3 indicated that they ”used the skip option [that day] because [they] felt [they knew] everything in this lesson well enough”. During the interviews, the participants also mentioned that they believe it is important to select the right resources. In the results of the diary entries, participants indicated being able to reflect on what they had learned and when they had learned enough. Participant 1 noted that they ”felt [they] had studied enough and passed the quizzes with very good results”. This shows that learners are able to monitor their own language learning process and make decisions to progress as efficiently as possible. Both Oxford et al. (1990) and Stern and Allen (1992) mention these strategies in their taxonomies as well. Oxford et al. (1990) argues that learners are able to arrange, plan, and evaluate their learning, while Stern and Allen (1992) argue that learners are able to set appropriate goals and that they are able to decide on the appropriate resources. By synthesizing the results found in the experiment with the results of Stern and Allen (1992) and the results of Oxford et al. (1990), the meta-cognitive code can be subdivided into four language learning strategies:

1. A learner is able to recognize where they are in the learning process, i.e., what they already know and what they do not know.

2. A learner is able to plan what steps need to be taken in order to progress.

3. A learner is able to choose the right materials in order to progress.

4. A learner is able to evaluate their learning and determine what they need to do differently.

The language learning strategies in the fourth code, time management, allow learners to decide when and how long to learn a language. In the results, the participants emphasized that creating a specific time for language learning and being consistent about language learning, i.e., learning in regular intervals such as daily, contribute to language learning. Participant 1, for example noted that they ”should try to plan a specific time every day where [they] can dedicate this time to doing the Duolingo, rather than doing it whenever is convenient during the day. For [them], this helps [them] to be more punctual and organized”. Participants also indicated that having sufficient time for language learning and dedicating time to really sit down and pay attention to what they are learning lead to better results. In the interview, one of the participants also indicated that they need sufficient time to be able to select the right materials to learn a language with. This shows that learners are able to monitor when in the best time for their language learning. This is different from what has been previously found in taxonomies of language learning strategies (cf. Hismanoglu, 2000; O’Malley et al., 1985; Oxford et al., 1990; Rubin, 1975; Stern and Allen, 1992; Wenden, 1987). Based on these results, the time management code can be divided into two language learning strategies:

1. A learner is able to plan dedicated time to language learning and follow through in a consistent manner.

2. A learner is able to dedicate time to finding the resource needed to progress their language learning.

The language learning strategies in the fifth code, cognitive, aid the learners’ ability to solve and analyze a problem, and synthesize learning materials. In the results, participants indicated they were able to analyze their own learning and determine how to make it more

effective. They were then able to apply this and monitor their mistakes. They were also able to discover the relationship between various different grammatical concepts and determine how to practice the skills for themselves to increase their language learning efficiency. Participant 4 noted that ”because [they had] not mastered definites and plurals [they were] not using the skip option but finishing them by alternating between them. As the two are linked in Swedish, it [was] aiding in [their] understanding of them”. Stern and Allen (1992) also found these language learning strategies and name practice, monitoring, and deductive reasoning in their taxonomy. By comparing the results of the diary entries and the results of Stern and Allen (1992), the cognitive code can be subdivided into three language learning strategies.

1. A learner is able to monitor their mistakes.
2. A learner is able to use deductive reasoning to link different aspects of the language to each other.
3. A learner is able to practice and memorize vocabulary and grammatical structures.

5.3 Implications

The findings of this research have several implications for both autonomous language learners and (modern foreign) language educators. As mentioned in the literature review, there was a pressing need for research into language learning strategies that took into account the technology and the language learning applications that are available to us now. This information can help autonomous language learners make more informed decisions on the steps they need to take to make their language learning more efficient. For example, learners may change the way that they decide to learn a language by adapting the time they generally learn a language or by looking at the materials that they use more critically. At the same time, the results of this research also help (modern foreign) language educators advise their student on how to use Duolingo and other technology-assisted language learning applications to enhance their language learning. It may even inform these educators on how to use these applications in the classroom or give them the

necessary tools to feel comfortable enough to do so. Furthermore, the results may also inform teacher-trainer programs about the technology-assisted language learning strategies that they should teach to pre-service teachers, as Almekhlafi and Almeqdadi (2010) and Kartchava and Chung (2015) suggest is important.

The findings of this research also have implications for the future design or updates of technology-assisted language learning applications. These designs or updates could hold into account the language learning strategies that were found in this research and design or update the application based on them. For example, Duolingo could update their streak function and only allow learners to maintain their streak after they have learned the language of their choosing for a minimum amount of time. Alternatively, new language learning applications could include or link to more resources outside of the application, like books or tv shows, to help learners find outside resources more easily. Moreover, Duolingo could expand their reminder option to include multiple reminders a day to ensure learners do not forget to learn a language that day.

5.4 Limitations and future research

Despite the limitations of this research, it also provides opportunities for future research. One of the main limitations of this research is the small sample size. Although participants were tracked for a month, the generalizability of the results, and, therefore, of the language learning strategies that were found, are limited. The small sample size may also give a skewed image of the language learning strategies that were found. It could, after all, be chance that the participants used the same strategy during the experiment. Future research should, therefore, aim to expand the sample size and follow a larger number of participants for a longer period of time to see if the results can be replicated.

Another limitation in the design of this research is that only one technology-assisted language learning application, namely Duolingo, was researched. This limits the generalizability of the results to other technology-assisted language learning applications, such as Rosetta Stone or Babble, as their designs are different. Future research should try to find sufficient participants

and research the language learning strategies that participants employ across different technology-assisted language learning applications simultaneously to ensure that the results are generalizable across different applications.

Finally, the design of the experiment is that participants were asked to self-report their behaviors in a diary entry. There is no way to ensure that participants actually employed the strategies that they indicated they used in the diary entries. The language learning strategies that participants indicated they employed are not automatically the language learning strategies that they actually employed as well. In other words, only those language learning strategies that the participants are explicitly aware of were found. Future research should hold this into account and research the language learning strategies used by experienced language learners by observing their language learning, rather than deducing the language learning strategies that were employed from diary entries. For example, future research could employ eye tracking, keystroke logging, and stimulated recall to get find if the participants employ any implicit strategies, i.e., strategies they are not aware of.

Chapter 6: Conclusion

This research investigated the language learning strategies employed by experienced language learners while using the technology-assisted language learning application Duolingo. Based on the results of the experiment, I propose a new taxonomy of technology-assisted language learning. This taxonomy consists of five types of language learning strategies subdivided into several related language learning strategies. The taxonomy I propose looks as follows:

- Internal motivation strategies
    1. A learner is able to recognize positive feelings towards language learning and knows how to act on those feeling.
    2. A learner is able to recognize negative feelings towards language learning and knows how to act on those feeling.
- External motivation strategies
    1. A learner is able to recognize the external factors that motivate them and is able to encourage themselves (to continue) to learn.
- Metacognitive strategies
    1. A learner is able to recognize where they are in the learning process, i.e., what they already know and what they do not know.
    2. A learner is able to plan what steps need to be taken in order to progress.
    3. A learner is able to choose the right materials in order to progress.
    4. A learner is able to evaluate their learning and determine what they need to do differently.
- Time management strategies
    1. A learner is able to plan dedicated time to language learning and follow through in a consistent manner.

2. A learner is able to dedicate time to finding the resource needed to progress their language learning.

- Cognitive strategies

1. A learner is able to monitor their mistakes.
2. A learner is able to use deductive reasoning to link different aspects of the language to each other.
3. A learner is able to practice and memorize vocabulary and grammatical structures.

In conclusion, the predictions about the effects of technology on the language learning process of a language learner seem to be correct. Although there are many similarities between language learning strategies found in traditional settings and technology-assisted language learning strategies, the results and the conclusion show that there are also many differences between them. Although the field of technology-assisted language learning has much work to do in finding answers to the remaining questions, and addressing and expanding on already existing work, an important start has been made.

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Appendices

Appendix A: Language background questionnaire and informed consent form

Participant information

Initials: _____

Age: _____

Gender: _____

Participant number: _____

Date: _____

language background

1. Please list all the languages that you know in order of dominance:

    1. _____
    2. _____
    3. _____
    4. _____
    5. _____

2. Please list all the languages that you know in order of acquisition, starting with your native language:

    1. _____
    2. _____
    3. _____
    4. _____

5. _____

3. Please indicate your age when you began acquiring the language that you know:

1. _____

2. _____

3. _____

4. _____

5. _____

4. Please state the number of years you have been learning the languages that you know:

1. _____

2. _____

3. _____

4. _____

5. _____

5. Please specify your approximate level of speaking the languages that you know according to any course/test you have followed.

1. _____

2. _____

3. _____

4. _____

5. _____

6. Please rate to what extend you are currently exposed to the languages that you know in the following contexts on a scale of 1 (never) to 10 (always).

1. Interacting with friends

    1) _____

    2) _____

    3) _____

    4) _____

    5) _____

2. Interacting with family

    1) _____

    2) _____

    3) _____

    4) _____

    5) _____

3. Tv or social media

    1) _____

    2) _____

    3) _____

    4) _____

    5) _____

4. Radio or music

    1) _____

    2) _____

    3) _____

    4) _____

    5) _____

5. Reading

    1) _____

    2) _____

    3) _____

    4) _____

    5) _____

6. Self instruction

    1) _____

    2) _____

    3) _____

    4) _____

    5) _____

Participant background

7. Please check your educational level (or the approximate equivalent degree obtained in another country).

☐ Less than high school

☐ High school

☐ Professional training (MBO)

☐ College (HBO)

☐ University (WO)

☐ Masters

☐ PhD

☐ Other (please specify): _____

8. Please indicate if you have ever immigrated to another country. Please provide the name of the country, the date of immigration, and list the number of years and months you spent in the language environment:

_____

Informed consent

By signing this form, you declare to have read the participant information below and have understood this information. You further declare to agree with the procedures described below. This research is designed to research the way that language learners use Duolingo. To this end, the activities of participants will be recorded through diary entries and an interview recording will be made. With signing this form, you agree that:

- The researcher may use the diary entries and other information gathered for research purposes.
- The recordings and future information may be used in future research.

All data will always be handled anonymously. The researcher will never spread the recordings and further information outside the research community, nor will anything gathered ever be used for commercial purposes. The information and recordings will be managed by the researcher.

With signing this you declare to have been informed in a way that was understandable to you, about the nature and method of the research, as it was laid out above, and that all your questions have been answered satisfactorily.

You voluntarily agree to participate in this research. You obtain the right to withdraw this consent at any time, without having to provide a reason for this. When your data has been fully anonymized, it is no longer traceable to you. It is, therefore, no longer possible to withdraw this data. If your data will be used for scientific publication, or are published in any other way, this will be done fully anonymized. Your personal data will not be accessible by third parties without your consent.

Signed:

Name: _____ Signature: _____

Appendix B: Diary entry survey

Participant identification

1. Please fill in your participant identification. It consists of the first letter of your first name and the first two letters of your last name. Example: for the name Jason Wouters, the participation identification would be JWO

During the experiment I would like to ask you to answer the questions in this part daily. The questions in this section are about what steps you took today and why you think it was beneficial to your language learning on Duolingo.

2. What skills and levels did you complete today? Please explain why you chose to complete it/them.
3. Did you use the review function today? Please explain why you did or did not use it.
4. Did you use any resources outside of Duolingo today? Please explain what resources you used and why you felt they were necessary?
5. How long did you spend on language learning today? Why did you stop when you did?

During the experiment I would like to ask you to answer the questions in this part at least once a week. You may also answer them more than once a week if you feel you have more to say. The questions in this section are about reflecting on your language learning.

6. What made your language learning successful this week?
7. What difficulties did you encounter?
8. What would you do differently next time? Please explain why and how you would do this.
9. Please write down any other experiences/thoughts/opinions on your language learning that you would like to share, but you have not been able to share yet.

That was the last question of your diary entry. Thank you for filling everything in! Please click the ”–>” button to hand in your entries.

Appendix C: Interview guide

Research question: What language learning strategies can be derived from experienced language learners' Duolingo use?

Topic: introduction

1. Welcome participants and ask them how they are doing. Explain how I would like to ask them just a few questions about their time learning with Duolingo.

Topic: Diary entries.

2. Some of the participants indicated that they really wanted to get a skill to gold before moving on. I would like you to tell me a bit more about your process. For instance, when did you feel you were ready to move on to the next skill? (**probe** for information on how participants knew when it was time to move on.)

3. The average time spent on Duolingo is 10-15 minutes. Participants indicated that they often knew they were done learning at that point. Could you tell me a bit more about how you know when you were done? (**probe** for information on the feeling? Is it cognitive or motivation related?)

4. One of the things that was noticeable in the diary entries is that no one made use of any outside resources, but that some people did consider it. I would like you to tell me a little bit more about why you did not use any? (**probe** for information on the design of Duolingo. Was this not used because the design of Duolingo is sufficient enough that learners do not need outside resources?)

Topic: future learning

5. In the future, if you were to start learning a new language with Duolingo, is there anything that you would do differently from the beginning?

6. Let's say you have to advise someone else, who has never used Duolingo before on how to learn a language with Duolingo. What would you advise them?

Topic: Ending

7. Is there anything that you would like to add that you have not been able to say yet?

8. Is there anything that you would like to ask me?

9. Thank participant for their time!