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AI-powered gamification for boosting second language acquisition efficiency

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ABSTRACT

While the capacity to use foreign languages opens many opportunities in life, it is not always easy for everyone due to multiple factors. Gamification has been incorporated as a subfield of computer-assisted learning into language learning tools, and it has proven to have a significant influence on learners' motivation and engagement. Still, there are gaps between fun and outcome results.

Nowadays, the use of artificial intelligence is rampant across many industries, creating great possibilities in language education to help learners achieve their goals with the support of technology, which is expected to accelerate the positive impact of gamification while filling the gaps they might have.

The study uses a mixed-method approach to answer questions regarding gamified language learning tools that incorporate AI. The research methods include a comparative analysis to discover AI applications in second language learning and a survey based on the UTAUT2 model conducted on 92 learners to analyse the influences of cutting-edge technology on support learning efficiency and users' perception towards it.

The results indicate that AI techniques, such as Machine Learning, Natural Language Processing, and Generative AI, are widely employed in gamified language learning tools to significantly enhance learners' experiences through immersive, playful, and personalised approaches. The influence of AI-powered language learning tools on learning efficacy is mixed. Research reveals that these tools excel at vocabulary and grammar acquisition but are not significant in areas like writing and overall linguistic proficiency. Overall, learners have a positive attitude towards the new technology, yet they still need to be convinced of the effectiveness and value of these tools in language learning outcomes.

Keywords: AI gamification, gamification, computer-assisted language learning, second language learning, SLA.

CONTENTS

1 INTRODUCTION

In today's globalised world, language is more than simply a means of communication. It is a doorway that opens opportunities, broadens one's horizon and boosts employability. Communicating in another language allows people to integrate with the culture where they live and create connections between humans, positively transforming their lives.

Understanding the criticality of the matter, the EU, EFTA, and enlargement countries like Germany, Finland, and Spain have mandated second language education for students as early as primary and secondary school (Eurostat 2024). However, not everyone finds learning languages easy. There are many obstacles that learners must overcome, ranging from extrinsic, like the learning environments and language input, to intrinsic, such as personal motivation and social stereotypes (Eguz 2019; Nugroho et al. 2020).

Gamification has been incorporated into education to enhance students' Second Language Acquisition (SLA) performance, which was proven to improve vocabulary acquisition, facilitate grammar learning, and boost motivation (Kaya & Sagnak 2022). While learning languages through gamification offers a more enjoyable experience than traditional classrooms, it faces two main challenges: maintaining motivation as the novelty wears off and balancing passive skills like listening and reading with productive skills like speaking and writing. The situation raises the question of the possibility of applying new technology – such as artificial intelligence – to overcome the challenges of gamified language learning.

The thesis explores the influence of AI-powered gamification - a new technology that is projected to step beyond the current solutions' limits to help learners acquire foreign languages more efficiently. Ideally, the research yields valuable insights for those who want to utilise the new technology and game mechanics for their second language learning and teaching, including students, teachers, education institutions, and ed-tech companies.

2 THEORY

2.1 Second Language Acquisition

There are significant differences between acquiring a first and second language. According to Ipek (2009), the first language is usually acquired subconsciously in an informal context, and the second language often involves a conscious learning effort, such as remembering grammar rules. Each type of language learning will have different critical periods when learners acquire language better than others. In the report, the author mentioned that the crucial period of first language acquisition is from 2 to 12 years old, and for the second language is until puberty. Biological factors, mainly neural mechanisms involved in second language (L2) acquisition, may differ from those involved in first language (L1) acquisition and are cited as an essential factor that makes adults unable to achieve the native level when learning a second language (Ipek 2009; Meisel 2011). Ipek (2009) mentions that the loss of the brain's plasticity and lateralisation and the flexibility of speech muscles when one matures, as well as the disparity in motivation and anxiety levels in adults, play an important role in impacting the second language learning outcome. Looking further at the differences in the learning state when a person learns the first and second languages, Meisel (2011) stressed in his book that L1 learners usually start with no prior knowledge of any language and are only influenced by the language they are acquiring, while contrastively, the L2 learners already know at least one other language, and be impacted by their first language or other languages that they know. Altogether, these ideas mean that second language learning significantly differs from first language learning, therefore requiring different education strategies and approaches.

2.2 Definition of language learning efficiency

Besides understanding the distinctions between learning native and non-native languages, it is necessary to know the definition of efficiency in language learning and the factors that impact it. Interestingly, assessing language proficiency is different in every language and country; for example, HSK and HSKK are typically used to evaluate Mandarin proficiency in China (Confucius Institute Maastricht, n.d.), but another system named TOCFL has been developed for the

same purpose in Taiwan (Taiwan Mandarin Educational Resources Center, n.d.). These two frameworks have different requirements for the number of words learned; for example, level 3 in HSK requires 600 vocabularies (Figure 1) and 2,245 in TOCFL (Figure 2), respectively.

HSK level	Vocabulary	CEFR	HSK
HSK 6	5000 +	C2	advanced
HSK 5	2500	C1	
HSK 4	1200	B2	intermediate
HSK 3	600	B1	
HSK 2	300	A2	beginners
HSK 1	150	A1	

Figure 1. HSK and HSKK: China's Mandarin assessment framework (Confucius Institute Maastricht, n.d.)

		Syllables 音节	Characters 汉字	Vocab Words 词汇	Grammar Points 语法
Advanced	Levels 7-9	1,110 (+202)	3,000 (+1,200)	11,092 (+5,636)	572 (+148)
Intermediate	Level 6	908 (+86)	1,800 (+300)	5,456 (+1,140)	424 (+67)
	Level 5	822 (+98)	1,500 (+300)	4,316 (+1,071)	357 (+71)
	Level 4	724 (+116)	1,200 (+300)	3,245 (+1,000)	286 (+76)
Beginner	Level 3	608 (+140)	900 (+300)	2,245 (+973)	210 (+81)
	Level 2	468 (+199)	600 (+300)	1,272 (+772)	129 (+81)
	Level 1	269	300	500	48

Figure 2. TOCFL: Taiwan's Mandarin assessment framework (Taiwan Mandarin Educational Resources Center, n.d.)

Although language assessment frameworks vary in criteria and purpose, the goal remains to evaluate the ability to use non-native language to accomplish communication goals. Therefore, during the assessment, learners must demonstrate their ability in four domains: listening, speaking, reading, and writing in different contexts, such as work and daily scenarios, in which specific criteria define the level of proficiency in each domain, depending on the framework. For example, the ACTFL framework defines proficiency in each skill according to four criteria, represented by the initialism FACT: Functions and tasks, Accuracy, Context and content, and Text type (ACTFL Proficiency Guidelines 2024).

2.3 Key factors influencing learning outcome

The language

Factors that affect the learning outcome of acquiring foreign languages have been an exciting topic that several researchers have addressed. Nosirova (2023) highlights that one of the challenges when learning English as a second language is remembering a vast amount of vocabulary and idiomatic expressions and learning grammar rules with various exceptions and sentence structures. They also have a hard time practising pronunciation due to accents and a lack of similar sounds in the native language that the learner possesses. These issues impact the learner's confidence level when using the second language, as they must simultaneously be capable of many requirements, from listening to a fast-paced conversation to understanding cultural references and context to choosing appropriate words and grammar. (Nosirova 2023.)

Besides the challenges depending on the target language, Nugroho et al. (2020) and Eguz (2019) explore even further other external and internal factors that impact the success of second language learners, covering aspects such as learning environment, input, age and motivation.

External factors

Nugroho et al. (2020, 4) suggest that all participants in the educational system need to pay attention to building a productive learning environment to achieve positive results in learning, which usually consists of three: an academic environment where the teacher is considered a vital role in promoting a positive learning atmosphere through their superior in academic knowledge and teaching method, the physical environment including the surroundings elements such as sounds, crowd or the infrastructure's quality, and the psychological environment including the learner's motivation and awareness.

In a study by Nugroho (2020) with Novia, an English learner, the most significant factor that impacted her excellent results in English acquisition was a conducive learning environment where she always felt motivated and got full support from

the staff. A positive learning environment is not only limited to the classroom context but also expands to the activities that one does after school; for example, practising speaking the language with family and friends or doing assignments related to the target language also helps enhance the learner's proficiency (Nugroho et al. 2020, 56-57). Nosirova (2023) stated that creating an immersion environment and engaging in conversation are strategies for improving learners' fluency and confidence. The author sees regular practice as a chance for learners to collect feedback, identify the focus areas for improvement and correct errors.

Table 2. The learning environment of a successful EFL learner

No	Types of environment	Description
1	Academic environment	- Conducive learning situation of the intensive and regular classes. - Kindly support from the academic staff of the faculty.
2	Physical environment	- Regular practices with fellow friends in the boarding house.

Figure 3. Types of learning environment (Nugroho et al. 2020)

Like the learning environment, input occurs in the academic classroom and beyond. Research shows that actively and frequently gaining input from several sources and forms, such as watching favourite movies, reading novels or participating in language clubs, positively impacts the learner's outcome. The quality of input is also critical, especially from the instructor, as it helps the learner understand learning materials quickly, hence contributing to improving their proficiency. Figure 4 shows the input types that Novia - the interviewee - took during her intensive English course. (Nugroho et al. 2020, 53-55.)

Table 1. The language inputs of a successful EFL learner

No	Types of inputs	Description
1	Classroom input	- Intensive English class on IELTS and speaking skills. - English for specific purposes course as the compulsory subject.
2	Beyond classroom input	- Watching English movies, listening to music, and reading English novels. - Being an active member of English communities.

Figure 4. Types of inputs of a successful EFL learner (Nugroho et al. 2020)

Besides input, output and feedback are considered equally important to SLA learning. Li et al. (2022) stress that the interaction promotes attention and helps learners define learning and modify their production following feedback.

Individual differences

Individual differences have been a topic investigated by researchers in order to figure out the correlation between variables such as age, language aptitude, motivation, and learning style with second language acquisition (Li et al. 2022; Dewaele 2009; Eguz 2019; Hartshorne et al. 2018; Ipek 2009). The term Individual Difference (ID) refers to traits, dispositions and characteristics, which can be either a combination of biological, social or psychological (Li et al. 2022). It shapes the learner's uniqueness, differentiates their language learning journey and hypothetically has a direct and/or indirect influence on their success

Age and prior knowledge

Age is one of the essential factors influencing the outcomes of learning foreign languages. Research from MIT University by Hartshorne et al. (2018) assessed a database of 669,498 native and non-native English speakers, citing a critical period for acquiring a language, in which the learning ability remains until 17.4 years old and begins to decline thereafter. Ipek (2009) notes that ageing affects biological condition changes that bring significant differences in the learning results of L1 and L2. Ageing results in a natural decline in cognitive functions such as memory, attention and processing speed, resulting in difficulty acquiring new sounds or patterns due to changes in speech perception and production abilities. Eguz (2019) added that the impact of age extends beyond physical changes, affecting social and psychological aspects through societal stereotypes about learning abilities. These biased perceptions can lead to learners’ self-doubt and anxiety, significantly impacting motivation and hindering progress as they fear making mistakes or appearing incompetent. (Hartshorne et al. 2018; Ipek 2009; Eguz 2019.)

Learning a second language in late adulthood means the learner usually experiences both negative and positive impacts from their established language knowledge, which is often their L1 (McManus 2022, 4). In the book "Introducing Crosslinguistic Influence," the author notes that learners tend to build a distinctive knowledge pool for second language acquisition, and this new knowledge might differ from what they already have in their native language. According to the author, words with similar pronunciation or even usage (e.g., articles) might have different or additional meanings in another language and, therefore, are not used in the same way. The situation creates a complex challenge for L2 learners when they have to do another “form-meaning mapping” for the new language, which usually competes with the “form-meaning mapping” of the native one. McManus (2022, 12) introduces an interesting concept about constructing L2 based on the former knowledge of L2 through a mechanics named copy-and-restructure, explaining that the L2 knowledge is a clone body of L1 that could be modified through input over time. This leads to another issue for second language acquisition, as the learner needs to build up a cognitive mechanism to separate this knowledge to avoid interference, deal with the competition of choosing the appropriate language to use, and learn to suppress the existing knowledge. (McManus 2022; Eguz 2019.)

However, crosslinguistic influence can also have a positive impact. When language patterns are similar across languages, the learning process of a second language can be simpler. This occurs when languages share the same sets of meanings or concepts or express similar ideas using comparable means (McManus 2022, 9).

Language aptitude

Researchers commonly define language aptitude as the ability to learn a new language independently of general intelligence. An individual's language aptitude may link L1 literacy skills with L2 attainments, where performance in one's native language correlates with outcomes in subsequently learned languages. While debate surrounds the components of language aptitude, Dewaele (2009, 625–

626) identifies it as a combination of cognitive capacities, particularly emphasising working memory and analytic abilities. Understanding language aptitude helps support learners with specific challenges, as individuals may differ in memory and analytical skills(Li et al. 2022, 5). This knowledge enables instructors to enhance learners' performance through targeted interventions and tailor instruction to diverse learning capabilities.

Motivation and anxiety

Communication anxiety has been found to have a strong link with L2 efficiency. Dewaele (2009, 627-632) explains that introverted individuals have less efficient short-term and working memory (WM) performance than extroverts due to differences in dopamine levels. Fluctuation in dopamine and norepinephrine caused by stress can lead to anxiety and disrupt WM performance. In addition, anxiety and stress often occur when learning a new language and maintaining motivation becomes challenging when progress feels sluggish, or obstructions appear (Nosirova 2023). They significantly impact the fluency of introverted people when speaking in L2, especially in intensive conditions.

Motivation is also impacted by age. Seniors' language learning inducement may differ from younger learners, and factors such as health concerns or family responsibilities can affect their commitment (Eguz 2019). Nugroho et al. (2020) indicate that motivation is a critical factor in learners' performance when acquiring a target language, which can come from external factors such as higher grades or internal factors like having a brighter future or being able to communicate in the global environment. These intrinsic and extrinsic motivations sustain the learning motivation, significantly impacting students' language achievement. Additionally, having a clear goal for the ideal L2 version can help learners achieve better results as long as they are specific and achievable. (Nugroho et al. 2020, 62; Nosirova 2023, 167.)

2.4 Chapter conclusion

Several interconnected factors influence the likelihood of mastering a second language, which are linked and influence one another. To provide a comprehensive view of the issue, the Figure 5 illustrates the relationships and dependencies among these factors and their impact on L2 learning success.

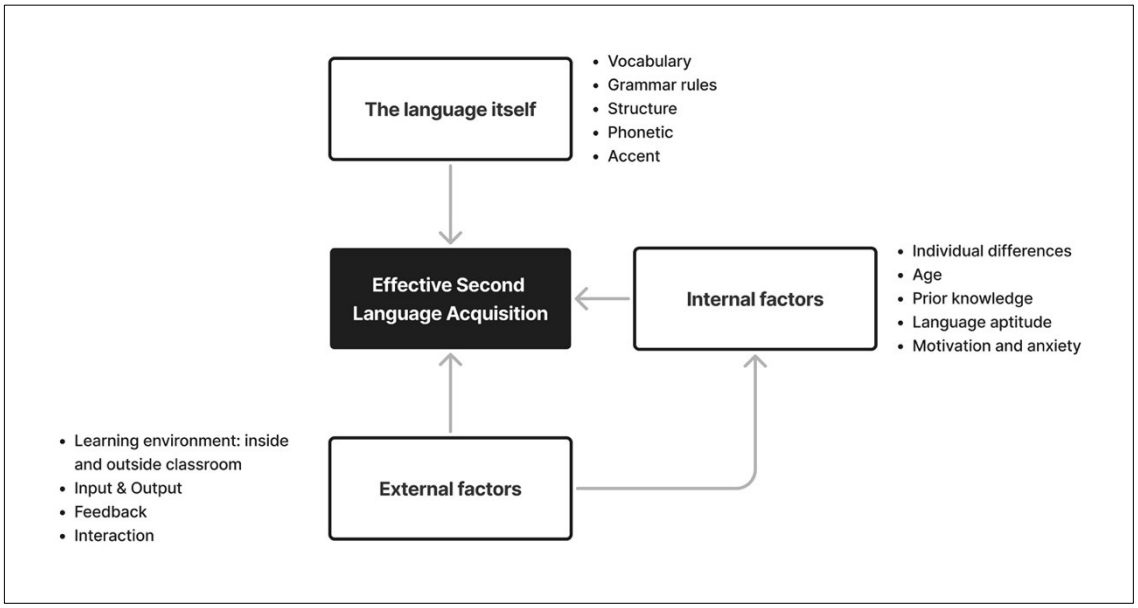

Figure 5. Factors influence the efficiency of Second Language Acquisition

Although the importance of various factors in Second Language Acquisition (SLA) is subjective and depends on individual learning contexts, Dewaele (2009) argues that certain factors impact learners' success more than others. This idea is also supported by Nugroho et al. (2020), who asserts that motivation strongly correlates with positive achievement in learning a foreign language, making it the most extensively researched variable in language acquisition studies.

3 ACQUIRING FOREIGN LANGUAGES ONLINE

3.1 Computer-Assisted Language Learning

Nowadays, the use of technology in education is widespread. According to a report from Denoyelles et al. (2023), most learners own digital devices and use them for learning at least once a week (Figure 6).

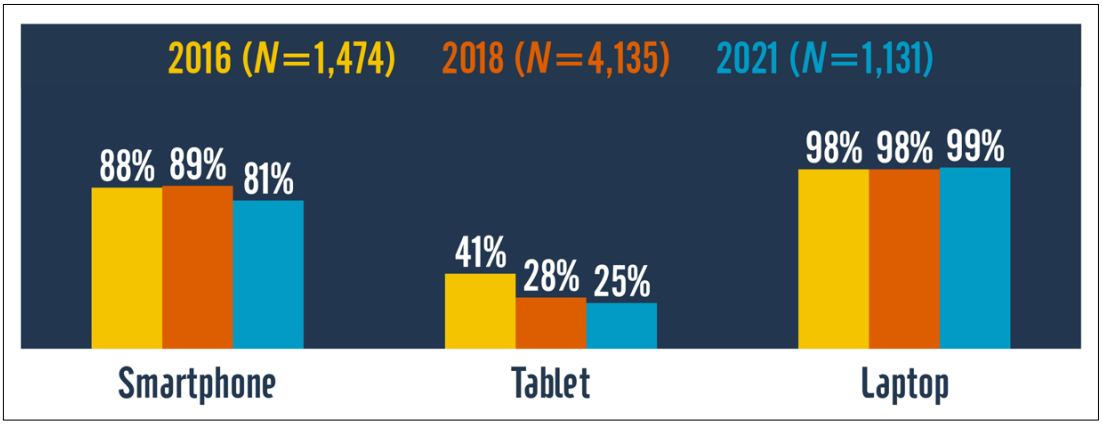

Figure 6. Devices used for learning at least once a week (Denoyelles et al. 2023)

Although students use various technology devices, the report shows that they primarily use laptops and mobile devices for educational purposes, and expect them to be able to handle more complex tasks and communication, providing a smoother and more tailor-made experience. Persson and Nouri (2018) add that the flexibility of learning with mobile devices, such as phones or tablets, allows learners to access learning materials anytime and anywhere to learn languages in real-life contexts. Mobile devices provide great personalisation options that serve different learning styles and needs while strengthening social connections between students and teachers by creating a collaborative environment for frequent discussion and feedback (Denoyelles et al. 2023; Persson & Nouri, 2018).

Technology-enhanced practices have revolutionised language learning and teaching diversely for decades. Examples include interactive and collaborative technologies that promote intercultural communication between learners, data utilisation for supporting language learning, game-based learning, and customised tools (Farr & Murray 2016). Lai et al. (2018) further categorise the technology-driven learning experience into three groups: instruction-oriented experience, information and entertainment-oriented technological experience, and social-oriented technological experience (Figure 7).

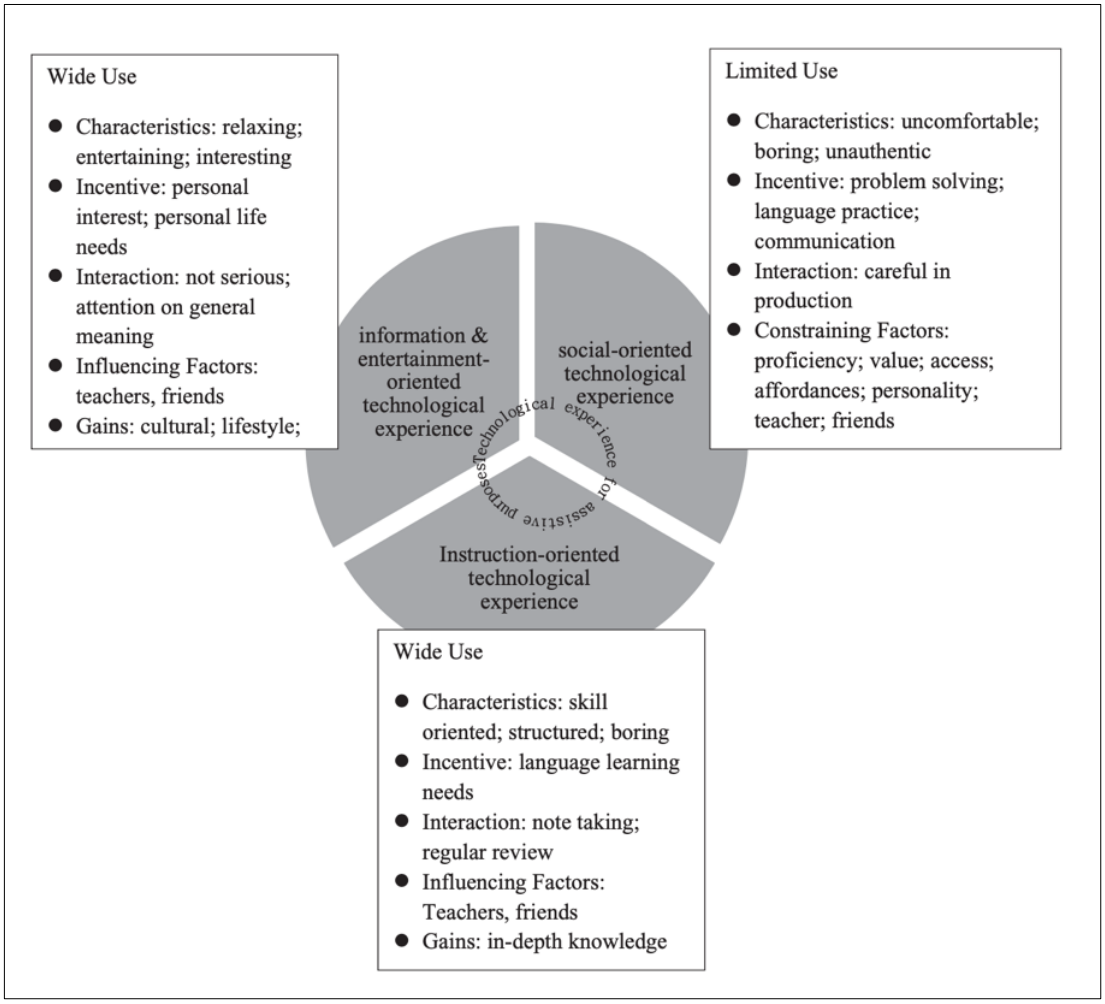

Figure 7. Technological experience from learner perspective (Lai et al. 2018)

The authors explain that instruction-oriented technological experiences, while often perceived as boring, are practical for participants consciously seeking to expand their language knowledge. In contrast, entertainment and information-oriented experiences are suitable for casual learning, while social-oriented technological experiences provide practice and error-recovery opportunities. (Lai et al. 2018.)

3.2 Challenges for online second language learning

The diversity of technology applications in online language acquisition necessitates investigating its benefits and drawbacks compared to traditional language classrooms to determine the most effective approach. This topic has attracted the interest of several researchers. Meşe and Sevilen (2021) conducted qualitative research examining learners' perceptions of online English learning in

Turkey and its impact on their motivation over a seven-week course. Their findings reveal that students generally hold negative views about online education. The primary factors contributing to low motivation in online language acquisition include dissatisfaction with course content, lack of self-discipline, limited communication with teachers and peers, and insufficient personal space to engage with the course material. The theory is echoed by Chen et al. (2022), citing that learners tend to feel bored if they experience poorly designed courses, face challenges in digesting difficult learning materials, or if the class ideology is different from reality.

Distance language learning also challenges establishing relationships and maintaining interaction between learners, instructors, and classmates. Traditional classroom allows students to meet in person almost every day and foster a comfortable learning environment through frequent interactions; on the other hand, students in online language courses have less opportunity for in-person meetings, taking more time to develop the relationship, which increases learner's anxiety due to the lack of authentic communication and the feeling of unfamiliarity (Ushida 2024). Unson & Lambenicio (2022) agree that face-to-face learning is more realistic, thanks to the instant response and the human interaction involved in the process. The author also added that additional reasons for demotivation when learning a second language online are the lack of guidance and experimentation.

Appropriate facilities are another factor worth considering when studying online. Students report that online setup requires specific software, security knowledge, and a stable internet connection, which not everyone can have (Unson & Lambenicio 2022).

3.3 Technology advantages

However, learning a foreign language online also presents advantages. Based on the findings of Akbari et al. (2016), online groups significantly increase students' motivation and engagement (Figure 8). These groups allow people with different communication styles to exchange knowledge and collaborate in an intercultural

environment while eliminating the space and time constraints typically seen in traditional classrooms Akbari et al. (2016). Learning a second language online allows students to access various free resources and connect with native speakers boundlessly, helping them to expand their understanding, learn culture, practice languages and enhance the knowledge-acquiring experience (Lai et al. 2018).

Group		TOEFL Pre-test	TOEFL Post-test	Engagement	Motivation
Facebook	Engagement	–0.62*	0.74*	-	0.27
	Motivation	–0.24	0.28	0.27	-
Face to Face	Engagement	0.14	0.18	-	0.41
	Motivation	0.57*	0.57*	0.41	-

*Significant Correlation Coefficients (α = 0.05)

Figure 8. Group differences in engagement and motivation between students in the Facebook condition and the Face-to-face condition (Akbari et al. 2016)

3.4 Chapter conclusion

It can be seen that the opinions towards online second language learning are mixed, and the result is impacted by various variables, from the way the learning experience is constructed to the methodology, technology, and the environment where the learning takes place. Certain methods have a greater impact on specific skills (Akbari et al. 2016), and different types of technology may cater to various learner characteristics and study needs (Lai et al. 2018). This disparity raises the idea of taking advantage of positive factors while reducing the negative ones when learning a second language online.

4 THE RISE OF GAMIFICATION IN SECOND LANGUAGE LEARNING

4.1 Definition

The definition of gamification in education usually needs to be distinguished from game-based learning (GBL). Whereas GBL turns the study objective into a game with an immersive experience (Al-Azawi 2016), gamification incorporates game elements into non-game contexts to encourage desired behaviours, for example, acquiring new knowledge (Luo 2023, 2). Contrastively, Al-Azawi (2016) argue

that gamification and game-based learning utilise the same game elements, such as badges, ranking systems, process bars, quests and level design in their development. According to Al-Azawi (2016), the only difference is the objective of the process when GBL focuses on a single learning objective, and gamification is the whole learning journey that incorporates game elements.

Another well-recognised concept of gamification elements is the gamification pyramid released by Werbach and his colleagues in 2012 (Werbach & Hunter 2012). Their book "The Gamification Toolkit: Dynamics, Mechanics, and Components for the Win" identifies core elements of gamification and provides a framework for engaging and compelling gamified experiences. The gamification pyramid model offers a comprehensive framework for designing effective gamification strategies, which involve a combination of three building blocks: Dynamics, Mechanics and Components. Following their explanation, the Dynamics block stands for high-level psychological and emotional elements that drive engagement and motivation in gamified systems, the Mechanics block includes processes and rules that govern the game and how players interact with it, and the Components block covers specific game elements that are used to implement the mechanics. Based on that pyramid, Costa and the team introduced a modified pyramid of gamification elements, getting into detail on each block, describing gamification tactics and how they impact learners at certain levels (Figure 9). (Werbach & Hunter 2012; Costa et al. 2017 ,6.)

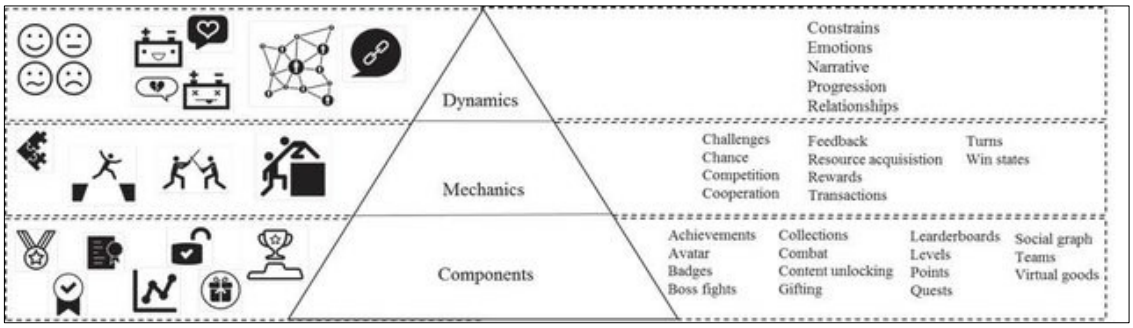

Figure 9. Pyramid of gamification elements (Werbach & Hunter 2012; Costa et al. 2017)

Gamification can occur in digital and non-digital environments and for multiple purposes, not solely education (Luo 2023; Al-Azawi 2016). For example, Google Maps has a Local Guides program that encourages people to share about their

favourite spots. The system allows users to earn points anytime they comment or add new places on Google Maps. These points can be accumulated for rewards, such as badges or early access to their feature. (Google Maps n.d.)

The use of gamification in education is an interdisciplinary field that involves information technology, game design, psychology, and education. When gamification is applied to foreign language education with technological support, it's called a gamified Foreign Language Learning (FLL) tool (Figure 10), in which "tool" refers to platforms or technologies that employ game elements, ranging from websites to information systems or mobile applications (Luo 2023, 2).

Table 1.

Terms and definitions.

Term	Definition
Gamification	The use of game design elements in non-game contexts [18].
Gamified learning	The use of game design elements for educational purposes [21].
Gamified learning tool	Educational website, information system, or mobile application (mobile app) that employs game design elements [19].
Gamified FLL tool	Website, information system, or mobile application (mobile app) that employs game design elements for foreign language learning.

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Figure 10. Gamification terms and definition (Luo 2023)

These gamified FLL tools leverage game-like mechanics, aesthetics, and principles to engage learners and enhance the language learning experience. Gamification elements, such as interactive exercises, point systems, and rewards, aim to foster a sense of enjoyment and achievement, thereby increasing learners' interest and persistence in the language-learning process. (Luo 2023.)

4.2 Gamification’s impact on SLA efficiency

Motivation

Luo (2023) systematically screened 64 articles to assess the efficacy of gamified tools in Foreign Language Learning (FLL), stating that the most popular impacts of gamification are the possibility of enhancing the learner’s engagement and improving academic performance. Based on the article, engagement is divided into three types depending on their impact areas: behavioural engagement, affective engagement, and cognitive engagement. Behavioural engagement focuses mainly on the learner's interaction and task completion rate, while affective engagement concentrates on the learning experience and emotional aspects, such as anxiety and curiosity, and cognitive engagement covers learners' persistence during the learning process. Findings show an uneven impact on several aspects of motivation; when learners report that there is an enhancement in interest and intrinsic motivation, there is no distinctive change in behavioural engagement. (Luo 2023.)

On the other hand, scholars found strong evidence regarding the influence of gamification on stimulating engagement, intrinsic and extrinsic motivation, and enhanced learning autonomy. Gamification allows users to have an immersive experience and encourages them to practice linguistic skills, thus creating a healthy competitive environment that is both joyful and dynamic. The instant response nature of gamification helps players learn from their mistakes and self-correction while fostering interactions between learners through peer feedback. As a result, learners are motivated to continue learning to reach their goals, and the competitive environment encourages them to perform better in defeating their peers on the leaderboard. (Arce & Valdivia 2020; Kaya & Sagnak 2022.)

Language skills

To assess gamification's impact on specific linguistic skills, Kazu and Kuvvetli (2024) conducted research on how the gamified language learning app Duolingo affects students' oral proficiency during pre-test, post-test, and attainment, with a mixed-methods approach incorporating experimentation and exploration. The results showed that Duolingo’s gamification elements and interactive exercises

help learners refine their speaking fluency and create an immersive learning environment that facilitates language learning. The integration of Duolingo's personalisation approach and technology and gamification effectively boosts learners' engagement and motivation, resulting in a remarkable advancement in proficiency among language learners. Arce and Valdivia (2020) echoed the two scholars' findings when they discovered that learners participate and practice more when learning a language with the support of gamification, such as doing more exercise and learning more grammar. However, it is worth noting that certain skills show more significant improvement than others. For instance, reading and listening abilities tend to exhibit the most substantial enhancement, whereas writing and speaking skills are less likely to show marked improvement (Kazu & Kuvvetli 2024; Arce & Valdivia 2020; Kaya & Sagnak 2022).

4.3 Chapter conclusion

The efficacy of gamification remains uncertain. Whilst some studies indicate enhancements in language proficiency (Kazu & Kuvvetli 2024; Arce & Valdivia 2020; Kaya & Sagnak 2022), research conducted by Boudadi and Gutiérrez-Colón (2020) revealed only a modest link between increased motivation and academic performance. Additionally, Luo (2023) noted a less substantial improvement in knowledge acquisition.

The importance of personalisation in gamification for language learning has been emphasised by various researchers, who advocate for considering individual differences and selecting appropriate game elements for specific educational objectives (Luo 2023; Kazu & Kuvvetli 2024). Despite some tools offering bespoke solutions, they often neglect other crucial factors such as learner characteristics, the target language, and external elements that influence second language acquisition effectiveness. The application of gamification in SLA typically necessitates customisation to meet diverse learning requirements, a feature that many commercial gamified tools struggle to deliver. Research suggests that the incorporation of game elements into Foreign Language Learning (FLL) frequently lacks substantial pedagogical content, underscoring the necessity for game developers to employ more innovative strategies when

creating educational tools (Luo 2023). Additionally, considering other factors that impact the efficiency of second language acquisition, such as differences in learners' characteristics, the target language, and other external factors, is also essential to help learners achieve better results, as mentioned in the previous chapters.

5 ARTIFICIAL INTELLIGENT DEFINITION AND CAPABILITIES

5.1 Definition

Artificial intelligence (AI) refers to technologies that enable machines to simulate human cognitive functions, including learning, understanding, reasoning, and creative thinking. AI systems can make decisions, learn, perform tasks, and act in a way that usually demands human intellect or analyse vast amounts of data that surpass human ability. Thanks to that power, AI-powered applications demonstrate remarkable capabilities in various fields. They can recognise and classify visual information, interpret and generate human language, adapt to new information, provide personalised recommendations, and operate autonomously. For instance, AI drives self-driving cars, demonstrating how it can replace human intelligence in complex tasks. (Stryker & Kavlakoglu 2024; Google Cloud n.d.)

Scholars and institutions have different perspectives on AI. Stryker and Kavlakoglu (2024) characterised AI as an evolving set of interrelated concepts with a history spanning over seven decades, while Google Cloud (n.d.) saw AI more practically as a cluster of technologies that empower machines to perform a range of sophisticated tasks which involve various disciplines, from computer science to data science, hardware and software development, linguistics, neuroscience, and even philosophy and psychology. However, they all agree that the power of AI is centralised around data and its ability to think, act, and predict based on input data (Stryker & Kavlakoglu 2024; Google Cloud n.d.). Complementary to their opinions, Athanasopoulou et al. (2022, 729) view AI as an umbrella concept encompassing many applications that can unite and affect almost every aspect of life, improve efficiency, and augment human capability. AI is divided into six broad fields: Machine Learning (ML), Neural Networks (NN),

Deep Learning (DL), Robotics, Computer Vision (CV), and Natural Language Processing (NLP), as presented in Figure 10 (Athanasopoulou et al. 2022, 729).

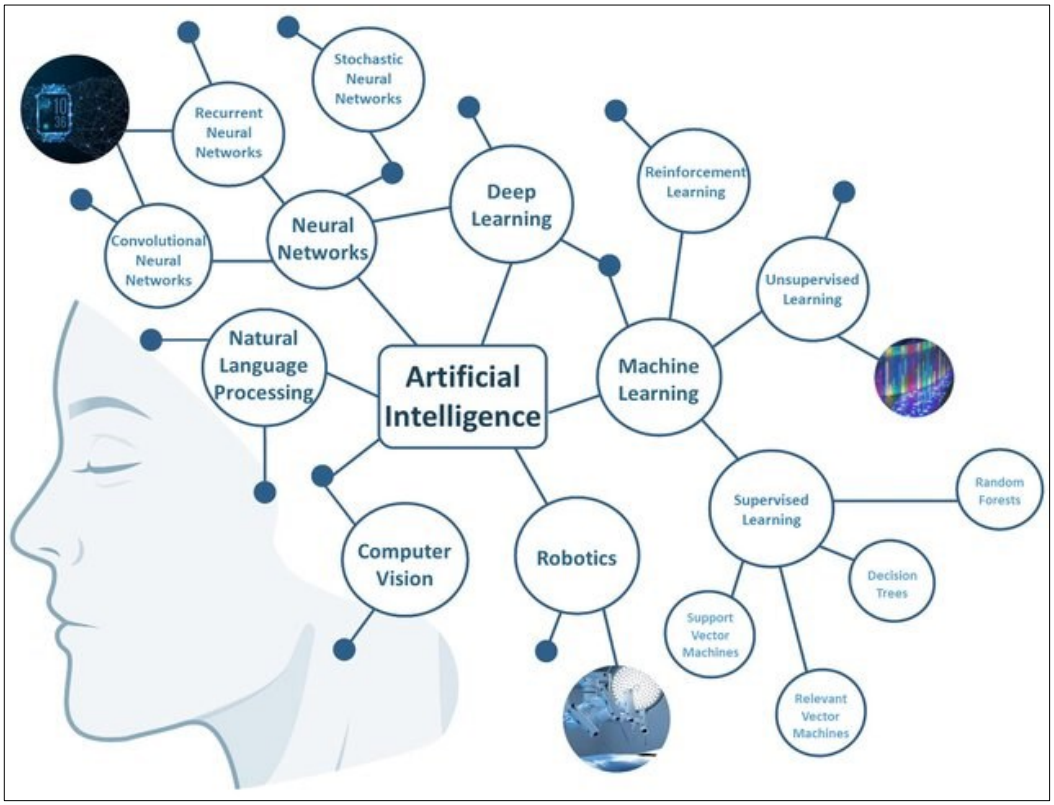

Figure 11. The six main categories of AI (Athanasopoulou et al. 2022)

These fields collectively contribute to AI's ability to perform tasks that typically require human intellect, further expanding its potential applications and impact across various domains.

5.2 Machine Learning and Deep Neuron Network

According to Stryker and Kavlakoglu (2024), Artificial Intelligence encompasses a field known as Machine Learning, which involves the development of algorithms that can learn from data to make predictions or decisions without the need for explicit programming. Google Cloud (n.d.) modified the definition by adding the ability to categorise information from large amounts of labelled or unlabeled data. Machine Learning has several training techniques and algorithms; the most popular algorithm is called a Neural Network, which mimics the human brain's function and structure through a system of neurons. As a subset of Machine

Learning, Deep Learning involves the use of multiple layers of neural networks that better imitate the complex decision-making capability of the human brain, which is called a Deep Neural Network (Stryker & Kavlakoglu 2024). When an input is received and recognised, the Deep Neural Network processes the information through multiple hidden layers to deliver refined results for prediction and decision-making purposes (Athanasopoulou et al. 2022, 730) (Figure 11).

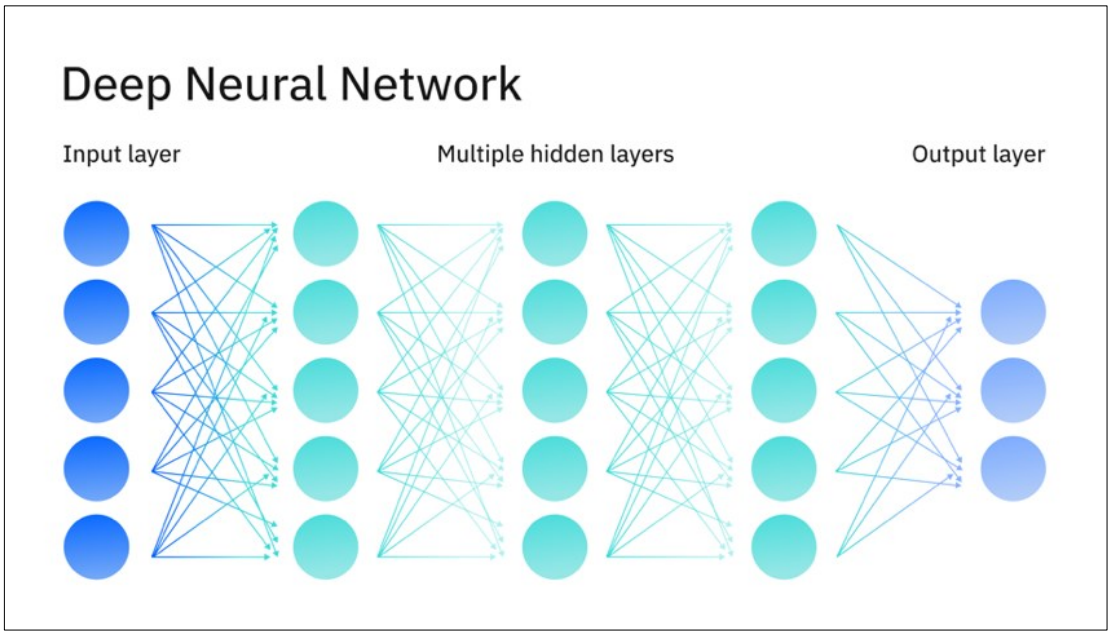

Figure 12. The Deep Neural Network (Stryker & Kavlakoglu 2024)

While the Deep Neural Network works with input to deliver output, it is important to know that the input data can be in any format, for instance, image, video, text or speech (Google Cloud n.d.). Since processing data is challenging, another sub-area was formed to significantly focus on language processing.

5.3 Natural Language Processing

Natural Language Processing (NLP), another significant subfield of Machine Learning, focuses on AI's ability to process language like the human brain in order to enhance its creative capabilities. NLP's strength lies in its ability to analyse text and speech from large datasets, identifying patterns, trends, and sentiments to provide insights, generate content, or act autonomously.

This technology has found applications in numerous sectors, including finance, healthcare, and customer service. In finance, AI systems can analyse diverse data sources to identify trade signals and provide valuable insights. In healthcare, AI can scan health records to detect potential issues, while in customer service, chatbots offer round-the-clock assistance (Stryker & Holdsworth 2022). More advanced NLP applications, such as ChatGPT and CoPilot, have demonstrated the ability to summarise information, assist with programming tasks, and even generate creative content like videos and images (Gruetzemacher 2022). These advancements in Machine Learning and NLP continue to push the boundaries of what AI can achieve, opening up new possibilities for innovation and problem-solving across various fields.

5.4 Generative AI

Today, AI tools like ChatGPT and Gemini have generated excitement with their ability to create content based on user prompts. Leveraging Natural Language Processing to comprehend human input, Generative AI enhances human creativity by engaging in conversations and anticipating appropriate responses. As Zewe (2023) explains, this capability stems from the AI's extensive training on datasets, enabling it to convert inputs into tokens as numerical representations of data chunks. In theory, any data that can be converted to this standard token format correlates with each other, and the AI can use them to generate similar new data, allowing them to recognise important chunks and learn patterns to respond effectively to users’ inputs. This gives Generative AI the ability to follow the conversation in a meaningful way based on previous prompts. Although Generative AI struggles to make accurate predictions from structured data like tables, it definitely outperforms traditional computers in facilitating more natural, human-like conversations.

5.5 Trends of AI in education

Researchers have recognised the benefits of using Artificial Intelligence in education, particularly personalised learning. AI's ability to analyse vast amounts of data enables it to create tailor-made experiences for learners, resulting in

improved engagement and learning outcomes (Randieri 2024). Jian (2023) categorises AI advancements into four areas: creating customised instructional content, providing instant feedback or answering questions, assessing students adaptively based on their own pace, and suggesting resources based on individual needs (Figure 12).

Area	AI Implementation	Benefits
E-Learning Modules	Data analysis of student interaction	Tailored instructional content
Virtual Tutoring	AI-powered chatbots and virtual assistants	Instant feedback, query resolution
Adaptive Assessment	AI-driven quizzes and tests	Personalized assessment based on student's pace
Resource Recommendation	Algorithm-based content suggestion	Suggests supplementary resources for individual needs

Figure 13. Personalised learning tools with AI (Jian 2023)

The study reveals favourable results in terms of improved grading and student perceptions. Participants indicated that AI-powered tools offered a more consistent learning progression, immediate feedback on their work, and customised materials that enhanced their ability to acquire new information. Another study at MIT University on AI-generated virtual instructors led by Pataranutaporn et al. (2022) reported similar findings, suggesting that learning from virtual characters one enjoys can motivate students, boost positive emotions, and enhance their perceptions of instructors.

While online language learning provides benefits like removing geographic barriers, convenient access to study materials, and gamification to boost motivation and self-regulation, these approaches still have limitations. This includes the demands for more realistic engagement and clearer improvements in learning outcomes.

Today, AI's ability to analyse vast data to provide personalised learning approaches and enhance engagement and motivation presents an opportunity to address these challenges, making it an essential research topic. Inspired by that idea, the thesis examines the application of artificial intelligence in gamified

language learning tools to identify its influence on second language acquisition efficiency, discover trends and best practices, and explore students' perceptions of it. The study's hypothesis is formulated as follows: "The use of Artificial Intelligence in Gamified FLL tools can improve second language learners' outcomes efficiency" (Figure 14).

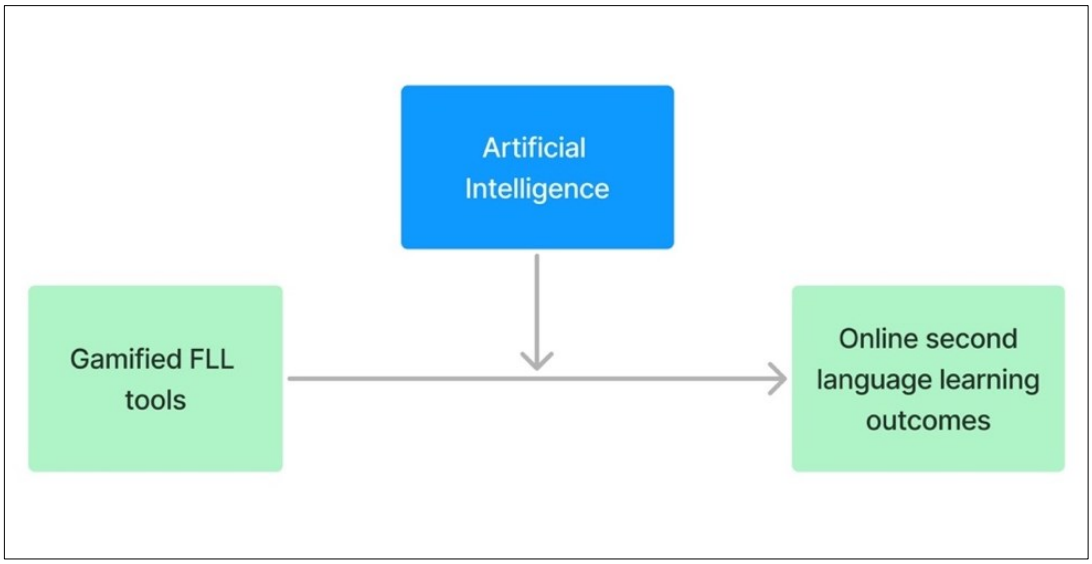

Figure 14. Hypothesis

In order to verify the hypothesis, the research questions are defined as follows:

- **RQ 1 (Main):** How does AI-powered gamification boost learners' second language learning efficiency?
- **RQ 2:** What AI capabilities are most popular in gamified FLL tools?
- **RQ 3:** What are the learners' perceptions when using AI-powered gamification to learn foreign languages?

6 METHODOLOGY

This study employs a mixed-methods approach that utilises both quantitative and qualitative data to address the research questions. First, a comparative study was conducted on three pioneering foreign language learning tools to assess the popular implementation of AI. This provides a comprehensive view of trends and patterns in using certain AI capabilities to support Second Language Acquisition through gamified tools, contributing to answering RQ2.

Comparative studies are defined by Coccia and Benati (2018) as the process of investigating and evaluating research objects across different areas to identify similarities and/or differences. They suggested that comparative analysis can be conducted using either quantitative or qualitative methods. Research targets can include phenomena, subjects, objects, or combinations depending on the study's objective. (Coccia & Benati 2018.)

At the beginning of the selection process, 20 language learning tools were identified from various sources like search engines, app stores, Google Play, and Social Networks. These tools offer diverse second-language learning solutions and are advertised as incorporating both gamification elements and artificial intelligence. However, most of them have fewer or no direct AI integration to gamification elements, resulting in only a few tools that meet the criteria.

The selection criteria include several factors, such as popularity (measured by user count or downloads), diversity of gamification elements, and the significance of artificial intelligence integration in the learning process. Most of the selected tools are available on mobile and web platforms with a large user base or high download volumes, making them excellent examples of diverse learning styles, experiences, and demographics. Table 1 provides information regarding the chosen tools: Duolingo, ELSA Speak and Loora.

Table 1. Information about selected AI-powered gamified tools (Duolingo, n.d.; ELSA Speak, n.d.; Loora, n.d.)

Company	**Tools**	**Users/ Downloads**	**Platform**	**Version**	**Segments**
ELSA Co. Ltd	ELSA Speak	7+ million	App	7.6.0 Android	English, Speaking, Pronunciation
Loora A.I Ltd	Loora	1.5 million	App	1.7.0 Android	English,Speaking, Fluency
Duolingo, Inc.	Duolingo	103.6 million	App	7.48.0 iOS	40+ languages. All 4 skills

The comparative study followed five practical steps developed by Esser and Vliegenthart (2017) to ensure the scientific nature of the research and avoid bias. The first step involved describing the contextual aspects of the target objects and providing empirical knowledge about essential topics and factors for analysis. The second step recognised functional equivalents to create an overview of available AI-gamified features in these tools, aiding in classification and typology development in the third step. The fourth step explained how differences in feature development can be applied to serve various learning goals, highlighting the causal link between features and targets. The final step predicted how AI applications in gamified learning tools may evolve in the future.

To address RQ 1 and RQ 3, a questionnaire was administered to 102 participants aged 18-54 years old, representing various target languages and characteristics. The survey was distributed across several channels, including Facebook, Discord, email, and school groups, to gather a wide range of opinions from people with diverse backgrounds. A data cleaning process was employed to remove incomplete answers, resulting in 92 valid responses for further analysis.

The survey includes three parts: the first part collects the respondents' background information, the second part assesses the influence of AI-powered gamification on learning efficiency in four linguistic skills, and the last part focuses on learners' attitudes towards AI-powered gamification in SLA. Questions were designed systematically based on the Unified Theory of Acceptance and Use of Technology 2 developed, exploring users' attitudes towards the new technology. The model considers seven constructs that impact behavioural intention and use of technology products in the consumer market: performance expectancy, effort expectancy, social influence, facilitating conditions, hedonic motivation, price value, and habit, as shown in Figure 15 .(Venkatesh et al. 2012.)

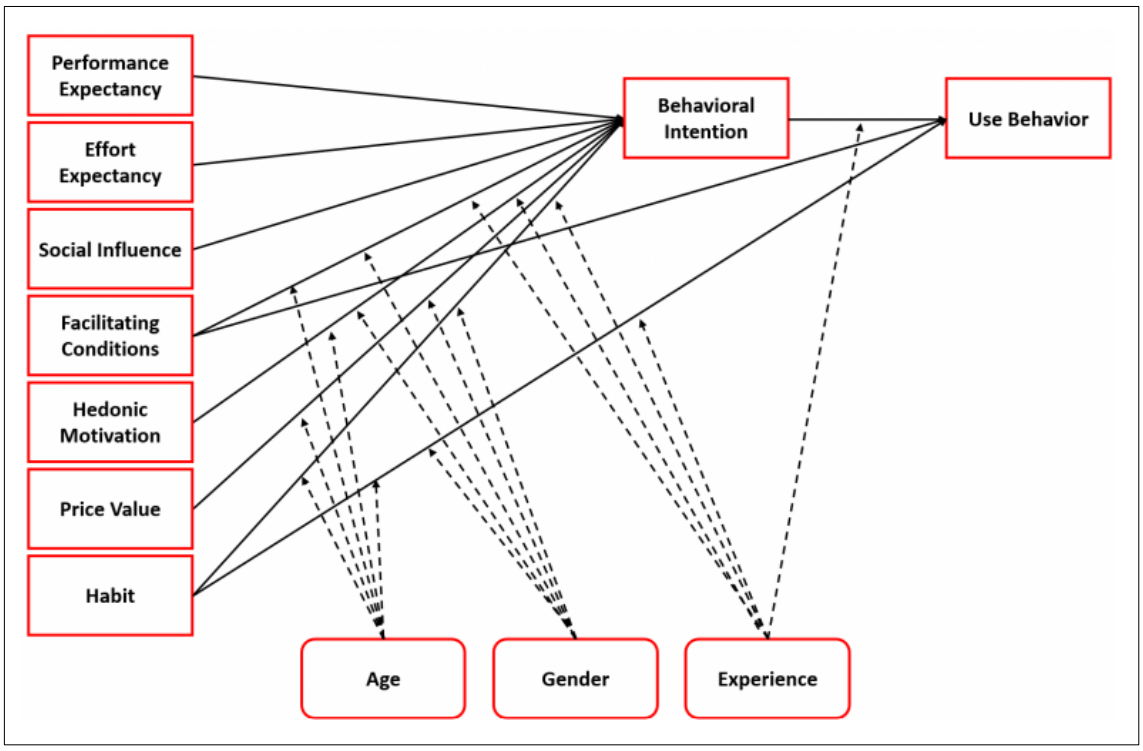

Figure 15. The Unified Theory of Acceptance and Use of Technology (Venkatesh et al. 2012)

In the survey, the respondents were asked to rate their opinion about AI-gamified language learning tools compared to tools that do not involve AI on a 5-point Likert-scale (1 = “Strongly disagree”, and 5 = “Strongly agree”). The questionnaire aims to explore respondent’s learning experience with AI-powered gamification tools via multiple questions, such as: “The tool gives me a personalised learning path that considers my prior language learning experience”, ”I felt the learning experience was tailored to my needs when using AI-powered gamified tools (e.g. academic, communication, getting certificates…)” and ”Compared to other learning tools, AI-powered gamified tools effectively adapted to my strengths and weaknesses in learning foreign languages”. They are also asked to rate their efficacy after using these tools, for instance, “The AI-powered gamified features support me in understanding and remembering grammar rules” and ”The AI-powered gamification features helped me improve my listening comprehension”. Their opinion towards the new technology is also addressed via questions like “I feel AI-powered gamification tools are fun to use” and “The cost I pay for using AI-powered gamification tools is worth it compared to the benefits it brings”.

This study prioritised ethical considerations during its execution by implementing rigorous protection measures to safeguard data privacy, including database access restriction and anonymising personal information. All participants provided informed consent, and the study obtained research permission approval from XAMK. Furthermore, the research strictly complied with the GDPR2 regulations (Directive 95/46/EC) and adhered to the Finnish Code of Conduct for Research Integrity and Procedures for Handling Alleged Violations of Research Integrity in Finland 2023 (TENK 2023). These measures collectively ensured the confidentiality and protection of the participants' data throughout the research process.

7 AI CAPABILITIES IN GAMIFIED SLA TOOLS: ANALYSIS AND RESULT

7.1 ELSA Speak

The two co-founders, Van Vu and Dr. Xavier Anguera established a company and released their first app named ELSA Speak in 2016. The app focuses on improving learners' English speaking skills by implementing speech recognition technology—an application of Natural Language Processing - that listens to users' voices and provides analysis, feedback, and recommendations on several aspects of speaking skills, such as fluency, pronunciation, accuracy, and grammar. ELSA has three payment models in total that are suitable for all types of needs. The free version offers a limited number of scenarios and lessons for everyone to try without payment. However, other features, such as certificate courses, AI-powered feedback, or dynamic transcripts, are unavailable. The Pro version provides 8000+ lessons, allowing users to track their processes and receive recommendations. Even so, it still lacks most AI-powered features compared to Premium, which offers unlimited access to all features and lessons. (Business Wire 2024; ELSA Speak n.d.)

The incorporation of artificial intelligence into ELSA Speak's gamification features is intensive, as can be seen in almost all its features. During onboarding, the user is asked to choose their learning targets, English level, time commitment, and perform a small test to analyse their strengths and weaknesses. While prior

learning experience and goals allow the app to design a personalised learning path, the commitment intends to maintain user retention through a reward system. Furthermore, the test data helps the app to identify frequent mistakes and adjust the challenge to enhance the user's speaking skills effectively. Notably, the learning path was not explicitly programmed and was different for all users. By analysing data from more than 34 million learners worldwide, ELSA Speak can recommend the most suitable learning approach that considers individual differences and motivates them with adapted challenges.

One of the unique features of ELSA Speak is the AI tutor, which can reproduce and facilitate narrative communication with learners in multiple scenarios, allowing them to immerse and learn through mistakes. Learners can choose a role to communicate with the AI via interactive dialogue and receive personalised assessments of their English-speaking abilities, covering various speech attributes in a game-like character stat map upon finishing the conversation. The chart illustrates the learners' pronunciation accuracy, vocabulary usage, grammatical correctness, and speech patterns, such as intonation and rhythm. Additionally, feedback is stored in the user profile, enabling the ELSA AI tutor to reference past errors for future lesson design. (Figure 16.)

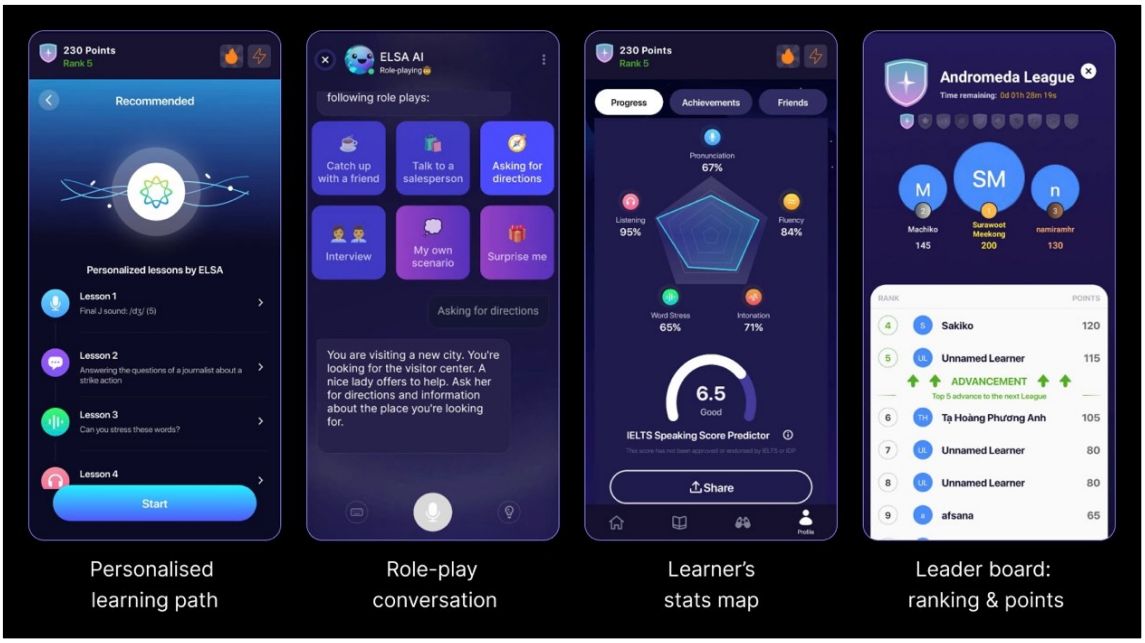

Figure 16. Features of the ELSA Speak app version 7.6.0 on Android (2024)

As previously mentioned, ELSA Speak's AI analyses data from multiple sources to create a personalised learning experience tailored to each user's strengths and weaknesses. These sources include global user data and individual learner data generated from the in-app activities. ELSA Speak has developed various mini-games and challenges in different play styles, enabling users to practice their speaking skills while earning points. Users can upgrade their leaderboard level within a limited timeframe by accumulating points via completed challenges, fostering healthy competition among learners. Moreover, to provide an intuitive experience and boost engagement, AI is implemented in these features to adjust difficulty levels and offer challenges relevant to each user's specific practice needs. (Figure 16.)

7.2 Loora

Established in 2020 by Mor and co-founder Yonti Levin, Loora was developed to provide learners with an economically viable option to enhance their English fluency with an AI tutor. In contrast to other applications that focus on informal learning, Loora aims to cater to dedicated learners who seek opportunities to advance their speaking skills for professional goals. Their virtual coach is designed to serve as a substitute for a native English tutor, capable of facilitating natural conversations that adapt to the learner's proficiency level and learning targets. Loora's mission is to make language learning accessible, affordable, and attainable for all individuals through the application of technology, which is reflected in its pricing models. The app's annual premium version costs only €10 per month for access to all features, and a complimentary version is available for users to engage with the AI freely to practice new vocabulary. (Loora n.d.; Cousins 2024.)

Unlike ELSA Speak, which offers an entrance test to determine English proficiency and personalises lessons based on the test results, Loora personalises lessons based on user-provided information. Initially, users share basic details such as age, native language, goals, preferred topics, and self-assessed proficiency level to receive lessons that match their preferences. After

completing the first lesson, Loora's AI tutor analyses the learner's speaking skills and offers personalised suggestions.

When using Loora, users may encounter several gamification mechanics, such as achievement badges, streaks, gems systems, and points. Users earn these rewards upon lesson completion and can use them to unlock new lessons or compete on the leaderboard. Throughout the learning journey, the AI adjusts the difficulty level and challenges to align with the learner's goals and areas for improvement and predicts how much the learner will improve based on their last lesson performance. These approaches benefit Loora users, as they can spend their hard-earned gems on items that are beneficial to them while also motivating them by showing the projected advancement of their skills in the future. Furthermore, the app also provides statistical insights into learners' speaking abilities via a stats map, though it is less detailed than ELSA Speak's. Another limitation of this feature is that it only considers daily lesson data, overlooking performance trends over extended periods. (Figure 17.)

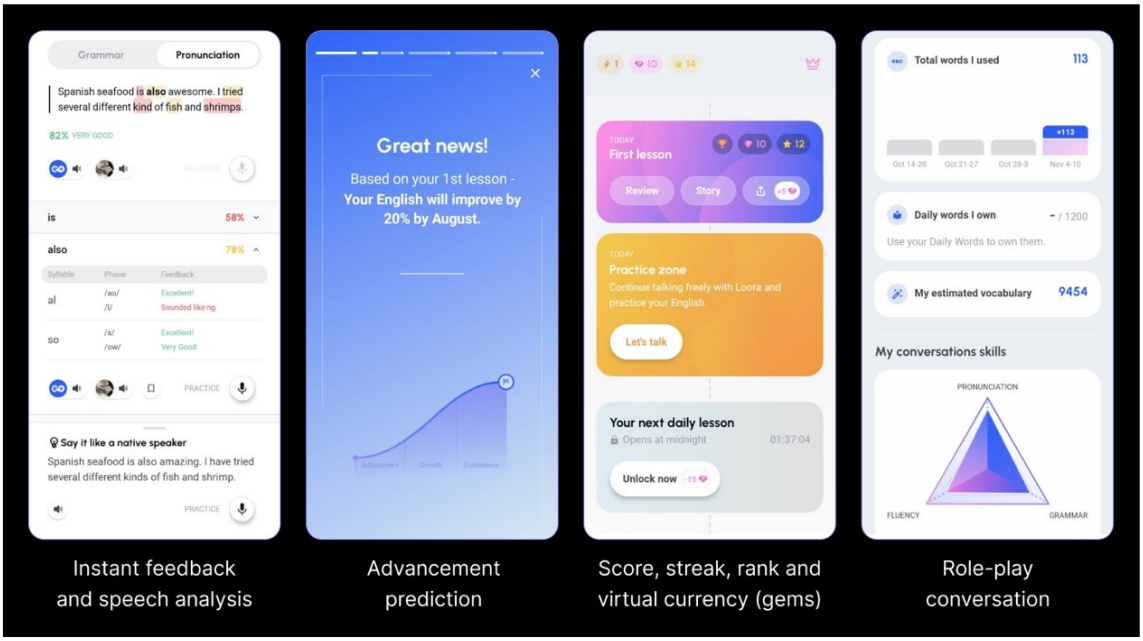

Figure 17. Features of the Loora app version 1.7.0 on Android (2024)

Regarding the content and methodology, Loora differs from other language-learning apps since it focuses on developing conversational fluency through role-play scenarios. Instead of solely relying on vocabulary and grammar lessons,

Loora's AI tutor engages learners in natural dialogues on various topics, such as travel, hobbies, and current events, to help them practice language in real-life contexts. As one of Loora's founders mentioned in an interview with Tech Funding News, the Loora AI model is trained and optimised using bespoke data to cater to individual user needs (Cousins 2024).

The AI's unique ability is its natural communication across multiple topics and contexts, such as job interviews or doctor's appointments. By unlocking the premium version, users can role-play with the AI to practice their English in real-life situations while concurrently learning. The AI tutor can extend conversations with complex grammar and phrases, paraphrasing learners' responses to help them achieve native-like fluency and expand their vocabularies. Moreover, it provides instant feedback on many aspects, including grammar and pronunciation, with detailed scores on every word and sound. The feedback’s judgement-free characteristic creates a comfortable learning environment, boosting users' confidence and making them feel at ease. Additionally, user performance mistakes are stored in their profile, which are then used to design future lessons and predictions. It can be said that the more one practices, the more personalised the experience becomes.

7.3 Duolingo

Established in 2011, Duolingo has emerged as a phenomenon that has transformed how people learn languages. Founded by Luis von Ahn and Severin Hacker, the platform's mission is to make language learning free and accessible to everyone, regardless of their financial means or background. By combining gamification with a scientifically grounded curriculum, Duolingo has created a uniquely delightful and productive learning experience, leveraging bite-sized lessons, interactive activities, and a reward system to promote engagement and motivation. This approach has proven highly successful, with the platform reporting 100 million monthly active users by 2024 and offering training in 40 languages to learners worldwide. The app's gamification features, including quests, reward incentives, structured progression levels, and user ranking systems, have demonstrated the capacity to substantially enhance learner

engagement and motivation. This statement is supported by the finding that 80% of Duolingo users report increased motivation after just four weeks of using the app. (Duolingo n.d.)

The popularity and accessibility of Duolingo can be attributed to its freemium business model, where users can access most of the educational content for free, only needing to watch advertisements or wait for their "hearts" to recover to continue learning. Users who wish to access more premium features, such as detailed mistake reviews, personalised skills practice, or immersive role-play conversations, can opt for a paid subscription to Super Duolingo or Duolingo Max plans. The applications of advanced AI technology and gamification in the Duolingo app can be seen in various features, depending on the platform's pricing options, platform and target languages. For example, Duolingo Max – which enables users to receive explanations on their feedback and make interactive conversations with AI characters - only works on iOS and is available in French and Spanish.

While gamification is a central design element in Duolingo, which incorporates game-like elements such as points, levels, and leaderboards to create a competitive and engaging learning experience for users, the integration of AI takes it to another level by providing personalised learning content based on the user's performance and pace (Duolingo n.d.). The app used users’ responses about their prior background and learning goals during onboarding to design a learning path that fit their goals and needs. Furthermore, as the user progresses in their second language acquisition journey, their performance data will be collected and analysed to identify challenges that match their level and are relevant to their weaknesses. Besides, Duolingo incorporates interactive exercises, such as translation challenges, role-play speaking practices or video calls, utilising natural language processing and speech recognition technologies to challenge user response speed in a realistic context and provide real-time feedback and guidance. (Figure 18.)

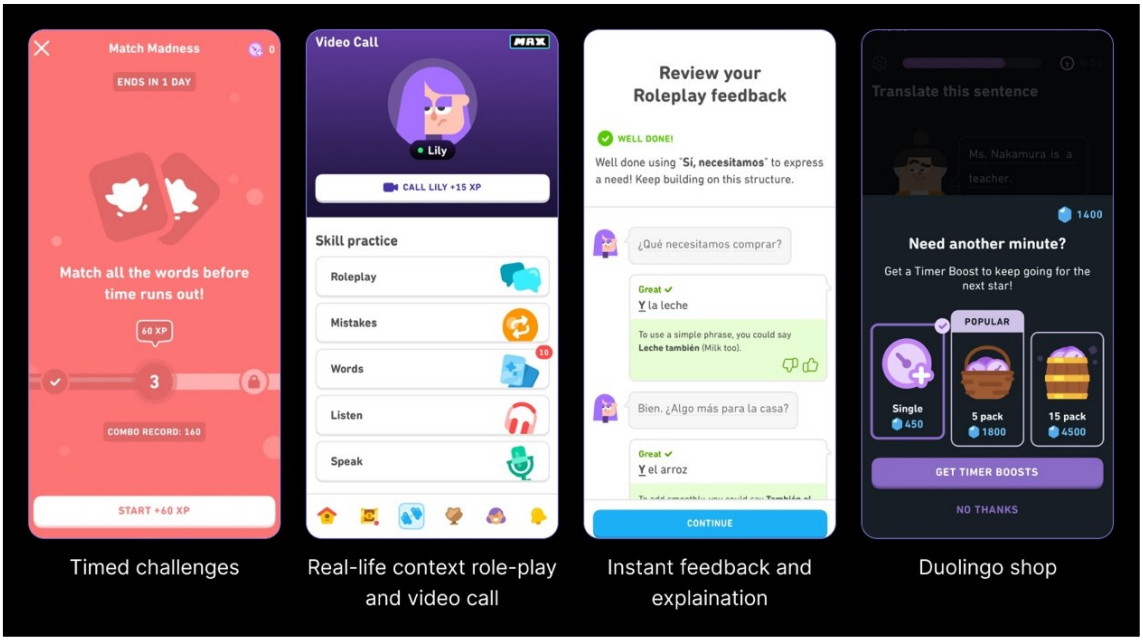

Figure 18. Features of Duolingo app version 7.48.0 on iOS (2024)

Further from frequently seen gamified features such as streak tracking or quests, Duolingo fosters healthy competition with several types of challenges for both groups and individuals. These challenges are usually set in a limited time frame, encouraging users to practice and maintain engagement. Users can earn experience points and rewards upon completing practices, which they can use to purchase supporting items that help them get advantages in the next competition. This system further gamifies the learning process, allowing users to have a game-like battling experience while learning efficiently. It serves the dual purposes of promoting engagement and exercise while collecting user performance data that the AI can use to tailor their lessons, catering to diverse user needs and preferences. (Figure 18.)

7.4 Classification

Based on the findings extracted from analysing the products above, Table 2 was created to classify these apps' AI techniques. The table includes four categories, providing a comprehensive overview of the AI capabilities leveraged by these gamified second language learning tools.

Table 2. AI techniques in gamified language learning tools

Theme	AI-powered gamificatipn techniques	Duolingo	ELSA Speak	Loora
Personalised learning paths	**Personalised learning path:** Tailor learning goals based on individual differnces.	Yes, after entrance exam	Yes, after entrance exam	No
	Adaptive difficulty levels: Adjust the difficulty of tasks based on learners' performance.	Yes	Yes	Yes
	Adaptive learning: learning meterials that adapt to the learner's progress and preferences.	Yes	Yes	Yes
Immersive and stimulation	**Interactive dialouge:** learner engage in interactive conversation such as video call or text message.	Yes	Yes	Yes
	Role-playing: Create immersive learning environments that simulate real-world situations.	Yes	Yes	Yes
Challenges and competitions	**Progressive challenges:** AI can gradually increase the difficulty of challenges/quests to keep learners motivated and challenged.	Yes	Yes	Yes
Other	**Learning result prediction**: Collect performance data to predict learning outcome	No	No	Yes

The “Personalised learning paths” section focuses on features that relate to customised solutions tailored to learners’ needs and individual differences. The “Immersive and stimulating activities” group involves interactive and role-playing experiences, where users often participate in real-life and real-time conversations with AI. Another category, “Challenges and competitions”, covers gamification mechanics such as timed challenges and matches. The "Other" category addresses applications that fall outside other categories.

7.5 Results of the comparative analysis

From the information collected, it appears that these apps leverage AI in numerous aspects of their gamification features. While familiar gamification mechanics like leaderboards, quests and streaks help maintain user motivation and engagement, the integration of AI in certain features takes them further by providing personalised and immersive learning experiences for their users.

In general, Duolingo, ELSA Speak, and Loora - all offer their users interactive and role-play conversations for language practice. Common approaches include engaging with learners in different contexts to exercise and collecting data to provide tailored feedback, explanations and recommendations. These interactions can take various forms, such as video calls, discussions on specific topics, or role-play scenarios.

Another widely used technique is adjusting learning levels and challenges' difficulty based on the learner's performance, which is tracked throughout their journey. Not only that, Duolingo and ELSA Speak go a step further in personalisation by assessing learners' results from entrance exams to design customised learning paths. On the other hand, Loora excels in providing users with insightful learning analytics, including projections of their vocabulary growth and fluency over time.

All these AI-powered gamification features leverage Generative AI and Natural Language Processing technology to develop meaningful connections with users, which could be through relevant conversations or tailor-made experiences that

consider their individual differences. The research also indicates that while gamification plays a critical role in these three apps, not all features integrate artificial intelligence, and some require a premium plan to fully experience the technology. Additionally, the pricing models for AI usage are also diverse in these tools, depending on the business strategy and vision of the company.

8 AI-DRIVEN GAMIFICATION IN SUPPORTING SLA: EFFICIENCY AND LEARNERS' PERCEPTIONS

8.1 Results of the survey

A survey was conducted with 92 participants to gather insights on AI-powered language learning tools and their effectiveness. The demographic breakdown showed a majority of women (70%) and men (28%), with a small percentage identifying as genderqueer or non-binary (1%) or not specifying their gender (1%), most of them are from 18 to 44 years old (Figure 19).

The survey revealed that an overwhelming majority (98%) of the respondents had prior experience in learning foreign languages, with only two participants reporting no previous language learning background. English emerged as the most studied language, followed by Finnish, Chinese, Japanese, French, and German. Interestingly, while most of the respondents had experience with two to three languages, one participant reported having learned up to seven languages.

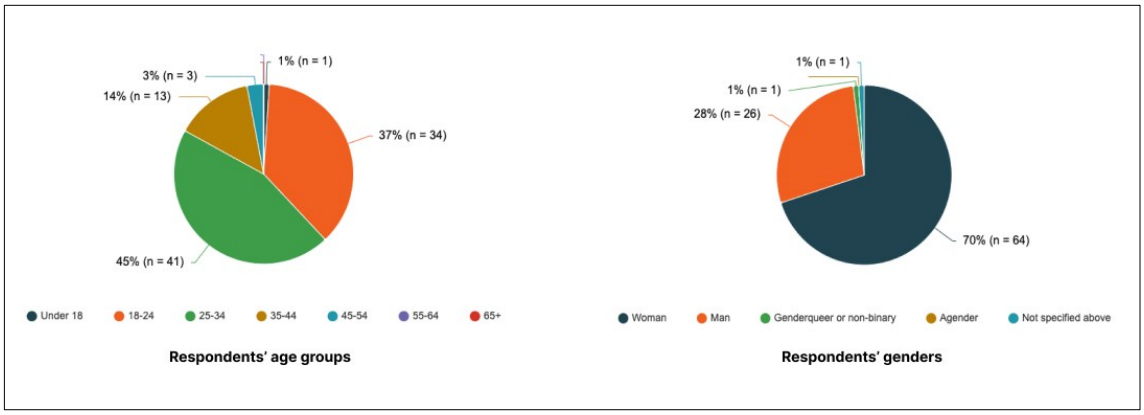

Figure 19. Survey respondent's demographic

Among AI-driven gamified language learning tools, Duolingo proved to be the most popular choice that was used by 65 participants. ELSA Speak was the second most-used app with 11 users, and 18 of the respondents reported using other AI-powered tools such as TalkPal, Buusu, and Lanatomy AI. Furthermore, it is worth noting that many respondents used multiple apps for their language learning journey, showing the emergence of using technology in SLA.

The survey findings highlighted the personalisation benefits of AI-powered gamification in language learning. It is reported that more than half of the respondents (53%) agreed that AI excels in adapting to their strengths and weaknesses when acquiring new languages, compared to traditional gamification methods. Furthermore, 58% of participants felt that AI provides a customised learning experience tailored to their needs, while 64% appreciated that AI considers their prior language learning experience to create suitable learning paths. Contrastingly, despite the fact that there is an abundance of features aiming to provide a realistic and immersive learning experience, like video calls, role-play and AI tutors, their impacts on the learning environment are unclear. While 50% of the respondents agreed that AI excels in this area, a significant portion (31%) were uncertain, and 19% disagreed. (Figure 20.)

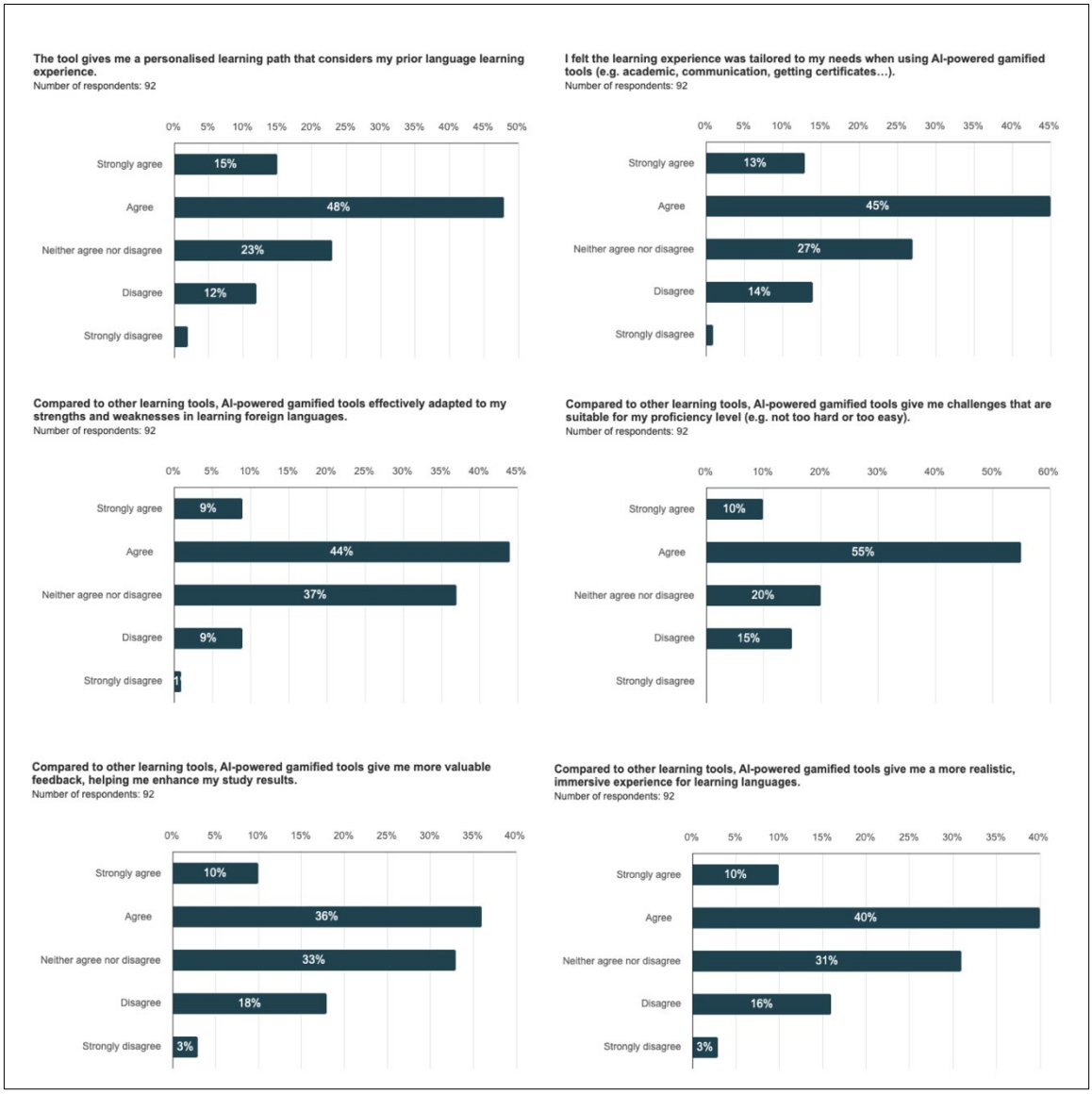

Figure 20. Report on personalisation, adaptive learning efficiency and immersive experience

Similarly, the learning efficacy of AI-powered gamification tools was met with uncertainty from the learners. When asked whether AI helps improve their linguistic skills, grammar knowledge, or general capacity to use the target language, up to one-third of participants chose "neither agree nor disagree.". However, there was a slightly higher agreement on two specific aspects: 64% of the respondents agreed that AI enhances word meaning comprehension (Agree = 48%, Strongly agree = 16%), and 60% agreed it improves listening comprehension (Agree = 49%, Strongly agree = 11%). (Figure 21.)

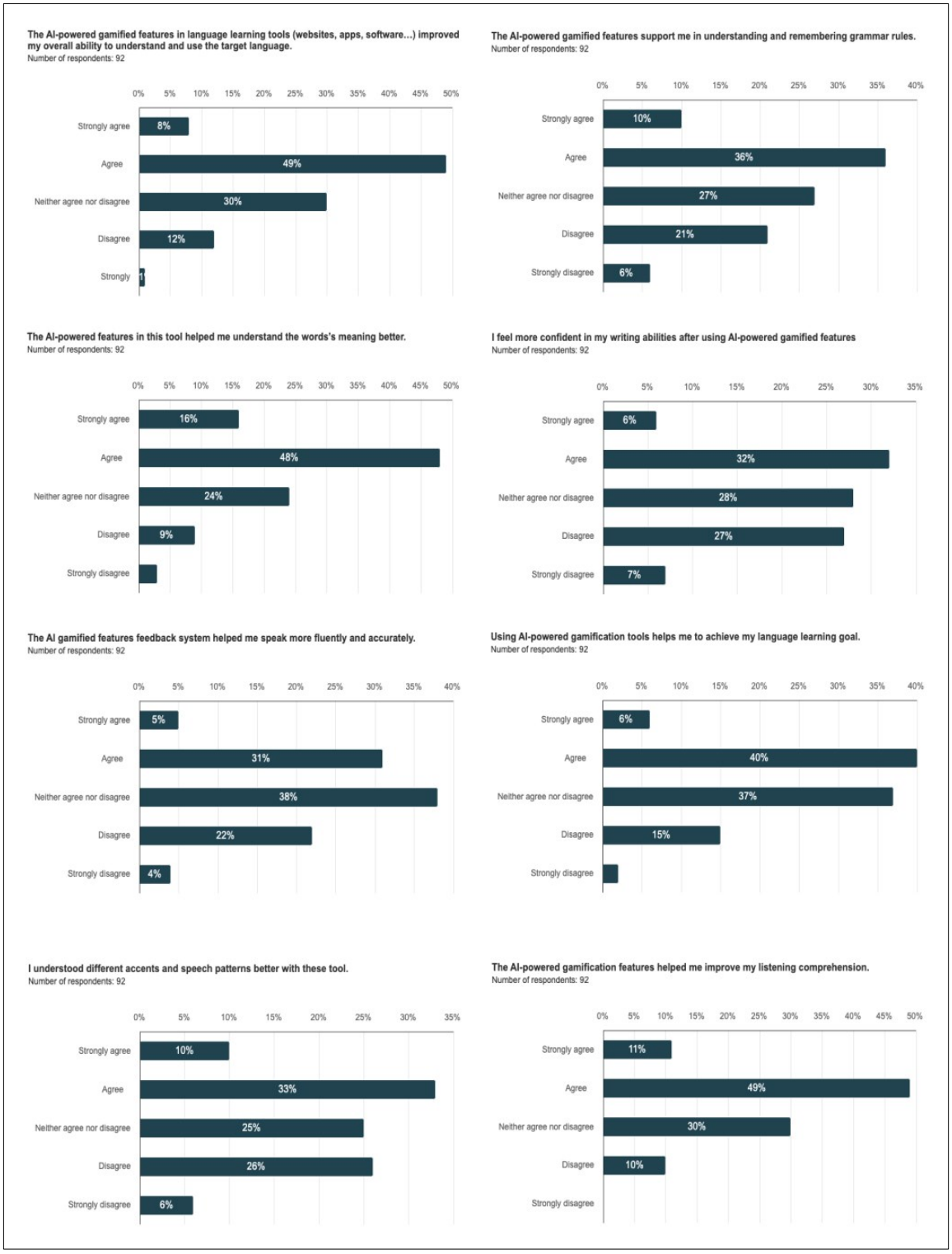

Figure 21. Impact of AI-powered gamification on four linguistic skills and language proficiency

The data shown in Figure 21 also suggests that AI applications in gamified SLA tools may be more effective in supporting users' vocabulary development and listening skills than other aspects. In general, it can be said that AI-powered gamification tools help users achieve their language learning goals, though less

impressive, as a total of 46% agree on this point (40% agree, and 6% strongly agree), while 37% remain sceptical about it. Regarding the view that feedback from AI is helpful in enhancing learners' results, only 46% of participants agreed with the opinion, and 33% of them felt unsure about it.

8.2 Attitude towards the new approach in second language learning

The survey results indicate a strong positive reception of AI-driven gamified language learning tools. An overwhelming 94% of the respondents agreed that these tools are easy to use, with 60% agreeing and 34% strongly agreeing. This ease of use can be attributed to several factors, including the clear instructions and good customer support provided by the tools, as reported by 64% of participants (51% agree, 13% strongly agree).

Additionally, the study also revealed the influence of social factors on the adoption of these tools. As mentioned in the previous chapter discussing the UTAUT2 model (Venkatesh et al. 2012), the social construct plays a significant role in technology adoption. This is evident in the survey results, with 48% of the respondents agreed that they use the tools due to social influences such as trends on social media or seeing others use them.

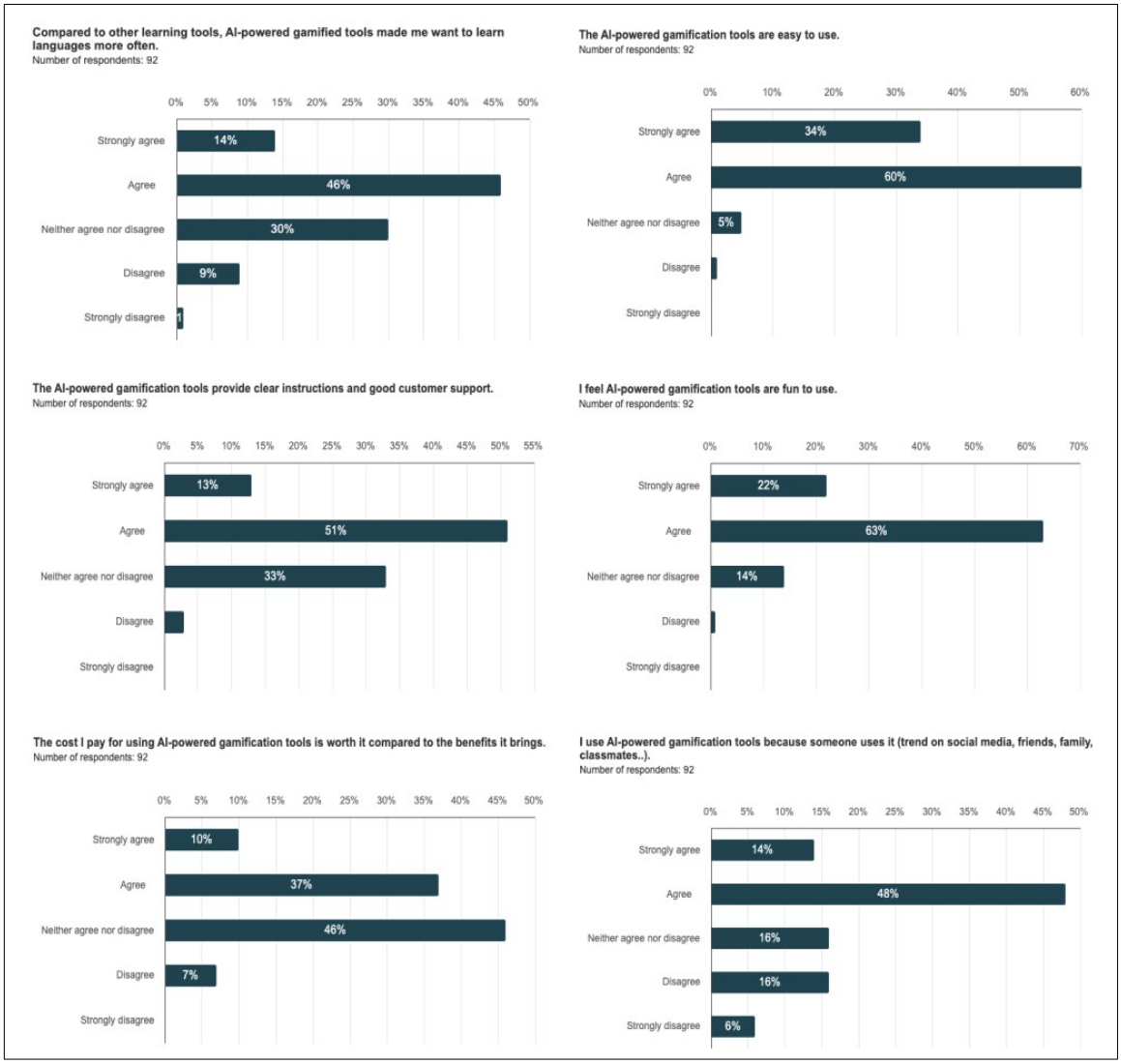

Figure 22. Learners' perception of AI-powered gamification tools for second language acquisition

User enjoyment is another notable aspect of these AI-powered gamification tools when a significant 85% of the participants found the tools fun to use (63% agree and 22% strongly agree); this finding aligns with another response where participants expressed that these tools give them the motivation to learn languages more often. However, users showed a more uncertain stance when it comes to the balance between cost and value. 46% of the respondents neither agreed nor disagreed on this point, which aligns with the previously reported ambiguous opinion about the tools' effectiveness in helping users achieve their learning goals.

9 CONCLUSION

Compared to non-AI gamification techniques, AI opens many possibilities for improving learning experiences and efficiency. Addressing RQ2, "What AI capabilities are most popular in gamified FLL tools?", it can be seen that AI in gamification leverages various techniques to provide users with more fruitful experiences. Thanks to its ability to analyse and label vast amounts of data, Machine Learning algorithms can learn from users' data (e.g., past student test performance, prior learning, their frequently encountered mistakes) to recommend relevant learning resources or predict learning outcomes. These algorithms learn through users' input to personalise the difficulty of challenges, help them recover from mistakes, and facilitate better learning through repetitive methods. Further from learning path personalisation, Natural Language Processing processes user inputs to provide relevant learning materials that match their topics of interest. The use of NLP can be seen in several tools, such as the video call feature in Duolingo, or chat with AI tutors in Loora and ELSA Speak. These features enable users to practice their language skills, train their reflexes at a realistic pace, and receive instant feedback with detailed explanations along the way.

Besides Machine Learning and NLP, another popular AI application in gamification language learning is Generative AI, which allows learners to communicate with virtual tutors in real-life contexts, such as job interviews or grocery shopping. While using these tools, learners can assume a role in a conversation and talk freely with the AI about any topic they choose. The AI is capable of facilitating the conversation in a meaningful manner. This provides an immersive learning experience, as users can now interact with AI as they would with a friend rather than a machine with implicitly programmed sentences as other non-AI gamified tools usually do. Nevertheless, although the use of AI in these tools is rampant and their employment methods might vary, it is vital to understand how to apply them effectively to create tangible benefits for second language learners. This is also the concern behind RQ1, “How does AI-powered gamification boost learners’ second language learning efficiency?”.

The survey results provide a bird-eye view into the evolving landscape of online second language learning, where gamification driven by AI is playing an increasingly prominent role. One of the most compelling findings is the strong emphasis on personalisation. The evidence shows that learners clearly value the AI's ability to adapt the learning experience to their individual differences, such as language aptitude, liking topics, study goals and prior languages. While individual differences are an important factor that affects learning efficacy, it is proven that AI-powered gamified tools greatly contribute to the success of users by enhancing this aspect. Furthermore, these tools go the extra mile in recognising learners' strengths and weaknesses to dynamically tailor study materials to keep users engaged and reach their target goals. This hallmark appears to be a substantial benefit over traditional gamification strategies, which often follow a one-size-fits-all approach.

However, the questionnaire also reveals some uncertainties about the efficacy of AI in improving general language proficiency. While they excel in areas like vocabulary building and improving listening comprehension, their impact on other aspects, such as grammar acquisition, writing and overall linguistic fluency, remains to be seen. Numerous learners expressed hesitance about whether these tools helped them achieve their learning goals or if the benefits they bring are worth the money they paid. The data indicates that while AI has made impressive strides, there is still room for improvement. Resulting from that, developers should either consider their future development in AI algorithms and gamification mechanics to tap further into other aspects of second language acquisition, such as grammar rules and writing skills, or balance their pricing strategies to make it worth the users' money spent. Besides, taking into account regional policies such as the AI Act (Act 2024/1689) and data privacy (Directive 95/46/EC) to ensure a safe and trustworthy use of artificial intelligence is also critical.

Nowadays, popular tools apply Generative AI intensively in their features, expecting to create immersive and realistic language learning experiences; however, their value is questioned. From the collected data, a significant number

of learners remained unconvinced about whether or not AI-powered gamification language learning tools can stimulate real-life scenarios. While the learning environment is a critical aspect that impacts study efficiency, the results indicate that developers still need to refine their approaches to provide learners with a more authentic environment in which to learn and practice their skills. Nevertheless, looking at the bright side, learner attitudes toward AI-powered gamification tools are positive. The respondents shared that these tools are easy to use, and a significant amount of them agreed on the enjoyment that they bring to the learning process. In general, users are satisfied with the support and instructions of AI-driven gamified foreign language learning tools, and the influence of society plays an important role in their decision to adopt the new technology.

The application of AI brings positive outcomes, transforming gamification from a method that is usually poorly integrated into the learning process (Luo 2023) to a more intuitive and adaptive approach. Thanks to the capacities of AI, learners can experience personalised experiences, as well as access study materials and receive detailed feedback anywhere and anytime. Although AI-driven gamification applications' impact on linguistic proficiency is limited in some aspects, as the technology keeps evolving, SLA learners can expect further innovative solutions to come to help them achieve study goals more efficiently.

Additionally, since the survey is mainly answered by people from EU countries aged 18 to 34, and 70% of the respondents are women, considering its limitations is also important. Further investigation with more extensive and diverse samplings is necessary to verify these conclusions and explore the long-term influence of artificial intelligence on language learning results.

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LIST OF FIGURES

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Appendix 1

ABBREVIATIONS

AI: Artificial Intelligence

SLA: Second Language Acquisition

FLL: Foreign Language Learning

NLP: Natural Language Processing

GBL: Game-based Learning

ID: Individual differences

L1: First language

L2: Second language

WM: Working memory

CALL: Computer-assisted language learning

FLL: Foreign language learning

Appendix 2

SURVEY QUESTIONS

1. Please select your age group
2. What is your gender identity?
3. Have you learned any foreign language before?
4. Which AI-powered gamification tools that you have been using so far? Please write its name
5. Compared to other learning tools, AI-powered gamified tools made me want to learn languages more often.
6. Compared to other learning tools, AI-powered gamified tools effectively adapted to my strengths and weaknesses in learning foreign languages.
7. I felt the learning experience was tailored to my needs when using AI-powered gamified tools (e.g. academic, communication, getting certificates…).
8. Compared to other learning tools, AI-powered gamified tools give me more valuable feedback, helping me enhance my study results.
9. Compared to other learning tools, AI-powered gamified tools give me challenges that are suitable for my proficiency level (e.g. not too hard or too easy).
10. The tool gives me a personalised learning path that considers my prior language learning experience.
11. Compared to other learning tools, AI-powered gamified tools give me a more realistic, immersive experience for learning languages.
12. The AI-powered gamified features in language learning tools (websites, apps, software…) improved my overall ability to understand and use the target language.
13. The AI-powered gamified features support me in understanding and remembering grammar rules.
14. I understood different accents and speech patterns better with these tool.
15. The AI-powered features in this tool helped me understand the words's meaning better.
16. I feel more confident in my writing abilities after using AI-powered gamified features.
17. The AI-powered gamification features helped me improve my listening comprehension.
18. The AI gamified features feedback system helped me speak more fluently and accurately.
19. Using AI-powered gamification tools helps me to achieve my language learning goal.
20. The AI-powered gamification tools are easy to use.
21. I use AI-powered gamification tools because someone uses it (trends on social media, friends, family, classmates..).
22. The AI-powered gamification tools provide clear instructions and good customer support.
23. I feel AI-powered gamification tools are fun to use.
24. The cost I pay for using AI-powered gamification tools is worth it compared to the benefits it brings.