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App-Supported Vocabulary Learning for Young EFL Learners – An Analysis of the Interactive Game and Learning World *Niki* in *Edurino*

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Abstract

This master's thesis aims to evaluate the implementation of app-supported vocabulary learning for young learners of English as a foreign language in the interactive game and learning world *Niki* in the *Edurino* app. For this purpose, a structuring qualitative content analysis was conducted, based on categories derived from theories of early foreign language learning, vocabulary acquisition, mobile-assisted and digital game-based language learning, as well as forms of feedback. Findings and analysis categories from previous studies were further considered in this process, which led to identifying a research void regarding studies that evaluate the quality of a specific language learning programme and focus on the previously mentioned dimensions. The findings of this study suggest that the learning world *Niki* implements a number of essential criteria and principles, such as using multimodal representations, embedding educational content into a coherent narrative, and focusing on oral communication. However, the analysis also identified potential challenges that may hinder vocabulary learning processes. These relate, in particular, to the learning world's ability to support productive language use, the limited use of the *Niki* figurine, and the restriction to standardised feedback responses. In addition to analysing the learning world *Niki*, this thesis introduced a comprehensive analytical tool that may prove valuable for future studies in this research area.

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List of Abbreviations

AI	Artificial Intelligence
AUC	Answer-until-Correct
DGBLL	Digital game-based language learning
EF	Elaborated feedback
EFL	English as a foreign language
HeaLinGO	Health and Language Integrated Gaming Online
HFW	High-frequency words
KCR	Knowledge of Correct Response
KR	Knowledge of Result
MALL	Mobile-assisted language learning
mpfs	Medienpädagogischer Forschungsverbund Südwest

1. Introduction

Recent studies on children's media use show that today, children are surrounded by and grow up with a wide range of media (Medienpädagogischer Forschungsverbund Südwest (mpfs) 2022, 2; 2023, 6). Personal access to digital devices, even among younger children, has increased in recent years (mpfs 2023, 9), with almost 30% of children aged four to five owning a tablet (mpfs 2023, 8), and regularly using apps and digital games (mpfs 2023, 39). While the latter was frequently criticised, and adverse effects on children's development were assumed in the past, there is now growing interest in the educational potential of digital games (Schmidt, Schmidt, and Schmidt, 2016, 18). Consequently, educators, publishing houses and game developers continually strive to enhance learning processes through digital games (Schmidt, Schmidt, and Schmidt, 2016, 34).

The potential of such media is also increasingly being recognised in the area of foreign language learning, evidenced by a significant growth in the number of language learning games and apps in recent years (Gabriel 2016, 1, 8; Alhinty 2015, 57) of which many focus on vocabulary acquisition (Blume, Schmidt, and Schmidt 2017, 221). These programmes are usually advertised with an emphasis on the fun that games and playful approaches supposedly entail (Schmidt 2016, 201). However, their educational quality depends primarily on whether they employ a didactic approach that is relevant to foreign language learning (Jones and Schmidt 2020, 5; Eisenmann 2022, 221).

The relatively recently launched *Edurino* app, which comprises a dedicated learning game for early English language vocabulary acquisition, similarly emphasises that "learning should be one thing above all: playful and entertaining" (Edurino GmbH n.d. a). Nonetheless, like is the case with most learning apps and games (Schmidt, Schmidt, and Schmidt 2016, 34; Blume, Schmidt, and Schmidt 2017, 209), Edurino provides little to no specific details of the English learning game's educational concept or efficacy for vocabulary learning, which raises important questions about its educational quality and alignment with principles of foreign language learning. Therefore, the present thesis seeks to answer the following research question: **How can the implementation of app-supported vocabulary learning for young children in *Edurino*'s game and learning World *Niki* be evaluated from a language learning theory perspective?**

For this purpose, the thesis is divided into seven chapters, including the present introductory section. The second chapter presents the study's theoretical framework, which draws on insights from the fields of early foreign language vocabulary learning, mobile-assisted and digital game-based language learning, and forms of feedback. This is followed by a presentation of previous research in the field of app- and game-supported vocabulary learning and their central findings to provide an overview of the current state of research. Chapter three then turns to the research object of this thesis and introduces the English game and learning world *Niki* in the *Edurino* app. Subsequently, chapter four presents the individual research questions derived from the overarching research question, which guide the following analysis. Furthermore, the method, design, and employed category system are outlined. Chapter five presents a formal description of the learning world, followed by a detailed presentation of the analysis results concerning each research question. These findings are discussed in the sixth chapter, which further includes suggestions for improving the learning world and acknowledges the limitations of the present study. The final chapter of this thesis comprises a summary of the results of the analysis to answer the overarching research question conclusively. It concludes by presenting perspectives for future studies on this particular educational game and similar learning programmes.

2. Early English as a Foreign Language Learning: Vocabulary, Mobile-Assisted and Game-Based Language Learning, and Feedback

This chapter, which constitutes the theoretical framework of the thesis, will present a combination of concepts and findings from different areas of foreign language learning, with a focus on young English as a foreign language (EFL) learners. Specifically, it will introduce principles of vocabulary acquisition, illustrate the role of mobile devices, apps, and games in modern language learning, and address computer- or mobile-assisted feedback. Lastly, the current state of research on app-supported vocabulary learning will be presented.

2.1. Early EFL Instruction and Vocabulary Acquisition

The main objective of early foreign language instruction is to provide children with the initial, basic skills needed to engage with the target language in authentic communicative situations (Elsner 2010, 39). Furthermore, early EFL instruction aims to foster an appreciation for the new language in young children, which is intended to encourage them to continue learning English and develop an interest in learning other foreign languages as well (Pienemann, Keßler, and Roos 2006, 27). While these objectives may apply to foreign language learning in general, it can be assumed that the needs of young children when learning a foreign language differ from those of adolescent or adult foreign language learners (Elsner 2010, 36).

Given that children tend to enjoy engaging in play, role-playing, and other imaginative scenarios, especially together with other children, language learning processes are most effective if they allow the young learners to become active, to form and test hypotheses, and to cooperate with others (Elsner 2010, 36). Furthermore, key principles of early foreign language instruction are a high level of target language use and a focus on oral communication (Pienemann, Keßler, and Roos 2006, 27). Initially, the development of listening and speaking competencies is prioritised (Elsner 2010, 40), while reading and writing skills, if they are even available, play a rather secondary, supportive role (Pienemann, Keßler, and Roos 2006, 27).

In order for young EFL learners to be able to engage in authentic communicative situations and develop their receptive and productive skills, they must also be supported in their vocabulary acquisition (Elsner 2010, 39–40). Vocabulary is considered a significant (Müller-Hartmann and Schocker-von Ditfurth 2015, 87; Nation 2013, 5), if not the most important (Ur 2022, 1) aspect in the development of foreign

language skills as it provides the basis that learners need to express themselves in the target language, to comprehend what they hear or read in this language, and to become aware of other facets of the target language (Tokowicz and Degani 2015, 216). While many English native speakers have developed a repertoire of 3.000 to 4.000 word families by the age of five, young EFL learners are just beginning to learn the language and, therefore, only know a limited number of English words (Nation 2013, 94). Further, English is not the dominant language of their surrounding linguistic environment, hence, there are fewer opportunities to come into contact with the target language (Kersten 2009, 76), and vocabulary cannot be acquired as incidentally as in their first language (Ur 2022, 2). Therefore, to support vocabulary acquisition, EFL learners need to encounter "strong representations of new word forms, and build[…] strong connections between the new vocabulary words and their meanings" (Tokowicz and Degani 2015, 216), which they can access quickly and effectively in communicative situations (Tokowicz and Degani 2015, 216). In this regard, vocabulary selection, presentation, and practice play an important role. Although the following subchapters will present more general theories and concepts of vocabulary learning, the particular importance of individual aspects for young learners will be explained, where applicable.

2.1.1. Selecting Vocabulary

Since not all words are equally helpful for communication (Müller-Hartmann and Schocker-von Ditfurth 2015, 89), word selection is essential in vocabulary learning. One important criterion that should be considered in this context is the frequency of a word (Kötter 2017, 15; Ur 2022, 5). So-called high-frequency words (HFW) are among the 2.000 most frequent English words, which are listed in the New General Service List (Browne, Culligan, and Phillips 2013). They are assumed to ensure that a person understands approximately 80% of spoken or written English texts (Müller-Hartmann and Schocker-von Ditfurth 2015, 89). Therefore, they are often regarded as more important than other, relatively rare words (Müller-Hartmann and Schocker-von Ditfurth 2015, 89).

Elsner (2010) also stresses the importance of including different word classes in vocabulary learning, stating that a collection of solely nouns is not valuable for the learner in real communicative situations (99). Instead, it is recommended to also

introduce learners to verbs, adjectives, and different function words from the beginning (Elsner 2010, 99).

2.1.2. Presenting Vocabulary

To present new words, a number of different techniques can be used, including "physical demonstration, mime and gesture, verbal explanation, […], visual support such as pictures, realia or blackboard drawings" (Müller-Hartmann and Schocker-von Ditfurth 2015, 96). Especially when combined, these presentation forms address different types of learners (Müller-Hartmann and Schocker-von Ditfurth 2015, 95–96), and young EFL learners, in particular, benefit from being able to experience content through different sensory channels (Elsner 2010, 36). Specifically pictures seem to hold a great potential for vocabulary learning, as they provide motivating and appealing representations of new words, which subsequently support learners in retaining the meaning of this vocabulary (Ur 2022, 32). Nevertheless, using pictures may also be problematic if they are ambiguous, such as a picture of someone laughing, which could be interpreted as "happy", "smile", or "laugh" (Ur 2022, 32).

Another important aspect of vocabulary presentation is to provide learners with opportunities to encounter "both how the new vocabulary item sounds and what it looks like when written" (Ur 2022, 15). However, in this context, it is important to distinguish between young EFL learners who can already read and those who are not yet literate (Ur 2022, 15). Although the latter may not yet benefit from it, the written form of a new word is helpful to EFL learners who can read for several reasons. As these learners already know that each spoken word has a correlating written form, the integration of the written form of a word helps to prevent learners from forming incorrect hypotheses about the spelling of this word based on their first language (Elsner 2010, 43; Kötter 2017, 116–17). It furthermore supports learners in perceiving the spoken form of a word more accurately (Ur 2022, 15) and can be used as an aid to memorise the new vocabulary, subsequently facilitating long-term retention (Kötter 2017, 116–17; Elsner 2010, 43).

Regarding the contextualisation of vocabulary, the language material needs to be structured "in a way that it is networked in the mental lexicon as intake" (Müller-Hartmann and Schocker-von Ditfurth 2015, 96). The mental lexicon contains linguistic information about words, including phonological, syntactic, and semantic data (Kersten 2009, 66). The *spreading* or *interactive activation model*, which Kersten

(2009) considers to be the most relevant model to explain the processing of lexical information in the context of foreign language vocabulary learning (71–72), represents elements in the mental lexicon as a network of nodes, with a wide range of connections between individual elements. These connections are not based on a hierarchical structure, as it is assumed in *hierarchic-serial* models of the mental lexicon, but are rather associative (Kersten 2009, 72), meaning that "the stimulus of a certain word brings up other words" (Müller-Hartmann and Schocker-von Ditfurth 2015, 89).

Therefore, Müller-Hartmann and Schocker-von Ditfurth (2015) suggest providing learners with new vocabulary in lexical units rather than as isolated individual words (87), which includes contextualising words in terms of their syntagmatic associations. For example, instead of introducing just the word "bus", learners should be presented with the multi-word item "get on the bus" to support fluency and ease the retrieval of information for language production (Müller-Hartmann and Schocker-von Ditfurth 2015, 87). Although it is assumed that words are also stored in paradigmatic associations in the mental lexicon (Schmitt 2000, 39; Müller-Hartmann and Schocker-von Ditfurth 2015, 89), there seems to be no consensus yet on whether they should also be contextualised in these paradigmatic relations. While several foreign language theorists and practitioners advocate for presenting vocabulary in semantically grouped sets (e.g., Carter and McCarthy 1988; Grandy 1992, quoted in Erten and Tekin 2008, 408), Ur (2022) argues that learners are more likely to confuse words with similar meanings or words that come from the same semantic field, which may hinder vocabulary learning (12). This seems to be supported by experimental studies such as those of Erten and Tekin (2008) or Papathanasiou (2009), who both found that beginning learners performed better if they were presented with words in semantically unrelated sets (Erten and Tekin 2008, 415; Papathanasiou 2009, 318). It should be noted, however, that Erten and Tekin's study (2008) was conducted with a relatively small sample of young EFL learners (418), and Papathanasiou (2009) focused on adult beginners and children at an intermediate level but not on children at beginner's level (318).

2.1.3. Practising Vocabulary

Finally, there are some principles to consider in vocabulary practice, which can further facilitate vocabulary retention and language production. To begin with, learners

should regularly re-encounter previously learned vocabulary (Kötter 2017, 115), for example, by linking new words with items they are already more familiar with (Ur 2022, 40). Furthermore, apart from hearing and reading words, it is essential that learners also have the opportunity to pronounce and write new vocabulary themselves, which activates and enhances their receptive competencies (Elsner 2010, 41–42) and ensures that they have correctly processed the items (Ur 2022, 40). In terms of early EFL learning, however, this can be limited to just speaking, as writing plays a subordinate role (cf. chapter 2.1). As it is estimated that learners retain approximately "10% of what they read; 20% of what they hear; 30% of what they see; 50% when hearing is combined with seeing; 70% when using it in their own speech production; and 90% when transferring it into corresponding actions" (Holler 1991, quoted in Kötter 2017, 22-23; author's own translation), activities that address multiple senses and facilitate productive, action-oriented language use appear more effective than reading or listening activities alone (Ur 2022, 41).

Regarding language production and action-oriented transfer, Ur (2022) differentiates between formats that involve receptive and those that involve productive vocabulary knowledge (41, 47). The first includes retrieval of meaning through activities such as multiple-choice questions, matching tasks or translation activities, in which the learner is presented with the target item and needs to do something with it (Ur 2022, 41). Formats that involve productive vocabulary knowledge, as is the case if learners are provided with the meaning of a word, for instance, as a picture, and need to produce the target item themselves, in contrast, are described as "more difficult, but perhaps more effective for learning" (Ur 2022, 41).

Considering the theories and principles mentioned above, it can be concluded that young EFL learners benefit from encountering and practising high-frequency vocabulary from different word classes in contexts that facilitate active engagement, interaction with others, and the reception and production of language, addressing as many senses as possible.

2.2. Mobile-Assisted Language Learning and Educational Apps

The previous chapters have already referred to learning materials and media to support vocabulary learning, such as the blackboard and pictures. However, many new educational media have emerged in recent decades (Grimm, Meyer, and Volkmann 2015, 206). Particularly widespread and increasingly prominent is the use of mobile

devices such as smartphones and tablets, referred to as *mobile-assisted language learning* (MALL) (Schmidt and Strasser 2018, 226). MALL provides learners with access to an almost unlimited amount (Eisenmann 2022, 209) of multicodal (combining different symbol systems, such as texts and pictures), multimodal (addressing different senses), and interactive media (Schmidt and Strasser 2018, 213–14). Interactivity can further be differentiated into navigational and didactic interactivity (Schmidt and Strasser 2018, 213–14; Blume, Schmidt, and Schmidt 2017, 217). While the former refers to aspects such as customising the content and order of activities through the user (Schmidt and Strasser 2018, 214), didactic interactivity is the adaptation of the media to the user (Schmidt and Strasser 2018, 214; Blume, Schmidt, and Schmidt 2017, 217).

MALL is supported by apps for mobile devices (Eisenmann 2022, 209), which are rapidly growing in numbers and are available for a wide range of purposes and user groups (Schmidt and Strasser 2018, 226), including educational apps for beginning EFL learners (Alhinty 2015, 57). A large number of these apps use interactive features, such as allowing learners to record themselves to practise speaking (Alhinty 2015, 57) or to write on the screen with their finger, which appear highly valuable (Rodríguez-Arancón, Arús Hita, and Calle 2013, 1191–1192) for vocabulary learning, as they enable productive language use (cf. chapter 2.1.3). Other features which seem to stimulate young learners' interest and motivation are the integration of songs and authentic videos (Alhinty 2015, 57) as well as learners' representation in the form of an avatar (Rodríguez-Arancón, Arús Hita, and Calle 2013, 1192).

According to Taylor et al. (2022), "a good educational app should […] include meaningful, specific, and constructive feedback […] and adjust the level of difficulty to the child's performance" (2), in other words, include didactic interactivity (Schmidt and Strasser 2018, 214). This is closely related to the principle of cognitive scaffolding, which Rodríguez-Arancón, Arús Hita, and Calle (2013) consider necessary for an educational app to provide value to the learner (1191). In many apps, scaffolding is realised "by guiding, aiding and rewarding children as they learn" (Alhinty 2015, 58). The latter, rewards, are a construct with which many children are already familiar from games, another feature found in many educational apps (Tso 2021, 1093; Alhinty 2015, 57).

2.3. Digital Game-Based Language Learning

Especially in terms of early foreign language learning, playful activities are emphasised as a holistic, active, and age-appropriate method (Elsner 2010, 56–57). In recent years, the number of digital games, particularly, has increased significantly (Gabriel 2016, 8). Three main categories of games can be considered in this context: commercial games, serious games, and gamifications (Jones and Schmidt 2020, 6). While commercial games are principally designed for entertainment, but can still hold potential in the field of foreign language learning, for instance, if they are available in a version of the target language (Schmidt and Strasser 2018, 230), serious games are explicitly designed for learning and focus on specific skills or knowledge (Rieckhoff 2022, 116), which usually align with curricular subjects (Jones and Schmidt 2020, 6). Aiming to "motivate participants, increase engagement, [and] improve work and feedback structures" (Jones and Schmidt 2020, 6), gamification is a process in which game mechanisms and playful elements are applied to an existing, non-game structure or process (Jones and Schmidt 2020, 6).

While the primary objective of gamification is to create positive user experiences, it can also be used to facilitate the acquisition of educational content (Rieckhoff 2022, 122). In this regard, digital games and gamification offer a wide range of opportunities for language learning (Jones and Schmidt 2020, 5).

2.3.1. Benefits of Digital Game-Based Language Learning

Researchers from different fields have been studying digital games and investigating the learning processes involved in gaming for several years, resulting in different perspectives on the potential benefits of digital games for language learning (Jones and Schmidt 2020, 4). Given the limited scope of this study, it is not possible to elaborate on all of these, but rather, a comprised overview of selected features that support language learning will be offered in this chapter.

One of the key benefits of digital games in this context is that they can provide learners with a significant amount of contextualised input in the target language while also offering opportunities to engage in productive language use (Dixon 2022, 52, 54). As this combination of productive and receptive language components suggests, many digital games incorporate multimodal elements (Jones and Schmidt 2020, 4), "where the rules, only sometimes linguistically articulated, are translated (and interpreted) into actions and behaviours observable visually or via other

senses" (Jones and Schmidt 2020, 4). Particularly through audiovisual techniques, learners are thus addressed through different senses (Jones and Schmidt 2020, 213). Again, this multimodality, which was also identified as a potential of MALL and educational apps, is particularly valuable in vocabulary acquisition (cf. chapter 2.2).

Another advantage already mentioned in the chapter on MALL and educational apps, which is also a feature of digital games, is interactivity. More specifically, this relates to the interaction between the player and the game through a game reaction or feedback, which promotes active learner engagement (Gabriel 2016, 4) and is considered to facilitate language learning (Blume, Schmidt, and Schmidt 2017, 218). Combining this system-based feedback and a playful atmosphere creates a learning environment where learners can test their knowledge without fearing negative consequences in the real world (Gabriel 2016, 5, 15). The implementation of game elements further supports this.

2.3.2. Game Elements

In frameworks of digital game-based language learning (DGBLL) and in the context of learning games in general, various game elements can be identified, with the same element sometimes being referred to using different labels (Toda, Klock et al. 2019, 1–3). Aiming to provide a guide for researchers, game designers, and educators, two research groups led by Toda (Toda, Cristea et al. 2019; Toda, Klock et al. 2019) proposed a gamification taxonomy that comprises 21 game elements, including common synonyms and examples of how the respective element might be used for learning purposes. As this taxonomy provides the basis for one aspect of the subsequent analysis (cf. chapter 5.3), the following sections will describe the dimensions and game elements included here. For a more comprehensive overview of the taxonomy, referring to the works of the two research groups mentioned before is recommended.

The gamification taxonomy classifies game elements into five dimensions, each corresponding to a specific context: performance/measurement, ecological, social, personal and fictional (Toda, Klock et al. 2019, 4–8). The performance/measurement dimension comprises game elements that provide extrinsic feedback to the learner, including *acknowledgement, level, progression, point,* and *stats* (Toda, Klock et al. 2019, 4–5). Here, *acknowledgement* is a symbolic form of reward such as a badge, *level* refers to a hierarchical structure otherwise known as skill level,

and *progression* is a form of guidance representing the learner's advancement in the game (Toda, Klock et al. 2019, 5). Furthermore, *point* is defined as a game element through which learners can earn points for their actions, and *stats* refers to the visual information available to the learner (Toda, Klock et al. 2019, 5). A lack or inappropriate application of elements from this dimension may lead to disorientation, frustration, as well as anxiety and can also result in learners focusing more on the quantity than the quality of their actions (Toda, Klock et al. 2019, 10).

Game elements in the ecological dimension hold a high potential for affecting learner interactions as they are subtle measures to ensure that the learner shows the desired behaviour in the game (Toda, Klock et al. 2019, 10). These include *chance*, which refers to the randomness of events, *imposed choice*, through which learners are required to make a decision, *economic transactions*, *rarity* and *time pressure* (Toda, Klock et al. 2019, 6–7).

As its name indicates, the social dimension includes elements that relate to social and interactional aspects, specifically the interaction between learners (Toda et al. 2019b, 11). It comprises elements that can, if applied correctly, prevent learners from feeling isolated. More specifically, the elements in this dimension are *competition*, *cooperation*, *reputation*, which refers to titles, and *social pressure* in the gaming context (Toda, Klock et al. 2019, 7).

Elements from the personal dimension “are intrinsic to educational environments and the learner might not perceive these elements as gamification” (Toda, Klock et al. 2019 11). As such, this dimension comprises *novelty*, an element which refers to the updating and adding of new content or game elements and *objectives*, which provide the learner with a purpose or a goal to achieve through interaction with the system (Toda, Klock et al. 2019, 7–8). Furthermore, the personal dimension relates to the use of *puzzles* and cognitive challenges, *renovation*, which allows learners to repeat specific actions after failure, and *sensation*, meaning the use of audiovisual resources to improve the sensory experience of the learner (Toda, Klock et al. 2019, 8). If personal elements are missing or not purposefully applied, learners might experience feelings of ambiguity, confusion, and demotivation, as the system cannot provide a meaningful educational experience (Toda, Klock et al. 2019, 7, 11–12).

Finally, the fictional dimension includes *narrative* and *storytelling*, two elements that are mostly not differentiated in other gamification frameworks (Toda,

Klock et al. 2019, 12). Toda, Klock et al. (2019), however, define *narrative* as "the order of events as they happen in the game, through the user experience" (8), while *storytelling* is defined as the way the narrative is realised and supported and how the story is told (Toda, Klock et al. 2019, 12). Both elements directly impact the learners' engagement and motivation to fulfil a particular task as well as the quality of their overall experience (Toda, Klock et al. 2019, 8,12).

As indicated in the previous sections, implementing game elements in learning environments should be carefully planned to avoid potentially undesirable results (Toda, Klock et al. 2019, 10–12). It is argued that the superficial application of game-like elements, particularly of those in the performance/measurement dimension, does not increase learner engagement (Jones and Schmidt 2020, 6) but can instead result in tasks being solved through trial and error, which is not conducive to language learning, especially in vocabulary acquisition (Gabriel 2016, 8).

2.4. Computer- and Mobile-Assisted Feedback

In the preceding chapters, feedback has already been briefly touched upon in the context of features of educational apps and game elements. In general, feedback is defined as information related to a person's performance or level of comprehension that is delivered by an agent, such as another person or media (Hattie and Timperley 2007, 81). Aiming to reduce the gap between a learner's current abilities or skills and a specific goal (Hattie and Timperley 2007, 86), feedback is an essential factor in foreign language learning (Kartchava and Nassaji 2021, 520). However, as feedback represents only a minor focus of the thesis at hand, this chapter will be restricted to computer- and mobile-assisted feedback methods and their effects. Reference should, nonetheless, be made to core literature in this area, such as Hattie's and Timperley's *The Power of Feedback* (2007) and Sheen and Elli's (2011) *Corrective Feedback in Language Teaching*.

Using the affordances of digital technology, computer- and mobile-assisted feedback offers a number of advantages, including consistency in the delivery of feedback, the ability to provide appropriately intense feedback (Kartchava and Nassaji 2021, 521), and the possibility of providing individualised feedback that considers the learner's specific needs (Mertens, Finn, and Lindner 2022, 1744). Moreover, the timing of computer- and mobile-assisted feedback may vary. Immediate feedback is usually provided to the learner directly following their response, whereas

delayed feedback is delivered after a preset time (Shute 2008, 163; Kartchava and Nassaji 2021, 521). Regarding the effectiveness of the timing of feedback, both immediate and delayed feedback are considered to impact learning outcomes positively. For instance, immediate feedback is reported to have a positive impact on the learner's motivation to practise (Shute 2008, 165), whereas delayed feedback "may encourage learners' engagement in active cognitive and metacognitive processing, thus engendering a sense of autonomy (and perhaps improved self-efficacy)" (Shute 2008, 166). In addition to the timing of feedback, different forms of feedback can also be distinguished. In this regard, Hattie and Timperley (2007) have indicated that feedback in the form of video and audio is highly effective, while praise, punishment, and extrinsic rewards are significantly less effective in promoting learning (84).

Moreover, computer- and mobile-assisted feedback can vary in complexity or specificity. Starting relatively unspecific, *Knowledge of Result* (KR) feedback provides information on the correctness of an answer (Shute 2008, 158). This can be either realised as a "correct" or "incorrect" statement or by adding a particular indication such as a highlight or a check mark to an answer (Shute 2008, 158). *Knowledge of Correct Response* (KCR) feedback is a more complex type of feedback than KR (Mertens, Finn, and Lindner 2022, 1744–45) as it further provides the learner with the correct answer (Shute 2008, 160). *Elaborated feedback* (EF), which usually provides additional information on the correct answer (Shute 2008, 159), along with an "explanation about why a specific response was correct or not" (Shute 2008, 160), is considered the most complex feedback type. Finally, if the provided feedback indicates the (in)correctness of a learner's answer and additionally allows them one or several further attempts, it is classified as *Answer-until-Correct* (AUC) feedback (Shute 2008, 160; Mertens, Finn, and Lindner 2022, 1745). In terms of the effectiveness of these feedback types, research has shown that all are beneficial to learning and positively impact the learner's performance, with more specific feedback being significantly more effective (Mertens, Finn, and Lindner 2022, 1755; Shute 2008, 157). However, it should be noted that there is little research available specifically for mobile-assisted feedback compared to literature focusing on the effects of feedback and effective feedback methods in general (Kartchava and Nassaji 2021, 528).

2.5. The Current State of Research

In the preceding chapters on the theoretical framework of this study, individual findings and insights from previous studies in the respective disciplines were already referred to in certain instances. However, while each of these disciplines represents a distinct field of research, the combination of these focuses in the context of app- and game-supported vocabulary learning for young EFL learners, as it is to be investigated in this thesis, can be regarded as an "emerging field of research" (Booton, Hodgkiss, and Murphy 2023, 410).

Previous studies in this area have primarily focused on the effectiveness of digital vocabulary learning methods compared to analogue approaches (Lin and Lin 2019, 880). For instance, the intervention study by Walter-Laager et al. (2017) investigated the vocabulary gains of 66 two-year-old children who either used an interactive word-learning app or analogue picture cards in their first language (Walter-Laager et al. 2017, 1062). It was found that children who used the app on a tablet learned more vocabulary, indicating that this method is more beneficial for young children than analogue media (Walter-Laager et al. 2017, 1069–70).

Furthermore, some studies have evaluated apps for vocabulary learning by examining learners' vocabulary knowledge after using the app (Lin and Lin 2019, 880). An interesting study in this regard is the mixed-methods experimental analysis conducted by Chen, Liu and Huang (2019). They investigated the vocabulary acquisition and retention of 20 sophomore EFL students using two versions of an English vocabulary learning app, one which uses game elements (experimental group) and one without any game-related functions (control group) and have further investigated learners' perceptions of these app versions (Chen, Liu, and Huang 2019, 170). In this study, learners from the experimental group performed better than the control group in terms of vocabulary acquisition and retention, supporting the hypothesis that game elements are beneficial and effective for EFL vocabulary learning (Chen, Liu, and Huang 2019, 182–183). Furthermore, the analysis of the interviews indicated that the combination of educational language learning content and game-related functions "provides a favourable learning approach to learners and offers additional benefits in promoting motivation and active involvement" (Chen, Liu, and Huang 2019, 185). Nevertheless, this study focused mainly on competition

mechanisms and gamified assessment (Chen, Liu, and Huang 2019, 184) and excluded other game elements.

As part of the *HeaLinGO* (Health and Language Integrated Gaming Online) project, Schmidt, Blume, and Schmidt (2014) developed a comprehensive test catalogue that combines elements from "the fields of foreign language learning theory, media pedagogy, computer-assisted language learning (CALL), digital game-based learning (DGBL), and game design" (Blume, Schmidt, and Schmidt 2017, 210). This *Prüfliste zur Analyse digitaler Fremdsprachenlernspiele*[1] was implemented in the analysis of 50 language learning apps that were either labelled as games or used game elements (Blume, Schmidt, and Schmidt 2017, 214). Overall, most gamified learning apps for beginners analysed in this study employed behaviourist approaches like *drill and practice* and predominantly focused on developing receptive skills (Blume, Schmidt, and Schmidt 2017, 220). Blume, Schmidt, and Schmidt (2017) discovered that although more than half of the language learning apps used listening activities, none allowed learners to produce language in response to a prompt (221). It was found that most apps used closed formats such as *multiple-choice* or *listen & click* tasks, and their difficulty was not automatically adapted to the learner's performance (Blume, Schmidt, and Schmidt 2017, 221, 223). In view of game elements, the analysis revealed that the programmes most frequently used points, followed by progression indicators, countdowns, and levels, which were also used to provide feedback to the learners (Blume, Schmidt, and Schmidt 2017, 224–225). The latter was shown to be mostly immediate and allowing AUC (Blume, Schmidt, and Schmidt 2017, 222). Regarding the feedback forms, half of the apps offered acoustic signals and 80% used visual reactions (Blume, Schmidt, and Schmidt 2017, 224). Elaborated feedback only included standard correction without further addressing the learners' errors (Blume, Schmidt, and Schmidt 2017, 224).

The studies presented so far addressed individual topics and dimensions of the present thesis. However, they either focused on language learning in general rather than specifically on vocabulary acquisition, were limited to first language acquisition, older learners, or did not consider individual features of apps and game elements or mobile-assisted feedback. As the evaluation of the quality and success of specific learning games remains a largely unexplored research area (Schmidt,

[1] Checklist for analysing digital foreign language learning games

Schmidt, and Schmidt, 2016, 34; Blume, Schmidt, and Schmidt 2017, 213), the investigation of digital vocabulary learning for young EFL learners, supported by specific app and game elements, as well as feedback mechanisms, in one selected language learning app presents an interesting desideratum.

3. The Interactive Game and Learning World *Niki* in *Edurino*

Edurino is a so-called *hybrid learning app* that combines digital content with tactile figurines and an ergonomic pen (Edurino GmbH n.d. b). The company asserts that the app was developed in close collaboration with educators and experts to facilitate children's digital education and to support the playful development of essential and emergent competencies (Edurino GmbH n.d. b). The tactile figurines are used to unlock a range of learning worlds (Edurino GmbH n.d. b), including mathematics, logical thinking, creativity and painting, and reading and writing (Edurino GmbH n.d. c). For the latter, the app was awarded the special prize in the category of kindergarten and preschool at the *TOMMI Deutscher Kindersoftwarepreis*[2] in 2022 (TOMMI 2022).

One of the learning worlds within the *Edurino* app, released in 2022, is called *Niki - Erstes Englisch*[3] and is accessed through the *Niki* figurine, a red bird. The educational concept for this learning world has been developed by a team of speech therapists, primary school teachers, and nursery school teachers to prepare children for their school start (Edurino GmbH 2024). In the educational game, designed for children aged four to eight, learners can discover and practice first words and phrases in English while developing their fine motor skills and a correct pen grip (Edurino GmbH 2024). This process is divided into four thematic sections, in which learners are guided through a series of games designed related to the following topics: animals (and feelings), vehicles (and numbers), colours, and fruits (Edurino GmbH 2024).

To date, no empirical studies of the *Niki* world in *Edurino* are available to the public. Therefore, the present study aims to address this specific research gap by evaluating the learning world's potential to support early EFL vocabulary learning.

[2] TOMMI German Children's Software Award
[3] First English

4. Methodology

Following the recommendation of Booton, Hodgkiss, and Murphy (2023), who stated that “a starting point for research on the effective design of mobile applications for children’s language learning is to examine the affordances they offer, and to consider how they may impact learning based on existing theory in language learning” (402), the present study comprised a theory-led, category-based analysis of *Edurino*’s digital English learning game *Niki* to investigate app-supported vocabulary learning for young EFL learners. In the following chapters, the research questions of the thesis will be presented before the chosen methodological approach and the analysis design will be described in the frame of foreign language didactics research. A separate chapter is dedicated to the process of creating the underlying category system for the analysis, which represents another core element of this thesis, as it is a new analytical tool that was not previously available in this form.

4.1. Research Questions

The results of previous studies in this field indicate that using digital media and game elements can potentially contribute to a more effective, engaging, and interactive vocabulary learning process. However, previously analysed language learning apps and games were found to lack open task formats, productive language use and complex, individualised feedback, as well as a genuine integration of educational content with gamification (cf. chapter 2.5; Blume, Schmidt, and Schmidt 2017, 226).

Therefore, the following analysis of the relatively new game and learning world *Niki* in *Edurino* considers app-supported vocabulary learning in the context of embedded learning in gamification and through interaction with feedback, using the following research questions:

1) How is vocabulary presented and practised in the learning world, and to what extent may this support vocabulary acquisition from an early foreign language learning theory perspective?
2) Which game elements can be identified in the learning world, and how may these affect learning in view of mobile-assisted and digital game-based language learning?
3) In what way does the learning world interact with learners through feedback?

4.2. Method and Design of the Analysis

Regarding the research questions and the aim of this thesis, it can be considered belonging within the field of foreign language didactics. Research in this area aims to analyse and improve the quality of foreign language teaching by investigating, among others, its contents and methods, as well as the processes involved in learning a language (Klippel 2022, 26). The conducted analysis focused on evaluating the *Niki* learning world in *Edurino* and can thus be assigned to the empirical research area of textbook and materials research. This research area is concerned with the systematic analysis of historical and contemporary educational materials in terms of their development, evaluation, and use (Caspari 2022, 14). It encompasses both analogue and digital learning media (Caspari 2022, 14). The methodological approach of the present analysis was developed based on the qualitative content analysis method, which Burwitz-Melzer and Steininger (2022) consider particularly useful in foreign language didactics research (277).

The base of any qualitative content analysis is the rule-based assignment of categories to specific elements (Mayring and Fenzl 2019, 636). Depending on the specific analysis technique, these categories can either be inductively or deductively developed (Mayring and Fenzl 2019, 636). Here, Mayring (2022) distinguishes three primary forms of qualitative content analysis: summary, explication, and structuring (66). The latter, which is most frequently used in German-language foreign language research (Burwitz-Melzer and Steininger 2022, 286) and is also described by Mayring as the most central content analysis technique (Mayring 2022, 96), was selected for the present analysis.

The structuring qualitative content analysis aims to identify specific aspects within the material or to assess the material based on particular criteria (Mayring 2022, 66). For this purpose, a deductive approach is used, which requires that the category system is developed prior to the analysis, deriving the categories from existing theoretical frameworks and then applying the system to the material in question (Mayring and Fenzl 2019, 638). In this case, the material, namely one learning world from the *Edurino* app, was to be analysed according to a selection of criteria derived from the theoretical background of this thesis (cf. chapter 2). To this end, the following process model was employed:

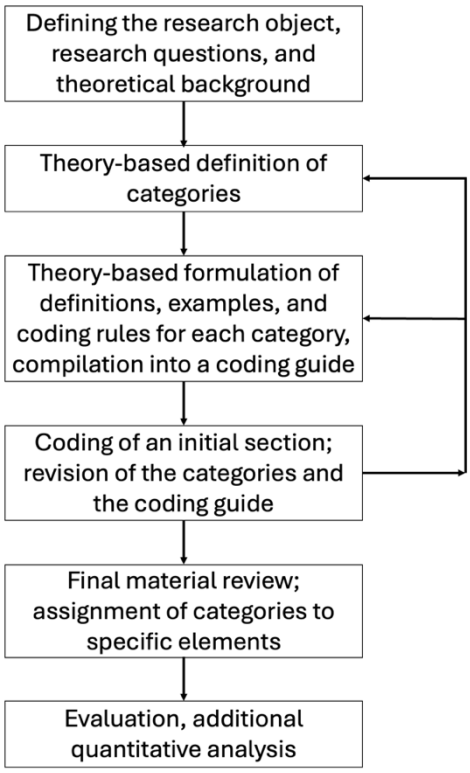

Figure 1: Process Model of the Structuring Qualitative Content Analysis (adapted from Mayring 2022, 97)

In order to guarantee the stability of the procedure and ensure the reliability of the analysis results, an intracoder agreement was pursued (Mayring and Fenzl 2019, 636). For this purpose, after the final material review, an intermediate step was inserted in which the data was re-coded from the beginning without consideration of the initial category assignment. After this second analysis process, the final category assignment was evaluated, and constituting a so-called *embedded design*, some aspects of the qualitative content analysis were quantified by counting the coding of individual categories (Schramm 2022, 56).

4.3. Development of the Category System and Coding Guide

Following the guidelines provided by Mayring (2022), a comprehensive category system was developed for this analysis, derived from the previously formulated research questions and founded on the theoretical framework of this thesis. In addition to this category system, a corresponding coding guide was created. As the centrepiece of structuring content analyses, this coding guide supports the interpretative qualitative act of assigning elements to the deductively established categories based on a set of rules (Mayring 2022, 96–97). The category system and coding guide were divided into different sections, which are thematically dedicated to different key aspects of the analysis.

To answer the first research question, categories to analyse vocabulary learning in the app were included on three levels: vocabulary, task formats, and competencies. On the level of vocabulary, the main categories *items*, *presentation,* and *contextualisation* were included. The first category, *items*, was defined to document which vocabulary items occur in the app. It comprises the categories *practised vocabulary*, which includes the vocabulary presented and practised in each level, and the category *high-frequency words*, which was included based on the theoretically described significance of word frequency in vocabulary learning (cf. chapter 2.1.1). The category *presentation* includes the subcategories *spoken form*, *written form*, and *picture,* derived from theoretical remarks about learning-supportive forms of encounter with vocabulary (cf. chapter 2.1.2). The subcategories *individual words*, *lexical units* and *in a semantic set* within *contextualisation* aimed at allowing suggestions about the form in which the vocabulary might be stored in and retrieved from the mental lexicon of the learner, focusing on syntagmatic and paradigmatic associations (cf. chapter 2.1.2).

At the level of task formats, the main categories *closed formats*, *semi-open formats*, and *open formats* were defined based on the options listed within the *Prüfliste zur Analyse digitaler Fremdsprachenlernspiele* (Schmidt, Blume, and Schmidt 2014, 15). Each main category included several subcategories, such as *sorting tasks, fill-in-the-blanks,* and *research tasks,* which were likewise derived from Schmidt, Blume, and Schmidt's framework (2014). An initial section comprising the first five levels in the app was coded to test the category system and coding guide. During this initial analysis, the author identified the original category *listen and click* as insufficient for several exercise formats in the app. At this point, the category system and the coding guide were revised accordingly, with the previously mentioned category being replaced by the category *listen & react* (cf. appendix, chapter 9.1).

The level of competencies was included in the analysis to investigate how vocabulary is practised, considering receptive and productive language skills. For this purpose, selected language competencies, namely *listening*, *reading*, *writing*, and *speaking* were deductively included. During the initial analysis of the first five levels, it became evident that most of the exercises addressed listening skills to varying degrees. Consequently, the subcategories *listening to individual words*,

listening to individual sentences, and *listening to longer texts in the program* were added inductively.

The second research question of this study focuses on mobile-assisted and digital game-based language learning within the app, questioning which elements of gamification can be identified and how these may affect learning in the learning world. For this purpose, the five main categories, *performance/measurement*, *ecological*, *social*, *personal*, and *fictional,* were derived from the gamification taxonomy by Toda, Klock et al. (2019, 4–8) and further distinguished into subcategories, which were also taken from the proposed taxonomy. Additionally, the subcategories *bonus*, *combos* (both in performance/measurement), and *ownership* (personal dimension) from the *Prüfliste zur Analyse digitaler Fremdsprachenlernspiele* were included in the analysis since the other subcategories did not sufficiently cover them. Furthermore, the element *avatar,* which was identified as a potentially beneficial feature for stimulating learner's interest and motivation, was included in the personal dimension (cf. chapter 2.2). Finally, based on the recommended features for educational apps by Taylor et al. (2022, 2), the two main categories, *difficulty adaptation* and *no difficulty adaptation*, were included in the analysis to record whether or not the difficulty of levels in the app is automatically adjusted to the learner's performance.

Lastly, the feedback in the learning world was analysed to answer this thesis's third research question. Based on *Die Lüneburger Prüfliste für Corrective Feedback in digitalen Fremdsprachenlernprogrammen*[4] by Wucherpfennig and Schmidt (2023) and Shute's (2008) article on formative feedback, the main category *timing* with the subcategories *immediate feedback*, *delayed feedback*, and *variable,* as well as the main category *mode*, including *sound effect*, *visual signal*, *video*, *audio feedback*, and *written feedback,* were defined. The category *feedback through extras* from Wucherpfennig and Schmidt (2023) was excluded here to avoid redundancy, as this feature was comprised and analysed within the previously mentioned category *bonus* in game elements. Furthermore, the main category *complexity* was added to the category system to analyse the feedback provided in the app, not only in terms of its presentation but also considering the content of the feedback. The subcategories in *complexity* include *Knowledge of Results* (*KR)*, *Knowledge of Correct Response* (*KCR)*, *Elaborated feedback* (*EF)*, and *Answer-until-Correct* (*AUC),* which

[4] The Lueneburg checklist for corrective feedback in digital foreign language learning programmes

were defined from Shute's (2008) framework for formative feedback and can also be found in *Die Lüneburger Prüfliste für Corrective Feedback in digitalen Fremdsprachenlernprogrammen* (Wucherpfennig and Schmidt 2023).

The coding guide for the category system described in this chapter can be found in the appendix of this thesis (cf. chapter 9.1). It includes all the categories and their respective definitions. Where needed to clearly distinguish them from other categories, typical examples and coding rules were included. To further support the understanding of coding decisions, the following chapter will present the analysis findings in combination with examples from the different levels.

5. Results

The qualitative content analysis conducted in this study focused on the English learning world *Niki* in *Edurino* to investigate app-supported vocabulary learning in terms of vocabulary presentation and practice, digital game-based learning, and interaction through feedback. The analysis results will be reported in four subchapters, of which one will comprise a formal description of the learning world, and three will correlate to the formulated research questions. Wherever suitable, the qualitative findings will be quantified to allow for comparisons between different aspects of the analysis.

Given the limited scope of this thesis, not all levels and their respective assignments to the analysis categories can be presented in detail in this chapter. However, a comprehensive description of all levels of the learning world, their formats, contents, and other characteristics can be found in the appendix (cf. chapter 9.3). In addition, the analysis results will repeatedly be explained and illustrated using exemplary levels so that each level will be referred to at least once for one of the analysis categories. Here, it should be noted that for pragmatic reasons, all levels were numbered and named by the author to facilitate comprehension.

5.1. Formal Description of the Learning World

Before analysing the content and features of the learning world in detail, this chapter will provide a brief overview of the scope and structure of the *Edurino* app, specifically the chosen learning world, to facilitate understanding of the subsequent analysis results.

Figure 2: Initial View

Figure 3: View after Completion

When learners open the *Edurino* app, they are first asked to choose their avatar and the figurine they want to use in German. To enter the English world, learners need the *Niki* figurine, a red bird, which serves as a key to unlock the game and learning world. Afterwards, a short introductory video is presented, in which the character *Niki* greets the learner and introduces themselves in English. If it is the

first time learners use the app to learn English, their view of the learning world corresponds to figure 2. Using a fixed linear pathway, in which learners must complete one level to unlock the next, the app consists of four thematic islands, each consisting of five levels, and one smaller island with only one level.

Figure 3 shows that each larger island is preceded by a light bulb symbol in a thought bubble. If learners click on the thought bubble, a short introductory video is played in which a virtual character's problem is presented. After completing the first two levels of the app, a free play area is unlocked, which can be accessed by clicking on the rocket in the middle of the map. Here, learners can play games from different areas in German, replay the levels they have already unlocked from the islands, and rewatch the corresponding introductory videos.

Although the 21 individual levels have a different focus and use different formats, which will be presented and discussed in chapter 5.2.2, they all share some common structural features. One of these is an introductory sequence before the activity, in which *Niki* or the learner is asked to help a virtual character or participate in a particular event, such as a race. Furthermore, each level includes a tutorial that provides the learner with a visual or verbal demonstration of the action required to complete the level. Finally, once a level is completed, a final screen, as presented in figure 4, appears with audible applause and the spoken message: "Yay! Wow! Well done. Do you want to play this game again or something else?". Depending on whether the learners have already completed all the levels once, the completion screen also comprises a display of one to five stars.

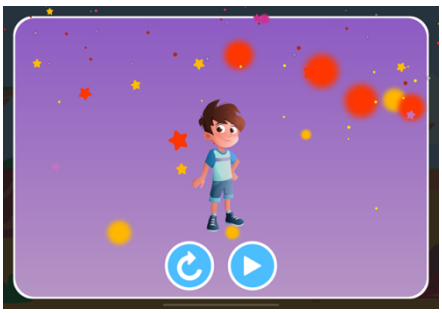

Figure 4: Final Screen

5.2. Vocabulary Learning

The individual levels and contents were analysed in more detail to answer the first research question, which focused on vocabulary learning in the *Niki* world. Here, the analysis proceeded from investigating the vocabulary items in terms of their selection, presentation, and contextualisation to the underlying task formats and

promoted competencies. The results of this analysis step will be presented in the same order in this chapter.

5.2.1. Vocabulary Selection, Presentation and Contextualisation

In analysing the vocabulary items in the learning world, a distinction was made between vocabulary presented in the context of narrative introductions or tutorials and vocabulary presented and practised in the activity. The following results section focuses solely on the latter.[5]

In the first step, every vocabulary item identified in the learning world was recorded in the category *practised vocabulary*. Subsequently, the number of new items was counted. An item was considered new if it presented a new semantic meaning. For example, the colour "orange" was distinguished from the fruit "orange". Consequently, plural forms of the same noun were counted as only one new item. In a second step, these new vocabulary items were analysed in terms of their frequency in the English language and the items that could be defined as high-frequency words were counted. In total, 50 vocabulary items from six vocabulary fields are presented and practised in the levels and games in the learning world, of which, according to the *New General Service List* (Browne, Culligan, and Phillips 2013), just over half are among the 2.000 most frequent words in English. Table 1 indicates that the number of new vocabulary items decreases after the second island and that the last level includes no new vocabulary. As can be seen in the completed category system in the appendix (cf. chapter 9.2), this is because vocabulary items from previous topics are practised again in later levels, and the last level of the learning world comprises vocabulary items from all previous thematic islands.

[5] It should be noted that this does not imply that vocabulary learning does not occur in these other contexts. However, due to the scope of this study, these contexts could not be analysed in more detail.

Learning Island	New Vocabulary Items	Number of New Items	New HFW	Number of New HFW
Animals (& Feelings)	pig, bear, bird, cat, rabbit, dog, mouse; shy, angry, surprised, happy, scared, silly	14	pig, bear, bird, cat, dog, mouse; angry, surprised, happy, sad	10
Vehicles (& Numbers)	boat(s), motorcycle(s), train(s), bicycle(s), airplane(s), car(s), bus(es); one, two, three, four, five, six, seven, eight, nine, ten; part(s)	18	boat, train, car, bus; one; part	6
Colours	yellow, blue, green, purple, red, orange, pink, black, white; paint bucket, paint brush(es)	11	yellow, blue, green, red, black, white	6
Fruits	lemon(s), orange(s), banana(s), apple(s), cherry/cherries, strawberry/strawberries, pear(s)	7		0
The Party		0		0
TOTAL		**50**		**26**

Table 1: New Vocabulary Items & High-Frequency Words

Secondly, these vocabulary items were analysed in terms of their presentation and contextualisation.

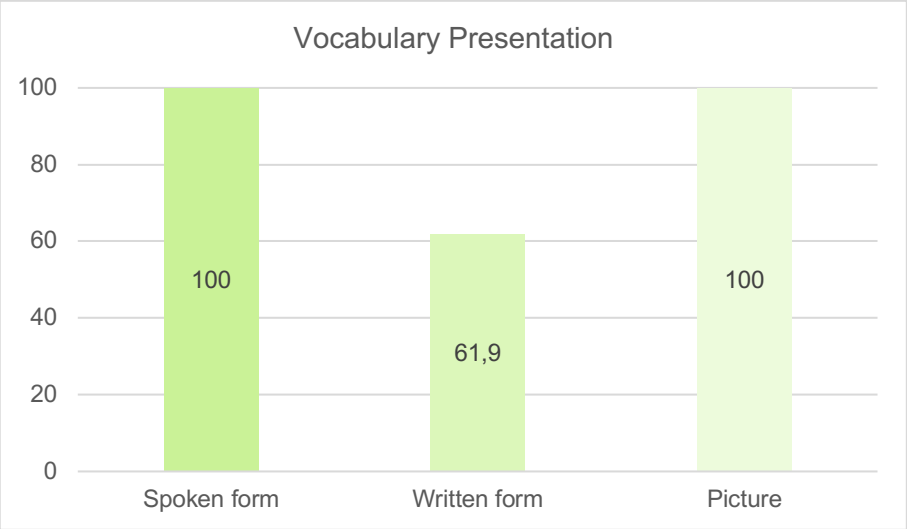

Figure 5: Vocabulary Presentation Forms (in per cent)

Regarding presentation, it was found that all levels (100%) present vocabulary items in their spoken form. In seven levels, specific conditions for this were identified, such as only offering the spoken form after the learner has selected the

corresponding element or completed one exercise item. For instance, in level *1_4 Animal Slot Machine,* learners are asked to move parts of an animal face to the left or the right to find the matching parts and reassemble the face. In this level, the spoken form of the vocabulary, such as “surprised bird”, is only offered if the learner clicks on the parts before moving them and after the animal face is reassembled. Another case where the spoken form of the vocabulary is only presented limitedly was found in *level 3_5 Colouring Picture.* Here, the colours are named as soon as the learner clicks on them, except for “black” and “white”, which are introduced at this point but whose names are never verbalised. Despite these limitations, it was found that all 21 levels stimulate the learners’ auditory senses, consequently addressing their listening competence. This aspect will be reconsidered in more detail in chapter 5.2.2.

As figure 5 indicates, 61.9% (13) of the levels also include the written form of vocabulary items, while the remaining 38.09% (8) do not include the spelling of words. Again, seven levels were identified, in which the written form of an item is only presented after selecting the item or after completing one exercise element. Additionally, it was found that some levels include only the written form of one vocabulary field, although vocabulary from another field is presented as well. One example of this is level *4_3 Circle the Fruits,* in which fruits and numbers are presented and practised, but only the names of the fruits are presented in written form.[6]

Figure 6: Level 4_3 Circle the Fruits

In three levels, an additional function to the written form of vocabulary items was identified. Here, the individual letters of a word are highlighted while it is verbalised.

Regarding the pictorial representation of vocabulary items, the analysis showed that all levels (100%) include pictures of the practised vocabulary. Most

[6] It should be noted that the number in its numerical form was coded as a picture.

pictures in *Niki* were assessed as unambiguously matching the vocabulary item they represent, however, one exception for this was found. This instance will be discussed in chapter 6.1.

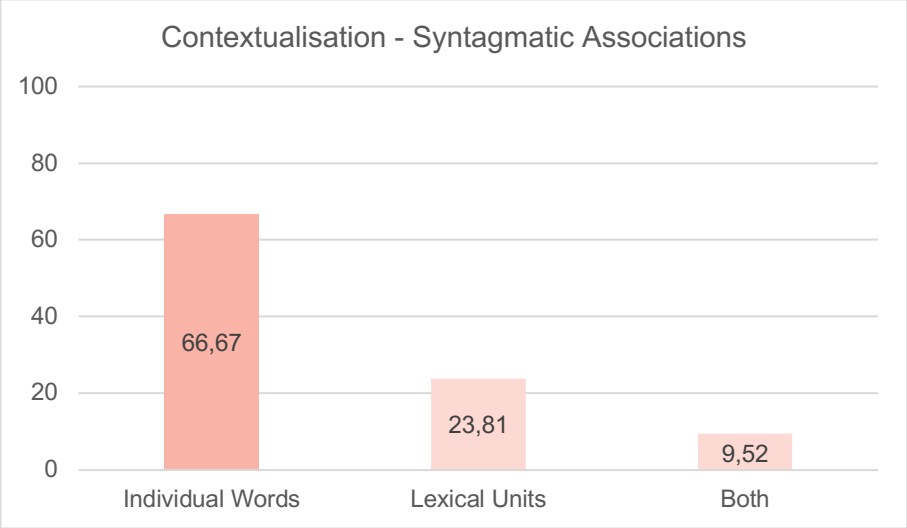

Figure 7: Contextualisation of Vocabulary Items in the Levels (in per cent)

In figure 7, a comparison of the analysis results regarding vocabulary contextualisation in the individual levels can be seen. The analysis showed that the vocabulary is presented individually in 66.67% (14) of the levels. In some levels, this was particularly noticeable. For example, in level *3_1 Colour Balloons,* each colour is represented by a single balloon, and its name is shown and verbalised in isolation, one after the other. In other levels, the vocabulary items are first introduced in a sentence but are later presented in isolation, for instance, when they are clicked. For example, in level *1_1 Animal Maze*, where instructions like “Let’s find the dog” are used, the learner is only presented with the isolated item “dog” in its written, pictorial and audible form. Thus, this level was categorised as presenting individual words rather than lexical units.

23.81% (5) of the levels were found to contextualise vocabulary items more explicitly by presenting them in lexical units and using multiword items. For example, in level *3_4 Coloured Vehicles,* items from the vocabulary field of colours are combined with vehicles in instructions such as “Can you find her purple boat?”. In this case, the learner is presented with the multiword item “purple boat” in writing, as a picture, and in sound. Two levels, which constitute 9.52% of the analysis data in this section, were identified as presenting vocabulary both individually and in lexical units.

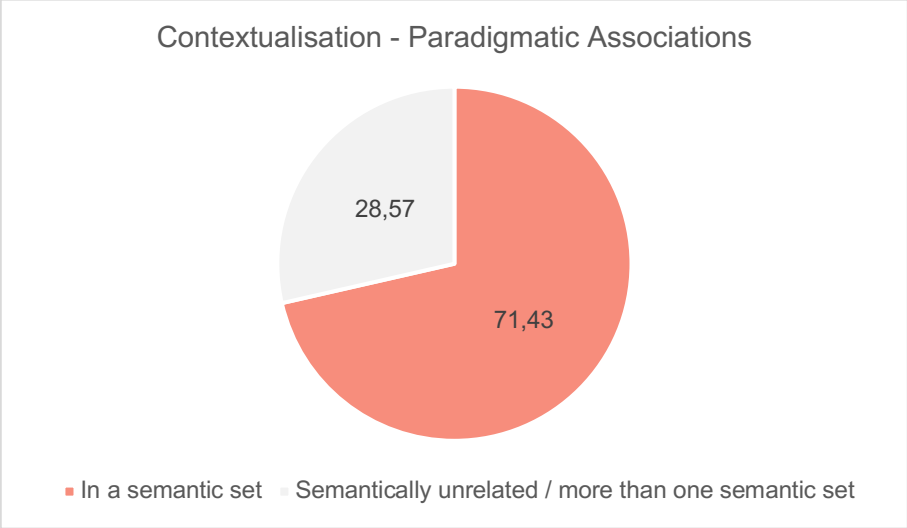

Figure 8: Paradigmatic Associations in the Levels (in per cent)

In a further step of the analysis, the contextualisation of vocabulary items was also investigated concerning the restriction to semantically related sets. As shown in figure 8, the analysis revealed that most levels, more specifically 71.43% (15), present vocabulary in a semantic set, meaning that the practised items are semantically related. In contrast, in 28.57% (6) of the levels, the items are semantically unrelated or come from more than one semantic field. The final level *5_The Party,* is one example of this, as it includes vocabulary from all previous topics and semantic fields.

5.2.2. Underlying Task Formats and Competencies

The analysis of all 21 levels in the app found that 95.24% (20) of the levels are based on closed formats, and 4.76% (1) use a semi-open format for vocabulary practice. Accordingly, none of the levels include open formats.

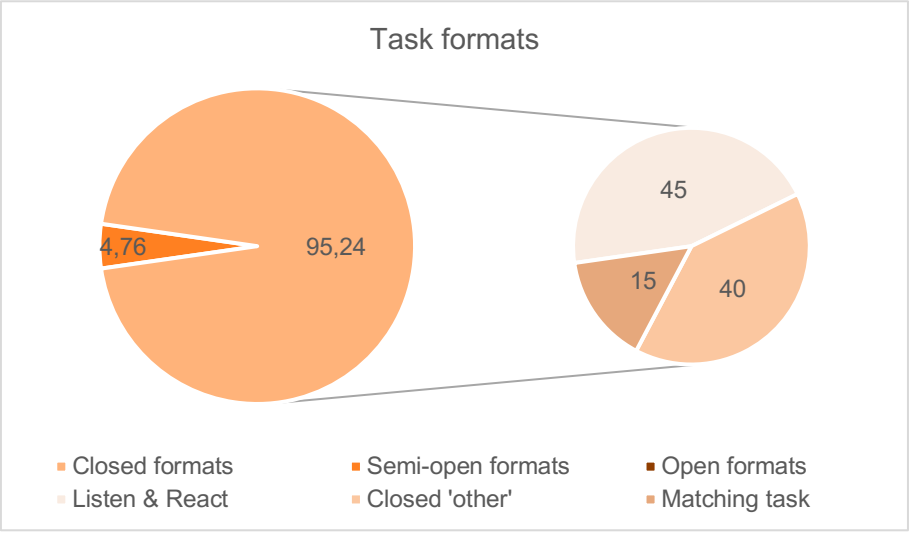

Figure 9: Overall Task Formats (in per cent)

Figure 9 reveals that the most frequently identified task format within the category *closed formats* was *listen & react*. This category, which accounts for 45% (9) of the closed format levels, comprises activities that require the learner to comprehend information from a listening text and perform brief actions, such as clicking or moving elements based on this information. For instance, in level *2_2 Pick the Correct Vehicle,* learners hear the instruction: “Looks like they need a (vehicle)” and see two or three vehicles from which they must choose the one mentioned and drag it onto the virtual road. The category *closed ‘other’*, which includes closed formats that did not correspond to any of the other predefined subcategories, was the second most frequently found in the app, with 40% (8) of the closed formats. Level *4_1 Fruit Salad*, in which learners draw lines through different fruits with their magic pen to cut them into pieces and subsequently drag them into a bowl, is one example of such an activity. The third specific closed format identified in the learning world was *matching tasks,* which were found to form the basis of 15% (3) of the closed format levels. Here, learners are usually presented with a given item and asked to match it with a corresponding one from a selection of items. For example, in level *1_3 Matching Feelings*, learners hear the name of a feeling, see it in the form of an emoji on the left-hand side of the screen and need to match it with the corresponding face of an animal on the right-hand side of the screen with two to three options to choose from. The only semi-open format in the learning world was found within the third learning island, *Colours*, and is realised as a *semi-open ‘other’* activity in level *3_5 Colouring Picture*.

Figure 10: Level 3_5 Colouring Picture

In this level, learners are asked to paint a colouring picture by dragging colours onto items on the screen. As shown in figure 10, the colours and picture elements in this level are preset and limited in number. Nonetheless, it was coded as a semi-open format since the analysis revealed that the program does not expect or

require specific combinations of colours and picture elements, thus allowing quite individual results within the frame of the provided colours.

As previously indicated, the analysis further comprised a review of the competence areas promoted in the app to allow for conclusions on whether the vocabulary is practised receptively or productively.

Figure 11 shows that no level in the learning world explicitly addresses learners' speaking or writing skills. Based on the result that 61.9% (13) of the levels offer a written representation of the vocabulary items, it was concluded that these levels address learners' potentially available reading skills, however, without explicitly requiring them. The potential implications of these findings and the limitations of the drawn conclusion will be considered in the discussion.

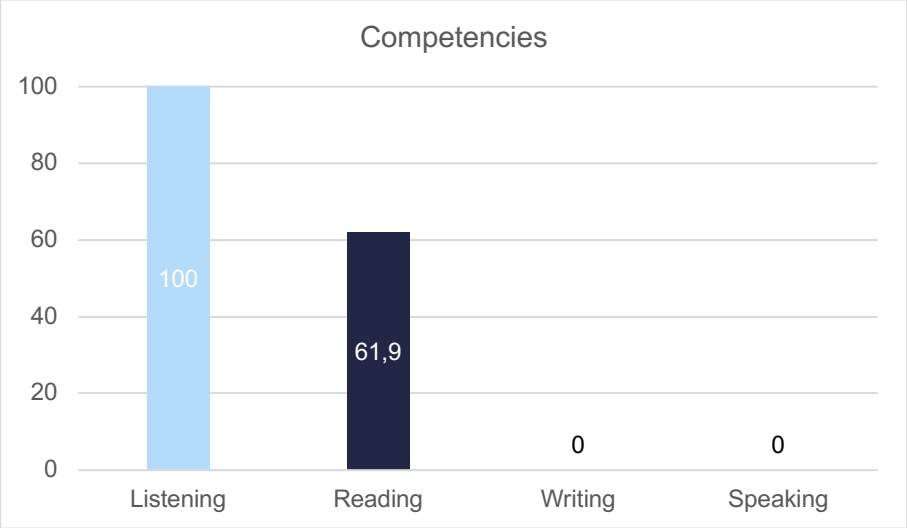

Figure 11: Competencies Addressed in the Levels (in per cent)

As previously mentioned, in view of the presentation forms, all 21 levels were identified to address the listening competencies of learners by presenting vocabulary in its spoken form. Therefore, this competence was further analysed. Here, the listening competence was differentiated regarding the length of audio texts, distinguishing individual words, individual sentences, and longer texts in the program. The introductory sequences and tutorials of levels in the learning world were found to consist of both individual sentences, such as, “Poor, poor Plush. Can you help my friend get down again?” or longer texts, for instance, “Ha! Plush wants to test smoothies for the garden party. So, let’s make a yummy smoothie for Plush. We need a lemon, a pear. First, drag one of the fruits to the mixer”. Instructions were found to comprise only individual words or sentences but no more than three consecutive sentences.

5.3. Game Elements and Adaptability

The second research question of the analysis focused on gamification elements in the learning world *Niki,* including categories in the dimensions of *performance/measurement*, *ecological*, *social*, *personal*, and *fictional*. As these are not limited to individual levels but are predominantly found in the global design of the learning world across all levels, they were coded continuously throughout the entire analysis process. In a further step, the adaptivity of the learning content was analysed, distinguishing between levels with difficulty adaptation and levels without difficulty adaptation.

Figure 12 provides an overview of the gamification elements from the applied category system, with those gamification elements that were identified within the learning world highlighted in colour and the remaining elements presented in grey.

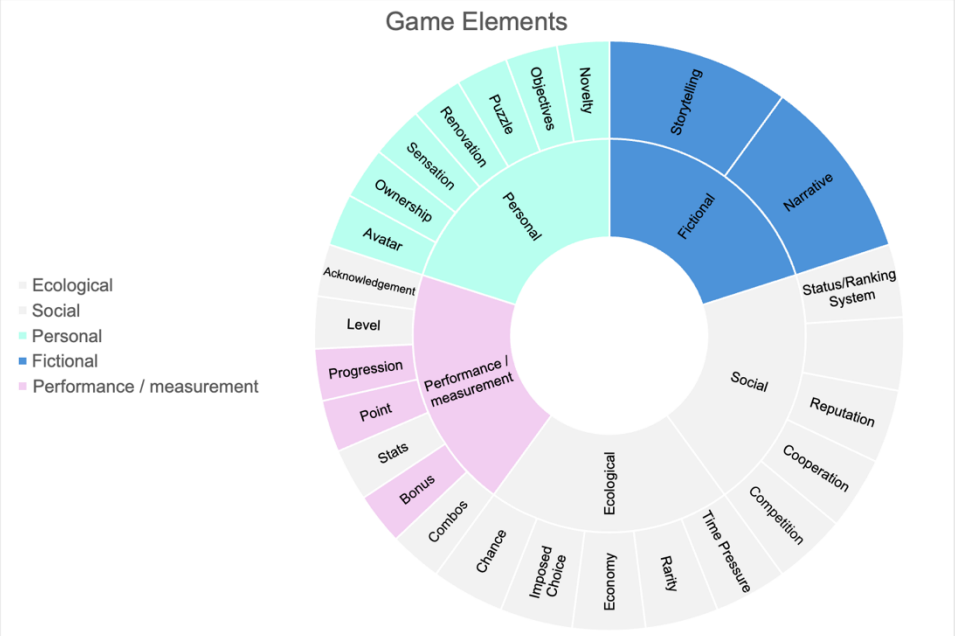

Figure 12: Game Elements in Niki (adapted from Toda, Klock et al. 2019, 6)

In the performance/measurement dimension, three of seven predefined gamification elements were found, namely *progression*, *point*, and *bonus*. It was found that *progression* is primarily realised by linearly unlocking levels and islands after completing the preceding level and island. Here, the learner's progress is visualised in the form of a progressively activated map, showing their current position in relation to the goal of unlocking all levels. Further analysis of this element revealed that after completing all levels once, this particular type of progress indicator is not available anymore, as all map elements are visible to the player (cf. figure 3). Thus, no information about the learner's progress is revealed after this point. Another form of

the progression element was identified in the adult area of the app, which can only be accessed by entering a numerical code. As shown in figure 13, the learning progress for each topic area of the learning world is displayed here as a progress bar.

Figure 13: Progress Bars in the Adult Area

Once each level of one island has been completed, learners can start collecting stars by replaying them, earning one star each time they replay a level. This feature was identified as a manifestation of the gamification element *point* and is directly linked to the third gamification element found in this dimension, namely *bonus*. Once learners have collected five of these stars for one island, they receive a bonus in the form of an accessory for their avatar. Furthermore, the previously described free play area that is unlocked after completing the initial two levels and the gimmicks learners receive after completing one island were identified as further variations of *bonus*.

On the level of the personal dimension, all seven considered gamification elements were identified within the *Niki* English world. It was found that the learning world uses *objectives* in the form of quests and challenges, which are presented in the introduction video for each island and the short introductory sequences of the individual levels. For instance, in *Vehicles and Numbers,* learners are asked to help the virtual character *Tool* find a way to get to the big race by completing several smaller quests, such as repairing vehicles (*level 2_3*) and bridging potholes in the street (*level 2_4*). All quests have in common that they pursue the overarching objective of freeing the English world from the chaos inflicted by virtual chaos monsters. Furthermore, the gamification elements *puzzle* and *sensation* were found to be realised in the learning world by including challenges and cognitive tasks as well as combining animations, sound effects and other elements of multimedia design.

Novelty is primarily realised by introducing new game elements, such as *point* after the first round of completion. Other identified gamification elements were *renovation*, *ownership* and *avatar*. Although the learning world does not contain any level in which the learner can ultimately fail, as each level ends with the described completion screen regardless of the time taken or the number of mistakes made, *renovation* is realised by allowing and encouraging the learner to replay the levels. *Ownership* was identified as being manifested through the physical *Niki* figurine. A closer review of this element revealed that the app uses the figurine to enter the learning world and within the level *4_5 Hot Air Balloon.* Here, learners tap the figurine on the screen to change the direction of a virtual balloon carrying Niki to avoid chaos monsters. Within the general *Edurino* app, the category *avatar* was identified as learners are asked to personalise an avatar that represents themselves, allowing them to customise the gender, skin colour, eye colour, hair colour and style, clothing and medical aids. This avatar was also found to be displayed within the *Niki* learning world.

Regarding gamification elements on the fictional dimension, it was found that both *narrative* and *storytelling* are realised in *Niki*. The events in the learning world are structured around a virtual journey through the English world together with *Niki*, in which the learner's actions in individual levels influence the order of events in these levels. The narrative was found to be supported and told by the virtual characters of the world, using audiovisual transmitted dialogues.

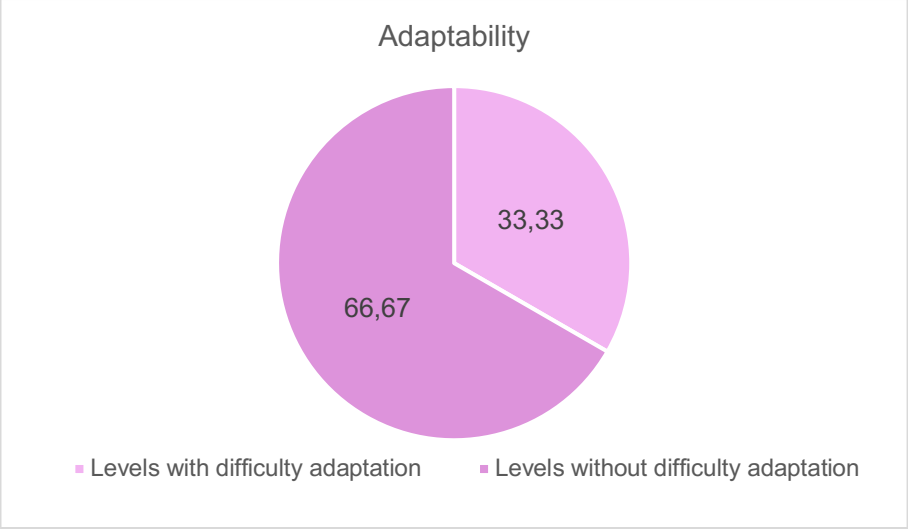

Figure 14: Performance-Based Difficulty Adaptation

As figure 14 illustrates, in terms of adaptability, the analysis revealed that of the 21 investigated levels, 33.33% (7) adapt the difficulty level in response to the learner's performance in this particular level. For instance, in level *1_2 Animal*

Slingshot, the default setting requires learners to choose from three animals in each round. However, if the learner makes mistakes in one round, the program automatically reduces the number of animals to choose from to two for the next round. In contrast, no such difficulty adaptation could be identified in 66.67% (14) of the levels. It should be noted that in this part of the analysis, only the linguistic requirements, including the quantity and quality of vocabulary items and answer options, were considered. Levels found to reduce the difficulty only at the motoric level, such as level *1_5 Joy Ride* were coded in the category *no difficulty adaptation*. Possible implications and limitations of the findings regarding game elements and adaptability will be discussed in chapter 6.2.

5.4. Feedback

The third research question of the thesis focused on the types of feedback the app provides to inform learners of their language learning process. For this purpose, the feedback identified in the levels was analysed in terms of its mode, timing, and complexity. Six of the 21 levels were excluded from this part of the analysis as they were found to not provide feedback on the learners' performance in terms of language use, for instance, because they instead refer to the motographic abilities of the learners, such as level *4_2 Fruit Slingshot*. The completed category system (cf. chapter 9.2) and the comprehensive overview of all levels in the appendix (cf. chapter 9.3) indicate which levels this applies to. Consequently, the following analysis results are based on the remaining 15 levels.

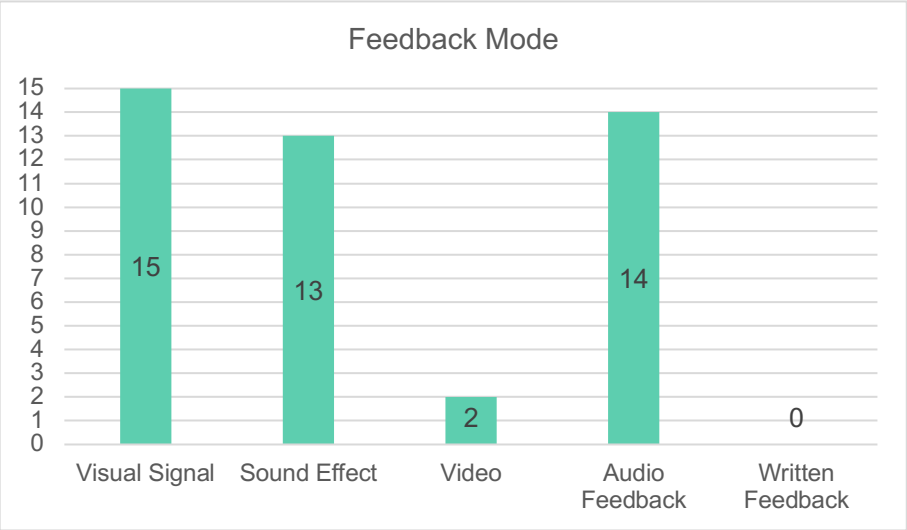

Figure 15: Feedback Modes in the Levels

In the first step, the analysis investigated the feedback regarding the modes used to respond to learner actions in the learning world. Here, it was revealed that sound effects, visual signals, video sequences, and verbal remarks in the form of audio are used in the levels to provide feedback to the learners. The predefined mode *written feedback* could not be identified in any level during the analysis process. Overall, the most frequently used feedback technique in *Niki* is feedback in the form of a visual signal, which was identified in all 15 considered levels. For a correct learner action, the visual signals in the learning world highlight the respective vocabulary item. As displayed in the screenshot from level *2_1 Vehicle Slot Machine* in figure 16, green is one of the colours used for this, but the analysis also identified blue and white highlights. To indicate an incorrect answer, the chosen vocabulary is highlighted in purple, as shown in figure 17.

Figure 16: Visual Signal (Correct)

Figure 17: Visual Signal (Incorrect)

In terms of audio feedback, which is provided in 14 of the levels, it became evident during the analysis process that in some levels, verbal feedback after an error was connected to a certain number of attempts, meaning that, for example, in response to the first two failed attempts, a visual signal is used, which is then further complemented by a verbal remark after the third failed attempt. As shown in figure 15, visual signals and audio feedback are accompanied by additional sound effects in 13 levels. Not all sound effects in response to learner actions were included in this category, but only those recognisable as sounds indicating whether an action is correct or incorrect. In *level 2_3*, for instance, the robot produces a burping sound in response to the learner feeding it the required number of parts. This sound was not classified as feedback in the form of a sound effect because, although it occurs in response to the learner's action and only occurs after the correct number of parts were fed, it was ultimately assessed as being too ambiguous in comparison to other, more explicit sound effects within the learning environment. The least frequently coded mode was feedback in the form of a video, which was identified in two levels,

level 2_5 and *level 2_2*. In both these levels, the learner is presented with a visual representation of the outcome of their choice in the form of a brief video sequence. For example, in *level 2_5 The Race*, the virtual character *Pong* can either be seen successfully navigating a bend in the road if the learner chooses the correct side or, following an incorrect response, colliding with roadworks, as illustrated in figure 18.

Figure 18: Screenshot of Video Feedback

Apart from the modality, the feedback timing was also investigated. Figure 19 shows the results of this analysis step. The category *variable feedback* was not coded for any of the 15 levels as the learning world does not offer a possibility to adjust the feedback timing. It was determined that six of the 15 levels provide learners with feedback at multiple times, using both immediate and delayed feedback. For instance, in level *3_3 Coloured Food*, the learner is provided with feedback when they choose one item and give it to the virtual character *Lolo*, and after giving all items to *Lolo*.

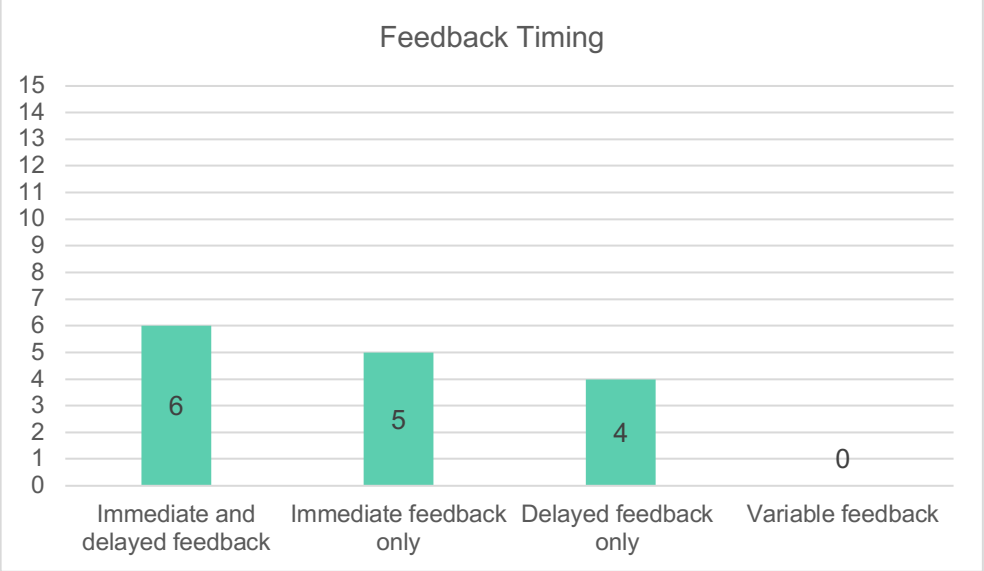

Figure 19: Feedback Timing in the Levels

A third of the levels use only immediate feedback in response to a learner's action, while just one fewer level, four in total, were found to provide only delayed feedback. One example of the latter is level *4_4 Smoothie Maker*. Here, learners

listen to the required ingredients of a smoothie for the virtual character *Plush* and choose those out of a selection of fruits. Although *Niki* repeats the name of the respective chosen fruit as soon as learners drag and drop them into the mixer, learners only receive feedback on whether they have chosen the right fruits after they have started the mixer and given the smoothie to *Plush*.

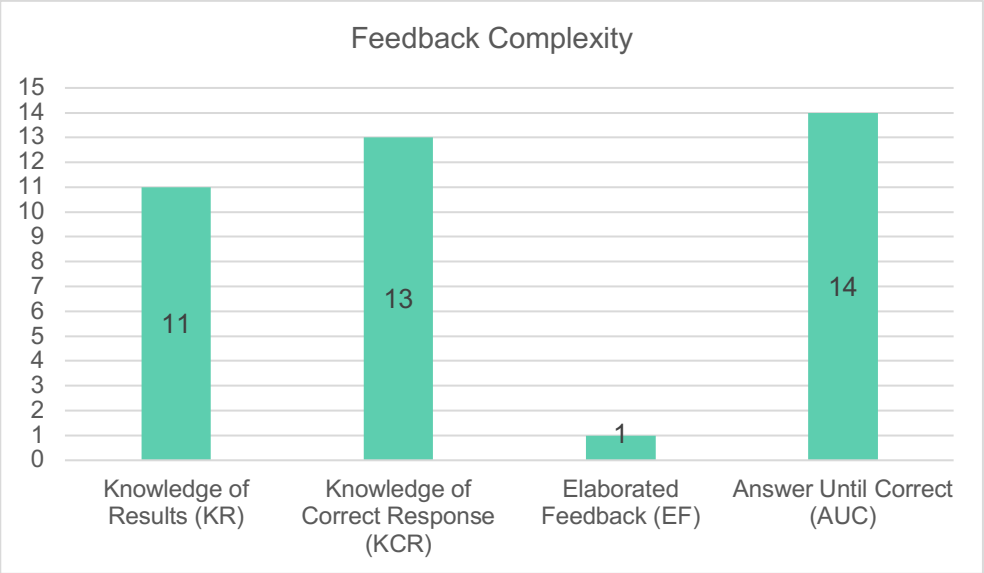

Figure 20: Feedback Complexity in the Levels

Further, the complexity of the information provided in the feedback was analysed. As figure 20 indicates, in some levels, the feedback comprises several dimensions of complexity. Overall, the feedback in eleven levels was assessed to inform the learner about the correctness of their choice without providing or repeating the correct answer. These instances were coded as *Knowledge of Results (KR)*. They were found to be realised mainly by confirmatory verbal feedback, such as “Yes, exactly!” for a correct answer or “Hm, let’s take another look” after an incorrect choice, combined with the visual signals and sound effects mentioned before. Informing learners of the correctness of their answers and repeating or providing the correct answers, 13 levels use *Knowledge of Correct Response (KCR)*. For example, in level *3_2 Matching Paint Buckets*, the feedback “Yes! It is (colour) as well”, in combination with a blue visual signal and a confirmatory sound effect, informs the learner that the chosen paint bucket is correct in the sense that it matches the previously selected paintbrush. *Elaborated feedback (EF)* was found in only one level, namely level *4_3 Circle the Fruits*. In this case, after three failed attempts, the provided KCR feedback differs, depending on whether learners circled the wrong number of fruits (“The number is not correct yet.”) or whether they circled the wrong fruit

(“Hm, that’s not the correct fruit yet.”). In both responses, the program informs the learner that their answer is incorrect and highlights the correct response but also provides further information on the source of the learner’s mistake.

Finally, the category *Answer-until-Correct (AUC)* was applied to the levels. Here, the analysis showed that only one level does not allow learners several solution attempts. This is level *2_5 The Race*, in which learners only have a limited amount of time, approximately twelve seconds, to react before the video feedback is shown. In contrast, 14 levels allow learners several attempts to find the correct answer. In eight of these levels, multiple attempts are granted before the solution is either permanently or briefly visually presented to the learner. The remaining six levels do not present the solution at any time, thus allowing the learner as many tries as needed.

6. Discussion

In the following, the previously presented results of the structured qualitative content analysis of *Edurino*'s learning world *Niki* will be discussed and interpreted based on the theoretical framework of this thesis. Again, this chapter will be divided into one subchapter for each research question, considering the possible implications of the research findings. Based on these implications, suggestions for optimising and adapting *Niki* will be presented in a subsequent subchapter. Finally, possible limitations of this study will be acknowledged.

6.1. Vocabulary Learning in *Edurino*'s *Niki*

Regarding vocabulary learning in *Edurino*'s *Niki,* the analysis focused on the vocabulary items selected, their presentation and contextualisation, and finally, how vocabulary is practised in terms of the underlying task formats and the competencies addressed. Given the extensive number of individual analysis aspects considered in each of these dimensions, the interpretation of the analysis results may vary significantly, even within one dimension. In the following sections, the analysis results for vocabulary learning will therefore be discussed in groups depending on whether they may facilitate the learning process of young EFL learners or indicate potential challenges from a language learning theory perspective.

In reviewing the analysis results, several features were identified that may support vocabulary acquisition. These relate, in particular, to individual aspects of vocabulary selection, presentation, and practice. Concerning the selected vocabulary, the learning world was found to introduce 50 vocabulary items from six semantic fields to the learners. A closer inspection of these items revealed that approximately half of the words are among the 2.000 most frequent words in the English language. It was furthermore shown that learners repeatedly re-encounter previously learned vocabulary items such as the word "bus", which is first presented individually, then combined with items from the semantic field of numbers, and later linked with different colours. Both the use of HFW and the reintegration of previously learned content can be evaluated as beneficial to the vocabulary learning process, as they may positively impact the learner's comprehension of target language texts within the learning world as well as in authentic communicative situations and may further facilitate vocabulary retention and language production (cf. chapter 2.1.1, 2.3.1). Based on the results in the section on vocabulary presentation, it can be

concluded that all levels in the learning world use multimodal techniques to present the vocabulary items to learners, which appears advantageous given the importance of addressing young EFL learners through different sensory channels (cf. chapter 2.1.2). The findings regarding integrating writing, reading, and listening competencies in *Niki* suggest a supportive implementation of vocabulary practice for young learners. As writing was found not to be included in the learning world and reading competencies are only implicitly addressed but never necessarily required to solve a task or complete a level, the learning world aligns with the principles of early EFL instruction by using these competencies as secondary support skills (cf. chapter 2.1). Furthermore, the additional function of highlighting the individual letters of a word while it is verbalised, which was identified in three levels, may further support learners in perceiving the spoken form of a word more accurately (cf. chapter 2.1.2). The finding that every level in the *Niki* learning world fosters the learner's listening skills can be interpreted as reflecting a focus on oral communication, which is important for young learners (cf. chapter 2.1). This competence was found to be addressed in the vocabulary practice activities as well as in the introductory sequences, tutorials, and instructions in the learning world. Although it was not the main focus of the analysis, the results in this section indicate that listening to complete sentences and longer texts is supported in the learning world, providing the learner with more context and syntagmatic associations. This may facilitate storing in the mental lexicon and retention for language use (cf. chapter 2.1.2).

Nonetheless, the review of the analysis results also indicated potential challenges across all four considered dimensions. Regarding vocabulary selection, the list of items in table 1 (cf. chapter 5.2.1) suggests a focus on nouns that does not align with the recommendations of language learning theories and may limit learners' communicative abilities in the target language (cf. chapter 2.1.1). Although the learning world was found to use multicodal techniques to present vocabulary, this is limited to those levels that include the spelling of words. Nearly 40% of the levels in *Niki* were, however, found not to present the written form of vocabulary items, which may negatively impact the vocabulary learning process (cf. chapter 2.1.2). While this may not apply to all young learners, with a target group of four- to eight-year-old children, it can still be assumed that at least some of them are literate and could be affected by this. Furthermore, during the process of conducting the qualitative analysis, the author noticed that in level *1_3 Matching Faces,* the facial expressions

of the bird are relatively similar for “surprised” (figure 21) and “happy” (figure 22). This ambiguous representation can be interpreted as a potential challenge, as it may confuse learners and lead to an impeded learning process, especially because it is the first time learners encounter the vocabulary for feelings.

Figure 21: Surprised Bird

Figure 22: Happy Bird

In terms of vocabulary contextualisation, it was shown that the majority of vocabulary is not presented together with syntagmatic associations but as individual words, which may negatively impact the learner’s fluency in the target language and can be evaluated as not facilitating storage in the mental lexicon (cf. chapter 2.1.2). Focusing on how the vocabulary is practised, the study found that the *Niki* learning world relies almost exclusively on closed formats. Considering the specific task formats in more detail, it became apparent that they involve receptive language knowledge only, which is assumed to be less complex and less effective for vocabulary learning (cf. chapter 2.1.3). Accordingly, no activities were identified in which learners produce and pronounce the new vocabulary. This neglect of speaking skills and productive language use does not reflect the focus on oral skills recommended in early EFL learning theories (cf. chapter 2.1.). It may also restrict the activation and further enhancement of receptive competencies (cf. chapter 2.1.3).

Finally, one result of the analysis that has not yet been discussed relates to the contextualisation of vocabulary in the learning environment and, more specifically, the use of paradigmatic associations. However, as there is no consensus on the effects of this specific aspect yet (cf. chapter 2.1.2), it cannot be evaluated as potentially impacting the vocabulary learning process positively or negatively. Instead, the finding that most levels in *Niki* present vocabulary items from the same semantic field suggests that the learning world may have been designed based on language learning theories that refer closely to the organisation of the mental lexicon and thus recommend the use of paradigmatic associations, rather than on experimental studies in this area.

6.2. Mobile-Assisted and Digital Game-Based Language Learning

Focusing on MALL and DGBLL, it should first be noted that except for the free play area, English is the only language used in the learning world. This provides the

learners with much target language input, which is considered to be one of the key benefits digital games offer (cf. chapter 2.3.1). In terms of interactivity, the identified fixed linear sequencing of the learning world does not allow learners to customise the content or order of activities, therefore limiting navigational interactivity. The implementation of didactic interactivity will be discussed towards the end of this chapter.

The analysis of game elements in *Niki* revealed that all considered game elements from the personal dimension are used. This can be interpreted as a positive finding, as it may provide learners with a meaningful, motivating, and appealing educational experience with a clear purpose (cf. chapter 2.3.2). However, the game element *ownership* through the tactile *Niki* figurine was found to be rarely present in the learning world. Thus, learners may not perceive *Niki* as a hybrid interaction partner, which in turn may reduce the learning world's potential to motivate and actively engage learners. In terms of the *objective* element, which is considered to be the most important element within gamified educational environments (Toda, Cristea et al. 2019), it should be noted that the overall objective of developing and fostering English language skills is never explicitly mentioned to the young learner. Instead, it is embedded into a storyline and corresponding smaller quests, games, and challenges, as described in the results section (cf. chapter 5.3). This embedding of educational content into a storyline refers to the fictional dimension of game elements, identified as *narrative* and *storytelling* in the learning world. As a result, learners may be less aware that they are learning, which could, in turn, lead to a more positive perception of the experience. This would correspond to the aim of gamification (cf. chapter 2.3), indicating that in the learning world *Niki*, educational content is genuinely and cohesively integrated with gamification.

In the performance/measurement dimension, *progression*, *point*, and *bonus* were found to be used to provide extrinsic feedback to the learner, however, to varying degrees. It was shown that the *progression* element is only visible during the first playthrough and in the adult area but is not permanently available to the children. This may lead to disorientation, frustration and anxiety (cf. chapter 2.3.2), as the learner has no insight into their learning process and progression. In view of the *point* element, the analysis revealed that learners gain points for each time they replay a level, which suggests an underlying frequency metric. This also applies to the *bonus* element in the form of gimmicks. Mainly since learners receive the same

number of points and the same gimmicks, regardless of their performance in the levels, it can be concluded that learners receive extrinsic feedback for the quantity but not the quality of their actions, which in turn may also lead to this becoming the focus of the learner (Toda, Klock et al. 2019, 10). The identified lack of game elements from the social and ecological dimension of the gamification taxonomy may result in learners perceiving the learning world as less attractive, and it could also lead to learners feeling isolated due to the absence of opportunities to interact with other learners (cf. chapter 2.3.2). Young learners may become demotivated and discouraged, particularly because their need for cooperation is not met (cf. chapter 2.1). It seems questionable whether the opportunities for parasocial interactions with virtual characters offered in the introductory sequences of the thematic islands can counteract this sufficiently.

As the learner's age needs to be entered in the *Edurino* app, and it is stated that this leads to age-appropriate adjustments, the author created three different learner profiles and adjusted the respective age. However, no relation between difficulty and learner age was identified, as the learning world introduced the same vocabulary items at what appeared to be the same speed, independently of whether the learner's age was four, six, or eight years. Furthermore, the analysis revealed that only one-third of the levels in the *Niki* learning world adapt the difficulty of the content to the learner's performance. Therefore, it can be concluded that the potential of didactic interactivity that MALL and educational apps offer in this sense is not fully used in *Niki*, and the learning process is largely not individualised.

6.3. Interaction through Feedback

Regarding the interaction through feedback, the analysis made apparent that verbal audio feedback is always accompanied by a visual signal and, in most levels, a sound effect. This multimodality of the feedback can be interpreted as beneficial for the learning process, as it provides learners with the opportunity to receive information about their performance, that they may be able to comprehend independently of their proficiency in the target language. Furthermore, verbal feedback in the form of audio and video feedback, which are considered highly effective for learning (cf. chapter 2.4), are both present in the learning world. However, it should be mentioned here that video feedback was only identified in two levels, and its potential may, therefore, not be fully exploited in *Niki*. The finding that there was no

written feedback in the learning world may be explained by the young age of the target group and their assumably low reading abilities, which could prevent learners from understanding the feedback. It can thus be positively evaluated in this context.

The analysis showed that the learning world interacts with learners through immediate and delayed feedback, which may positively affect the learners' motivation and sense of autonomy (cf. chapter 2.4). However, in some instances, the delayed feedback might also lead to confusion, as the mistake is not directly visible and recognizable to the learner due to the late response. For instance, in level *4_4 Smoothie Maker*, learners may not realise that they have made a mistake, or what exactly their mistake was, for a long time, as feedback is only provided after the smoothie has been mixed and given to *Plush*.

The feedback in the learning world was found to comprise all four types of feedback complexity considered in this thesis, mostly in combination. Considering that more specific feedback is significantly more effective for improving the learner's performance, the finding that KCR is provided in most levels can be positively evaluated. It was shown that learners are provided with AUC in every level except one, which can also be assessed as beneficial from a theoretical perspective. As described in the results, in some levels, the correct solution is provided after a set number of attempts in this context. Although this could potentially demotivate learners who want to try again on their own, learners who struggle with an element may benefit from this feature, as it allows them to move on to the next item and potentially experience more success there.

Despite these potentially supportive feedback mechanisms in the learning world, the findings concerning EF indicate that the learner's answers are not analysed in more detail than just in terms of 'correct' or 'incorrect', as only one level was identified to provide the learner with more specific feedback or rather an explanation of what part of their answer was incorrect. As this type of feedback is considered most effective for learning but is rarely used in the learning world, learners may be unable to identify the source of their errors and may resort to techniques such as trial and error, which do not facilitate vocabulary retention (cf. chapter 2.3.2). The analysis of the verbal feedback provided suggests that *Niki* relies on a set of preformulated feedback sentences that are transmitted independently of the learner who is playing the game. The advantage of mobile-assisted feedback to provide individualised feedback, thus, seems not to be used in the learning world, as the analysis

found no instances in which *Niki* interacted with the learner more extensively or provided feedback that explicitly considered the learner's individual needs.

Furthermore, as touched upon in the previous chapter, the learning world also provides extrinsic feedback to the learner through rewards, specifically by awarding them points and bonus items for their avatar. Although this aspect was considered within the analysis of game elements, it is also relevant in the discussion of feedback, as such extrinsic rewards are significantly less effective in learning (cf. chapter 2.4). It should, however, be considered that the *bonus* rewards are not provided after every level and are closely related to the game element *avatar*, which may positively impact the learner's identification with the content in the app. In *Niki*, no punishments could be identified, neither as a loss of points nor by omitting *bonus* rewards. This is to be positively evaluated as this type of feedback interaction would not be effective in improving the learner's proficiency and learning motivation (cf. chapter 2.4).

6.4. Suggestions for Improving the Learning World *Niki*

In addition to the positive findings about the implementation of app-supported vocabulary learning in the interactive game and learning world *Niki*, the previous chapter also described individual aspects that were not implemented or realised beneficially and could potentially hinder the learning process. The following chapter presents recommendations for further optimising and adapting the digital learning environment derived from the abovementioned implications.

In order to allow young learners to use their acquired vocabulary knowledge outside of the virtual learning world, in authentic communication in the target language, it is crucial that they are familiar with vocabulary from different word classes and can comprehend and produce simple language chunks and sentences (cf. chapter 2.1). To this end, the levels in *Niki* could be supplemented by incorporating a greater variety of multi-word units from different word classes and commonly used collocations as vocabulary items. For example, instead of using only the names of vehicles in level *2_2 Pick the correct vehicle,* the learner could also be introduced to collocations such as "ride a bike", "drive a car", or "go by bus". Furthermore, following a strategy proposed by Müller-Hartmann and Schocker-von Ditfurth (2015, 97), the learning islands of the learning world could be organised in topics rather than in semantic fields. To stay with the previous example, this could be implemented in practice by using the topic of *Travel* rather than *Vehicles*. In such a

context, vehicles, the collocations named above, different places (e.g., mountains, beach, airport, city) and other relevant objects (e.g., suitcase, passport) could be introduced.

An improvement could be made regarding the task formats used for vocabulary practice in *Niki* by allowing more individual solution approaches and increasing the learners' language output. This could be achieved by including more open, productive task formats, for example, a level where learners see a picture of an animal and are then required to name it, thereby producing the target item themselves. Another option could be integrating a level in which learners can express their individual preferences, for instance, regarding fruits. In level *4_4 Smoothie Maker,* instead of solely listening to *Niki* naming the fruits for *Plush*'s smoothie, this could be realised by engaging learners in a dialogue with *Niki* or *Plush* in which they talk about their favourite fruits or the fruits they like in their own smoothie. Learners could either click on these items or name them verbally, in which case, *Niki* could provide the beginning of sentences such as “My favourite fruit is …” or “In my smoothie, I like …” and learners could finish the sentences through voice input. In order to implement both of these suggestions, it would be necessary for the app to use the microphone of the learner’s mobile device.

In terms of embedding vocabulary learning in a gamified environment, it would be important for learners to be provided with a sense of progression, for instance, by including a progression bar similar to the one in the adult area in the map of the English world. Being able to locate themselves and monitor their learning progress is essential from a learning psychology perspective, as it can enhance the learners’ engagement and motivation (Toda, Cristea et al. 2019, 87). Furthermore, it would be desirable for the *Niki* figurine to be used more actively and frequently in the learning world to better accommodate children’s need for interaction in the learning process. Rather than perceiving the figurine merely as an inanimate key to the learning world, learners could also consider *Niki* as an interactive partner, a storyteller or a source of assistance if the hybrid nature of the app was used in more levels and if the figurine could also be used to play audio texts.

Finally, a revision and adaptation of the feedback mechanisms in the learning world would be beneficial to provide learners with more specific and individualised feedback to facilitate the learning process further. In this regard, the feedback should take the learner’s answer into account in more detail than just ‘correct’ or ‘incorrect’

and provide guidance for the next solution attempt. For instance, instead of responding with “I think that’s not correct yet”, feedback such as “Good try! This is a dog. But we need to find the cat! If you need help, tap on the animals to hear their names and sounds. Try again and see if you can find the cat!” that is supported by visual signals and sound effects could be provided. Moreover, especially if the previous suggestions of allowing learners to record themselves were to be incorporated, the learning world could evaluate the learner’s input and subsequently generate feedback with the help of artificial intelligence (AI). This could lead to a more effective and targeted use of the affordances of digital learning, with feedback tailored to the individual learner's specific needs rather than being a *one-size-fits-all* response. Regarding this suggestion, the potential advantages and challenges of AI-generated feedback for language learning, which, for pragmatic reasons, cannot be discussed in this thesis, should be further considered[7].

6.5. Limitations of the Study

Before drawing final conclusions based on the results presented and discussed in the previous chapters, it is important also to point out the limitations of this study that may affect the significance of individual findings.

For one, this concerns the restriction to vocabulary directly used by learners in the context of individual levels. Due to the limited scope of this master’s thesis, it was not possible to consider the vocabulary presented to learners in the context of introductory sequences, tutorials, or videos in the learning world, neither in terms of their selection and presentation nor regarding their contextualisation. Nevertheless, these instances could provide opportunities for incidental learning, and the learner may still retain vocabulary, although it is not actively and explicitly practised. This is also linked to another limitation, as the introductory sequences, tutorials, and instructions were considered in terms of their length. However, the sentences and longer texts identified here could not be further analysed regarding their linguistic complexity, for instance, in view of the use of different tenses or conditional sentences. Whether and to what extent the linguistic requirements of such texts may also affect the learning process presents an interesting focus for further research.

[7] Reference should be made to the article on *Artificial Intelligence in Foreign Language Learning and Teaching* by Schmidt and Strasser (2022) which also introduces other aspects, such as dynamic difficulty adaptation in learning environments through AI.

As it provides a comprehensive overview of game elements that are frequently employed in gamification in education and educational games, the analysis primarily relied on the gamification taxonomy of the research groups led by Toda (Toda, Cristea et al. 2019; Toda, Klock et al. 2019). This approach made it possible not only to identify game elements in the learning world but also to anticipate their potential implications. However, other interactive or playful elements, which may also affect young EFL learners' motivation and gaming or learning experience, could not be considered in this context. For instance, the author noticed that in level *5_The Party*, learners can click on objects such as a music player or a disco ball to trigger visual and acoustic effects or find hidden objects behind the front door (cf. appendix, chapter 9.3).

Another limitation of this study is that only one person (the author) conducted the analysis and tested the learning world. Although the re-coding without consideration of the initial category assignment (cf. chapter 4.2) aimed to establish intracoder agreement and increase the reliability of the analysis results, the analysis was limited to those aspects that the author identified after multiple playthroughs. This does not imply that there are no further relevant elements within the learning world; rather, they could not have been identified. This is particularly important in relation to the analysis results on difficulty adaptation in *Niki*, as there may be other adaptations, such as a potentially unidentified influence of the learner's age. However, to allow for complete certainty, insights into the exact programming of the app, which was not available within the scope of this work, would be required.

Moreover, as feedback was not the main focus of this thesis, it could not be analysed in more detail, for example, by applying the complete checklist rather than only selected items from *Die Lüneburger Prüfliste für Corrective Feedback in digitalen Fremdsprachenlernprogrammen.* This could allow for additional conclusions regarding feedback techniques, such as the use of direct and indirect or implicit and explicit feedback and their potential effects on the vocabulary learning processes of young children.

A further limitation relates to the fact that no studies that focused on the *Niki* learning world in *Edurino* or app-supported vocabulary learning for young EFL learners considering the exact dimensions as this study could be identified. Therefore, the analysis relied on a self-compiled category system that has not yet been tested

in terms of its validity and efficacy. However, this can also be regarded as a potential of this thesis, indicating a research void that could be further explored in the future.

Lastly, due to the methodological approach selected for the analysis and the limited scope of this master's thesis, the formulated implications of the findings for young EFL learners' vocabulary learning were drawn solely based on theoretical concepts and recommendations from the literature reviewed. The actual efficacy of app-supported vocabulary learning through the analysed elements could not be assessed, just as learners' perceptions regarding these aspects could not be gathered and included.

7. Conclusion and Perspectives

This study evaluated the implementation of app-supported vocabulary learning in the interactive game and learning world *Niki* in *Edurino* from a language learning theory perspective. In the theoretical part of this thesis, different dimensions of early EFL vocabulary learning were examined, and the relevance and potential of digital and gamified approaches, including system-based feedback, were highlighted. Based on the needs of young children and the derived principles of early foreign language learning (cf. chapter 2.1), the relevance of using high-frequency words, multimodal and contextualised vocabulary presentation, and integrating both receptive and productive activities with a focus on oral communication for effective vocabulary retention and language production was presented (cf. chapter 2.1.1 – 2.1.3). Furthermore, the role of MALL and educational apps for language learning was illustrated, considering specific features, such as voice recordings, authentic audiovisual materials, avatars, and didactic interactivity (cf. chapter 2.2). This was followed by an introduction to the concept of DGBLL and its potential to provide learners with contextualised language input and opportunities for language production (cf. chapter 2.3.1). It was shown that gamification elements such as *bonus*, *narrative*, and *objective* can facilitate learner engagement and motivation but should be carefully planned to avoid adverse effects on the learning process (cf. chapter 2.3.2). Finally, the role of computer- and mobile-assisted feedback was considered, emphasising the potential of multimodal, individualised, and complex responses to facilitate learning (cf. chapter 2.4).

The overview of previous research in this area indicated a lack of open, productive exercise formats, a profound integration of game elements as well as specific and individualised feedback in language learning apps and games (cf. chapter 2.5), which led to the formulation of three research questions to guide the analysis. These questions concerned the presentation and practice of vocabulary, game elements, and interaction through feedback in the *Niki* learning world (cf. chapter 4.1). To answer the research questions, a structuring qualitative content analysis of the learning world was conducted using a self-compiled category system and coding guide combining elements from the theoretical framework of this thesis and categories from previous studies (cf. chapter 4.2, 4.3).

The analysis showed that the learning world uses several methods that are assumed to support vocabulary acquisition, particularly the integration of high-frequency words, the representation of vocabulary in its spoken, pictorial, and sometimes written form, and the reintegration of familiar items. Furthermore, regarding the fostered competencies, a focus on listening skills, as recommended in early EFL learning theories, is implemented in *Niki*, including listening to individual words, complete sentences, and longer texts. However, it was also revealed that the practised vocabulary, which is mainly comprised of nouns, is predominantly presented individually and practised in closed formats that rely on receptive vocabulary knowledge. Regarding the second research question of the thesis, it was shown that in *Niki*, several game elements that proposedly enhance learner motivation and engagement are integrated, particularly by adding new game elements, providing learners with a purpose to solve challenges and allowing them to revisit levels and videos. This is contextualised in a narrative in which the learner accompanies *Niki* through the virtual English world that is realised through audiovisual storytelling. Furthermore, the learning world uses extrinsic feedback in the form of rewards, specifically points and bonus items, as well as, to a limited extent, a progression indicator. Despite these affordances, the quantitative focus of the available performance/measurement elements and the lack of ecological and social game elements were identified as potential challenges. It was further discussed that the low number of levels that adapt the difficulty to the learner's performance and the content, which does not appear to be modified by the learner's age, limits the learning world's potential to cater to individual learners' needs. Finally, the learning world's potential to interact with the learner through feedback was outlined. Here, using multimodal feedback forms such as visual signals, sound effects, and verbal audio-transmitted feedback was considered beneficial, while the integration of video feedback was identified as an area for improvement. Although the learning world uses all feedback complexity levels that support learners, it became apparent that verbal feedback consists of pre-formulated standard responses rather than more complex, elaborated and individualised information. The significance of analysis results across all three research areas was critically discussed in the frame of the study's limitations (cf. chapter 6.5). Specific suggestions on how the app could be adapted to address the identified challenges in the future were introduced. These include integrating different word classes in lexical units and topic-based learning islands, designing

more open and productive task formats, including a continuous progression indicator, and integrating the *Niki* figurine more prominently. Additionally, the potential of using AI to generate more individual, complex, and detailed feedback was touched upon (cf. chapter 6.4).

In conclusion, the overarching research question formulated at the beginning can thus be answered as follows: The implementation of app-supported vocabulary learning in *Edurino*'s game and learning world *Niki* aligns with a number of principles of early foreign vocabulary learning and digital game-based, as well as mobile-assisted language learning. In particular, the use of multimodal, audiovisual techniques in all considered dimensions and the continuous and comprehensive integration of educational content into a coherent game-based storyline through fictional and personal game elements can be positively mentioned here. However, the closed exercise formats, immediate, unelaborated feedback, and, to some extent, extrinsic rewards provided by the program could potentially lead learners to rely on trial and error, which does not facilitate long-term vocabulary retention. Furthermore, the learning world currently consists primarily of language input, which learners are required to comprehend and then perform brief corresponding actions, but it lacks opportunities for language output and the use of productive vocabulary knowledge.

The growing accessibility and use of mobile devices among young children, together with the increasing influence of learning apps and games in foreign language learning, as outlined in the opening of this thesis, highlight the importance of critically evaluating the quality of language learning apps, such as *Edurino*'s *Niki*, to guide parents and educators in selecting, and game developers in designing age-appropriate and learning-supportive media. In discussing the limitations of the present study, new perspectives for future research in this area emerged. These include a follow-up study in which young learners' interactions with the learning world are documented through techniques such as video and screen recordings, and their vocabulary gains are tested. Such a study could explore the extent to which the theoretically anticipated effects outlined in this thesis are observable in actual practice. Furthermore, it would be desirable for the category system developed for this thesis to be tested for validity and, if necessary, further adapted in future studies that consider the same or similar dimensions when analysing language learning apps.

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9. Appendix

9.1. Coding Guide for the Analysis of App-Supported Vocabulary Learning in Digital Learning Games

Vocabulary:

Category	Definition	Typical Example(s)	Coding Rules
Items			
Practised Vocabulary	Vocabulary used by the learner in the activity of a level		Only vocabulary presented and practised in the activity, excluding introductory sequences and tutorials
High-frequency words	Vocabulary items that are among the 2.000 most frequent words in English according to the New General Service List		
Presentation			
Spoken Form	The vocabulary item is presented in its spoken form		
Written form	The vocabulary item is presented in its written form		
Picture	A pictorial representation of the vocabulary item is provided		
Contextualisation - Syntagmatic and Paradigmatic Associations			
Individual words	The vocabulary is presented and/or practised as an individual word	“dog“	
Lexical units	The vocabulary is presented and/or practised in lexical units; may consist of different word classes	“get on the bus”, “silly dog”	
In a semantic set	The vocabulary is presented and/or practised together with semantically related items	“purple, yellow, blue”	

Task Formats (cf. Schmidt, Blume, Schmidt 2014)**:**

Category	Definition	Typical Example(s)	Coding Rules
Closed formats			
Multiple-Choice	There are several possible answers provided to a question; more than one may be correct		
Right/Wrong	There are two answer options (true/false) provided to a question		
Cloze	Fill-in-the-blank exercises with given answers		
Matching tasks	Tasks in which two lists are provided and the elements in these lists need to be assigned to each other in a meaningful way	Matching written words to pictures	
Sorting tasks	Tasks in which elements must be placed in a particular order or structure	Putting sentence parts in the correct order	
Listen & React	Tasks requiring comprehension of a listening text, or understanding of specific information from that text, and learner actions related to that information	"Let's find the dog." – answer options (as pictures) are "dog, bird, pig" – the learner needs to draw a line to the correct picture	
Word puzzle	Tasks that involve forming, discovering or changing words		
Other	Other closed task formats where the answer options are given, and a specific answer/action is expected		
Semi-open formats			
Sentence completion	Tasks in which a sentence needs to be completed without given answer options		
Fill-in-the-blank	Fill-in-the-blank exercises without given answers		
Find out information	Tasks in which learners are required to find, organise, and/or compare information from a medium		

Other	Other semi-open task formats in which a specific answer/action is expected, but no answer options are given or formats which provide answer options but do not require a specific answer		
Open formats			
Research task	Tasks where learners need to find a source / several sources and obtain information from them		
Communication with virtual characters	Tasks in which (action-oriented) communication with virtual characters in the programme is required	e.g., via text or voice input	
Communication with other users or tutors	Tasks that require (action-oriented) communication with other users or tutors	e.g., via text/audio or video chats	
Collaborative tasks	Tasks that involve cooperation and collaborative work on a common product		
Discovery-based tasks	Tasks in the area of discovery-based and exploratory learning (in a rich learning environment)	e.g. “Go to the supermarket and listen to what people are talking about”	
Problem-solving with the game plot	Active problem-solving tasks in the game using the target language		
Creation of creative products	Tasks that allow learners to create creative products on their own		
Other	Other open tasks where no specific answer is expected and no answer options are given		

Competencies:

Category	Definition	Typical Example(s)	Coding Rules
Listening	Receptive activities that involve listening to a spoken text		
Listening to individual words	The audio text consists of individual words	"bird"	
Listening to individual sentences	The audio text consists of individual sentences	"Let's connect the matching faces."	
Listening to longer texts in the program	The audio text consists of at least three consecutive sentences	"Hm, Lolo has lost her blue car. Can you see the blue car somewhere? Ah, I can see the blue car. Do you see it, too? Try to grab the blue car with your magic pen and drag it to Lolo."	
Speaking	Productive activities in which the learner produces target language items in oral communication		
Writing	Productive activities in which the learner produces target language items in written form		
Reading	Receptive activities that either explicitly involve reading a text or provide a written text that may be read		

Game Elements (cf. Toda, Cristea et al. 2019; Toda, Klock et al. 2019; Schmidt, Blume, Schmidt 2014)**:**

Category	Definition	Typical Example(s)	Coding Rules
Performance/measurement			
Acknowledgement	Extrinsic feedback that praises the players' specific set of actions, virtual symbols that signal the accomplishments of players	badges, medals, trophies and achievements	
Level	Hierarchical layer that provides the user with new advantages as they advance in the environment	skill level, character level	
Progression	The app visually indicates the players' advance in the environment	progress bars, (un)locked islands/levels	
Point	Players earn points throughout the game; points can be used to unlock things	stars	
Stats	Visual information provided by the environment to the learner	dashboards, health bar	
Bonus	Rewards for having completed a series of challenges or tasks	bonus levels, unlocking further levels, gimmicks	
Combos	Award skills through doing a combination of actions		
Ecological			
Chance	Random property of a certain event or outcome		
Imposed Choice	The player is required to make an explicit decision to advance in the environment		
Economy	Any transaction or use of virtual goods that may occur in the environment		
Rarity	Limited resources and collectables within the environment		
Time Pressure	Limited amount of time, deadlines		

Social			
Competition	A challenge where the user faces another user to achieve a common goal		
Cooperation	A challenge where the user must collaborate with others to achieve a common goal		
Reputation	Titles the learner may gain and accumulate within the environment		
Social Pressure	Social interactions that exert pressure on the learner		
Personal			
Novelty	Updates within the environment, by adding new information, content or game elements		
Objectives	Related to goals; provide the player with an end, or a purpose to perform the required tasks		
Puzzle	Challenges such as cognitive tasks and actual puzzles that are implemented within the environment		
Renovation	Possibility of re-doing a task or event; allows the learner a second chance after they fail a task		
Sensation	The use of learners' senses to improve the experience, for example through visual and sound stimulation, or a dynamic and gameful interface		
Ownership	Involves a relationship between the user and a virtual or tactile object; similar to the principle of a Tamagotchi		
Avatar	A virtual representation of the user within the game		
Fictional			
Narrative	Order of events as they happen in the game, through the user's actions		Not the same as "imposed choice" – *narrative* structures the game's events without

			necessarily providing the user with different choices; rather, the user's actions can implicitly affect the order of events
Storytelling	The way the story of the environment is told; tool to support the narrative	animated scenes, audio texts	

Difficulty Adaptation:

Category	**Definition**	**Typical Example(s)**	**Coding Rules**
Difficulty adaptation	The learner's performance leads to changes in the level's difficulty (quantitative or qualitative)	Less options to choose from, easier items	Only coded if the difficulty changes relate to the language properties of a level
No difficulty adaptation	The learner's performance has no effect on the level's difficulty (quantitative or qualitative)		Coded if there are no noticeable effects or if these effects do not relate to the language properties of a level

Feedback (cf. Shute 2008, Wucherpfennig and Schmidt 2023):

Category		**Definition**	**Typical Example(s)**	**Coding Rules**
Timing	Immediate feedback	Feedback is given after each entry relating to an exercise item		

	Delayed feedback	Feedback is given after completing an exercise consisting of several items or an exercise group (with a delay)		
	Variable feedback	Feedback is provided depending on the selected user setting		
Mode	Sound effect	A sound effect is played in response to the learner's answer/action	music, applause	Only coded if the sound is clearly interpretable as an indication of whether the answer is correct; excluding, for example, a 'burp' sound
	Visual signal	A visual signal is given in response to the learner's answer/action	checkmarks, pictures, animations, highlighting	
	Video	A video is played in response to the learner's answer/action	A virtual character either navigates a bend in the road or collides with roadwork	
	Audio feedback	Verbal feedback is provided in the form of an audio	"Very good!" / "I think that's not correct yet."	
	Written feedback	Feedback is provided in the form of a written text/word		
Complexity	Knowledge of Results (KR)	Provides information about the correctness of a given answer, indicating that the response is correct	„Correct." / "Oh no, try again.", clear sound effect or visual signal	
	Knowledge of Correct Response (KCR)	Informs the learner about the correctness of their response and provides (information about) the correct answer	"Yes! The cat is feeling sad.", "Try this one!" (the correct item is highlighted)	

	Elaborated feedback (EF)	The system provides information on why a given answer is correct or provides a meta-cognitive hint on how to proceed; can include the correct answer	"The number is not correct yet."	
	Answer-until-Correct (AUC)	Feedback which enables the learner to discover the correct answer themselves by offering the possibility of further solution attempts (either a set number of attempts or until the correct solution is found)		

9.2. Completed Category System

Vocabulary:

	Items		Presentation			Contextualisation - Syntagmatic and Paradigmatic Associations		
	Practised vocabulary	High-frequency words	Spoken form	Written form	Picture	Individual words	Lexical Units	In a Semantic Set
Animals (& Feelings)			5	5	5	4	2	4
1_1 Animal Maze	pig, bear, bird, cat, rabbit, dog, mouse	pig, bear, bird, cat, dog, mouse	1	1	1	1		1 (animals)
1_2 Animal Slingshot	pig, bear, bird, cat, rabbit, dog, mouse	pig, bear, bird, cat, dog, mouse	1	1	1	1		1 (animals)
1_3 Matching Feelings	shy, angry, suprised, happy, sad, scared, silly, (pig, bear, bird, cat, rabbit, dog, mouse)	angry, surprised, happy, sad, (pig, bear, bird, cat, dog, mouse)	1	1 (feelings)	1	1 (feelings)	1 (in the provided feedback)	1 (focus on feelings)
1_4 Animal Slot Machine	shy, angry, suprised, happy, sad, scared, silly; pig, bear, bird, cat, rabbit, dog, mouse	pig, bear, bird, cat, dog, mouse, angry, surprised, happy, sad	1 (only if players click on the parts and when one exercise item is completed)	1 (after completion)	1		1 (e.g., 'silly pig')	
1_5 Joy Ride	pig, bear, bird, cat, rabbit, dog, mouse	pig, bear, bird, cat, dog, mouse	1	1	1	1		1 (animals)
Vehicles (& Numbers)			5	2	5	3	2	4
2_1 Vehicle Slot Machine	boat, motorcycle, train, bicycle, airplane, car, bus	boat, train, car, bus	1 (only if players click on the parts and when one exercise item is completed)	1 (when one exercise item is completed)	1	1		1 (vehicles)
2_2 Pick the Correct Vehicle	boat, motorcycle, train, bicycle, airplane, car, bus	boat, train, car, bus	1	1	1	1		1 (vehicles)
2_3 Number Robot	one, two, three, four, five, six, seven, eight, nine, ten, (boat, motorcycle, train, bicycle, airplane, car, bus), part(s)	one, (boat, train, car, bus), part	1		1		1 (e.g., 'five parts')	1 (numbers)
2_4 Number Potholes	one, two, three, four, five, six, seven, eight, nine, ten, (motorcycle, car, bicycle, bus)	one (car, bus, train)	1 (only if players click on the block and when they drag it to the pothole)		1	1		1 (numbers)
2_5 The Race	one, two, three, four, five, six, seven, eight, nine, ten; boat, motorcycle, train, bicycle, airplane, car, bus	one, boat, train, car, bus	1		1		1 (e.g., 'one car')	
Colours			5	4	5	4	1	4
3_1 Colour Balloons	yellow, blue, green, purple, red, orange, pink	yellow, blue, green, red	1 (after the item is selected)	1 (after the item is selected)	1	1		1 (colors)
3_2 Matching Paint Buckets	yellow, blue, green, purple, red, orange, pink, paint bucket, paint brush	yellow, blue, green, red	1 (after the item is selected)	1 (after the item is selected; only colors)	1	1		1 (colors)
3_3 Coloured Food	yellow, blue, green, purple, red, orange, pink	yellow, blue, green, red	1	1	1	1		1 (colors)
3_4 Coloured Vehicles	yellow, blue, green, purple, red, orange, pink + boat, motorcycle, train, bicycle, airplane, car, bus	yellow, blue, green, red, boat, train, car, bus	1	1	1		1 (e.g., 'yellow car')	
3_5 Colouring Picture	yellow, blue, green, red, purple, orange, pink, (black, white)	yellow, blue, green, red, (black, white)	1		1	1		1 (colors)
Fruits			5	2	5	4	1	3
4_1 Fruit Salad	lemon, orange, banana, apple, cherry, strawberry, pear, one two, three, four, five	one	1	1 (fruits - briefly)	1 (fruits)	1		
4_2 Fruit Slingshot	lemon, orange, banana, apple, cherry, strawberry, pear		1		1	1		1 (fruits)
4_3 Circle the Fruits	orange(s), cherry/cherries, lemon(s), pear(s), banana(s), apple(s) strawberry/strawberries, one, two, three, four, five	one	1	1 (fruits)	1		1 (e.g., 'two apples')	
4_4 Smoothie Maker	lemon, orange, banana, apple, cherry, strawberry, pear		1		1	1		1 (fruits)
4_5 Hot Air Balloon	lemon, orange, banana, apple, cherry, strawberry, pear		1 (when the fruit is collected)		1	1		1 (fruits)
5_The Party	apple, strawberry, banana, lemon, pear, cherry, orange, bear, mouse, rabbit, dog, pig, bird, cat, motorcycle / bicycle, green paint bucket, blue paint bucket, pink paint bucket, purple paint bucket, orange paint bucket, red paint bucket, yellow paint bucket	pig, bear, bird, cat, dog, mouse, yellow, blue, green, red	1 (when the object is given to the figure)		1	1	1 (e.g., 'green paint bucket')	
Total:			**21**	**13**	**21**	**16 (14 only individual words)**	**7 (5 only in lexical units)**	**15**

Task Formats:

	Closed Formats								Semi-open Formats				Open Formats							
	Multiple-choice	Right/Wrong	Cloze	Matching task	Sorting task	Listen & React	Word puzzle	Other	Sentence Completion	Fill-in-the-blank	Find out information	Other	Research tasks	Communication with virtual characters	Communication with other users or tutors	Collaborative tasks	Discovery-based tasks	Problem-solving with the game plot	Creation of creative products	Other
Animals (& Feelings)	0	0	0	1	0	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0
1_1 Animal Maze						1														
1_2 Animal Slingshot						1														
1_3 Matching Feelings				1																
1_4 Animal Slot Machine								1												
1_5 Joy Ride								1												
Vehicles (& Numbers)	0	0	0	0	0	3	0	2	0	0	0	0	0	0	0	0	0	0	0	0
2_1 Vehicle Slot Machine								1												
2_2 Pick the Correct Vehicle						1														
2_3 Number Robot						1														
2_4 Number Potholes								1												
2_5 The Race						1														
Colours	0	0	0	1	0	2	0	1	0	0	0	1	0	0	0	0	0	0	0	0
3_1 Colour Balloons								1												
3_2 Matching Paint Buckets				1																
3_3 Coloured Food						1														
3_4 Coloured Vehicles						1														
3_5 Colouring Picture												1								
Fruits	0	0	0	0	0	2	0	3	0	0	0	0	0	0	0	0	0	0	0	0
4_1 Fruit Salad								1												
4_2 Fruit Slingshot								1												
4_3 Circle the Fruits						1														
4_4 Smoothie Maker						1														
4_5 Hot Air Balloon								1												
5_The Party				1																
Total	**0**	**0**	**0**	**3**	**0**	**9**	**0**	**8**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total per main category				**20**						**1**						**0**				

X

Competencies:

		Listening (introduction, tutorial, instruction)			Speaking	Writing	Reading
		Listening to individual words	Listening to individual sentences	Listening to longer texts in the program (3+ consecutive sentences)			
Animals (& Feelings)		2	5	5	0	0	5
	1_1 Animal Maze		1 (instruction)	1 (introduction + tutorial)			1
	1_2 Animal Slingshot	1 (instruction)	1 (introduction)	1 (tutorial)			1
	1_3 Matching Feelings	1 (instruction)	1 (tutorial)	1 (introduction)			1
	1_4 Animal Slot Machine		1 (tutorial + instruction)	1 (introduction)			1
	1_5 Joy Ride		1 (instruction)	1 (introduction + tutorial)			1
Vehicles (& Numbers)		0	5	4	0	0	2
	2_1 Vehicle Slot Machine		1 (introduction + tutorial + instruction)				1
	2_2 Pick the Correct Vehicle		1 (instruction)	1 (introduction)			1
	2_3 Number Robot		1 (instruction)	1 (introduction)			
	2_4 Number Potholes		1 (instruction)	1 (introduction + tutorial)			
	2_5 The Race		1 (tutorial + instruction)	1 (introduction)			
Colours		2	4	5	0	0	4
	3_1 Colour Balloons	1		1 (introduction + tutorial)			1
	3_2 Matching Paint Buckets		1 (tutorial + instruction)	1 (introduction)			1
	3_3 Coloured Food		1 (instruction)	1 (introduction + tutorial)			1
	3_4 Coloured Vehicles		1 (instruction)	1 (introduction + tutorial)			1
	3_5 Colouring Picture	1	1 (tutorial)	1 (introduction)			
Fruits		2	4	3	0	0	2
	4_1 Fruit Salad		1 (introduction + tutorial + instruction)				1
	4_2 Fruit Slingshot	1 (instruction)	1 (introduction)	1 (tutorial)			
	4_3 Circle the Fruits		1 (introduction + instruction)	1 (tutorial)			1
	4_4 Smoothie Maker		1 (introduction + tutorial + instruction)	1 (tutorial)			
	4_5 Hot Air Balloon	1					
5_The Party		1	1 (tutorial)	1 (introduction)			
Total:		7	19	18			13

Difficulty Adaptation:

		Difficulty adaptation	No difficulty adaptation
Animals (& Feelings)		2	3
	1_1 Animal Maze		1
	1_2 Animal Slingshot	1	
	1_3 Matching Feelings	1	
	1_4 Animal Slot Machine		1
	1_5 Joy Ride		1
Vehicles (& Numbers)		2	3
	2_1 Vehicle Slot Machine		1
	2_2 Pick the Correct Vehicle	1	
	2_3 Number Robot		1
	2_4 Number Potholes		1
	2_5 The Race	1	
Colours		1	4
	3_1 Colour Balloons		1
	3_2 Matching Paint Buckets		1
	3_3 Coloured Food		1
	3_4 Coloured Vehicles	1	
	3_5 Colouring Picture		1
Fruits		2	3
	4_1 Fruit Salad		1
	4_2 Fruit Slingshot		1
	4_3 Circle the Fruits	1	
	4_4 Smoothie Maker	1	
	4_5 Hot Air Balloon		1
5_The Party			1
Total		7	14

Game Elements:

	Performance / Measurement							Ecological					Social					Personal							Fictional	
	Acknowledgement	Level	Progression	Point	Stats	Bonus	Combos	Chance	Imposed Choice	Economy	Rarity	Time pressure	Competition	Cooperation	Reputation	Social Pressure	Status/Ranking System	Novelty	Objectives	Puzzle	Renovation	Sensation	Ownership	Avatar	Narrative	Storytelling
In the learning world			✓	✓		✓												✓	✓	✓	✓	✓	✓	✓	✓	✓

Feedback:

	Mode					Timing			Complexity			
	Visual Signal	Sound Effect	Video	Audio feedback	Written Feedback	Immediate Feedback	Delayed Feedback	Variable Feedback	Knowledge of Results (KR)	Knowledge of Correct Response (KCR)	Elaborated Feedback (EF)	Answer-until-correct (AUC)
Animals (& Feelings)	4	4	0	4	0	3	3	0	2	4	0	4
1_1 Animal Maze	1	1		1		**1**	**1**		1	1		1 (three attempts before solution)
1_2 Animal Slingshot	1	1		1		**1**	**1**		1	1		1 (three attempts before solution)
1_3 Matching Feelings	1	1		1 (note: incorrect after 4)		1				1		1 (four attempts before solution)
1_4 Animal Slot Machine	1	1		1			1			1		1
1_5 Joy Ride												
Vehicles (& Numbers)	5	3	2	4	0	3	3	0	4	3	0	4
2_1 Vehicle Slot Machine	1	1		1			1			1		1
2_2 Pick the Correct Vehicle	1	1	1 (note: only for correct)	1		1			1	1		1 (three attempts before solution)
2_3 Number Robot	1			1			1		1			1
2_4 Number Potholes	1	1		1		**1**	**1**		1	1		1
2_5 The Race	1		1			1			1			
Colours	3	3	0	3	0	2	3	0	3	3	0	3
3_1 Colour Balloons												
3_2 Matching Paint Buckets	1	1		1			1		1	1		1 (three attempts before solution)
3_3 Coloured Food	1	1		1		**1**	**1**		1	1		1
3_4 Coloured Vehicles	1	1		1		**1**	**1**		1	1		1 (three attempts before solution)
3_5 Colouring Picture												
Fruits	2	2	0	2	0	1	2	0	1	2	1	2
4_1 Fruit Salad 4_2 Fruit Slingshot												
4_3 Circle the Fruits	1	1		1		**1**	**1**			1	1	1 (three attempts before solution)
4_4 Smoothie Maker	1	1		1 (note: only for incorrect after 2)			1		1	1		1 (two attempts before solution)
4_5 Hot Air Balloon												
5_The Party	1	1		1		1			1	1		1
Total:	**15**	**13**	**2**	**14**	**0**	**10**	**11**	**0**	**11**	**13**	**1**	**14**

9.3. Comprehensive Description of all Levels

(all images taken from: *Erstes Englisch*. 2022. Edurino: Digitale Lernspiele mit Figuren und Stift. München: Edurino GmbH.)

1. Animals & Feelings

Intro Video

- Learners listen to a longer audio text and watch the video, they interact with the virtual character Keap by giving her a tissue and taping the bush to see what is hidden in it

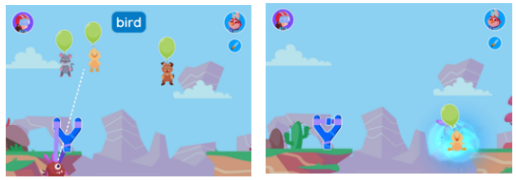
1_1 Animal Maze

- Description: Learners hear the name (and the sound) of an animal and select it by drawing a line to it with the pen. After finding the correct animal, they draw a line from the animal to the center.
- Adaptability: Number of animals is not adapted to the learners' performance
- Task format: Listen & React
- Introduction: Keap: "There they are! Huh? Look!" – video – "Hey! The chaos monsters are confusing them. They can't find their way back anymore. Can you please help them?"
  - Niki: "We need to help the animals."
- Tutorial: just one animal, visual and verbal instruction
  - "Let's start with the (animal). If you forgot which animal, you can tap on this box." – learner action – "(Animal). Yeah! Now, let's carry this animal to the center. The (animal)." – learner action – "Very good! You helped the (animal) find the exit!"
- Further rounds (2): three animals – four animals if the tutorial is skipped
- Instruction: "Let's find the (animal)."
- Vocabulary: pig, bear, bird, cat, rabbit, dog, mouse

- Written form, sound, and picture

- Feedback:
  - **Modes:** Visual signal (blue/purple circle), sound effect, oral feedback
  - **Timing:**
    - immediate (when the correct/incorrect animal is selected)
    - delayed (when the correct animal is in the middle, when all animals of one round are in the middle)
  - **Complexity:**
    - KR:
      - "Yes, exactly!" / "Terrific!" / "Perfect!" / "Sweet!" / "Excellent!"
      - "I think that's not correct yet."
      - "Hm, let's take another look."
    - KCR:
      - "(animal)" + sound of the animal
      - "Maybe this could be the animal we are looking for." (Animal is constantly highlighted after the third failed attempt)
  - Other feedback: "Excellent/Perfect!/Very good! Great! We saved them all. Well done!" (at the end)
- Other aspects:
  - Learners can click on the picture of an animal to hear its name and sound
  - Learners can click on the written form of the word to hear it – letters are highlighted while the word is spoken

1_2 Animal Slingshot



- Description: Learners hear the name and the sound of an animal and select it by aiming at it (with the pen)

- Adaptability: default setting = three animals to choose from; number of animals to choose from can be adapted to two based on the learner's performance
- Task format: Listen & React
- Introduction: Keap: "Hm, look at that nonsense. How do we get them back down?"
- Tutorial: visual and verbal instruction
  - Niki: "Oh no! We have to help the animals. I think, I have an idea. Tap here to hear the name of the animal we need to help." – learner action – "(animal name + sound). Well done! Use your magic pen to pull the slingshot. Now, aim at the animal we want to help. If you are ready, let go of the slingshot."
- Further rounds: 5
- Instruction: "(name of the animal)"
- Vocabulary: bird, bear, cat, dog, mouse, rabbit, pig
  - Written form, sound, picture
- Feedback:
  - **Modes:** Visual signal (blue/purple circle), sound effect, oral feedback
  - **Timing:**
    - Immediate (when the correct/incorrect animal is selected)
    - Delayed (after all rounds are completed)
  - **Complexity:**
    - KR:
      - "Oh no, try again."
    - KCR:
      - "It is the (animal)." + sound of the animal
      - "Oh no, we have to help the animals. I think, I have an idea."; after three failed attempts, the correct animal is briefly enlarged
  - Other feedback: "Huu. I think, that's it."
- Other aspects:
  - Learners can click on the picture of an animal to hear its name and sound
  - Learners can click on the written form of the word to hear it – letters are highlighted while the word is spoken

After unlocking the third level: German audio text for the free play area

1_3 Matching feelings

- Description: Learners hear the name of a feeling and see it in form of an emoji. They match it with the corresponding face of an animal (with the pen)
- Adaptability: default setting = three animals to choose from → if learners make four mistakes, there are only two animals to choose from in the next round
    - After one/two successful rounds, there are three animals to choose from again
- Task format: Matching task
- Introduction: Keap: "I always want to know how my animal friends are feeling. This pig is feeling happy." (+ animation) – video – "The chaos monsters are messing up everything! Can you help me?"
    - Niki: "Ha, sure!"
- Tutorial: visual and verbal instruction
    - "Let's connect the matching faces."
    - "(feeling)" + animation of the magic pen
- Further rounds (7): Three animals to choose from in each round
- Instruction: "(feeling)"
- Vocabulary: shy, angry, surprised, happy, sad, scared, silly (five feelings used per level), (bird, bear, dog, mouse, rabbit, cat, pig)
    - Written form, sound, picture
    - Animal names only receptive (not used by the learner in the game)
- Feedback:
    - **Modes:** visual signal (green/purple highlight), sound effect, oral feedback
        - Oral feedback for incorrect choices after four failed attempts
    - **Timing:**
        - Immediate (when the correct/wrong animal face is selected)
    - **Complexity:**
        - KCR
        - "Correct! / Yes! / Right! The (animal) is/is feeling/looks (feeling)."
        - Correct face is enlarged, animation of the pen draws a line to it; after four failed attempts
    - Other feedback:
        - "Use your magic pen to connect the correct faces." (after four failed attempts)
- Other aspects
    - Face of the bird sometimes hard to interpret!
    - Learners can click on the picture to hear the name of the feeling + the written form is presented

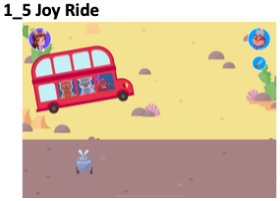
1_4 Animal Slot machine

- Description: Learners move parts of an animal face to the left or the right to put it back together (with the pen). Three rows for each animal – learners need to find the three matching parts
- Adaptability: 7 animals in total, regardless of learner level; no adaptive changes
- Task format: Other (closed format)
- Introduction: Keap: "These bad, bad chaos monsters. I can't see how my friends are feeling again! Can you maybe …"
    - Niki: "Ha, yes of course!"
- Tutorial: visual and verbal instruction
    - "Hm, I think we can use this machine to put their faces back together. Try to move the parts to the left or right with your magical pen."
- (Instruction: "I think we are still missing some animals here.")
- Vocabulary: silly, shy, scared, sad, angry, surprised, happy, dog, bird, mouse, rabbit, pig, bear, cat

- Picture
- Sound if learners click on the parts and when all three parts are matching, written form only when one exercise item is complete

- Feedback:
  - **Mode:** visual signal (green), sound effect, oral feedback
  - **Timing:** delayed (when all three parts are matching, after all the animal faces are put back together)
  - **Complexity:**
    - KCR:
      - "It's a (feeling) (animal)." / "The (animal) is feeling (feeling)." / "The (animal) looks (feeling)."
  - Other feedback: "Very good! Now, I am not sad anymore."
- Other aspects:
  - Answer is only "accepted" if it is correct → Answer until correct
  - Learners can click on the parts to hear the feeling and the name of the animal (support) (e.g. "silly cat")

1_5 Joy Ride




- Description: Learners select an animal and draw a line to the bus. They jump over obstacles (monsters) by tapping on the screen (with the pen).
- Adaptability: number of obstacles is adapted to the level of the learner (less obstacles if the learner hits them), but no adaptation in terms of language
- Task format: Other (closed format)
- Introduction: "Huu! After all this chaos, it's time for an adventure! Let's take our friends for a ride."
  - Niki: "Good idea!"
- Tutorial: visual and verbal instruction
  - "Let's pick an animal!" – learner action → video – "Oh yeah! Here we go. But we need to jump over the chaos monsters. Tap on the screen to make the bus jump."
- Instruction: "And the next animal is..." / "Which animal will we take with us next?"
- Vocabulary: "Hey / Hi / Welcome (animal name)!" – mouse, dog, rabbit, pig, cat, bird, bear
  - Sound, picture + written form
- No language-related feedback (only regarding the ability to jump over the obstacles; excluded from the analysis)
- Other aspects:
  - Learners can click on the picture of an animal to hear its name and sound

→ After this island is completed, a short video is shown, and learners receive a gimmick (binoculars and an outfit) for their avatar

2. Vehicles & Numbers

Intro Video



- Learners listen to a longer audio text and watch the video. They interact with the virtual character's vehicle by opening the window.

2_1 Vehicle Slot Machine


- Description: Learners move parts of a vehicle up or down to make it whole (with the pen). Three rows for each vehicle – learners need to find the matching parts.
- Adaptability: 7 vehicles in total, regardless of the learner's performance – difficulty is not adaptive
- Task format: Other (closed format)
- Introduction: Tool: "Grr... Look what these annoying little monsters have done to my vehicles!"
    - Niki: "Oh no, maybe that machine can help us sort the vehicles." (+ animation of the magic pen)
- Tutorial: visual and verbal instruction
    - "Oh look, I see. Now, move the pieces to make the vehicle whole."
- (Instruction: "I think, we are still missing some vehicles here.") (after inactivity)
- Vocabulary: boat, motorcycle, train, bicycle, airplane, car, bus
    - Picture
    - Sound only if learners click on the parts and when one exercise item is complete, written form only when one exercise item is completed
- Feedback:
    - **Modes:** visual signal (green), sound effect, oral feedback
    - **Timing:** delayed (when all three matching parts are put together; after all the vehicles are put together)
    - **Complexity:**
        - KCR
            - "It's a/an (vehicle). / That is a/an (vehicle). Yes, exactly! / Fantastic! / Perfect! / Great! / Sweet! / Well done! / Terrific!"
            - "Wow! A (vehicle). Fantastic!"
    - Other feedback: "Woho! Thank you." (at the end)
- Other aspects:
    - Answer is only "accepted" if it is correct → Answer until correct
    - Learners can click on the parts to hear the name of the vehicle (support) (e.g. "train")

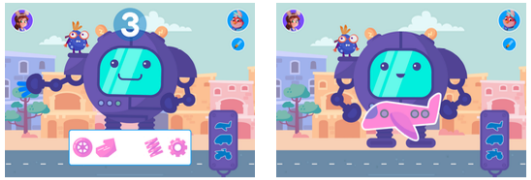
2_2 Pick the correct vehicle

- Description: Learners listen to a sentence including one vehicle name and select the correct vehicle by dragging it to the center.
- Adaptability: number of vehicles to choose from is adapted to the learner's performance (two or three vehicles)
- Task format: Listen & React
- Introduction: Tool: "Look, they'd love to drive to the racetrack. But that won't work. Let's help them pick the correct vehicle."
- Tutorial: Visual instruction
- Further rounds: default setting → 1-5 = two vehicles to choose from, 6-9 = three vehicles to choose from
- Instruction: "(Hm, what vehicle would be a good match for them?) Ah, a (vehicle)! / Maybe a (vehicle). / Looks like they need a (vehicle). / Let's try a (vehicle)."
- Vocabulary: boat, motorcycle, train, bicycle, airplane, car, bus
    - Written form, sound, picture
- Feedback:
    - **Modes:** Visual signal (white/purple), sound effect, video, oral feedback
        - Video of the vehicle arriving and the characters getting on is shown if learners choose the correct vehicle
    - **Timing:** immediate (when the correct/incorrect vehicle is chosen)

- **Complexity:**
  - KR:
    - "Oops. That was not the correct vehicle."
    - "Hm, let's try another one."
  - KCR:
    - "Look! A (vehicle) is arriving."
    - "(Vehicle) incoming."
    - "Yes! That's a (vehicle)."
    - "Try this one!" (highlights the correct vehicle; after the third failed attempt)
- Other feedback: "Yay! See you at the race." (at the end)

- Other aspects:
  - Learners can click on the pictures to hear the name of the vehicle
  - Learners can click on the written form of the word to hear it – letters are highlighted while the word is spoken

2_3 Number Robot



- Description: Learners listen to the number the robot needs and feed it the right amount of vehicle parts. The robot is counting. When the robot has had enough parts, learners tickle the robot with their pen until it burps out a vehicle.
- Adaptability: no difficulty adaptation
- Task format: Listen & React
- Introduction: (video) Tool: "Ugh… The chaos monsters destroyed all the vehicles here as well. Ah! But my robot can repair them, if we feed him the parts."
  - Niki: "Alright, let's feed the robot."
- Tutorial: Visual instruction
- Three rounds in total
- Instruction: "I need to eat (number) parts." / "(number) parts please." / "I want (number) parts."
- Vocabulary: one, two, three, four, five, six, seven, eight, nine, ten (counts up to the respective number), part(s)
  - Vehicle names only receptive (not actively used by the learner): boat, motorcycle, train, bicycle, airplane, car, bus (three items are used)
- Feedback:
  - **Modes:** Visual signal (animation of the vehicle), oral feedback
  - **Timing:** delayed (after all required parts were fed to the robot; at the end of the level)
  - **Complexity:**
    - KR: Animation is triggered by the learner action of feeding the robot the right number of parts
  - Other feedback: "Thank you!" (at the end)
- Other aspects:
  - Answer is only "accepted" if it is correct → Answer until correct
  - Burping sound after the parts are fed – not coded as a sound effect; ambiguous

2_4 Number Potholes

- Description: Learners see a hole in the street and count the number of rows in the hole. Then, they choose the block with the correct number from below by dragging it into the hole.
- Adaptability: Not adaptive, but possibility to add up several blocks (mathematically differently challenging)
- Task format: Other (closed format)

- Introduction: Tool: video + “Look, they want to drive to the big race. But… hey! What is that? Argh, not again… Chaos monsters!
- Tutorial: visual and verbal instruction
    - “The vehicles can’t drive over the holes in the street. Let’s fill the hole with these blocks. Drag one or more blocks into the hole to fill it.”
- Five rounds in total
- Instruction: “Could you please help the (vehicle)? / The (vehicle) needs your help. / The (vehicle) cannot drive. The (vehicle) needs your help.”
- Vocabulary: one, two, three, four, five, six, seven, eight, nine, ten (flexible number of items is used)
    - Picture
    - Sound only if learners click on the block or drag it to the pothole
    - motorcycle, bicycle, car, bus (only receptive)
- Feedback:
    - **Modes**: visual signal (blue/purple), sound effect, oral feedback
        - Oral feedback for an incorrect choice after three failed attempts
    - **Timing:**
        - immediate (when a fitting/too large block is chosen)
        - delayed (when the hole is filled; after all rounds are completed)
    - **Complexity**:
        - KR
            - „Now, the (vehicle) can drive.“; when the hole is filled
            - „Hm, try a different block.“ (after three failed attempts)
        - KCR
            - „(number)“; when a fitting block is selected
    - Other feedback: „Hooray! The chaos monsters gave up. Now, the race can begin.”
    - Correct answer is not provided at any time → Answer until correct
- Other aspects:
    - Learners can click on the blocks to hear the name of the number

2_5 The Race

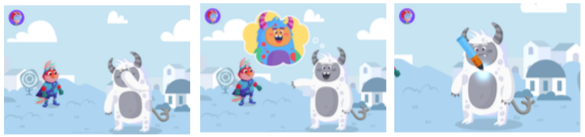
- Description: Learners listen to the question: “On which side is/are (number) (vehicles)?”. They look at the two pictures and choose the correct one by clicking on / dragging the car to the side.
- Adaptability: difficulty is adapted to the level of the learner – lower numbers and same number for both vehicles if the learner makes mistakes
- Task format: Listen & React
- Introduction: Tool: “Hoho! Finally, it’s time for the big race!”
    - Niki: “How exciting! Pong, are you ready?” → “3, 2, 1 – go!”
- Tutorial: visual and verbal instruction
    - “Choose the correct side of the track.”
- Five rounds in total
- Instruction: “On which side is/are (number) (vehicles)? Choose the correct side of the track.”
- Vocabulary: one, two, three, four, five, six, seven, eight, nine, ten (five items are used), boat, motorcycle, train, bicycle, airplane, car, bus (five items are used)
    - Sound and picture
- Feedback:
    - **Modes**: visual signal (green/purple box), video, oral feedback
    - **Timing**: immediate (shortly after the correct/wrong side is chosen)
    - **Complexity**:
        - KR
            - Video of Pong either navigating the bend or driving into roadworks

- Other aspects:
    - Learners have 12 seconds to make a decision (no visible countdown, but time restriction) → No AUC

→ After this island is completed, a short video is shown and learners receive a gimmick (a helmet and a racing suit) for their avatar

3. Colours

Intro Video



- Learners listen to a longer audio text and watch the video. They interact with the virtual character Blanco by tickling him.

3_1 Colour Balloons

- Description: Learners drag the coloured balloons to Blanco with their magic pen. Blanco pops the respective balloon, a splash is presented, showing the colour and some parts of Blanco's body are coloured in this colour.
- Adaptability: No difficulty adaptation
- Task format: Closed - Other
- Introduction: Blanco: "Look, these mean, mean chaos monsters. They filled my beautiful colours into the ballons. I really need them back! But I just can't reach them."
- Tutorial: visual and verbal instruction
    - "Oh no, poor Blanco. Let's give him the balloons to bring his colours back. Drag the balloons to Blanco with your magic pen."
- Seven "rounds" – until all the coloured balloons are popped
- Vocabulary: yellow, blue, green, purple, red, orange, pink (as pictures)
    - Written form and spoken form after the item is selected
    - When a balloon is given to Blanco: the name of the colour is repeated
- Feedback: (not coded; feedback is not based on the performance in terms of language use)
- Other aspects:
    - No possibility to make any mistakes
    - Learners can click on the balloons to hear the name of their colour

3_2 Matching Paint Buckets

- Description: Learners match coloured buckets and coloured brushes by drawing a line from one coloured bucket/brush to its' correspondingly coloured brush/bucket with their magic pen.
- Adaptability: no difficulty adaptation
- Task format: Matching task
- Introduction: "Oh no, not again! They messed around with my colours here too. Can you please, please, please help me with sorting the colours and brushes?"
    - Niki: "These troublemakers!"
- Tutorial: Visual and verbal description
    - "Let's help Blanco and put the brushes back into the correct paint buckets. First, draw a path from our little helper to a brush or a paint bucket." - learner action - "And now draw a line to the paint bucket/brush of the same colour."
- Further rounds: Three rounds with three items each

- Instruction: After selecting one item "And now draw a line to the paint bucket/brush of the same colour."
- Vocabulary: yellow, blue, green, red, purple, orange, pink
    - Written form and sound after the item is selected (written form only of the colours, not paint brush / paint bucket)
        - "(colour). It is (colour)."
- Feedback:
    - **Modes**: visual signal (blue/purple circle), sound effect, oral feedback
    - **Timing**: delayed (after matching two items; after each round)
    - **Complexity**:
        - KR:
            - „Yes, exactly! Terrific!" / "Great!" / "Very good!" / "Excellent!" / "Sweet!" / "Fantastic!"
            - "I think that's not correct yet."
            - "Hm, let's take another look."
        - KCR
            - "Yes! It is (colour) as well."
            - "I think this colour is a perfect match." (correct item is permanently highlighted; after three failed attempts)
    - Other feedback: "That's the last one. Thank you so much!" (at the end)
- Other aspects:
    - Learners can click on the items to hear the name and see the written form of the colour

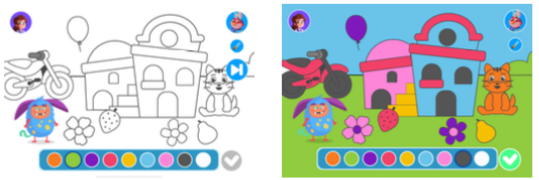
3_3 Coloured Food

- Description: The learner hears the name of a colour and needs to find the fruit/food in that colour by dragging it to Lolo with the magic pen
- Adaptability: not adaptive
- Task format: Listen & React
- Introduction: "Hey, it's my friend Lolo. But… But she also lost her colours. Hm. The fruits! They can bring Lolo's colours back."
- Tutorial: Visual and verbal instruction
    - "Ha, look! All this yummy, colourful food! Looks like Lolo wants her (colour) back first. You can tap on the fruit to hear its colour. Then, let's give her the (colour) food."
    - After some time: "(colour) is next." / "Now, she wants (colour)."
- 7 items in total (blue blueberry, pink dragon fruit, orange orange, purple grapes, green apple, yellow banana, red cherry) – fruits are not named in this level
- Instruction: "Now she wants (colour)." / "(colour) is next."
- Vocabulary: yellow, blue, green, purple, red, orange, pink
    - Written form, picture and sound
- Feedback:
    - **Modes**: visual signal (blue/purple), sound effect, oral feedback
    - **Timing**:
        - Immediate (when the correct/wrong item is selected)
        - Delayed (after the last item was selected)
    - **Complexity**:
        - KR
            - "Hm, that's not (colour)."
        - KCR
            - "Yes! That's (colour)."
            - "Yay! (Colour) is back."
    - Other feedback: ""That's all. Lolo looks beautiful again."
    - **Answer until correct**
- Other aspects:
    - Learners can click on the food to hear its colour / click on the word

3_4 Coloured Vehicles

- Description: Learners hear the colour and name of a vehicle and need to find it on a virtual street with moving vehicles. They drag the respective vehicle to the box at the bottom of the screen.
- Adaptability: speed and number of different moving vehicles is adjusted to the learner level (performance based)
- Task format: Listen & React
- Introduction: Blanco: "These chaos monsters think they are so funny. But Lolo really wants her vehicles back. Can you please find them?" – "Can you see her (colour) (vehicle)?"
- Tutorial: slow, only one vehicle, visual and verbal instruction
    - "Hm, Lolo has lost her (colour) (vehicle). Can you see the (colour) (vehicle) somewhere? Ah, I can see the (colour) (vehicle). Do you see it too? Try to grab the (colour) (vehicle) with your magic pen and drag it to Lolo."
- Further rounds: ten rounds, different number of moving vehicles to choose from
- Instruction: ("Help Lolo find her vehicles."), "Where is her red airplane?" / "Can you see her (colour) (vehicle)?"
- Vocabulary: yellow, blue, green, purple, red, orange, pink + boat, motorcycle, train, bicycle, airplane, car, bus (in combination, e.g. "blue car")
    - Sound, written form and picture
- Feedback:
    - **Modes:** visual signal (blue/purple), sound effect, oral feedback
    - Timing:
        - Immediate (when the correct vehicle is chosen)
        - Delayed (when all rounds are completed)
    - **Complexity:**
        - KR
            - „Try another one."
            - „Hm, that is not the one."
        - KCR
            - „(colour) (vehicle). Perfect! / Excellent! Great! Well done."
            - „Look, maybe this could be the (colour) (vehicle)." (vehicle is highlighted as soon as it is visible on the screen)
- Other aspects:
    - Learners can click on the box or on the vehicles to hear their colour and name

3_5 Colouring Picture



- Description: Learners paint a colouring picture by dragging colours onto items on the screen
- Adaptability: not adaptive
- Task format: semi-open "other" (answer possibilities are given, but learners are relatively free in their creation; no specific answer/action required/expected)
- Introduction: Blanco: "Hey, there you are! You know so much about colours now. But before we say bye-bye, could you please paint our home?"
- Tutorial: visual and verbal instruction
    - Niki: "Yay, this will be really fun. What's your favourite colour?" – learner action – "(colour). Good choice! And now tap on the picture to colour something."
- Instruction: /
- Vocabulary: yellow, blue, green, red, purple, orange, pink, (black, white)
    - Sound and picture
    - Black and white = new vocabulary items, not introduced before – no sound (when learners click on them, they are not named)

- Feedback: (not coded; no language-related feedback)
- Other aspects:
    - The elements that can be coloured are not named or used in this level

→ After this island is completed, a short video is shown, and learners receive a gimmick (colour palette and an outfit) for their avatar

4. Fruits

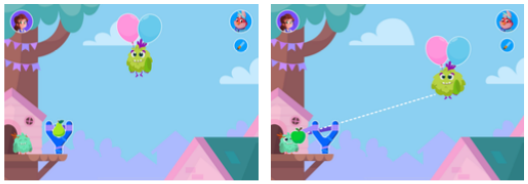
Intro Video

- Learners listen to a longer audio text and watch the video. They interact with the virtual character Nani by cleaning a plate for them.

4_1 Fruit Salad

- Description: Learners draw lines through different fruits with their magic pen to cut them into pieces. Then, they drag the pieces into the bowl.
- Adaptability: no difficulty adaptation
- Task format: Closed - Other
- Introduction: Nani: "Okay, okay. Everything's ready for the fruit salad."
- Tutorial: Visual and verbal instruction
    - "Let's cut the (fruit) into pieces with your magic pen."
    - "Perfect! Now, we have two pieces of (fruit). Cut the (fruit) once more."
    - "Great! Now put them into the bowl."
- Further rounds: 6 fruits, different number of pieces to cut
    - Instruction: "Next up is the (fruit)." / "Let's cut the (fruit)." → "Great! Now put them into the bowl."
- Vocabulary: lemon, orange, banana, apple, cherry, strawberry, pear, one, two, three, four, five
    - Sound and picture of the fruits
    - Written form of the fruits (briefly shown on the screen)
- Feedback: (excluded; feedback provided does not refer to the performance of the learner in terms of language use; focus on motographic skills)
- Other aspects:
    - Learners can click on the fruit to hear its name and see its written form
    - No real possibility to make mistakes

4_2 Fruit Slingshot



- Description: Learners aim fruits at the play figure plush to make him heavier
- Adaptability: no difficulty adaptation
- Task format: Closed - Other
- Introduction: "Poor, poor Plush. Can you help my friend get down again?"
- Tutorial: Visual and verbal instruction
    - "Sure. Let's feed Plush with some fruits to make him heavier. Use your magic pen to pull the slingshot. Now, aim at Plush and let go of the slingshot."
- Further rounds: four rounds, one fruit per round
- Instruction: "(fruit)"
- Vocabulary: apple, pear, orange, lemon, strawberry, cherry (4 items are used)
    - Sound and picture

- Feedback: (excluded; feedback provided does not refer to the performance of the learner in terms of language use)

4_3 Circle the Fruits

- Description: Learners listen to the name of the fruit and the number. They circle the right number of fruits with their magic pen.
- Adaptability: difficulty is adaptive; number of different sorts of fruits is adapted to the learner's level (based on the performance)
- Task format: Listen & React
- Introduction: Nani: "Hey, woah! Look, the chaos monsters are scaring away our fruits!" – video – "Can you help me sort the fruits correctly, please?"
- Tutorial: Visual and verbal instruction
    - "What a mess! The fruits are all over the place. Let's help Nani sort them. Here, we see which fruit we need and how many. Use your magic pen to circle the fruit."
- 7 rounds in total
- Instruction: "We need (number) (fruit)."
- Vocabulary: orange(s), cherry/cherries, lemon(s), pear(s), banana(s), apple(s) strawberry/strawberries, one, two, three, four, five
    - Written form (fruits)
    - Sound and picture (fruits and numbers)
- Feedback:
    - **Modes:** visual signal (green/purple), sound effect, oral feedback
    - **Timing:**
        - Immediate (when the correct number of the correct fruit or the wrong number of fruits/the wrong fruits are circled)
        - Delayed (at the end of the level)
    - **Complexity:**
        - KCR
            - "(Number) (fruits). Well done! Fantastic! / Very good!/ Great! / Sweet! / Yes, exactly! / Terrific!"
            - Solution is briefly shown after three failed attempts
        - EF
            - "The number is not correct yet."; if the wrong amount of fruits is circled
            - "Hm, that's not the correct fruit yet."; if the wrong fruit is circled
    - Other feedback: "Well done! We got all fruits. Thank you!/Thanks!" (at the end)

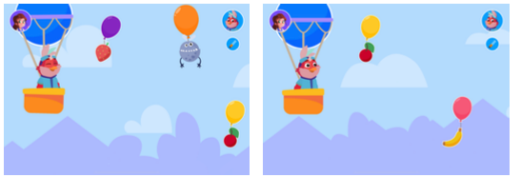
4_4 Smoothie Maker

- Description: Learners listen to the ingredients for Plush's smoothie. They select the correct fruits and drag & drop them into the mixer. Once the smoothie is mixed, they drag it to Plush with their magic pen.
- Adaptability: difficulty is adaptive; number of required fruits is adapted to the learner's performance
- Task format: Listen & React
- Introduction: Nani: "Plush, what's going on?" → Plush gestures and makes a sound → "Oh, you're thirsty and you want a smoothie?" → Plush laughs
- Tutorial: Visual and verbal instructions, two fruits and only these are available
    - "Ha! Plush wants to test smoothies for the garden party. So, let's make a yummy smoothie for Plush. We need a (fruit), a (fruit). First, drag one of the fruits to the mixer." – learner action – "Yay, now the other fruit." – learner

action – “That’s it! Let’s switch on the mixer.” – learner action – “That looks yummy. Let’s give it to Plush.”

- Further rounds: 5 rounds, more sorts of fruits than required available to choose from
- Instruction: “We need a/an (fruit), a/an (fruit)” & “We need a/an (fruit), a/an (fruit), a/an (fruit).”
- Vocabulary: lemon, orange, banana, apple, cherry, strawberry, pear (5 are used)
  - Sound and picture
- Feedback:
  - **Modes:** Visual signal (blue/purple), sound effect, oral feedback
    - No oral feedback for the correct smoothie
    - Oral feedback after two failed attempts
  - **Timing:** delayed (when the smoothie is given to Plush)
  - **Complexity:**
    - KR (sound effect + visual signal)
    - KCR: “Try these fruits.” + correct solution is briefly shown; after two failed attempts
- Other aspects:
  - Learners can click on the thought bubble to hear the name of the fruits (not individually), or they can click on the fruits to hear their name (individually)

4_5 Hot Air Balloon



- Description: Learners tap the Niki figurine on the upper or lower part of the screen to move the virtual balloon up or down. They collect fruits and dodge chaos monsters.
- Adaptability: no difficulty adaptation in terms of language
  - But: speed is adaptively changing
- Task format: Closed – other (similar to “Flappy Bird”)

- Introduction: Nani: “Oof, we’re almost ready for the garden party. We just need some more fruits.” – video – “Oh no, no, no, no! Where are they taking our fruits?”
  - Niki: “Haha, I found them! I will bring them back.”
- Tutorial: Visual and verbal instruction
  - “But I need your help flying this balloon. Use my figurine. Put my figurine on the screen to change where I fly.” – learner action – “Great! Now do it one more time to collect these fruits over there.”
- Instruction: “Let’s collect all the fruits.”
- Vocabulary: lemon, orange, banana, apple, cherry, strawberry, pear
  - Picture
  - Sound when the fruit is collected
- Feedback: (excluded; no feedback on the performance in terms of language use)

5. The Party

Intro Video

- Learners listen to a longer audio text and watch the video

5_ The Party

- Description: Learners see (or hear) the object that characters need. They use their magic pen to scroll from left to right to find the object. Then, they drag and drop the object close to the respective character.
- Adaptability: not adaptive
- Task format: Matching task

- Introduction: “Everything is ready for the party! Huh? But some of our guests aren’t happy yet. What do they need?”
- Tutorial: Visual and verbal instruction
    - “Use your magic pen to move around in the garden.” – learner action – “Great! Now, could you find me an apple, please?” – learner action – “Oh, there is an apple. Can you give it to me?” (highlighted) – learner action – “You can just drop it close to me.” – learner action – “Thanks a lot!” - “Now, try to make the other guests happy too.”
- 7 further objects that need to be found
- Vocabulary: Items from all previous islands (picture; sound when the object is given to a figure)
    - apple, strawberry, banana, lemon, pear, cherry, orange, bear, mouse, rabbit, dog, pig, bird, cat, motorcycle / bicycle, green paint bucket, blue paint bucket, pink paint bucket, purple paint bucket, orange paint bucket, red paint bucket, yellow paint bucket
- Feedback:
    - **Modes:** Visual signal (blue/purple), sound effect, oral feedback
    - **Timing:** immediate (when the object is given to the character)
    - **Complexity:**
        - KR
            - “Hm, that doesn’t seem to be the right object.”
            - “Let’s try another object.”
        - KCR
            - “Very good! / Yes, exactly! / Terrific! / Sweet! / Well done! (Name of the object).”
    - Other feedback: “Yay! You made everyone happy. This was so much fun!”
    - **Answer until correct**
- Other aspects: Learners can click on the objects to hear their names; when learners click on the characters: “(Name), would like to have / needs a (object).” / “Would you find (name) a (object), please?”
    - Extra: Other objects can be clicked, e.g. music player / disco ball → effects and hidden objects (behind the door)