

Duolingo's Effects on Iranian EFL Learners' Self-Regulated Learning, Enjoyment, and Engagement: A Mixed-Methods Study

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ABSTRACT

Recent technological innovations have significantly influenced the process of language learning. Among these, language learning applications have emerged as a major development that has gained substantial attention in empirical research. Duolingo, in particular, has become one of the most widely used applications globally, largely owing to its user-friendly features. The current study explored the effects of Duolingo-based language instruction on EFL learners' Self-Regulated Language Learning (SRL), Foreign Language Enjoyment (FLE), and Language Engagement (LE). It further investigated learners' attitudes toward this instructional approach. To achieve this, the researcher employed an explanatory mixed-methods design. At the quantitative phase, 50 intermediate-level male EFL learners from a prestigious language institute in Urmia (Iran) were selected as participants using convenience sampling, and data were gathered through pretests, instructional sessions, and posttests. At the qualitative phase, a semi-structured interview protocol was used to elicit learners' views on this approach. Quantitative and qualitative data were analyzed using T-test, MANOVA, and thematic analysis, respectively. Nonetheless, the study was not able to determine the impacts of the participants' personal characteristics on the data collection process. Findings revealed that Duolingo-based instruction exerted significantly positive effects on learners' SRL, FLE, and LE. The study offers valuable insights for teacher education program developers, syllabus designers, and instructors regarding the incorporation of Duolingo into language classrooms in foreign language settings.

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Introduction

The examination of recent research (e.g., Li & Bonk, 2023; Li & O'Rourke, 2022) underscores that scholars have concentrated on the influence of technological advancements on the process of language learning. Interactive mobile multimedia represents one of these innovations that has received notable attention in technology-mediated language instruction (Kazu & Kuvvetli, 2022). This form of multimedia integrates content in multiple formats such as text, image, audio, and video, accessible through mobile devices like smartphones and tablets, and is designed to support and accelerate learners' acquisition of the target language through meaningful interaction (Ekici, 2021). Among the different categories of interactive mobile multimedia, language learning applications have been the focus of numerous investigations (Fadda & Alaudan, 2020; Kessler et

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al., 2023). These applications are software programs installed on mobile devices that incorporate gamified elements and visually appealing interfaces, enabling learners to engage in interaction with the application interface (Purwanto et al., 2022).

Duolingo is one of the aforementioned applications and is utilized by millions of language learners worldwide (Perez, 2020). It is a free program available on multiple mobile platforms and provides language courses in 43 widely spoken languages as well as in languages with fewer speakers across different regions (Nushi & Eqbali, 2017). Its popularity among learners can be attributed to several features, including its accessibility for diverse groups of learners and its ease of use (Purwanto et al., 2022). Furthermore, the appeal of this application lies in its interactive, concise lessons and courses, which align well with the busy lifestyles of many learners (Kessler, 2021). These favorable characteristics have motivated researchers to investigate its applicability in various educational contexts (Kessler et al., 2023).

However, the related studies have mainly adopted the quantitative approach and have not collected qualitative data on the effectiveness of Duolingo-informed language teaching. Moreover, they have disregarded a large number of language learner factors including the learners' Self-Regulated Language Learning (SRL), Foreign Language Enjoyment (FLE), and Language Engagement (LE) among the others (Purwanto et al., 2022). Therefore, there is a need for more studies of Duolingo in different contexts including the Iranian context.

The present study attempted to deal with the above-mentioned gap in the research on Duolingo-based language instruction in the context of Iran by answering the following questions:
RQ1: Does Duolingo-based language instruction have significant impacts on Iranian EFL learners' SRL, FLE, and LE?

RQ2: What are Iranian EFL learners' perspectives on Duolingo-based language instruction?

Literature Review

Duolingo-Informed Language Instruction

The review of research on technological innovations in language education (e.g., AlAzzam-Khraiwish et al., 2021; Liu & Leveridge, 2017) indicates that much attention has been directed toward interactive mobile multimedia that supports the process of language acquisition. Within the different categories of multimedia, mobile language-learning applications have received particular focus (Kaid Mohammed Ali & Rashad Ali Bin-Hady, 2019). These applications consist of software programs that employ interactive lessons to accelerate learners' interlanguage development across various academic contexts (Shortt et al., 2023). Interest in such applications arises from features such as accessibility and convenience, ease of use, engaging content, and gamified elements, among others (Xu et al., 2020).

Duolingo constitutes one of the above-mentioned applications and has been examined in numerous studies in recent years (Yin et al., 2021). It is a free application that can be installed on various mobile devices, comprises an interactive interface, and aims to ameliorate the learners' development of various language skills and aspects by means of riveting and engaging gamified characteristics (Alamer & Al Khateeb 2021).

This application is regarded as more effective than other comparable tools due to its distinctive features. In particular, Duolingo incorporates gamified elements such as points, levels, and rewards, which motivate learners to complete tasks and transform the language learning experience into a game-like process (Ali, 2021). Moreover, it offers learners concise and manageable lessons that align with their demanding schedules and prevent them from feeling overwhelmed during the learning process (Alsaadat, 2018).

In addition, Duolingo employs a variety of task types to support learners' development of different language skills and components (Cai et al., 2021). It also personalizes learners' acquisition of the target language by tailoring tasks to their individual learning preferences and styles (Ekici, 2021). Alongside this, the application includes social elements such as leaderboards and the option to follow other users, which foster a sense of community in the language learning process (Flores, 2015). Furthermore, Duolingo is consistently updated based on learners' feedback and current research in language acquisition to enhance the effectiveness of its lessons (Ghounane & Rabahi, 2021). Finally, the app emphasizes practical vocabulary and grammatical structures and incorporates cultural notes to enable learners to interact effectively across diverse situational contexts (Li et al., 2022). Collectively, these features suggest that Duolingo has the potential to affect multiple dimensions of language learning (Ekici, 2021).

Learner Factors

In language instruction, learner factors encompass all of the learner characteristics including the personal, cognitive, and affective attributes that are likely to have a significant effect on the learners' rate and ultimate level of language learning in various academic settings (Moe, 2016). Among these characteristics, affective factors have been recurrent variables in the pertinent empirical studies (Robertson-Kraft & Duckworth, 2014). These factors encompass the learner characteristics that determine the extent to which the learners are able to deal with the stress-inducing factors that interfere with their language learning and use in both natural and academic settings (Skaalvik & Skaalvik, 2018).

SRLI constitutes one of these affective factors and determines the learners' language learning management capability (Zee & Koomen, 2016). It refers to the language learners' capability to set specific and achievable learning objectives, to monitor progress in a constant way, and to develop and implement efficacious strategies for dealing with areas for improvement (Billett et al., 2022). Considering these discussions, Tseng et al. (2017) developed a model of SRLI and itemized its sub-components including *awareness*, *boredom*, *goal*, and *emotion*. They explained that, awareness refers to the language learners' cognizance of their need to take the responsibility for learning the various aspects of the target language. Additionally, boredom refers to the learners' ability to prevent their negative emotions from reducing their interest in language learning. Moreover, goal encompasses the learners' capability to set realistic and achievable learning objectives in their academic settings. Finally, emotion determines the extent to which the learners take advantage of their positive feelings to facilitate their language acquisition.

In addition to SRLI, learners' FLE has attracted considerable attention in recent years (Derakhshan et al., 2022). FLE refers to the positive emotions and feelings that the learners experience in the process of language acquisition (Derakhshan et al., 2022). It determines the extent to which learners' pleasurable language acquisition experiences influence their motivation, learning persistence, and goal attainment (Zee & Koomen, 2016). Considering the significant role of FLE in language learners' language learning success, Dewaele and MacIntyre (2014) developed a model of this construct. In this model, Dewaele and MacIntyre (2014) itemized three sub-components of FLE including *personal enjoyment*, *social enjoyment*, and *teacher appreciation*. They explained that, personal enjoyment refers to the learners' satisfaction with their ability to use the target language effectively. Moreover, social enjoyment determines the learners' pleasure that stems from their effective communication with the other users of the second language. Lastly, teacher appreciation refers to the learners' satisfaction with their teacher's positive feedback in the context of their classes.

Lastly, learners' LE has been one of the extensively examined learner factors (Federici & Skaalvik, 2012). LE determines the degree to which language learners are actively involved in learning the second language in their academic settings. This construct determines the learners' overall attitude towards the diverse factors in language acquisition including the learning settings, the instructional methodology, materials, tasks, and peers among the others (Federici & Skaalvik, 2012).

It has been argued that language learners' LE is likely to influence a number of the other affective factors including their motivation for learning the target language, autonomy, and language learning attitudes among the others (Dewaele & MacIntyre, 2014). In light of these discussions, Eerdemutu et al. (2024) developed a model of the learners' LE and particularized three underlying sub-components of this construct including *emotional engagement*, *cognitive engagement*, and *behavioral engagement*. As they explained, emotional engagement refers to the learners' positive emotions about language learning that enhance their engagement with the learning tasks. In addition, cognitive engagement determines the degree to which the learners make mental efforts in order to understand different aspects of the second language. Lastly, behavioral engagement specifies the learners' learning behaviors including their interaction with peers and completion of tasks that facilitate the acquisition of the target language.

Method

Design

In this study, the researchers used the explanatory sequential mixed-methods design to conduct the study. Creswell (2009) stated that in this design the researchers gather data on the examined variables at two stages including the quantitative stage and the qualitative stage. As he pointed out, the qualitative data of the study are used to explain the quantitative results. Accordingly, in this study, the researchers used reliable questionnaires to gather quantitative data on the effects of Duolingo-informed language instruction (i.e. independent variable) on the EFL learners' SRL, FLE, and LE (i.e. dependent variables). Moreover, they used the semi-structured interview protocol to gather qualitative data on these learners' perspectives on Duolingo-informed language instruction and to explain the quantitative results.

Participants

In light of the objective, the researchers used convenience sampling to select the participants from among 346 language learners from a language institute in Urmia (Iran). Accordingly, they selected 50 intermediate-level male EFL learners in two intact classes of the relevant institute and obtained their written informed consent. Allan's (2004) Oxford Placement Test was used to determine these learners' proficiency level. These learners were native speakers of Azeri (26), Kurdish (14), or Persian (10) and ranged in age from 16 to 23. They had attended the general English courses of the relevant institute for two years.

Instruments

The researchers used the following materials and instruments in the process of data collection:

Proficiency Test

In order to select the participants and to ensure their homogeneity, the researchers used Allan's (2004) Oxford Placement Test (OPT). This test encompasses three sections including vocabulary (20 items), grammar (20 items), and cloze test (20 items). To ensure the reliability of

this test, the researchers conducted a pilot study (with 20 male intermediate-level learners) and used Cronbach's Alpha (α) measure. The results of analysis indicated that the test was satisfactorily reliable ($\alpha=.85$) and could be used in the study.

Self-Regulated Language Learning (SRL) Questionnaire

The researchers used Tseng et al.'s (2017) SRL questionnaire as the SRL pretest and posttest. This questionnaire encompasses 20 Likert-scale items. The items are rated on a four-point scale and address the sub-components of SRL including *awareness, boredom, goal, and emotion*. The reliability analysis indicated the acceptable reliability ($\alpha=.81$) of this instrument in Iranian EFL context. Moreover, the Confirmatory Factor Analysis (CFA) results showed that its validity index (.85) was satisfactory.

Foreign Language Enjoyment (FLE) Questionnaire

The researchers took advantage of Dewaele and MacIntyre's (2014) FLE questionnaire to examine the participants' FLE before and after the treatment sessions of the study. This questionnaire encompasses 21 items that are rated on a five-point Likert scale. The relevant items focus on three main sub-components of FLE including *personal enjoyment, social enjoyment, and teacher appreciation*. Based on the results, this instrument was satisfactorily reliable ($\alpha=.87$) and valid (.89) and could be used in Iranian context.

Language Engagement (LE) Questionnaire

The researchers utilized Eerdemutu et al.'s (2024) LE questionnaire as the LE pretest and posttest. This questionnaire comprises nine items that scrutinize three main sub-components of LE including *emotional, cognitive, and behavioral* engagement. The pertinent items are rated on a five-point Likert-scale scale. On the basis of the results of analysis, the reliability index of this questionnaire ($\alpha=.87$) and its validity index (.88) were acceptable in the context of the present study.

Semi-Structured Interview Protocol

The researchers used the related literature in order to develop a three-item semi-structured interview protocol to determine the participants' perspectives on Duolingo-informed language instruction in their courses. To ensure the content validity of this instrument, the researchers provided six professors of Applied Linguistics at two universities in Urmia with its items, revised the relevant items in light of the professors' feedback and comments, and developed the final version of the interview protocol.

Data Collection Procedure

In the present study, first, the researchers used convenience sampling to select 50 intermediate-level male EFL in two intact classes (i.e. 25 learners in each class) of a language institute in Urmia based on their results on Allan's (2004) OPT. Moreover, they assigned one of these classes to the experimental groups or the Duolingo Group (DG) and the other to the Control Group (CG). Second, they administered the SRL, FLE, and LE pretests of the study to both of the groups in order to ensure their homogeneity in terms of these affective factors before the beginning of the treatment.

Third, the researchers provided DG with Duolingo-informed treatment in 16 sessions in an eight-week period (i.e. two sessions per week). More specifically, they prompted the learners to install Duolingo on their mobile phones, and provided them with detailed information about the structure of its courses and units along with the characteristics of its interface. Moreover, they

prompted the learners to use their background information and to engage in meaningful interaction with the application to complete their tasks. Additionally, the researchers encouraged the learners to complete different vocabulary tasks of this application including the translation, matching words to pictures, fill-in-the-blanks, and scrambled word tasks in a systematic and step-wise way. Moreover, the researchers engaged the learners in DG in story engagement task that facilitated their use of the relevant vocabulary items in follow-up discussions. Lastly, the researchers promoted the learners to complete summary writing tasks in which the learners had to use their learned vocabulary items to summarize the content of the Duolingo podcasts. In each of the treatment sessions, the researchers used peer review sessions to enable the learners to assess their peers' vocabulary performance and to provide each other with formative feedback. Nonetheless, CG was not provided with Duolingo-informed vocabulary teaching. In this group, the researchers provided the learners with the lists of the relevant vocabulary items and explained their meanings using different strategies.

Fourth, the researchers administered the SRL, FLE, and LE posttests to DG and CG in order to examine the efficacy of Duolingo-informed treatment of the study. Fifth, the researchers used the semi-structured interview protocol to conduct 30-minute Farsi interviews with 15 participants in DG (based on data saturation principle) and recorded the interview sessions in order to determine their perspectives on the treatment of the study. Finally, the researchers used SPSS version 25 and thematic analysis to analyze the quantitative data and the qualitative data respectively.

Data Analysis

At the quantitative phase, the researchers used descriptive statistics including Mean and Standard Deviation to explain the central tendency and dispersion of the data (Pallant, 2020). Moreover, they used independent-samples t-test, paired-samples t-test, and MANOVA test as the inferential statistics to answer the first research question of the study.

In addition, at the qualitative phase, first, the researchers familiarized themselves with the data by reading the interview transcripts many times. Second, they identified the patterns in the data and determined the codes. Third, they integrated the related codes with each other and determined the themes of the study (Creswell, 2009). In order to ensure the inter-rater reliability, the researchers used Cohen's kappa measure. The results of the analysis showed that this measure (.85) was satisfactory and indicated the reliability of the qualitative data analysis.

Results

Quantitative Results

In order to analyze the data, first, the researchers examined the data characteristics. The preliminary analysis showed that the data were compatible with parametric test assumptions since they were independently gathered data that were normally distributed based on the results of Kolmogorov–Smirnov and Shapiro–Wilk normality tests. Table 1 and Table 2 show the results of these tests for DG and CG respectively:

Table 1
Tests of Normality of Performances of DG on Pretests and Posttests

	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
SRLL Pretest	.151	25	.376	.876	25	.522
SRLL Posttest	.187	25	.437	.956	25	.465
FLE Pretest	.122	25	.345	.865	25	.365
FLE Posttest	.127	25	.256	.943	25	.376
LE Pretest	.165	25	.342	.954	25	.464
LE posttest	.176	25	.228	.846	25	.546

Table 2
Tests of Normality of Performances of CG on Pretests and Posttests

	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
SRLL Pretest	.178	25	.234	.983	25	.256
SRLL Posttest	.154	25	.498	.822	25	.376
FLE Pretest	.136	25	.436	.985	25	.435
FLE Posttest	.176	25	.467	.865	25	.325
LE Pretest	.125	25	.382	.922	25	.278
LE posttest	.167	25	.436	.984	25	.435

As shown in Table 1 and Table 2, all of the data on the pretests and posttest were normally distributed ($p > .05$). Accordingly, the researchers used independent samples-test, paired-samples t-test, and MANOVA test in order to perform the data analysis. Before analyzing the data, it was necessary to ensure the homogeneity of DG and CG in regard to their pretest performances. Table 3 shows the descriptive statistics on the SRLL pretest performances of these groups:

Table 3

Descriptive Statistics on SRLL Pretest

Groups	N	M	SD	SEM
DG	25	44.76	8.987	1.797
CG	25	46.40	4.743	.949

Table 4 provides the results of the independent-samples t-test of the SRLL pretest:

Table 4

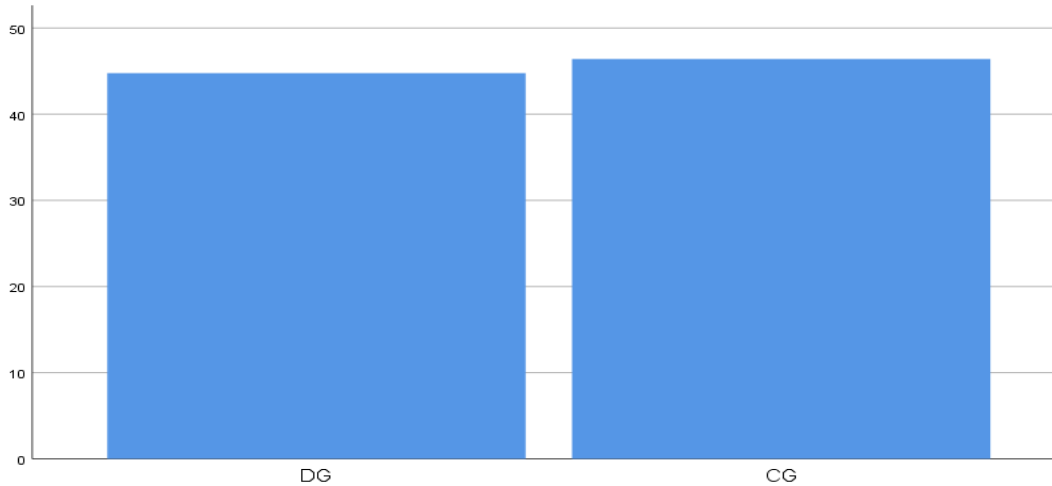
Independent Samples t-test of SRLL Pretest

		Levene's Test		t-test		95% CI				
		F	Sig.	t	df	Sig. (2-tailed)	MD	SED	Lower	Upper
Equal variances assumed		.278	.601	-.807	48	.424	-1.640	2.032	-5.727	2.447
Equal variances not assumed				-.807	36.408	.425	-1.640	2.032	-5.760	2.480

As shown in Table 4, DG and CG were homogeneous in regard to their SRLL pretest results ($p > .05$). Figure 1 shows these results:

Figure 1

SRLL Pretest Performances of DG and CG



In addition, Table 5 provides the descriptive statistics on the FLE pretest results of DG and CG:

Table 5

Descriptive Statistics on FLE Pretest

Groups	N	M	SD	SEM
DG	25	58.76	2.818	.564
CG	25	57.92	3.415	.683

Table 6 provides the results of the independent-samples t-test of the FLE pretest:

Table 6

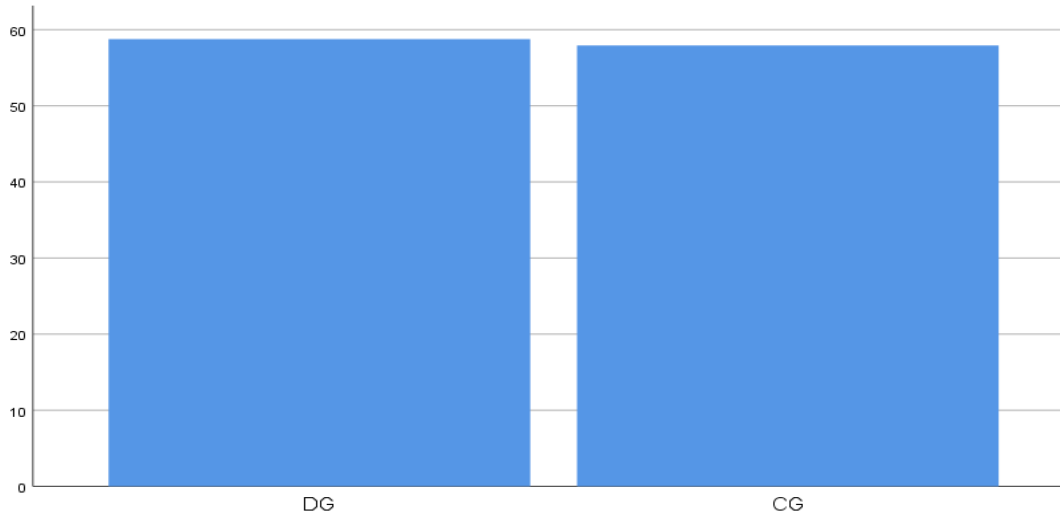
Independent Samples t-test of FLE Pretest

	Levene's Test		t-test		Sig. (2-tailed)	MD	SED	95% CI	
	F	Sig.	t	df				Lower	Upper
Equal variances assumed	variances.484	.490	.949	48	.348	.840	.885	-.940	2.620
Equal variances not assumed			.949	46.331	.348	.840	.885	-.942	2.622

According to Table 6, the groups were homogenous regarding their FLE pretest results ($p > .05$). Figure 2 illustrates these results:

Figure 2

FLE Pretest Performances of DG and CG



Additionally, Table 7 indicates the descriptive statistics on the LE pretest results of DG and CG:

Table 7

Descriptive Statistics on LE Pretest

Groups	N	M	SD	SEM
DG	25	24.20	2.255	.451
CG	25	24.76	2.847	.569

Table 8 shows the results of the independent-samples t-test of the LE pretest:

Table 8

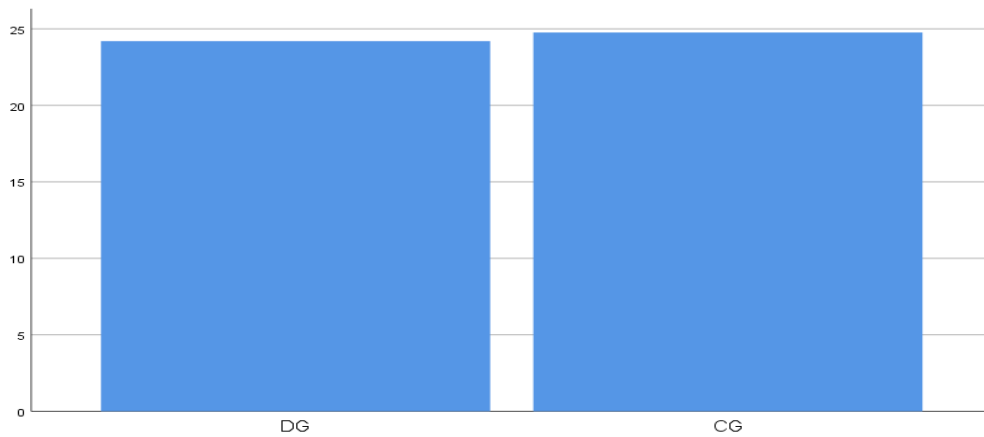
Independent Samples t-test of LE Pretest

	Levene's Test		t-test		Sig. (2-tailed)	MD	SED	95% CI	
	F	Sig.	t	df				Lower	Upper
Equal variances assumed	2.242	.141	-.771	48	.445	-.560	.726	-2.020	.900
Equal variances not assumed			-.771	45.604	.445	-.560	.726	-2.022	.902

As shown in Table 8, the groups were homogenous in regard to their LE pretest results ($p > .05$). Figure 3 shows the relevant results:

Figure 3

LE Pretest Performances of DG and CG



Considering the above-mentioned results, the researchers analyzed the data to answer the questions. The following section answers the questions based on the results of analysis:

The first research question focused on the effects of Duolingo-informed language instruction on EFL learners' SRL, FLE, and LE. Based on the aim of this question the researchers compared the pretest and posttest performances of DG. Table 9 shows these results:

Table 9

Descriptive Statistics on Pretest and Posttest Results of DG

		M	N	SD	SEM
Pair 1	SRL Pretest	44.76	25	8.987	1.797
	SRL Posttest	67.28	25	2.590	.518
Pair 2	FLE Pretest	58.76	25	2.818	.564
	FLE Posttest	88.24	25	3.032	.606
Pair 3	LE Pretest	24.20	25	2.255	.451
	LE Posttest	35.44	25	1.635	.327
Pair 4	WTC Pretest	158.88	25	5.061	1.012
	WTC Posttest	231.68	25	7.819	1.564
Pair 5	FLCA Pretest	95.04	25	2.937	.587
	FLCA Posttest	46.52	25	1.358	.272

Table 10 provides the results of the paired-samples t-tests of the pretest and posttest results of DG:

Table 10

Paired-Samples t-test of the Pretest and Posttest Results of DG

Paired Differences	t	df
--------------------	---	----

	M	SD	SEM	95% CI		Sig. (2-tailed)	
				Lower	Upper		
Pair 1	SRLL Pretest--22.5208780		1.756	-26.144	-18.896	-12.82424	.000
	Posttest						
Pair 2	FLE Pretest--29.4804771		.954	-31.449	-27.511	-30.89724	.000
	Posttest						
Pair 3	LE Pretest--11.2402728		.546	-12.366	-10.114	-20.60424	.000
	Posttest						

According to Table 10, there were significant differences between the results of DG on the pretests and posttests ($p < .05$).

Finally, the researchers used MANOVA to ensure that the improvements in the SRLL, FLE, and LE, of the learners in DG stemmed from Duolingo-informed treatment of the study. Table 11 provides the results of multivariate tests:

Table 11

Results of Multivariate Tests

Effect	Value	F	Hypothesis df	Error df	Sig.	
Groups	Pillai's Trace	.996	2156.562 ^b	5.000	44.000	.000
	Wilks' Lambda	.004	2156.562 ^b	5.000	44.000	.000
	Hotelling's Trace	245.064	2156.562 ^b	5.000	44.000	.000
	Roy's Largest Root	245.064	2156.562 ^b	5.000	44.000	.000

According to the results of Wilks' Lambda multivariate test in Table 11, there were significant differences between the posttest performances of DG and CG ($p < .05$). As a result, the researchers examined the results of the tests of between-subjects effects. Table 12 shows these results:

Table 12

Results of Tests of Between-Subjects Effects

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.
Groups	SRLL Posttest	4195.280	1	4195.280	538.432	.000
	FLE Posttest	8738.420	1	8738.420	790.569	.000
	LE Posttest	1200.500	1	1200.500	69.601	.000

As shown in Table 12, the results of DG on SRLL, FLE, and LE posttests were significantly better than that of CG ($p < .05$). Figure 4, Figure 5, and Figure 6 show these results:

Figure 4

SRLL Posttest Performances of DG and CG

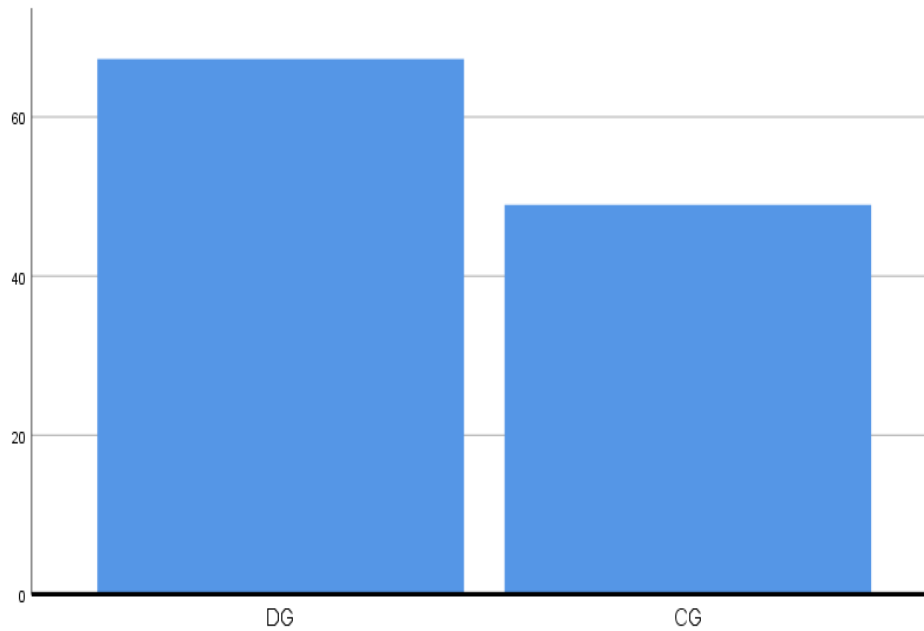


Figure 5

FLE Posttest Performances of DG and CG

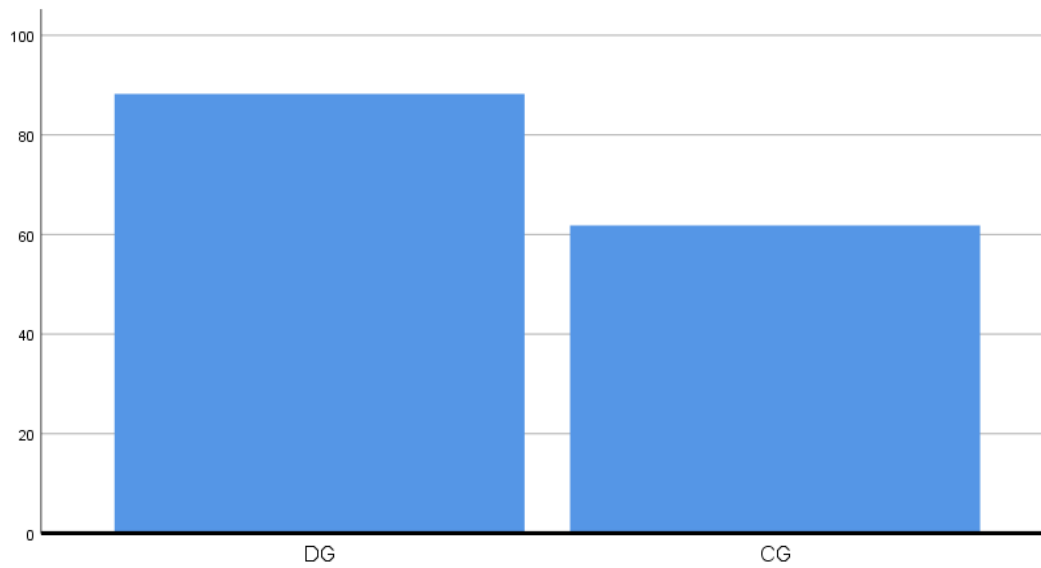
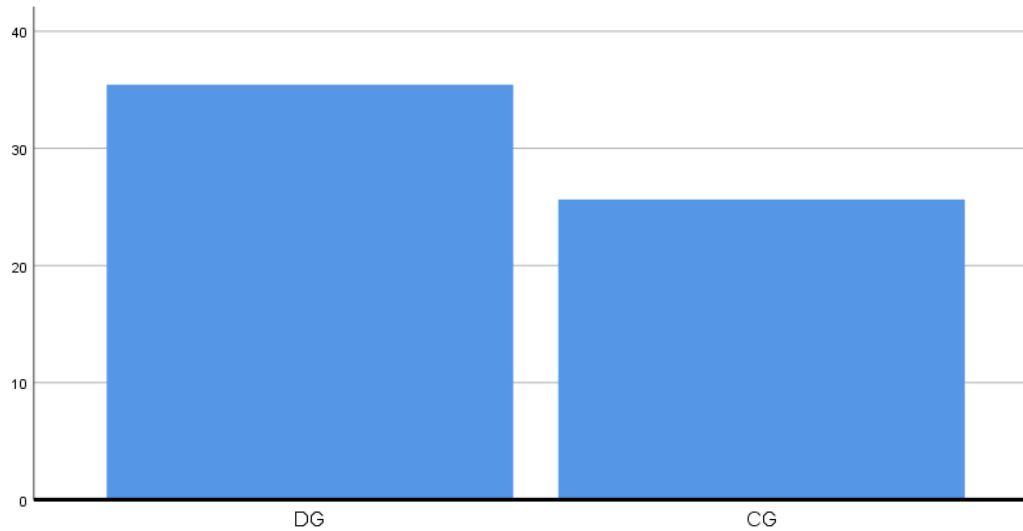


Figure 6

LE Posttest Performances of DG and CG



Qualitative Results

The researchers used thematic analysis in order to determine the codes and the themes in the obtained interview data on EFL learners’ perspectives on Duolingo-informed language instruction. Table 13 provides the relevant findings:

Table 13

Codes and Themes in the Data on DG

Codes	Themes
Realizing the responsibility to determine learning goals	Amelioration of language learning management
Developing and implementing learning plans	
Evaluating progress in light of objectives	
Understanding the significance of language learning	Development of positive attitudes towards language acquisition
Being excited to use the target language in communication	
Enjoying exposure to the target language on various media	
Understanding task requirements	Improvements to language task performance
Managing time effectively	
Focusing on the task stages	

According to Table 13, the first theme in the data was *amelioration of language learning management*. Twelve of the learners in DG stated that Duolingo-informed language instruction improved their ability to manage their acquisition of the target language. In this regard, participant 6 noted that:

“The tasks were developed in a user-friendly way and made me realize that I was the person who made the decisions about language learning. My access to the tasks and learning materials and the useful instructions about task performance on the application helped me to learn different words and enabled me to determine the effectiveness of my learning during our course”.

In addition, the second theme in the data was *development of positive attitudes towards language acquisition*. Ten of the participants noted that Duolingo-informed language instruction had a positive impact on their perspectives on the learning of the second language. Regarding this theme, participant 3 stated that:

“I was able to use the language in an effective way when I engaged with the tasks of the application. The positive results of my endeavors made me aware of the fact that I could learn the language like the other students. As a result, I was motivated to follow my language studies more energetically”.

Lastly, the third theme in the data was *improvements to language task performance*. Eleven of the participants noted that Duolingo-informed language instruction had beneficial effects on their performance of language tasks. In this regard, participant 14 noted that:

“The application helped me to understand that our tasks had to be completed in a systematic and step-wise way. I followed the instructions and completed the task stages in a row to perform them in an effective way”.

Discussion

Research question one of the study examined the effects of Duolingo-informed language instruction on Iranian EFL learners' SRL, FLE, and LE. The results indicated that this approach to language teaching significantly ameliorated the learners' SRL, FLE, and LE in their classes.

Regarding SRL, the results are in line with the results of Xiangying et al. (2021), and Yu (2022). Xiangying et al. (2021) argued that in their study Duolingo-informed language teaching was effective for improving the learners' ability to manage their language acquisition since it personalized the learning process for them. As they explained, the adaptive algorithm of this application tailored the content to the learners' needs, made them aware of the areas for improvement, and helped them to take control over their language learning. Likewise, Yu (2022) stated that the effectiveness of Duolingo in his study was related to its gamified features. As he explained, these features that involved points, levels, and awards among the others motivated the learners to set personal learning goals and to track their progress effectively. Therefore, it can be argued that in the present study, Duolingo-informed language teaching ameliorated the learners' SRL due mainly to the fact that it involved gamified features and personalized the learners' language acquisition.

Moreover, regarding FLE, the results corroborate the result of Perez (2020), and Li and Bonk (2023). Perez (2020) noted that Duolingo had a positive effect on his participants' FLE owing to the fact that it encompassed interactive and engaging content. As he explained, the engaging tasks of this application along with its colorful graphics and interesting narratives kept

the learners' language acquisition experience fresh and enjoyable and prompted them to explore language more deeply. Similarly, Li and Bonk (2023) attributed the utility of this application to its social features. According to them, these features involved clubs and forums that facilitated the learners' connection with their peers, fostered their sense of community, established a supportive learning environment in which learners shared their experience with others, and improved their task performance enjoyment. In light of these discussions, it can be averred that in this study, the positive effect of Duolingo on the learners' FLE stemmed from its interactive content and its social features.

Finally, in regard to LE, the results support the results of Ajisoko (2020), and Fadda and Alaudan (2020). Ajisoko (2020) noted that in his study, Duolingo significantly ameliorated the learners' LE since it was compatible with learners' various learning styles. According to him, the variety of the tasks in this application enabled the learners with different learning styles to study the language without suffering from monotony and improved their LE. Moreover, Fadda and Alaudan (2020) argued that the efficacy of this application was related to the structured progression of language learning in its tasks. They explained that, the progression system of Duolingo helped the learners to develop language skills in a step-wise way, facilitated their achievement of their objectives, and engaged them in their tasks. Consequently, it can be stated that in the present study, Duolingo was effective in improving the learners' LE since it was congruent with their different learning styles and facilitated and expedited their structured language learning.

Research question two of the study examined the EFL learners' perspectives on Duolingo-informed language instruction. The findings indicated that most of the learners had positive perspectives on this approach and believed that it improved their language learning management, enabled them to adopt positive attitudes towards language learning, and facilitated their task performance. In general, these findings support the findings of Liu et al. (2016), and Li and O'Rourke (2022). Liu et al. (2016) noted that in their study the learners had favorable attitudes towards this application owing to the fact that it had a low-stakes environment. According to them, the interface of this application enabled the learners to practice their language skills without the fear of failure or judgment, encouraged their experimentation with the target language, and improved their attitudes towards it. Likewise, Li and O'Rourke (2022) stated that their learners had positive views about this application due mainly to its accessibility and convenience. As they explained, this application was accessible to learners anytime and anywhere, allowed the learners to fit language practice to their busy schedule, and enhanced their language learning experiences. Therefore, it can be argued that in the present study, the participants had positive perspectives on Duolingo-informed language instruction owing to its lo-stakes language learning experiences and its accessibility and convenience.

Conclusion

The present study strived to determine the extent to which Duolingo-informed language instruction influenced Iranian EFL learners' SRL, FLE, and LE. In addition, it made an effort to determine these learners' perspectives on this approach to language teaching. The obtained results indicated that this approach had significant positive effects on the participants' SRL, FLE, and LE. In addition, most of the participants had favorable views about it in their academic setting.

Based on the results, it can be argued that EFL teacher education course-developers should provide the teacher educators with the opportunity to attend empowerment courses that provide

them with information about state-of-the-art technological advancements in language teaching including Duolingo and help them to include the discussions of these developments in their courses. In addition, the results underline the need for the inclusion of a technology-based module in the content of the current teacher education courses. This module has to make the language teachers cognizant of the significant role of language teaching applications including Duolingo in the amelioration of the learners' affective factors including their SRL, FLE, and LE. Additionally, it has to enable them to put these applications into practice in their language classes in an effective way.

Additionally, it can be stated that EFL syllabus designers need to develop local applications in Iranian context that are similar to Duolingo and are likely to facilitate the learners' language acquisition and to ameliorate their affective factors including their SRL, FLE, and LE. These applications are likely to enhance the effectiveness of the traditional language courses in Iranian context and to expedite the process of teachers' language instruction. In addition, the syllabus designers need to include specific Duolingo-based language tasks in the EFL instructional materials in order to enable the learners to practice their language skills in a low-stakes environment without the fear of their peers' negative judgments. These tasks can personalize the learners' development of various language skills and aspects in their language classes.

Lastly, the obtained results of the study highlighted the fact that EFL teachers should take advantage of language teaching applications including Duolingo to improve their learners' language acquisition and affective factors. To this end, teachers can integrate specific Duolingo-based tasks into their classes that help the learners to take control over their language learning process and provide them with an enjoyable learning experience. The relevant tasks are likely to ameliorate the learners' attention to various formal aspects of the target language and may help them to cast aside their language learning inhibitions in the process of language learning.

This study suffered from two main limitations since the researchers could not use random sampling and random participant assignment to the groups of the study. Moreover, they were not able to determine the effects of learners' personal attributes such as their age on the results.

In addition, the study had two main delimitations owing to the fact that the researchers focused on language institute settings and did not examine the efficacy of Duolingo-informed language teaching in the other settings. In addition, they examined the impacts of Duolingo-based language teaching on the EFL learners' SRL, FLE, and LE without dealing with the other learner factors.

The future studies need to deal with the above-mentioned limitations and delimitations. In addition, they should involve larger samples and should take advantage of other data collection techniques such as questionnaires to delve more deeply into the learners' perspectives on Duolingo-based language teaching. Additionally, these studies have to examine the efficacy of this application for improving both language skills and affective factors that were not examined in this study. Finally, the relevant studies should be carried out in both second and foreign language learning contexts.

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