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DESIGNING AN EFL VOCABULARY APP FOR AUTONOMOUS LEXICAL LEARNING

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Summary. This paper identifies key features crucial for design and development of vocabulary learning apps for English as a foreign language. Theories and models from (psycho)linguistics and multimedia design come together to provide a comprehensive point of departure for designing mobile apps. Taking the newly developed coursebook-corresponding app LexiFun for secondary EFL learners as an example, this paper also shows how such theories and models can be implemented into designing a digital tool for autonomous lexical learning for young secondary school students in Germany.

1. INTRODUCTION

One of the major goals of English school education in Germany is to develop learners' intercultural communicative competences (KMK 2012), which emphasizes learner's ability to *use* words productively and meaningfully (cf. Hymes 1972). Empirical studies conducted with transition phase learners[1] in Germany show that young EFL learners experience major difficulties in the area of lexical learning when entering secondary schools (Brunsmeier 2019a, 2019b). The learners are overwhelmed with the quantity of new vocabulary items that they must master on a weekly basis. Copying the words from the blackboard

[1] Transition phase in Germany refers to two first grades in secondary schools (grades 5 and 6).

seems especially overwhelming as students experience major problems with spelling (see e.g. Brunsmeier 2019b).

At the same time digital learning and digital competences have become an important component of general education in Europe (see e.g. Redecker 2017) and Germany (KMK 2016; Medienberatung NRW 2016). Publishing houses designing English coursebooks for North Rhine-Westphalian schools include therefore explicit references to chosen dimensions of digital competence described by the *Medienkompetenzrahmen* (German for "Framework for media competences") (Medienberatung NRW 2016) to assure the systematic teaching of media competence. This includes using learning software for (lexical) learning, which is considered to be an integral part of media competence (e.g. in *GreenLine G9 1*) – lexical learning with digital media is thematized in year 5 already. Mobile learning has a potential to improve learners' lexical knowledge as it can address the complexity of lexical knowledge (Schmitt 2000; Nation 2001), implement multimedia factors that can boost active learning (Mayer 2005) and balance the subordinate role of lexical teaching in institutionalized settings (Nation 2008). Still, there are not many apps for EFL lexical learning that take these factors into account; the question of how an effective app design can boost learners' receptive and productive knowledge of L2 lexis should be posed.

This paper discusses crucial lexical and multimedia factors that should be considered when choosing and designing an app for English vocabulary learning. The paper is embedded in the context of an interdisciplinary dissertation project that aims to empirically test the effectiveness of chosen features in mobile apps for English vocabulary learning in regard to various kinds of words and their dimensions. The paper starts with a brief overview of theoretical and empirical research, in order to develop a theoretical framework for an app design. It explains how existing theories and models can be translated into digital tools promoting EFL autonomous lexical learning and introduces a new app "LexiFun", which has been created for this purpose. The final part highlights some of the challenges related to the pragmatic application of chosen theories or models and discusses future implications.

2. LITERATURE REVIEW

2.1. LEXICAL LEARNING

The process of developing lexical knowledge is cumulative in nature – each learnt word must be revised by students more than once (Schmitt 2000, p. 117, 2007, pp. 831–832). Furthermore, numerous exposures to a given word are needed, ideally in various contexts. It is important that these exposures take place in increasingly spaced encounters. This principle of learning distribution means that learners go back to learnt words after some minutes, hours, days, weeks, and finally months (Nation 2008; Fritz et al. 2010). It allows learning to be strengthened and enriched, potentially resulting in new aspects of word knowledge being memorized. Findings from psycho- and neurolinguistics support the abovementioned observations: "neurons that fire together wire together" (Hebb 1949). Moreover, as connectionist research on language learning and parallel distributed processing has shown, the more often a given neural connection gets activated, the stronger the associative connections become (see e.g. Randall 2007). This corresponds closely to what we know about the mental lexicon: lexical choice and meaning are interrelated. Work with synonyms, antonyms, word classes or collocations can significantly contribute to the development of lexical knowledge as it highlights the relationship between semantically related units (Singleton 1999, p. 36).

Lexical knowledge is fundamental to the development of communicative competence in a foreign language – vocabulary plays the central role in the processes of communication and learning (Richards 2000; Snow, Kim 2007). Nevertheless, vocabulary training often plays a minor role in classroom practice and is controversial from the TEFL perspective. For instance, Nation (2008, p. 97) argues that "[d]eliberately teaching vocabulary is one of the least efficient ways of developing learners' vocabulary knowledge [...]", mostly because of the time-consuming instruction that would be needed to cover various dimensions of word knowledge. According to Nation (2001, p. 27) these word knowledge dimensions include word meaning, form, and use. EFL learners must master all of these dimensions in order to truly know a word.

Table 1. Word knowledge dimensions

Form	Spoken	Productive and receptive knowledge
	Written	
	Word parts	
Meaning	Form and meaning	
	Concept and referents	
	Associations	
Use	Grammatical functions	
	Collocations	
	Constraints on use	

Source: adapted from Nation (2001, p. 27)

As table 1 shows, each of the word knowledge dimensions can be further subdivided into relevant subcategories relating to both receptive and productive word knowledge. As the empirical study by Fritz et al. (2009) has shown, students tend to develop stronger receptive rather than productive word knowledge when using a tool that does not allow them to produce relevant and meaningful output embedded in sentence or discourse contexts. Given the importance of lexical knowledge for the development of communicative competence (Richards 2000), it is argued that digital tools developed for autonomous lexical learning should not only introduce new words in a meaningful context but also provide students with opportunities for practicing the usage of new words in activities that go beyond simple word spelling (ideally on both sentence and paragraph/discourse level).

Given the complexity of word knowledge as well as the limited classroom time, language-focused learning usually does not exceed twenty five percent of the course time (Nation 2008, p. 114) – a great deal of lexical learning must take place at home, requiring the learners to learn vocabulary autonomously. As Kötter (2017, p. 81) points out, there is most probably not enough attention paid to language-focused learning in German EFL classrooms. Nation's (2008, p. 7) claim is therefore especially imperative: "[l]earners need to take responsibility for their own learning, that is, they need to become autonomous learners". It is specifically important since deliberate vocabulary learning tends to surpass incidental learning: learners need less time to learn more words when learning deliberately and the results hold considerably longer (Nation 2008, p. 104).

2.2. DIGITAL AND MOBILE LEARNING

It is not only necessary to consider the word knowledge dimensions when deciding on a tool for lexical learning, but one should also pay attention to aspects of the tool design[2]. Tool design has a huge impact on the effectiveness of learners' knowledge gains and language learning motivation. Behaviorist traces in learning apps can be mostly found in activities like drills, quizzes, instant (model) answers, and immediate feedback (Tso 2020; Heil et al. 2016). Even though such activities have been empirically proven to benefit learners' lexical knowledge development (see e.g. Fritz et al. 2009; Hao et al. 2019), they miss the social element of language learning and pose the danger of decontextualized language settings, which in turn can lead to motivation loss (Tso 2020; Heil et al. 2016).

Although cognitive approaches focus on similar instructional explanations, illustrative examples and corrective feedback mechanisms, they go beyond behaviorist approaches in that they perceive learners as active agents in the learning process. Cognitivism points out that the content that learners can attend to as well as user-centered activities such as transforming, storing or retrieving newly learnt knowledge are important for (lexical) knowledge gains. Typical features of an instructional design that incorporates the use of cognitive strategies would therefore be learner control, self-planning and monitoring. Learning apps need to support learners to structure and organize information (e.g. outlining or summarizing), and to connect new and previously learnt knowledge (Ertmer, Newby 2013, pp. 51–53; Schmidt et al. 2014). Like cognitivism, constructivist learning theories emphasize the agency of the learner. In addition, they point at the importance of the learning environment and argue that the interaction between learner and learning environment is crucial in the process of knowledge creation. The design of lexical learning apps should thus also entail meaningful contexts, allowing learners to change and construct information, present information in a variety of ways (e.g. various times, contexts, purposes) and support users' problem-solving skills (Ertmer, Newby 2013, p. 58).

Last but not least, the design of digital vocabulary learning tools should also consider insights from the Cognitive Theory of Multimedia Learning (Mayer 2005). This theory is based on three major assumptions: (1) the dual-channel assumption, (2) the limited capacity assumption, and

[2] It is beyond the scope of this paper to provide a full overview of critical features of digital tools for autonomous lexical learning. Factors like price, target age groups, target proficiency levels, gamification, adaptive technologies, reference to linguistic competences, quality or forms of didactic interventions should be considered. For more information, see e.g. Schmidt et al. (2014); Blume et al. (2017); Heil et al. (2016); Chik (2014).

(3) the active processing assumption. The active processing assumption argues that in order to develop coherent knowledge representations multimedia users should engage in active cognitive processes with multimedia content. Digital activities should therefore make use of knowledge structures like classifications, processes, generalizations, enumerations, and comparisons (Mayer 2005, p. 36). Moreover, Mayer's (2005, p. 31) Multimedia Principle states: "people learn more deeply from words and pictures than from words alone". Thus, visual aids should accompany the learning process.

Combining mobile, autonomous, and integrated lexical training can provide learners with personalized activity types and therefore more nuanced feedback that has a potential to boost their learning success. Explicit, immediate, and detailed feedback enables learners to improve their L2 performance (Heift, Chapelle 2013; Heift 2008). Considering the complexity of word knowledge, it is imperative that learners are presented with feedback that goes beyond the simple information of whether a given translation has been correct or not.

3. APPLICATION DESIGN

The analysis of coursebook-corresponding vocabulary apps for German secondary schools has shown that there is little to no focus on productive word knowledge, especially within the word knowledge dimensions of "use" and "meaning"[3]. Although such an approach is easily explainable due to the technological challenges related to accurate and automatized judgements of learners' output evaluated by apps, it is crucial to assist learners in their development of productive word knowledge outside of the classroom.

The analyzed apps for lexical learning closely follow the principles of behaviorism: in mechanical practice exercises, words are presented and tested in isolation through spelling exercises. Even though there are numerous benefits to behaviorist app activities (e.g. repetition or immediate feedback), the existing apps tend to neglect presenting, testing and revising lexical items in a meaningful context. Particularly problematic is the fact that the focus usually lays on written word form only; other aspects of word knowledge dimensions are ignored. Furthermore, there is little to no focus on productive word knowledge. Such apps are nevertheless still widely used in schools. The question arises whether it would be possible to design a tool for autonomous lexical learning

[3] It is crucial to clarify that even though the conducted analysis has pinpointed certain shortcomings of existing apps, this paper does not undermine their didactic value in general.

that addresses the theoretical and empirical insights and resulting exigencies summarized in the previous chapter in order to improve the effectiveness of digital tools for autonomous lexical learning for young secondary school learners in Germany.

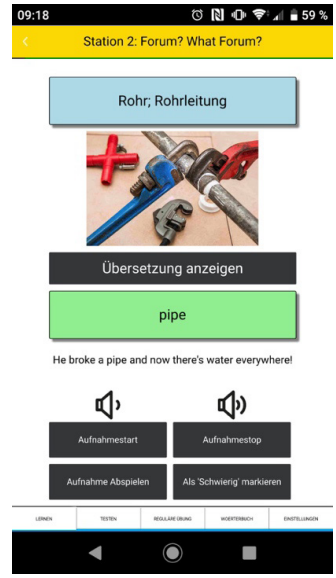
In order to tackle this question, this study conceptualizes and develops[4] a new app for lexical learning for secondary EFL learning. The app is called LexiFun, which stands for "Fun with Lexis". LexiFun is a coursebook-corresponding app that covers two units of the coursebook *GreenLine G9 2*[5] by Klett for grade 6. Each unit is comprised of lessons, which in turn contain a given number of lexical items, mirroring the layout of the coursebook. The following subchapters describe the learning and testing modi in the app as well as the regular exercise mode. LexiFun also includes two more features, i.e. dictionary and settings; due to space limitations, these are not going to be described in this paper.

3.1. LEARNING MODE

LexiFun uses digital flashcards as the basis of its learning mode. Users are presented with a word in L1. After clicking the button "show translation", the English equivalent, together with the corresponding example sentence, appears on the screen. Example sentences in LexiFun have been designed to comprehensively depict the meaning of a given word in a coursebook-related context. In accordance with Mayer's Multimedia Principle (2005), each word is accompanied by a visual aid (see figure 1).

As shown in figure 1, students are also offered the possibility to listen to the pronunciation of the target word and corresponding example sentence (all audios have been recorded by an English native

Figure 1. Learning mode in LexiFun



Source: author's own work

[4] The app development took place under the supervision of Prof. Dr. Matthias Bolten, University of Wuppertal.

[5] This coursebook was chosen due to its explicit references to the *Medienkompetenzrahmen* and the possibility to cooperate with the publishing house.

speaker[6]). They can also record and check their own pronunciation. This allows users to obtain self-feedback regarding the productive knowledge of the spoken word form (cf. Nation 2001, p. 27). Learners can also mark words that they find especially difficult in order to separate them from remaining vocabulary items and engage in target practice at a later time.

3.2. TESTING MODE

Figure 2. Feedback in testing mode in LexiFun

Source: author's own work

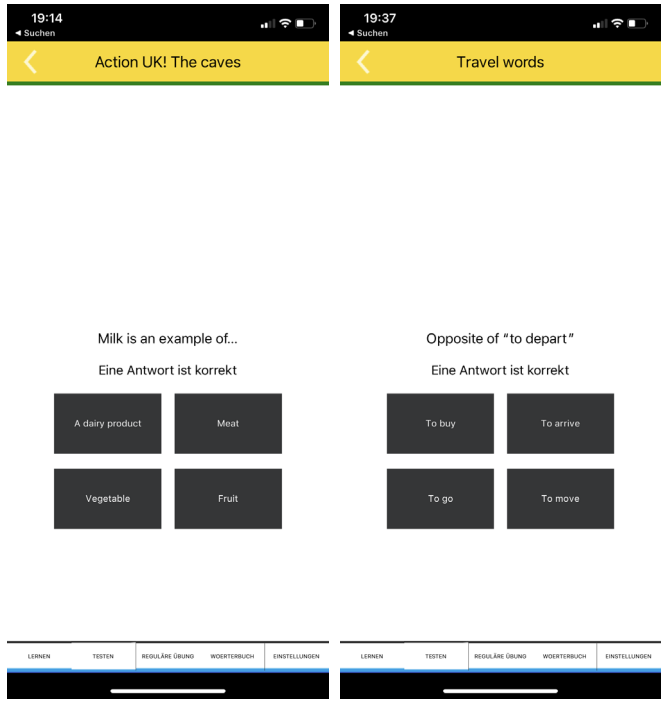
The testing mode allows learners to solve different tasks on the words that they have already learnt. Users can either be redirected to the testing mode after finishing learning a particular lesson or they can open the testing mode in the menu and practice chosen items. By developing the testing mode specific emphasis was put on feedback mechanisms and activity types, which have been designed in accordance with models and principles of mental lexicon, word knowledge and multimedia design. Given the importance of feedback for FLL (Heift, Chapelle 2013; Heift 2008), LexiFun implements it in form of clouds that students see after they have incorrectly solved a task in a testing mode. This feedback focuses on various dimensions of word knowledge by Nation (2001) and engages with collocations, word synonyms, antonyms, word categories and associations (Singleton 1999, p. 36; Randall 2007).

Figure 2 shows an example of a multiple-choice task in which learners must choose two correct answers. If even one of these is incorrect, students are presented with a feedback cloud: in this example, the feedback focuses on collocations. The example is related to the word knowledge dimension of "use", subdimension "collocations" (Nation 2001) and it recognizes the importance of syntagmatic sense relations (Lyons 1995).

[6] LexiFun corresponds to a coursebook with a focus on British English.

LexiFun employs various behaviorist activity types: single choice questions, multiple choice questions, and gap texts with one and three gaps. These activities provide content developed in accordance with (1) the cognitive processing assumption developed by Mayer (2005), (2) the principles of mental lexicon (Singleton 1999, p. 36; Randall 2007), and (3) the word knowledge dimensions by Nation (2001, p. 27). LexiFun also uses drag and drop activities. Since these refer, however, to translation only, they will not be described in detail.

Figure 3. Single choice questions in LexiFun



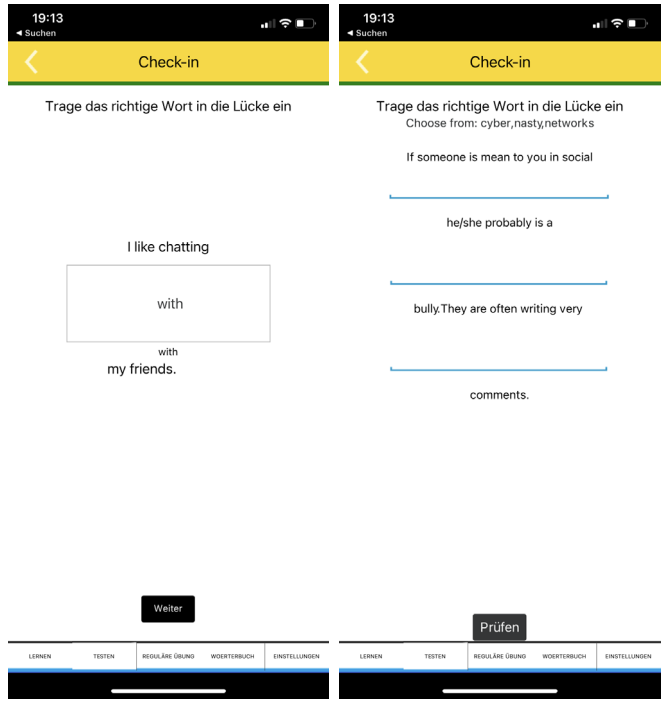
Source: author's own work

Behaviorist activity types in LexiFun partially follow cognitivist and constructivist assumptions and approaches to knowledge representation[7] Learners' agency is included in that learners can plan and monitor their learning and choose their own learning content. Including activity types and tasks related to work with categories, associations, synonyms and antonyms establishes links to learners' pre-knowledge.

[7] It is important to point out that the link between LexiFun and constructivism and cognitivism is only partial as learners are not as active as these learning theories require them to be.

Information is presented to learners in a variety of ways, for instance by using various contexts or purposes of a given word. Figure 3 above depicts two single choice activities in LexiFun: the activity on the left focuses on the notion of word categories, the one on the right uses antonyms. Multiple choice questions in LexiFun are always constructed in the same way, with two correct answers out of four to choose from.

Figure 4. Gap activities with one and three gaps in LexiFun



Source: author's own work

In order to help learners to use words productively in a sentence and paragraph context, LexiFun implements gap activities with one and three gaps subsequently. As shown in figure 4, gap activities with one gap (on the left) require learners to come up with a target word on their own, whereas gap activities with three gaps (on the right) provide learners with the target words to choose from (target group is of low proficiency level). By solving gap activities LexiFun users get a chance to not only practice spelling but also to foster their productive word knowledge that goes beyond simple isolated and decontextualized item translation.

3.3. REGULAR EXERCISE

A possibility to revise learnt words is imperative for lexical knowledge development in L2 (cf. Schmitt 2000, 2007; Nation 2008; Fritz et al. 2010). Therefore, LexiFun incorporates a "regular exercise" mode in which every word that has been learnt (= engaged with by clicking the button "show translation" in the learning mode) is shown again so that students can get additional practice. All the aforementioned activity types reappear in this mode.

4. CONCLUSION

This paper highlights that designing and creating an app is a complex process that requires a thoughtful consideration of various (psycho-)linguistic and multimedia theories and models. It shows that the inclusion of cognitivist and constructivist learning theories going beyond behaviorist pattern drills poses numerous technological challenges, especially regarding the accurate and automatized assessment of learners' open-ended answers. This is closely linked to the technological issue of implementing intelligent and personalized feedback[8]. Following the active processing assumption by Mayer (2005) might be challenging in terms of workload necessary for preparing the app content. Items in coursebook-corresponding apps should be presented in the coursebook context, which in turn can narrow down the choice of word categories, synonyms, antonyms, associations or collocations. Although Mayer's (2005) Multimedia Principle is generally quite straightforward to implement, there might be some challenges regarding visualization of grammatical words, especially in case of prepositions or conjunctions. This paper argues that app design and development should consider the roles of learning theories, word knowledge dimensions, mental lexicon, and multimedia design. It emphasizes that the learner's ability to *use* a word productively and meaningfully is necessary for communication; simple knowledge of words does not suffice in order to convey meaning in L2 (see e.g. Heil et al. 2016; Hymes 1972).

The quality of the aforementioned app features is empirically evaluated by using pre-, post- and delayed post-tests that measure learners'

[8] LexiFun provides pre-programmed feedback that consciously targets most problematic aspects of a given word. It is, however, neither intelligent nor adaptive, in that it does not adjust to learner's answer or progress.

productive and receptive knowledge of different kinds of words, e.g. nouns, verbs, adjectives, prepositions/connectives, phrases or collocations. Numerical data obtained from Phase6 and LexiFun sheds additional light on learners' knowledge gains. In order to capture different dimensions of learners' autonomous learning with the two apps, data triangulation is implemented. Information obtained from teachers' and learners' pre- and post- questionnaires as well as learning diaries is qualitatively analyzed and cross-correlated with the results obtained from the quantitative research instruments.

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PROJEKTOWANIE APLIKACJI MOBILNEJ DO AUTONOMICZNEJ NAUKI LEKSYKI JĘZYKA ANGIELSKIEGO

Słowa kluczowe: aplikacje mobilne, nauka słownictwa angielskiego, nauka leksykalna, autonomia, MALL, projektowanie multimedialne, wiedza leksyki

Streszczenie. Niniejszy artykuł identyfikuje kluczowe cechy niezbędne do projektowania i rozwoju aplikacji do autonomicznej nauki słownictwa angielskiego jako języka obcego. Teorie i modele z (psycho)lingwistyki oraz projektowania multimediów zapewniają kompleksowy punkt wyjścia do projektowania aplikacji mobilnych. W artykule pokazano również, w jaki sposób omówione teorie i modele mogą być stosowane w projektowaniu cyfrowych narzędzi do nauki słownictwa języka angielskiego na przykładzie nowo utworzonej aplikacji mobilnej LexiFun dla uczniów szkół średnich w Niemczech.