



Second language acquisition in the digital world: Use of language learning apps as an individual difference

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Abstract: In this study, I investigated the role of language learning applications (apps) in long-term second language (L2) grammar learning and explored the interplay between app use, motivation, and L2 exposure. Twenty-seven students recruited from a Russian summer immersion program in the United States participated in the study. The analyses revealed a small effect of app use on learning gains during the program ($R^2 = .12$, $p = .31$) for all curricular levels (1-7). A large effect was found for levels 1-4 ($R^2 = .43$, $p = .23$), suggesting that apps may be particularly valuable for beginner and intermediate students. A statistically significant positive correlation between app use before and during the summer program was found ($r = .58$, $p < 0.01$), suggesting that the participants used language learning apps consistently during their Russian studies. Moreover, the amount of app use before the summer

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program positively correlated with the participants' prior exposure to Russian literature, movies, music, and social media ($r = .58$, $p < 0.01$). To conclude, theoretical and pedagogical implications are discussed.

Keywords: second language acquisition, language learning apps, individual differences

Introduction

To better understand what makes second language acquisition (SLA) successful, various researchers have investigated the role of learners' individual differences (IDs) such as motivation (Dörnyei & Chan, 2013; Thompson, 2017) and L2 exposure (Brooks & Kempe, 2013; Muñoz, 2014; Ranta & Meckelborg, 2013). In this paper, I investigated the role of a recently emerged and potentially important ID: L2 learners' use of language learning apps. Despite the rich insights provided by research on computer-assisted language learning (CALL; for review, see Sharifi et al., 2018), including studies on longitudinal mobile-assisted language learning (MALL; e.g., Isbell et al., 2017; Loewen et al., 2019; Vesselinov & Grego, 2012), it remains unclear whether apps can be a valuable addition to instructed SLA settings and if they can affect learning gains over an extended time period. Moreover, it is important to investigate relationships between app use and other IDs such as motivation and different sources of L2 exposure (Ma, 2017). To address these issues, I investigated the role of daily use of language learning apps as an ID in learning L2 Russian grammar at a large language and culture immersion program in the United States. I considered the amount of L2 learners' app use to study Russian before and during the program. Moreover, I explored the relationships between use of language learning apps, motivation, and other aspects of L2 exposure.

Literature review

The role of language learning apps in SLA

Technology has affected every aspect of our lives and L2 learning is not an exception, with free apps like Duolingo (<https://www.duolingo.com/>), BrainPOP (<https://www.brainpop.com/>), VoiceTube (<https://www.voicetube.com/>), and subscription-based tools like Babbel (<https://www.babbel.com/>) becoming a larger part of learners' daily routines (Chen, 2016; Loewen et al., 2019). As SLA researchers and language teachers, we cannot ignore CALL and MALL (Kukulska-Hulme, 2012).

As of 2019, Duolingo claimed to have over 200 million active users and Babbel had over one million subscribers (Loewen et al., 2019). Prior research has also generally favored the inclusion of computer-assisted tools along with language learning apps in language education (for review, see Burston, 2015; Shadiev et al., 2017; Sharifi et al., 2018). The meta-analysis by Sharifi et al. (2018) revealed that L2 learners of English using computer-assisted tools often showed better learning outcomes than their peers from traditional face-to-face-only classes. The authors also identified four important moderators of learning: type of interaction, communication mode, language learning context, and treatment duration. Treatment duration has also been considered an important factor in MALL research (Burston, 2015; Loewen et al., 2019). For the purpose of meta-analysis, Burston (2015) identified 291 studies within this domain; however, due to sample size, treatment duration, and other methodological issues, only 19 studies were included in the final analyses. The researcher found that 15 out of 19 studies had reported strong positive relationships between app use and L2 reading, listening, and speaking development, whereas the other four studies focusing on vocabulary did not report any significant relationships. In their review paper, Shadiev et al. (2017) also reported that language learning apps had generally shown positive effects on L2 proficiency. Remaining consistent with the high app store ratings (Chen, 2016), Shadiev et al. also found that MALL had been positively viewed by many L2 learners.

To address the call for more longitudinal studies in the area of MALL (e.g., Burston, 2015; Shadiev et al., 2017), SLA researchers have investigated the effects of language apps in the long term (e.g., Isbell et al., 2017; Loewen et al., 2019; Vesselinov & Grego, 2012). For example, Isbell et al. (2017) adopted researcher narratives as their primary methodology and explored the experiences and efficacy of learning Turkish on Duolingo. The researchers-participants' motivation, their short-term goals, and their persistence in achieving these goals varied throughout the study. None of them went beyond the 34-hour target on Duolingo. It is important to note the participants also felt a high level of isolation from the target language and culture. They identified potential areas of improvement for Duolingo such as going beyond "decontextualized grammar-translation exercises and audiolingual drilling," (p. 18). The researchers also identified potential ways of how Duolingo can be implemented in a language classroom, in addition to self-guided learning. For example, teachers can use Duolingo's classroom function and help students set weekly goals.

In a follow-up Duolingo study, Loewen et al. (2019) found evidence that all participants improved their knowledge of Turkish; however, "after 34 hours of study, only one participant received a score that would be considered a passing grade in the

university's first semester Turkish course" (p. 308). Considering the contradictory results of previous research on the use of Duolingo (see Loewen et al., 2019; Vesselinov & Grego, 2012), future research will need to further explore the role of MALL in longitudinal SLA. It is important to explore whether Duolingo or other apps can be a valuable addition to a language classroom and help learners study their L2 as opposed to self-guided learning with no prior knowledge of the target language (e.g., Isbell et al., 2017; Loewen et al., 2019).

Moreover, it is beneficial to explore the relationships between MALL and other IDs, including motivation and various sources of L2 exposure. Ma (2017) suggested that mobile technologies can amplify students' personalized learning, which is directly linked to their motivation, learning styles and strategies, beliefs, and strategic knowledge and skills. The participants in this multi-case study were university students from Hong Kong who actively engaged in various e-resources (e.g., e-books, dictionary apps, vocabulary testing apps, social media, etc.). Inspired by Vygotsky's sociocultural theory (1978), the author suggested that "mobile technologies are becoming an indispensable social, cultural artefact and tool to mediate L2 learners' learning" (p. 200).

The role of motivation in SLA

To assess learners' L2 motivation, researchers have often adopted Dörnyei's (2009) L2 Motivational Self System (L2MSS), which includes three components: learning experiences, ideal L2 self, and ought-to L2 self. "Learners with a strong ideal self are able to utilize imagery to visualize who they would like to become," while the ought-to self is "a manifestation of the external pressures that the learner feels" (Thompson, 2017, p. 483). As for the learning experiences, Dörnyei (2019) views this component of L2MSS through the prism of a "perceived quality of the learners' engagement with various aspects of the language learning process" (p. 26). L2MSS has shown its effectiveness in assessing learners' motivation in drastically different contexts (e.g., learners of L2 Japanese from New Zealand, see de Burgh-Hirabe, 2019; native speakers of Cantonese learning English and Mandarin, see Dörnyei & Chan, 2013; Iranian students learning English, see Papi, 2010). Previous SLA motivation research has also consistently shown "significant positive associations between desired language self-guides (particularly the ideal L2 self) and the learners' L2-related learning effort and achievement" (Dörnyei & Chan, 2013, p. 457).

However, L2MSS has been primarily used with learners of English; in general, SLA motivation research is dominated by research in ESL/EFL settings (Boo et al., 2015). Considering the potential bias in assessing L2 motivation that the traditional L2MSS may have created (Lanvers, 2016), alternative options need to be considered

in a study of less commonly taught languages (LCTLs) such as Russian (Pastushenkov & McIntyre, 2020), the target language of the present study. In Anglophone contexts, foreign language learning, specifically in the area of LCTLs, is often perceived as irrelevant (de Burgh-Hirabe, 2019; Lanvers, 2016). Therefore, various researchers have suggested incorporating “rebellious” (Lanvers, 2016) or anti-ought-to L2 self (Thompson, 2017) in the traditional L2MSS framework. Research has shown that this type of self-vision is particularly important for learners of LCTLs (Thompson, 2017), including Russian (Pastushenkov & McIntyre, 2020). Moreover, L2 Russian learners’ experiences and motivation to study the language may vary (Merrill, 2013). Therefore, language learning experiences should not be neglected, despite the common trend of motivation research to focus on self-visions (Dörnyei, 2019). Considering these astute observations, I have elected L2MSS, complemented by the concept of anti-ought-to L2 self as the motivational framework for the present study, with the goal to investigate the relationships between app use and L2 learners’ motivation.

The role of exposure in SLA

Exposure to the target language is a combination of linguistic input and output (Ranta & Meckelborg, 2013). The quantity of input and output along with interaction, a concept associated with exposure (for review, see Loewen & Sato, 2018), have been regarded as beneficial for L2 development (e.g., Brooks & Kempe, 2013; Denhovska et al., 2016; Muñoz, 2014; Ranta & Meckelborg, 2013). For example, Muñoz (2014) found empirical evidence suggesting that the quantity of input was a stronger predictor of oral performance in a L2 than starting age. Within the domain of Russian SLA, Brooks and Kempe (2013) explored the interplay of cognitive IDs and metalinguistic awareness in the SLA of Russian vocabulary and grammar. The researchers found evidence that learning under incidental conditions was shaped by prior linguistic experiences with languages having similar grammatical patterns (e.g., rich morphology of Spanish). In their laboratory-based study, Denhovska et al. (2016) utilized the complexity of Russian morphology and investigated the role of working memory in incidental learning of noun-adjective agreement. The researchers found evidence that at the early stages, working memory was not engaged when production was supported by a high input frequency, further illustrating the importance of input in Russian SLA. Therefore, to better understand the role of language learning apps in SLA, it is important to consider their relationships with other sources of input, including hours of formal instruction and interactions with peers (Muñoz, 2014).

Present Study

This study is a part of a larger project that focuses on the role of cognitive IDs, motivation, and exposure in learning L2 Russian grammar, writing, and speaking (Pastushenkov, under review). To further investigate the impact of language learning apps on long-term L2 development (see Loewen et al., 2019), I aimed to investigate whether MALL can make a difference with regards to gains in learning L2 Russian grammar in an instructed learning environment. Moreover, I explored the correlations between learning gains, app use, and other important IDs: motivation as assessed by Dörnyei's L2MSS (2009) complemented by the concept of anti-ought-to L2 self (Thompson, 2017) and other sources of L2 exposure as self-assessed by participants (average hours per week) for various facets of students' learning routines (see Muñoz, 2014). In the present study, I addressed the following research questions:

- 1) To what extent does the use of language learning apps predict learning gains in L2 grammar in the long term?
- 2) To what extent do students' motivation and different sources of L2 exposure correlate with the use of language learning apps?

Methodology

Participants

Twenty-seven students from an 8-week summer immersion program in the United States participated in the study. The sample included 14 females and 12 males (one participant preferred not to report gender). The participants' mean age was 23.65 (SD = 4.69). They were initially placed in one of the seven levels of instruction based on a series of placement tests for grammar, speaking, and writing. The participants were recruited from all seven levels: Level 1 Introductory Russian (n = 3), Level 2 Advanced Introductory Russian (n = 4), Level 3 Basic Intermediate Russian (n = 1), Level 4 Enhanced Intermediate Russian (n = 4), Level 5 Advanced Intermediate Russian (n = 5), Level 6 Advanced Russian I (n = 7), and Level 7 Advanced Russian II (n = 3). The participants were native speakers of English (n = 23), English and Spanish (n = 2), Norwegian (n = 1), and Spanish and French (n = 1). The participants had studied a variety of languages besides Russian, including: Arabic, Chinese Mandarin, French, German, Latin, Spanish, and Urdu. They were compensated \$10 for their participation in a form of cash or a gift card of a major online retailer.

Immersion program

This summer language and culture immersion program is recognized as one of the leading Russian language institutions in the United States. A distinct feature of the program is the language pledge that all students need to take prior to starting the program. A typical summer 24/7 immersion at this program starts at 7 a.m. with breakfast with the program's faculty, their families, and guests. Morning classes start immediately after breakfast. Lunch is at noon, followed by afternoon co-curricular activities. At 6 p.m., students have dinner, followed by evening lectures, movie nights, and work with tutors. On weekends, the students actively participate in different cultural events, celebrations, etc.

Materials and procedure

Placement and exit tests

The immersion program conducts a series of placement and exit tests: two online grammar tests (fill-in-the-blank and multiple-choice quizzes), one speaking test (the American Council on the Teaching of Foreign Languages [ACTFL] Oral Proficiency Interviews), and one writing test (the ACTFL Writing Proficiency Tests) before and after the program. The same tests are used for all levels; the students are informed that they may not be able to answer all the questions. Based on the results of the placement tests, the students are placed in one of the seven levels of instruction. After obtaining access to the program's internal learning management system, I was able to explore their placement and exit grammar quizzes. The students can complete the quizzes on their personal computers. Each grammar quiz has a time limit of 60 minutes. Both fill-in-the-blank and multiple-choice quizzes cover a wide range of grammatical forms from grammatical gender to verbs of motion. The tests are non-adaptive. This fill-in-the-blank quiz is 100 questions, and all answers must be in Russian. For example, to complete Question 1 in Figure 1, the learners will need to have solid knowledge of Russian vocabulary and grammar (tenses, comparative and superlative adjectives, passive voice, and pronoun-adjective-noun agreement in grammatical gender, number, and case).

The multiple-choice quiz includes 150 questions. In this quiz (see Figure 2 for examples), the students are discouraged from using wild or strategic guessing. For example, Question 2 in Figure 2 tests the learners' knowledge of noun-adjective agreement in the accusative case; Question 3 tests their knowledge of verb conjugation. The last part of the multiple-choice test includes four reading passages with multiple spaces that are left blank. The students need to read the passages first,

and then answer the questions. The passages include excerpts from Russian literature.

Figure 1. Examples from the fill-in-blank grammar quiz

Question 1	14 pts
<p>О родственниках (1. of [my] father) <input type="text"/> я знаю (2. more than) <input type="text"/> о маминых. Дед (3. was born) <input type="text"/> в Петербурге и работал (4. [as a] teacher) <input type="text"/>. Семья была (5. the simplest) <input type="text"/> : ну, учитель и учительница. Но дед, (6. obviously) <input type="text"/>, ещё хорошо готовил, (7. because) <input type="text"/> (8. after the war) <input type="text"/> его (9. was invited) <input type="text"/> на работу в подмосковные Горки, где (10. lived) <input type="text"/> Ленин. Когда Ленин (11. died) <input type="text"/>, (12. [my] grandfather) <input type="text"/> перевели на одну (13. of the summer houses) <input type="text"/> Сталина, и он там (14. for a long time) <input type="text"/> работал.</p>	

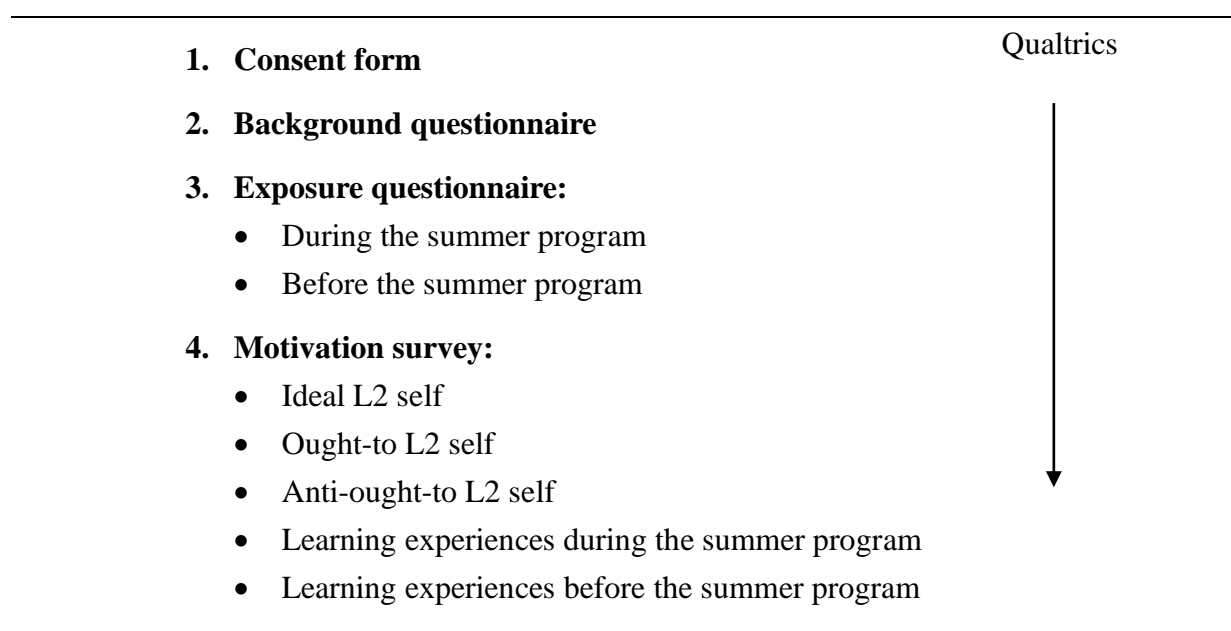
Figure 2. Example from the multiple-choice grammar test

Question 2	1 pts
<p>Мы слушаем _____.</p> <p><input type="radio"/> русскую музыку</p> <p><input type="radio"/> русской музыки</p> <p><input type="radio"/> русской музыке</p> <p><input type="radio"/> русская музыка</p>	
Question 3	1 pts
<p>Отец часто _____ письма.</p> <p><input type="radio"/> пишут</p> <p><input type="radio"/> пишет</p> <p><input type="radio"/> пишем</p> <p><input type="radio"/> пишете</p>	

Procedure

The students were recruited through the program's internal email system. They were able to complete the study on their own computers outside the classroom, so they would be able to fit the experiment in their schedules. I used Qualtrics, an online survey tool (<https://www.qualtrics.com/>) to collect the data. In the recruitment email, the students were given the link to the study. In Qualtrics, the participants completed the consent form, background questionnaire, a motivation survey, and answered questions about their Russian language exposure. The survey's structure is shown in Figure 3. It took participants approximately 10-15 minutes to complete the study. The survey questions are available on [the author's website](#).

Figure 3. Survey



Background questionnaire, exposure, and motivation

After the students completed the consent form in Qualtrics, they were redirected to the background questionnaire. The participants answered questions about their gender, student status, native language, and the number of semesters of Russian taken before the program. Next, the participants were asked about their Russian language exposure (before and during the summer program). Considering that the quality and quantity of linguistic input affect language acquisition (Muñoz, 2014), the participants were asked how long each of their Russian learning activities took in hours per week: formal classroom instruction; interactions with teachers outside the classroom; interactions with peers outside the classroom; language learning apps; and learning from literature, TV, music, movies, or social media. The participants

were given three “other” options to indicate learning activities that were not included in this list. The participants were also asked to rate their learning experiences as part of the next section on L2 motivation.

Dörnyei’s L2MSS (2009) complemented by the concepts of anti-ought-to L2 self (Thompson, 2017) was used the framework for the motivation component of the study. The survey questions were adapted from the studies by Papi (2010) and Thompson (2017). The questionnaire included four sections: ideal-L2 self (e.g., “I can imagine myself living abroad and using Russian....”), ought-to L2 self (e.g., “If I fail to learn Russian, I’ll be letting other people down.”), anti-ought-to L2 self (e.g., “I chose to learn Russian despite others encouraging me to study something different.”), and Russian learning experiences (e.g., “I like the atmosphere of my Russian classes.”). The learning experience section was divided into two sub-sections: before and during the program. The participants rated their self-visions and learning experiences on a 10-point Likert scale.

Analysis

One participant who did not complete the program’s exit tests was excluded from analyses. Due to the limited sample size, I chose not to exclude native speakers of languages other than English. In the analyses, I explored the effects of app use and other variables on learning gains for levels 1-7 ($n = 26$), levels 1-4 ($n = 12$), and levels 5-7 ($n = 14$). As the sample size was limited, I did not explore app use in each curricular level separately. Mean scores (M), standard deviations (SD), and 95% confidence intervals (CI s) were calculated for each variable (see Tables 1). There were two dependent variables: gains in learning Russian grammar based on the differences between the exit and placement fill-in-the-blank and multiple-choice quizzes. I conducted linear regression analyses (univariate and multiple) to investigate the effects of app use on learning gains (RQ 1). To explore the relationships between apps use, motivation, and L2 exposure (RQ 2), I conducted correlation analyses.

Results

Descriptive statistics

The descriptive statistics, along with 95% CI s for each variable and all curricular levels (1-7) are shown in Table 1. The participants’ daily use of language learning apps in hours varied: during the summer program ($M = 1.60$, $SD = 3.02$, 95% CI s [0.19, 3.01]) and before the program at their institution ($M = 2.05$, $SD = 2.80$, 95% CI s

[0.74, 3.36]). Peer interaction was another important differentiating factor, as illustrated by the interactions with peers in Russian during the program ($M = 32.40$, $SD = 19.78$, 95% CIs [23.14, 41.66]) and before the program ($M = 1.23$, $SD = 2.32$, 95% CIs [0.14, 2.31]). This is indicated by the broad SDs and 95% CIs. The participants' ideal-L2 self-visions were consistently high with narrow SDs and 95% CIs, whereas their ought-to-L2 self-visions were consistently low. However, the students' anti-ought-L2 self-visions were stronger than their ought-to-L2 self-visions. The participants' ratings of their learning experiences during and after the program were relatively high.

Table 1. Descriptive statistics (Curricular levels 1-7)

Categories	Variables	M	SD	95% CIs	
				Lower	Upper
L2MSS	Ideal-L2 self	8.58	1.13	8.05	9.10
	Ought-to-L2 self	2.43	1.52	1.72	3.14
	Anti-ought-L2 self	4.84	2.07	3.87	5.81
	Learning experiences (in the program)	8.91	0.92	8.48	9.34
	Learning experiences (before)	7.68	2.20	6.65	8.70
Russian exposure in the program (in hours)	Formal classroom instruction	20.00	4.30	17.99	22.01
	Interactions with teachers outside classes	3.13	1.93	2.22	4.03
	Interactions with peers outside classes	32.40	19.78	23.14	41.66
	Language learning apps	1.60	3.02	0.19	3.01
	Literature/TV/movies/music/social media	8.65	6.26	5.72	11.58
Russian exposure before the program (in hours)	Formal classroom instruction	3.38	3.19	1.88	4.87
	Interactions with teachers outside classes	0.62	0.73	0.28	0.96
	Interactions with peers outside classes	1.23	2.32	0.14	2.31
	Language learning apps	2.05	2.80	0.74	3.36
	Literature/TV/movies/music/social media	2.60	2.56	1.40	3.80
Gains (fill-in-the-blank quiz)		19.85	13.35	13.60	26.10
Gains (multiple-choice quiz)		28.75	16.67	20.95	36.55

Use of language learning apps as a predictor of L2 learning gains

I have explored various regression models with app use before and after the program as the independent variables and learning gains on fill-in-the-blank and multiple-choice quizzes as the dependent variables. For Levels 1-7, a small effect was found for the use of language learning apps before and during the program on gains on the multiple-choice quiz ($R^2 = .12$, $p = .31$). A large effect of app use on

learning gains was found for Levels 1-4 ($R^2 = .43$, $p = .23$), and almost no effect for Levels 5-7 ($R^2 = .03$, $p = .85$). Table 3 represents the regression analyses. Considering that the only large effect was found for the multiple-choice quiz, further analyses did not include the fill-in-the-blank quiz.

Table 2. Regression analysis summary for the effects of app use on gains on the multiple-choice quiz

<i>Variable</i>	<i>B</i>	<i>Std. Error</i>	<i>B</i>	<i>t</i>	<i>P</i>
(Constant)	24.496	4.478		5.471	.000
App use before the program	1.013	1.606	.170	.631	.536
App use during the program	1.219	1.485	.221	.821	.422
Levels 1-7 model: $R^2 = .12$, $p = .31$ (R^2 adjusted = .02)					
(Constant)	31.382	5.918		5.302	.003
App use before the program	1.237	2.179	.314	.568	.595
App use during the program	1.511	2.201	.379	.686	.523
Levels 1-4 model: $R^2 = .43$, $p = .23$ (R^2 adjusted = .20)					
(Constant)	24.387	6.157		3.961	.003
App use before the program	-.557	2.320	-.075	-.240	.815
App use during the program	-.972	1.977	-.155	-.492	.634
Levels 5-7 model: $R^2 = .03$, $p = .85$ (R^2 adjusted = -.16)					

Relationships between app use, motivations, and L2 exposure

To better understand the relationships between app use, motivation, and L2 exposure, I explored all possible correlations between these variables. The correlation between app use before the program and app use during the summer program was positive and statistically significant ($r = .58$, $p < 0.01$). As for motivation, I did find any statistically or practically significant correlations between app use (before or during the program), and any aspects of L2MSS for levels 1-7, 1-4, and 5-7. A potential problem is the lack of variance in the participants' motivation, which will be discussed in the next sections of the paper. With regards to L2 exposure, the only statistically significant positive correlation was found between app use before the summer program and exposure to Russian literature, movies, music, and social media ($r = .58$, $p < 0.01$).

Discussion

Use of language learning apps as a predictor of L2 learning gains

To address the call for more long-term MALL research (e.g., Burston, 2015; Shadieff et al., 2017), I investigated the role of language learning apps in L2 learning of Russian grammar during and before the participants' studies at a large summer immersion program in the United States. In this study, app use was considered as an additional factor that can assist learners to study the language that they are already studying, rather than a tool to learn an L2 with no prior exposure to the target language (e.g., Isbell et al., 2017; Loewen et al., 2019). The results of the study showed that use of language learning apps can be considered an ID: the learners' app use varied during and before the summer program as suggested by broad SDs and 95% CIs. Therefore, app use can be potentially added to ID research, which had previously focused on such variables as motivation (e.g., de Burgh-Hirabe, 2019; Thompson, 2017), language experiences and various sources of L2 exposure (Ma, 2017; Muñoz, 2014), as well as other cognitive, social, and affective factors. Remaining consistent with the findings of various studies, reviews, and meta-analyses (e.g., Burston, 2015; Shadieff et al., 2017; Vesselinov & Grego, 2012), the findings of this study revealed that apps may positively affect learning gains. A small positive effect was found for the use of language learning apps before the program on the gains on the multiple-choice grammar quiz. However, a large effect of language learning apps on gains was found for levels 1-4 (beginner and intermediate levels), with almost no effect found for levels 5-7 (advanced levels). These findings suggest that apps may be particularly valuable for beginner and intermediate learners of Russian. Considering that previous studies had often recruited participants with no prior exposure to the L2 (e.g., Loewen et al., 2019), further research will need to include proficiency as an important mediating/moderating variable. It is also important to note that the present study and the work by Loewen et al. (2019) are conceptually different. For example, the present study focused on the hours spent using apps in general rather than on specific apps such as Duolingo. As for pedagogical implications, the findings of the present study suggest that Russian teachers may still encourage their students to use language learning apps outside of formal classes, specifically at beginner and intermediate levels.

Relationships between app use, motivation, and L2 exposure

The second goal of the present study was to explore the relationships between app use, motivation, and other sources of L2 exposure. With a few exceptions in recent years (Isbell et al., 2017; Ma, 2017), the interplay of these variables has not yet been

widely investigated in SLA research. To address this question, I explored all possible correlations between app use, the traditional L2MSS components (ideal L2 self, ought-to L2 self, and learning experience; see Dörnyei, 2009), the newly emerged anti-ought-to L2 self (Thompson, 2017), and different sources of L2 exposure, another important ID category (Muñoz, 2014; Ranta & Meckelborg, 2013). I found a statistically significant positive correlation between the amount of app use during the summer immersion program and the amount of app use before the program at the participants' institution. This finding suggests that the participants used language learning apps consistently during their studies of Russian in different contexts. This finding once again illustrates the importance of apps for many L2 learners and that teachers and researchers should take this source of L2 exposure into consideration (see Kukulska-Hulme, 2012). Interestingly, the participant's self-visions, learning experiences, and various types of exposure during and before the program were often consistently high (or low) and lacked variance. The students in summer immersion programs tend to be motivated individuals; they have a solid background in language learning and usually enjoy L2 classes. Indeed, this summer immersion program is unique. However, the lack of variance is always problematic for analysis. I did not find any significant correlations between any components of L2MSS and app use. With regards to other sources of L2 exposure, the only significant positive correlation was between app use before the program and prior exposure to Russian literature, movies, music, and social media ($r = .58, p < 0.01$). This finding may suggest that app use is a relatively distinct and independent source of L2 exposure. However, more research into the relationships between app use, motivation, and other sources of L2 exposure is needed. As Ma (2017) suggested, MALL has become an important tool that mediates L2 learning.

Limitations and future directions

Sample size was the main limitation of the study, preventing me from conducting separate analyses for each curricular level. However, this study is a part of a larger study that focuses on various ID categories in Russian SLA (Pastushenkov, under review). In the future, I plan to return to this immersion program and collect more data. To reliably measure gains between the placement and exit tests, I conducted a separate pilot study to verify that the tests were equally difficult, equating the tests if necessary. Conducting the pilot was challenging, considering that the placement and exit tests (500 items total) should be distributed to the participants simultaneously to understand whether the tests were equally difficult. Using a separate grammar test (e.g., with identical pre- and post-tests) may have been beneficial as well. However, I had to follow the procedures used in the program. Moreover, I consider adding a

qualitative component to the study to better understand how Russian learners use language learning apps. Considering that sample size will often be a limitation in a study of Russian SLA, conducting a qualitative case study would be beneficial (Pastushenkov & McIntyre, 2020).

Conclusion

As language professionals, we should consider a variety of resources that can help our students master a L2. This study has shown that language learning apps can be a valuable addition to instructed SLA contexts, specifically at beginner and intermediate proficiency levels. However, due to the limited sample size, these results should be interpreted with caution. More research in this area is needed, particularly research focusing on long-term use of apps and adopting rigorous methodologies. MALL has become an essential element of many L2 learners' routines, and we as researchers and teachers should not ignore this source of L2 exposure. Finally, this paper focused on the L2 acquisition of Russian grammar. The program also conducted separate placement and exit tests for speaking and writing. In the future, I plan on extending this project by adding more participants and skills other than grammar.

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