Potentials of Learning a New Foreign Language Using the Duolingo App: Opinions of Croatian University Students

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Abstract The introduction discusses the importance of multilingualism and foreign language competences in EU citizens. This is followed by a description of the Duolingo app and of mobile-assisted language learning. The results of earlier research studies by the same authors that dealt with the use of mobile applications in foreign language learning are also discussed, and the requirements that had to be met in the new study are presented here. The authors used a self-constructed French test and asked the participants in the study (students from the Faculty of Teacher Education at the University of Zagreb) what they thought (in a self-constructed short questionnaire, containing 14 statements) about the potentials of learning French as a completely new language through Duolingo app. The results showed that the respondents had an overall positive opinion about the quality and potentials of learning a new foreign language through Duolingo app (it lowers anxiety, it is efficient for learning correct pronunciation, memorizing new words, practicing grammar and structure drills). The conclusion states that the initial hypothesis was confirmed and gives implications for further research.

1   Introduction

Today's European Union can look back on a long history of emphasizing the importance of its citizens' language competences and mentioning multilingualism in its documents. The first discussions on the model of multilingualism started in the 1970s, and in the 1980s, multilingualism started to be seen as a precondition for the peaceful coexistence of different nations. The first document mentioning it was the document referred to as the Homburg Recommendations. The 1995 White Paper on Education and Training was much more important, wherein the European Commission defined the goal that in addition to their mother tongue all European citizens should master two foreign languages (hereinafter FLs) (Filipan-Žignić et al., 2013). Today, multilingualism is one of the main goals of the European Union's language policy and is gaining in importance due to globalization and internalization (Vučić, 2020). As Croatia has been an EU member since 2013, the guidelines of the European Commission and EU documents are binding for it.

In addition to the binding character of EU documents, familiarity with several languages is also important for Croatian citizens because Croatia earns a large percentage of its income from tourism. FLs had been considered an important part of basic education even before Croatia joined the EU. FLs had been obligatory subjects in primary and secondary schools for a long time before Croatia gained its independence in 1992. While in the past German and Italian were universally taught in the north and south of the country, respectively, English has prevailed in recent decades, and today it is the most taught FL (European Commission/EACA/Eurydice, 2017, p. 73).

Although English has become a modern lingua franca, the knowledge of English as a single FL is not enough for Croatian citizens because of the tourist-based character of the Croatian economy. According to the Eurydice 2017 report on the analysis of education and youth policies, French is the second most learnt FL in Europe (European Commission/EACA/Eurydice, 2017, p. 73). That is reason enough for people in Croatia to start learning French as well. The problem with French is that only 0.7% of Croatian students learn it in schools (Nacionalni centar za vrednovanje obrazovanja, 2012, p. 9). The authors of this paper think that smartphone applications like Duolingo could be of great help here, since mobile learning applications have enabled virtually everybody to learn numerous FLs.

In recent years, we have seen a considerable increase in the use of mobile applications specialized for independent FL learning. This paper is based on research into the opinions and practices of students from the Faculty of Teacher Education at the University of Zagreb, Croatia, who used the Duolingo application to learn French. The study presented here dealt with Croatian university students' use of the Duolingo mobile-assisted language learning (MALL) app. Duolingo is free to use and has a large number of downloads in the Google Play Store (currently over 100 million). Its users' average rating is 4.7 (out of 5). The app offers courses in more than 35 languages, including Spanish, French, German, Italian, Russian, Portuguese, Turkish, Dutch, Irish, Danish, Swedish, Ukrainian, Esperanto, Polish, Greek, Hungarian, Norwegian, Hebrew, Welsh, Swahili, Romanian, and English.

Duolingo is a gamified platform. It contains a system of jumping points, which allow users to choose the level at which they want to start learning a FL. Moreover, Duolingo has been found to be visually attractive and possessing of good usability and an element of fun, although researchers have observed some major flaws in its content and pedagogy.

The Duolingo app is safe, and it is marked as PEGI 3: "The content of games with a PEGI 3 rating is considered suitable for all age groups. The game should not contain any sounds or pictures that are likely to frighten young children. A very mild form of violence (in a comical context or a childlike setting) is acceptable. No bad language should be heard" (Pegi, 2021).

The term "gamification" is generally used to denote the application of game mechanisms in non-gaming environments with the aim of enhancing the processes enacted and the experience of those involved. In recent years, gamification has become a catchword throughout the fields of education and training, thanks to its perceived potential of making learning more motivating and engaging (Caponetto et al., 2014).

Gafni, Biran Achituv and Rahmani (2017) conclude that "most of the participants found the MALL Duolingo application enhanced the learning process. The gamification characteristics, ease of use, ubiquity and self-learning facilities had a stimulating effect on the process of learning and contributed to the willingness to continue using the application and to recommend it to others."

A study by Ajisoko (2020) on 19 participating students showed that 89% students strongly agree and 10% agree that Duolingo provides advantages in learning vocabulary. The students felt that Duolingo helped them discover new ideas, gain better understanding, and master vocabulary. The results showed that Duolingo facilitates students in understanding and practicing their vocabulary.

The study by Munday (2016) on two student groups, one group of 46 students at the beginner level and one of 16 students at a more advanced level, both learning Spanish as a second language, showed that 91% of students in the first group found Duolingo easy to use, 82% found it helpful, 80.4% enjoyed using it, and 78.3% were satisfied with the app. The students in the second, more advanced group, found the app helpful (80%), but only 43.8% of the students enjoyed using it, and only 50% of the class was actually satisfied with Duolingo (strongly agree and agree).

Jiang et al. (2020) report their results of a study on 225 participants, who were students of Spanish or French and resided in the United States, had little to no prior proficiency in the target language and used Duolingo as their only learning tool. The results showed that the students reached Intermediate level in reading proficiency but remained at Novice level in listening proficiency (assessed using the American Council on the Teaching of Foreign Languages (ACTFL) reading and listening proficiency tests). The proficiency scores of the participants were comparable with the proficiency outcomes of university students at the end of the fourth semester in language programs as reported in largescale studies. The participants were spending only half of the usual four semesters of university classes. "These findings demonstrate that Duolingo is effective and efficient, in addition to being accessible and free" (Jiang et al, 2020).

The results of an earlier study by Oreški et al. (2018) showed that university students thought that the Duolingo application had more advantages than disadvantages. In this new research being presented in this paper, the authors wanted to examine how university students progress in learning French by means of the same app and to learn what students think about its potentials. The potentials had to be checked with regard to preconditions for successful FL learning offered by the results of modern research in FL acquisition.

One of those preconditions is that FL learning should not cause high FL anxiety. FL anxiety is thought to be a highly debilitating affective factor in FL learning. Anxiety is experienced by FL students both in the classroom (Horwitz et al., 1986) and outside the classroom (Legac, 2019). It hinders students learning in all the stages of the FL learning process (MacIntyre & Gardner, 1994; Mihaljević et al., 2008).

Another important feature of good material for FL learning is that it should not be considered difficult by the students that use it. If it is thought to be difficult, then it lowers the student's motivation and raises their level of anxiety. Motivation is the key factor and the main driving force leading to success in FL learning (Gardner, 2010).

If we want our students to learn French or any other language properly, then they have to learn correct pronunciation in addition to learning vocabulary and grammar patterns. Pronunciation and intonation are a common problem in the early stages of FL learning (Velički, 2006). Therefore, it is important that students think that the course material makes it possible for them to learn correct pronunciation. Problems with learning pronunciation were one of the sources of FL anxiety when English was used outside the classroom (Legac, 2019). It is also known that students with lower levels of anxiety thought that their pronunciation was better than those with higher levels of anxiety (Szyszka, 2011), so it can be expected that if students are learning pronunciation easily by means of an application that their level of FL anxiety will be lower. The acquisition of correct pronunciation is particularly important in the case of French because of desyllabifications, which are traditionally marked as "enchainement" and "liaison" (Defterdarević-Muradbegović, 2008).

Students can only learn a FL well if they have learnt its grammar and have mastered structure drills. If the goal is to ascertain the potentials of a course, it would be advisable to find out what its students think; whether or not the course makes it possible for them to progress in learning grammar and in using structure drills properly.

One of the basic aims of every language course is increasing the number of vocabulary units that students are familiar with. Designers of course materials must always keep in mind the strict conditions for successful vocabulary learning. Only by observing them can real progress be made (Udier, 2009).

The course material and the FL method should keep the intensity of motivation high. This can be achieved if participants in the course think that the materials are entertaining and if they think that they can get quick feedback.

1.1   Description of the Study

This study was a follow-up study to an earlier study that was conducted by the same three authors during the 2017/2018 academic year with a different sample of students from the same institution. That earlier study (Oreški et al., 2019) asked the students to compare two applications for mobile FL learning (Duolingo and Memrise). They were free to choose the language they wanted to study through the apps, and they were not tested. The results of that study showed that student responses were mostly positive: they were very interested or highly interested in learning a FL (83.6%), they liked the gamification quality of the FL applications (80.1%), they learned how to use them quickly or very quickly (85.4%), and they liked the fact that they could use the applications whenever and wherever they wanted (77.6%). On the other hand, only 24% of respondents completely agreed with the statement that they would be able to learn a FL using one or more such mobile applications. In their implications for future research, the authors stated that the results of a possible follow-up study "would have to show whether the high motivational factor expressed by respondents in that study would remain constant in spite of the repetitive nature of exercises present in the said applications" (ibid, 27). In the current study, the same authors wanted to discern whether students from the same institution would be equally satisfied and motivated to learn one particular language (French) for a very short time and to see their achievements in learning the FL after completing a mini course through Duolingo for Schools. Some of the results of this new study are presented below.

Duolingo for Schools is a dashboard inside of a teacher's Duolingo account that allows them to create classrooms and assignments, and to follow students' activity. (…) It brings the Duolingo app into the classroom, with features designed to maximize teacher effectiveness and student learning (Duolingo, 2021). A screen capture of the Duolingo for Schools class used in the experiment is shown in *Figure 1*.
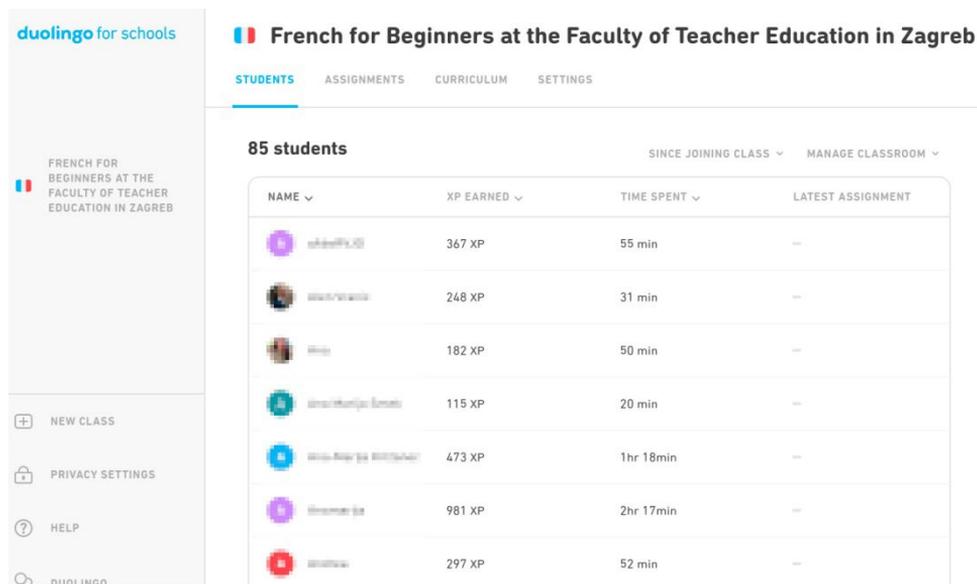
Figure 1: Duolingo for Schools Class
Source: https://schools-v2.duolingo.com

2   Methodology

2.1   Participants

Several figures will have to be given for the number of participants. The number of participants whose complete data were analysed for the purpose of the main analysis of this study was 63. However, the number of students that took part at various points of the experiment was different: 85 students attended the French language course and 66 students filled in the questionnaire. In the main analysis, only those participants were included who took the test and answered the survey after completion of the mini-French course. The analysis of the French test was done on the sample of 66 participants. The reason for these differences in the number of participants lies in the fact that the participants in the study were overburdened with other obligations at the end of the summer term, hence they gave up or they simply lost interest or forgot, although the authors of the study repeatedly asked them, via e-mail, to complete the experiment.

All the participants were students at the Faculty of Teacher Education in Zagreb, which is a constituent of the University of Zagreb in Croatia. Twelve students (19.05%) were studying to become kindergarten teachers (a 3-year study program, ending with a BA degree), 28 students (44.44%) were studying to become primary school teachers of core subjects (Croatian, Mathematics, Science, Music, Art and Physical Education) in primary school grades 1-4 (a 5-year integrated study program, ending with an MA degree), and the remaining 23 students (36.51%) were studying to become primary school teachers of core subjects in grades 1-4 and primary school teachers of English as FL in grades 1-8 (also a 5-year integrated study program, ending with an MA degree). Of the participants, 3.17% in the sample were men and 96.83% were women. The reader whose imminent thought is that female respondents were over-represented in this sample is wrong; on average, female students constitute over 95% of the students at the Faculty of Teacher Education at the University of Zagreb, since the teaching profession in Croatia still mainly attracts women.

At the time of data collection, all the participants in the study were in their early twenties (21 being the average age).

Since this study focuses on the use of technology and emphasizes the practical value of smartphone applications for learning FLs, it seems necessary to mention the use of the information and communications equipment by the students during the experiment. The survey showed that over two thirds of the students (71.43%) used their smartphones, meaning that smartphones are slowly but surely overtaking laptops and computers among university students. Students in this age group seem to use smartphones both for their leisure activities and for their studies.

2.2   Instruments

Two online instruments were used for the purpose of this study: a test and a questionnaire. Both were self-constructed by the three authors of this article.

The test contained five tasks. The first task asked the respondents to complete six sentences. Five of them had to be completed with entire words, and in one sentence only a part of the word was omitted (two letters from the first person of the present indicative of the verb *venir*). Each dot represented an omitted letter from the word.

In task 2, the students had to supply the correct indefinite article for three nouns. In task 3, they had to insert the correct definite article for 4 nouns. In task 4, the participants had to choose the correct answer in six short dialogues, and in task 5, they had to supply three correct present tense forms of the verb *travailler*. The theoretical range was 0-22 points.

The questionnaire contained 22 statements, but only some of them can be analysed for the purpose of this study; namely those 14 that covered the potentials. The statements that were analysed based off on a 5-point Likert scale with values from 1 – I totally disagree, to 5 – I totally agree. The students were also asked to give their comments on the course and the French test for beginners. There were three additional multiple-choice statements about students' biodata.

2.3   Procedure

The experiment and the survey were conducted during from mid-May to mid-June 2019. The students attending regular English courses offered by the first two authors of this article were informed about Duolingo for Schools and the aims of the study. During the last month of the 2019 summer term, the students were asked to do at least three half-an-hour lessons of French in Duolingo for Schools until they had earned 225 app points. This mini course was followed by a 10-minute French test for beginners and a short questionnaire. The students' participation in the experiment, the test, and the questionnaire were voluntary.

2.4   Aim of the Study, Hypothesis and Justification

This new study aimed to see what students from Zagreb studying to become teachers thought about the efficiency of learning a completely new FL by means of the Duolingo app. The following aspects of FL learning were included: the level of difficulty, availability, gamification, mastering the technology of learning, amusement, general efficiency, motivation, FL anxiety, acquisition of correct pronunciation, acquisition of structure drills and grammar in general, acquisition of vocabulary, authenticity, comparison of the experience of this kind of learning with their previous methods of FL learning and the possibility of learning a new language only by means of the Duolingo app.

The starting hypothesis was that Croatian university students studying to become kindergarten and primary school teachers would have an overall positive opinion on the quality and potentials of learning a new FL through Duolingo app.

The authors grounded their hypothesis within the results of their earlier study (Oreški et al., 2019).

3 Results and Discussion

The presentation and discussion of results will be subdivided into two parts. First a short summary of the quantitative (illustrating the number and percentages of students per ranges of achieved points) and qualitative (analysing the sources of student errors) results of the French test will be given. This will be followed by an analysis of the Duolingo app potentials as they were seen by the students in our sample after completing a mini course in French on Duolingo for Schools. The analysis will include illustrations in tables using frequency distributions of values from the questionnaire and mean values with their standard deviations.

3.1 French Test

Table 41 contains quantitative data regarding the French test results. It shows the number of students and percentage of students for five groups of achieved points. About one fifth of the students in the sample (20.63%) achieved low results (between 3 and 5 correct answers). Another group of similar size (a little less than a fifth or 19.04%) were somewhat better (they were within the 6-9-point range). Again, there was one fifth of students with average results (22.23% achieved between 10 and 12 points). Close to one quarter of the students (23.81% of them ended within the 13 to 16 points range) achieved very good results. Only 14.29% of the students achieved between 17 and 21 points, which meant that their performance was excellent. The mean value of achieved points was 10.67, whereby the standard deviation was 4.86. One can conclude that the students in this sample achieved moderate results in French as a FL in this test for beginners.

The qualitative analysis shows that not all the students had successfully mastered the present tense of the verb *être* as they did not know its form for the first-person singular, first-person plural or second-person plural.

Table 1: Number of points on French test

Number of achieved points	Number of students	Percentage of students
3-5	13	20.63
6-9	12	19.04
10-12	14	22.23
13-16	15	23.81
17-21	9	14.29
Mean value:	10.67	100.00
St. dev.:	4.86	

The grading of the students' French accents presented one group of mistakes. Some students seemed to have problems with the French word used to refer to the "left-hand side", likely because of the marking for the French accent *à,* and some of the students in the sample were not quite familiar with the question word *où.* A small group of them seemed not to be able to recall the spelling of *plaît* in the expression *s'il vous plaît.*

The form of the present tense indicative *venir* seemed to be extremely difficult for our students in the sentence where they were asked to say that they come from Zagreb.

The students were expected to have problems with forms of the indefinite and definite articles, as that part of speech does not exist in Croatian. However, the authors were happy to note that they made fewer mistakes with that grammar feature than would normally be expected from native speakers of Croatian.

The students did quite well in choosing the correct answers in short dialogues, e.g.:

> *Ça va bien, et toi?*
> A) *Volontiers.*
> B) *Très bien.*
> C) *Bonsoir.*

3.2   The Duolingo App's Potential

The potentials of the Duolingo app have been analysed through the presentation of the results and the discussion of students' answers from the questionnaire. The questions referred to their opinions on the efficiency of the Duolingo app and its

other characteristics: level of difficulty, the possibility of lowering FL anxiety, efficiency in learning correct pronunciation, structure drills, and new vocabulary. The students were asked to compare the efficiency of the Duolingo app with ordinary and traditional methods of teaching of FLs. They were urged to speculate about the possible advantage of the Duolingo app because of its availability and its gamification. The students had to assess how successfully they had mastered the FL through the Duolingo app, how amusing their learning was, whether or not the app was good for learning grammar, and whether learning was authentic. The assessment also dealt with the app's general efficiency. The students were also required to speculate on the possibility of learning a new language exclusively by using the application in question.

A) The Students' Opinions About the Level of Difficulty of FL Learning Through the Duolingo App

The first statement referred to the level of difficulty of the Duolingo app, stating that "Learning a FL with the Duolingo app is hard" (see *Table 2*). As can be seen from the mean value for this statement (1.89%; S.D. = 0.9) and the percentages of different values (39.68% strongly disagreed and 38.1% disagreed), close to four fifths of the students in our sample disagreed with that statement. No student in the sample strongly agreed with that statement. The difficulty of the FL or the difficulty of the course materials and methods of teaching can cause FL anxiety. What can be gathered from this is that the Duolingo app as course material did not pose as a threat or obstacle in this respect.

Table 2: Perceived level of difficulty of the Duolingo App

Value	Number of students	Percentage of students
1	25	39.68
2	24	38.10
3	10	15.87
4	4	6.35
5	0	0
Mean value:	1.89	100.00
St. dev.:	0.90	

B) The Students' Opinions About the Possibility of Mitigating FL Anxiety when learning French with the Duolingo App

In one question, the students were asked directly about the possibility of lowering FL anxiety through the Duolingo app. The results of that statement are illustrated in *Table 3*, and show that over 60% of the surveyed students agreed with the statement (25.4% strongly agreed and 34.92% agreed). About a quarter of the students (25.4%) were not sure, as they neither agreed nor disagreed with the statement. Only 3.17% of the students strongly disagreed, and 11.11% disagreed with the statement. The mean value for this statement was 3.68 (SD. = 1.08). From the analysis of the question on the level of difficulty, one can confirm even more strongly that the Duolingo app can be successfully used in learning French. The difference in the percentages between the two statements (this one and the one dealing with the level of difficulty) leads us to think that the students thought about other aspects of FL anxiety when they circled their answers on this statement and not only about the difficulty level.

Table 3: Perceived mitigation of FL anxiety

Value	Number of students	Percentage of students
1	2	3.17
2	7	11.11
3	16	25.40
4	22	34.92
5	16	25.40
Mean value:	3.68	100.00
St. dev.:	1.08	

C) The Students' Opinions on the Efficiency of the Duolingo App for Learning Correct Pronunciation

In the eyes of the participants (see *Table 4*), the Duolingo app was thought to be efficient for the acquisition of correct pronunciation, since about three quarters of the students either strongly agreed (31.75%) or agreed (44.44%) with the statement that stated that the Duolingo was excellent for the acquisition of correct pronunciation. This can also be seen from the height of the mean value (4.02; SD. 0.89). Less than 5% of the students strongly disagreed (1.59%) or disagreed (3.17), and less than one fifth of the students in our sample were undecided (19.05%).

Table 4: Efficiency of Duolingo app regarding the acquisition of correct pronunciation

Value	Number of students	Percentage of students
1	1	1.59
2	2	3.17
3	12	19.05
4	28	44.44
5	20	31.75
Mean value:	4.02	100.00
St. dev.:	0.89	

D) The Students' Opinions About the Efficiency of the Duolingo App for Structure Drills

The analysis of the results of the next statement from our questionnaire, presented in *Table 45*, reveals that the students regarded the Duolingo app as being efficient for the acquisition of structure drills, since the mean value was 4.05% (SD =0.79) and more than half of the students agreed (50.79%) while over a quarter (28.57%) strongly agreed with the statement "Learning a FL by means of the Duolingo app was excellent for language structure drills". Structure drills tend to be boring to students, so the results on this statement indicate an important advantage of the researched app.

Table 5: Efficiency of Duolingo app regarding the acquisition of structure drills

Value	Number of students	Percentage of students
1	1	1.59
2	0	0
3	12	19.05
4	32	50.79
5	18	28.57
Mean value:	4.05	100.00
St. dev.:	0.79	

E) The Students' Opinions on the Efficiency of the Duolingo App for Learning Vocabulary

Learning lexemes in French by using the Duolingo app can be very successful, according to the opinion of the students (see *Table 46*), as more than 90% of them strongly agreed (44.44%) or agreed (47.62%) with the statement that inquired about the efficiency of the Duolingo app for memorizing vocabulary statements. The mean

for this statement was 4.3, whereas the standard deviation was 0.63. Nobody in our sample strongly disagreed or disagreed with the given statement.

Table 6: The efficiency of Duolingo app for memorizing vocabulary statements

Value	Number of students	Percentage of students
1	0	0
2	0	0
3	5	7.94
4	30	47.62
5	28	44.44
Mean value:	4.37	100.00
St. dev.:	0.63	

F) Comparison of FL Learning with Duolingo School and with Classic Methods

The students were asked to compare learning by means of this app with other traditional or classic methods that they had come across earlier during their FL learning in terms of motivation. Over 70% of the students (see *Table 7*) thought that learning via the Duolingo app was more motivating than those other methods (31.76% strongly agreed and 41.26% agreed). A considerable number of students (26.98%, or over a quarter of the students in the sample) were hesitant about their agreement or disagreement, since they neither disagreed nor agreed with this statement. There were no students in the sample that strongly disagreed or disagreed. The mean was quite high (4.05; SD = 0.77). Motivation is regarded as a key factor leading to progress in learning. From the aspect of motivation, according to our respondents, using the Duolingo app for learning French in the early stages of learning would lead to success and achievement.

Table 7: Comparison of Duolingo versus classic methods of learning FL

Value	Number of students	Percentage of students
1	0	0
2	0	0
3	17	26.98
4	26	41.26
5	20	31.76
Mean value:	4.05	100.00
St. dev.:	0.77	

G) The Students' Opinions About the Advantage of the Duolingo App Because of Its Availability

Availability is seen by this young generation of millennials as an important advantage of the Duolingo app. The proof for that (see *Table 8*) is that the overwhelming majority (over 93% of the students) circled value 5 (more than a half of the sample – 50.79%) or value 4 (42.86%). Only 6.35% of students in the sample neither agreed nor disagreed with the statement that FL learning with the Duolingo app is important for them because they can learn anytime and anywhere. There were no students who disagreed or strongly disagreed. The mean value for this statement was 4.44 with a standard deviation of 0.62.

Table 8: Perceived advantages of Duolingo app in terms of availability

Value	Number of students	Percentage of students
1	0	0
2	0	0
3	4	6.35
4	27	42.86
5	32	50.79
Mean value:	4.44	100.00
St. dev.:	0.62	

H) The Students' Opinions About the Gamification of the Duolingo App

The new generation of young people tend to yearn to get feedback on their progress in FL learning and like to be rewarded for their effort and praised for their achievements. This can be clearly seen in the figures illustrated in *Table 9*, since over 90% of the surveyed students strongly agreed (58.73%) or agreed (31.75%) with the statement that they like this kind of FL learning because they can follow their level of progress and get points and prizes; much like one would in a computer game. The mean value was very high (4.46) with the accompanying standard deviation of 0.76. There was a relatively small percentage of ambivalent students who neither agreed nor disagreed with the above-mentioned statement. An even lower percentage of the students in the sample (only 3.27%) disagreed with the statement and there was no single student who strongly disagreed.

Table 9: Perceived advantages of Duolingo app regarding gamification

Value	Number of students	Percentage of students
1	0	0
2	2	3.17
3	4	6.35
4	20	31.75
5	37	58.73
Mean value:	4.46	100.00
St. dev.:	0.76	

I) The Students' Opinions About How Successfully They Mastered This Kind of FL Learning

The students were also enormously satisfied with how successfully they mastered learning French by means of the Duolingo app (see *Table 10*); again, well over 90% of them circled values higher than 3; 39.69% opted for value 4, and more than half (52.38%) for value 5. A high mean value of 4.41 with a standard deviation of 0.73 was recorded here. A very low percentage (4.76%) of the surveyed students were irresolute in giving their decision on this statement. An even lower percentage (only 3.17) disagreed with the statement on this statement. Nobody strongly disagreed with it.

Table 10: Perceived levels of mastering the FL through Duolingo app

Value	Number of students	Percentage of students
1	0	0
2	2	3.17
3	3	4.76
4	25	39.69
5	33	52.38
Mean value:	4.41	100.00
St. dev.:	0.73	

J) The Students' Opinions About the Amusing Character of FL Learning by Means of Mobile Apps

That FL learning can be amusing (see *Table 11*) when French is learnt by means of the Duolingo app was thought by over 95% of the surveyed students, wherein 79.37% strongly agreed and 17.46% agreed with the statement that stated that FL

learning with this app is fun. The mean value of 4.76 with a low standard deviation of 0.5 was the highest of all in this section of the questionnaire. An insignificant percentage of 3.17% of the surveyed students were not sure about their decision regarding this statement. Nobody disagreed or strongly disagreed with the statement.

Table 11: Perceived satisfaction levels of FL learning through Duolingo app

Value	Number of students	Percentage of students
1	0	0
2	0	0
3	2	3.17
4	11	17.46
5	50	79.37
Mean value:	4.76	100.00
St. dev.:	0.50	

K) The Students' Opinions About the Efficiency of the Duolingo App for Learning Grammar

The respondents in our sample were quite satisfied with the efficiency of the Duolingo app for learning grammar (see *Table 12*), since the mean value for this statement was 3.44, whereas the standard deviation was 1.01. However, this was the lowest mean value in this section of the questionnaire. Furthermore, one can notice the highest percentage of students that could neither agree nor disagree with the statement that learning by means of the Duolingo app was excellent for learning grammar rules (36.51%). That the students were positively biased about the potential of this app for the excellent learning of grammar rules can be noted in the much higher percentages of students that circled value 4 (31.75%) and value 5 (15.87) than the percentages of those that circled value 2 (12.7%) and value 1 (3.17%).

Table 12: Efficiency level of the Duolingo app regarding learning grammar

Value	Number of students	Percentage of students
1	2	3.17
2	8	12.70
3	23	36.51
4	20	31.75
5	10	15.87
Mean value:	3.44	100.00
St. dev.:	1.01	

L) The Students' Opinions About the Efficiency of the Duolingo App for Bringing Authenticity to FL Learning

That learning French by means of the Duolingo app has similarities with learning a FL in a natural environment is reflected in the high figures registered in the students' answers about the possibility that this app brings authenticity (see *Table 13*). Over 60% of the respondents in our sample were positively biased on this statement. An equal percentage of them agreed and strongly agreed (31.75%) with the statement regarding authenticity. The mean value was relatively high at 3.92, whereby the standard deviation was 0.89. Exactly one third of the surveyed students were not sure about their attitude towards this statement. A very small percentage (3.17%) disagreed, and nobody completely disagreed with the given statement.

Table 13: Perceived efficiency of Duolingo app regarding authenticity

Value	Number of students	Percentage of students
1	0	0
2	2	3.17
3	21	33.33
4	20	31.75
5	20	31.75
Mean value:	3.92	100.00
St. dev.:	0.89	

M) The Students' Opinions About the General Efficiency of Learning a FL by Means of the Duolingo App

The students (see *Table 14*) were quite generous in giving their ratings for this FL learning app, since the mean value of their ratings was 4.11 (standard deviation being 4.11), and over 80% of them gave it a rating of 4 (58.73%) or 5 (26.98%). Of the students, 12.7% gave it a rating of 3 and only 1.59% rated it a 2. Nobody rated it a 1.

Table 14: Efficiency rating of Duolingo app

Value	Number of students	Percentage of students
1	0	0
2	1	1.59
3	8	12.70
4	37	58.73
5	17	26.98
Mean value:	4.11	100.00
St. dev.:	0.67	

N) The Students' Opinions About the Possibility of Learning a New FL Only by Means of the Duolingo App

The students were quite positive about the possibility of learning a FL only through the Duolingo app (see *Table 15*). This can be seen from the mean value for this statement (3.78, whereby the standard deviation was 0.83) and again from the percentages of students that chose value 4 (41.28%) and value 5 (20.63%). One third (33.33%) of the surveyed students were not sure about their attitude towards this statement. Only 4.76% of the students were negative about the possibility of learning a new language only by means of the tested app. Nobody absolutely disagreed about the existence of that possibility.

Table 15: Perceived efficiency levels of learning a FL only through Duolingo app

Value	Number of students	Percentage of students
1	0	0
2	3	4.76
3	21	33.33
4	26	41.28
5	13	20.63
Mean value:	3.78	100.00
St. dev.:	0.83	

The results of this study have confirmed the authors' starting hypothesis that Croatian university students studying to become kindergarten and primary school teachers would have an overall positive opinion about the quality and potentials of learning a new FL by means of the Duolingo app.

4   Conclusion and Implications for Future Research

Croatian university students studying to become primary and kindergarten teachers achieved moderate success in learning French as a new FL after having completed a mini course in the Duolingo app. Their experience was mostly positive.

This study has shown that the FL students using Duolingo think that:

- The learning process with Duolingo is not difficult.
- It can be used to lower FL anxiety.
- It can be efficient for the acquisition of correct pronunciation.
- It is excellent for language structure drills.
- It is quite efficient for memorizing vocabulary statements.
- It is more motivating than traditional methods.
- The app's constant availability is a welcome characteristic.
- Its game-like organization and feedback encourage FL learners.
- The app brings authenticity into the learning process.

In conclusion, the respondents were enormously satisfied with how successfully they mastered learning French by means of the Duolingo app, like this kind of FL learning because they can follow their level of progress and get points and prizes, much like in a computer game and are open to the use of mobile apps and would welcome their inclusion in the teaching process. They have an overall positive opinion about the quality and potentials of learning a new FL and are positive about the possibility that they could learn a FL only by using the Duolingo app.

The results of this study are similar to results of other studies, such as Gafni et al. (2017), Ajisoko (2020), Munday (2016), and Jiang et al. (2020). The students' views and opinions, as well as the fact that they are becoming ever more proficient in the use of such apps, points at the need for FL teachers in general to develop their competences in mobile app usage because it will enable them to introduce these into the teaching process in a meaningful way.

Previous research (cf. Mikulan et al., 2018) shows that the digital competences of foreign language teachers as a whole are not sufficient and that teachers do not keep up with the increasingly rapid development of new technologies. The development of computers, multimedia, and software has gone a long way, which university curricula have not considered.

Today, students in higher education acquire basic IT education, while accepting and using some devices and applications that are informed individually because they are extremely popular among the population (primarily smartphones and applications for them). However, they do not learn much about such devices and applications and their possibilities in learning and teaching FL **at** school, and they rarely use them for these purposes. It is therefore necessary to design a system of lifelong learning that would allow teachers to periodically become acquainted with new technologies and the methods of their use.

The results of this study have shown that the Duolingo app can be regarded as a useful application for FL learning. The researchers believe that it would be necessary to conduct a new follow-up study, which would encompass either this or some other mobile learning applications to learn other FLs followed by a similar test to verify the students' achievements in learning the respective FLs. They think that it should be tested primarily on Italian and Hungarian, as they are mother tongues of two important national minorities in Croatia and because they are the official languages of two neighbouring countries whose citizens also constitute an important share of tourists in Croatia.

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