Towards More Effective App-Assisted Language Learning: The Essential Content and Design Features of Educational Applications

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Abstract

While the use of apps specifically designed for language learning has witnessed a surge over the past decade, research on the productivity of these apps for language learning purposes along with their essential design and content features from students' lens remains scant. The present paper illustrates an attempt to explore the way using language learning apps throughout an academic semester develops university-level students' semi-technical English language knowledge and the features and qualities they find essential in these educational apps. Drawing on empirical data obtained from pre- and post-tests and App Feature Interview form, it was observed that students who used language learning apps had a significantly better performance in a semi-technical English language post-test compared to the students who did not use language learning apps of their choice. Following content analysis, participants' responses to an interview question were explored to determine the qualities they found crucial for language learning apps. Students highlighted 18 qualities, which were categorized under three main themes: smartphone, pedagogical content, and design features, as required for effective language learning apps. The findings of this study provide insights for educational app designers and educators on what works better in these apps from users' perspective.

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INTRODUCTION

With more affordable prices, improved wireless connections, increased data storage capacity, larger screen-size with better resolution, and more compatible operating systems (Naismith et al., 2004); the use of smartphones has rapidly grown over the past decade. Just as smartphones become a part of everyday social/personal life of an increasing number of individuals including university students, there is a growing expectation to witness the widespread integration of these devices and related technologies such as educational apps into students' learning (Morris et al., 2016).

Different apps are being designed and introduced to the market for different purposes including language learning. In line with such growth, the pace of learner engagement with and use of these apps has increased (see Huang et al., 2012; Ng & Nicholas, 2012). Consistent with Beetham and Sharpe's (2013) argument regarding the essence of well-designed pedagogies and approaches for enhancing student achievement, it is suggested that effective app-assisted language learning requires well-designed software apps that aim at improving users' academic achievement. This necessitates the development of a solid knowledge-base on the essential features of such apps (Huang et al., 2012).

Mobile assisted language learning (MALL) research; however, has predominantly focused on teacher- or researcher-led intervention studies that investigate the effectiveness of a particular mobile learning course or system in formal classroom settings (Ma, 2017). Studies that systematically explore the required features of language learning apps and/or students' choice of them remain largely scant (e.g., Ahn & Lee, 2016; Cavus & Ibrahim, 2017; Moroz, 2013; Steel, 2012). Considering the relative newness of app-assisted language learning, Moroz (2013) believes, this scarcity appears natural. Given that exploring the quality of educational materials and technologies used for teaching/learning purposes in different contexts is essential (Economides 2008) and considering the determining role users play in the sustainability of technology-assisted education, exploring the

effective design and content features of language learning apps from their lens appears crucial.

To shed more light on this evolving research base, the productivity of app-assisted language learning was explored drawing on pre- and post-test results obtained from 450 non-English major students at Amirkabir University of Technology. Additionally, the characteristics of an effective language learning app were explored from the perspective of a total of 241 undergraduate students, from 15 general English (GE) courses, based on their experience of using several apps during an educational semester. This study is grounded on the concepts of mediation in sociocultural theory (Donato & McCormick, 1994; Lantolf & Throne, 2007) and situatedness in situated cognition (Hung & Chen, 2001). The findings of the study offer useful insights and implications for the design and development of smartphone apps for language learning purposes.

LITERATURE REVIEW

Theoretical Groundings

The term mobile device, which encompasses any portable tool carried and used on the move, is commonly applied to palmtop devices such as tablets and smartphones in MALL research (see Kukulska-Hulme & Shield, 2008; Sandberg, Maris, & de Geus, 2011). While the uptake of mobile phones for educational purposes has been a gradual phenomenon, the development of smart devices, as "the fastest growing technology in hi-tech industry" (Hsu 2013, p. 198), with design features and functionalities far beyond early mobile devices has significantly increased the pace of this uptake (Moroz, 2013).

Today, smartphones have moved beyond the conventional functionalities of text messaging by offering a wider range of multimedia potentials (Cavus & Ibrahim, 2017). These features coupled with the possibility of having access to a wider range of resources (Kukulska-Hulme & Shield, 2008) and authentic information and content turn these ubiquitous

devices into apt technologies for language learning support and development (Chung, Chen, & Kuo, 2015; also Ganapathy, Shuib, & Azizan, 2016; Hsu, 2013).

As Ma (2017) notes, emerging mobile devices and technologies can act as mediating tools in the process of language learning. Mediation plays a determining role in knowledge construction (Donato & McCormick, 1994). The sociocultural theory highlights the mediating roles of the activities, artifacts, and tools that surround a language in human mind functioning and language production (see Lantolf & Throne, 2007; Ma, 2017). As social artifacts, smartphones can play this mediating role between the individual who aims at learning a language and the peers or the environment by means of particular activities and/or the content designed for educational apps which extend the learning experience beyond the confines of the physical classroom and provide opportunities for personalized learning.

Additionally, by situating language and activities in authentic real-world contexts, language learning apps operationalize situated learning (Godwin-Jones, 2017). The concept of situatedness in situated cognition suggests that learners can be expected to develop both implicit and explicit understanding of their learning experience is situated in socially productive activities and rich contexts (Hung & Chen, 2001). Getting engaged with situated activities using smartphone apps, users can be involved in a process of learner-driven, lifelong, situated learning (Comas-Quinn et al., 2009).

Smartphone Apps and Second/Foreign Language Learning

As a combination of computer and phone technologies that embrace almost all capacities of laptops, smartphones are considered superior to the earlier versions of cellular phones particularly for learning purposes (Sad & Göktas, 2014). While battery, smaller screen size compared to other mobile devices, and storage capacity remain significant issues to be addressed (Cavus & Ibrahim, 2017), their portability and ubiquity make them convenient for any-time, any-place learning (Dashtestani, 2016). These

qualities not only facilitate students' exposure to the language they are trying to learn but also help busy learners better fit their learning experience into their lives (Steel, 2012; also Economides, 2008) or personalize their learning experience (Dashtestani, 2016). Furthermore, the possibility of accessing language learning resources beyond time/place restrictions enables students to draw on a wider variety of information sources (Ng & Nicholas, 2012) based on their learning needs (Ganapathy et al., 2016).

The growing consensus on the potential of smartphones for supporting language learning has promoted the use of software apps (Ahn & Lee, 2016; Moroz, 2013). The pace, with which new apps with different learning objectives emerge justifies this argument (Sad & Göktas, 2014). The term *app* stands for application software – accessible in online app stores – designed for smartphones and tablets (Gangaiamaran & Pasupathi, 2017). The smartphone app, in this study, refers to an educational app designed for learning/teaching one or more language skills.

Whether as supplementary to textbooks or as standalone materials for self-learning, a language learning app should entail a *variety of quality* features to be effective. As Morita (2003) puts, mobile-assisted learning is inherently different from other modes of technology-enhanced learning in that it requires materials and content carefully designed for learning on-the-move in spare-time. When effectively designed, language learning apps situate users in a structured environment for meaningful learning beyond the confines of the classroom (Sandberg et al., 2011). Hence, ensuring that app content is appropriately designed to satisfy students' learning needs is of prime significance. As Moroz (2013) states, "with more research on features of these apps and how they can be effective for language learning, better apps will become available for students to use" (p. 76).

Language Learning Apps

Focusing on MALL studies published in peer-reviewed journals and conference proceedings, Kukulska-Hulme and Shield (2008) identified two

main research strands: content-based studies emphasizing learning tasks/materials usually developed for formal language learning contexts and those focusing on research design issues. More than a decade later, a careful review of MALL research brings a more or less similar focus to the forefront. These mostly quasi/experimental teacher-driven projects (Ganapathy et al., 2016), which are predominantly exploring the pedagogical effectiveness of palm-held devices and laptops and/or students' and educators' perception, "might not be revealing facts in an all-sided way" (Ma, 2017, p. 3).

The rapid pace of development and use of language learning apps over the past few years has increased researchers' consensus on the essence of gaining more insights into the design of these apps. However, as it is usually the case with any evolving field, few systematic and empirical attempts have been made to explore the educational value of smartphone apps for language learning (e.g., Ahn & Lee, 2016; Cavus & Ibrahim, 2017; Moroz, 2013; Steel, 2012). Even fewer are non-intervention studies on students' choice of language learning apps and their viewpoints of the essential qualities of such apps (e.g., Ganapathy et al., 2016).

Focusing on 134 language learners' out-of-class mobile app use, Steel (2012) observed that, of different language skills, mobile apps appeared more beneficial for vocabulary, reading, writing, grammar, and translation practice. Moroz (2013) explored students' awareness of Japanese apps and their useful features. The most widely downloaded apps by students in Moroz's study were dictionaries. Moroz (2013) concluded that no app encompassed all the features addressed by the students. In another study, Ahn and Lee (2016) investigated Korean middle-school students' experience of using an app with speech recognition capacity for improving English speaking proficiency. Their participants were positive about the app in general and the speech recognition feature in particular for authentic speaking practice.

Exploring the usability of a grammar app, Ganapathy et al. (2016) observed that students considered user-friendliness and ease of use,

usefulness for learning, effectiveness for achieving the desired outcome, anytime anyplace access, and the fun element as five essential features of an effective app. Ganapathy et al. (2016) highlighted the need for a more detailed look into the apps designed for language learning. Cavus and Ibrahim (2017) reported the development of an interactive Android mobile phone app with speech recognition capacity for teaching English using children's stories. Exploring the effectiveness of this app for learning vocabulary, pronunciation, listening, and comprehension, Cavus and Ibrahim (2017) observed a significant change in the experimental group's English language skills, namely pronunciation, compared to the control group.

A careful look into research on language learning app design and use in Iran brings a similar concern for more empirical data and a systematic look into the essential content and design features of language learning apps to the forefront. Over the past decade; for instance, there has been tremendous growth in the number of English as a foreign language (EFL) apps designed by national information technology (IT) companies. In line with international apps, these mostly inexpensive apps are widely available to students through online global and local app stores like Google Play, Café Bazaar, and Sibche. However, there is no consolidated picture on the extent to which these technologies are benefiting users and/or which features are most valued.

PURPOSE OF THE STUDY

Consistent with Mostakhdemin-Hosseini (2009), it is suggested that evaluating the effectiveness and usability of the current mobile apps designed for learning purposes is crucial. Furthermore, considering the great extent of exposure, use, and familiarity of today's students, as digital natives, with different sophisticated personal and social apps, their viewpoints on what works well in an app and what does not is needed for the development of better educational apps. As Economides (2008) puts, the

satisfaction of students is determining for mobile learning applications and their design.

To address the abovementioned research needs, a mixed-method research design was adopted. According to Nielsen, Randall, and Christensen (2017), "mixed method in evaluation research goes beyond traditional notions of effectiveness to explore intervention acceptability, the quality of intervention implementation and the application of the intervention" (p. 5). First, the possible effectiveness of using language learning apps were explored in a pre-test/post-test (between-subject control and experimental groups) quasi-experiment by comparing the language achievement of app-using students across 15 general English courses with that of control groups' students.

Second, to gain a look into university students' viewpoints regarding the essential features of language learning apps, qualitative data obtained from their responses to interview questions were explored. Hence, the following research questions are addressed:

1. What is the effect of supplementary app-based language learning on students' language achievement, while controlling for a semi-technical English language achievement pre-test?
2. Does students' performance in the semi-technical English language achievement post-test differ based on the type of treatment provided (i.e. supplementary app-based language learning/practice vs. traditional language learning/practice)?
3. What are the essential content and design features of an effective language learning app from the perspective of students with the experience of using apps for language learning purposes?

METHOD

Participants

Students at Amirkabir University of Technology need to take a semi-

general, a general, and a technical English course throughout their four-year Bachelor of Science (BS) program. These compulsory courses mainly aim at enhancing students' knowledge of technical vocabularies (in different fields of engineering and science), reading comprehension, pronunciation, academic writing, and sometimes listening and speaking. To increase students' learning time and exposure to English beyond the classroom setting, the use of different language learning apps is usually promoted and welcomed by instructors in English courses.

The researcher who took part in the study as the courses' instructor fully explained the overall purpose of the study early at the beginning of the semester and invited students in the 15 GE courses she had during the second educational semester to take part in the study. General English courses in this university usually comprise 30 students from different majors. Of a total of 450 students, from 18 different engineering and science majors, attending these 15 semi-technical English courses, 241 students (N = 92 or 38.2% female and N = 149 or 61.8% male) who had at least one language learning app in their smartphone and used them throughout the course for supplementary language learning/practice agreed to share their viewpoints regarding the essential design features of language learning apps. The remaining 209 students (N = 88 or 42.1% female and N = 121 or 57.9% male) across the 15 courses did not use any kind of language learning app and comprised the control group.

Instrumentation

The instruments applied for addressing the first and second research questions included semi-technical English language pre- and post-tests, each comprising 50 (30 vocabulary, 8 reading comprehension, and 12 structure) multiple-choice items. The items were selected from the item bank of the Department which is created by the instructors based on the content of the instructional pamphlet. Exam items were designed and finalized through several rounds of discussions among the instructors to achieve a similar

level of difficulty.

To address the third research question, qualitative data obtained from a written semi-structured (open-end) interview question were focused on. Open-ended questions fit in studies that explore the usability of a tool or product, as they can offer fruitful information regarding the possible ways for improving that product (Albert & Tullis, 2013). Additionally, such questions enable participants to freely comment on a particular topic and help the researcher to gain an in-depth insight into learners' experience. The interview question was printed on a single sheet of paper and distributed among the participants. The paper contained a notification of consent. In addition to the introductory note, there was a Table which required the participants to name the apps they had been using throughout the semester. The rationale for collecting information about the app-types used by each learner was exploring the way using apps of different kinds might have shaped students' perspectives on the essential design and content features of language learning apps.

This was followed by the interview question which asked students to *elaborate on the qualities they find essential for a language learning app* considering their app-assisted language learning experience during the semester. As Hung (2011) notes, interviews are effective instruments for collecting data when "the researcher cannot observe participants' behaviors and other visible cues as to their feelings" (p. 740). The interview question was in Persian (participants' native language) and students could respond in Persian and/or English.

Data Collection Procedure

During the first phase of data collection, a pre-test was administered to 450 students who registered in 15 semi-technical English language courses. Throughout the first session, the instructor spent a few minutes talking about the educational potentials of smartphone apps for English learning. She also informed the students regarding three main types of language

learning apps: *the lexical apps* (e.g., Oxford Dictionary) such as dictionary and/or vocabulary learning apps which are designed for words' meaning search and vocabulary practice, *whole language apps* (e.g., Rosetta Stone) which aim at developing all language skills and sub-skills, namely reading, writing, structure, vocabulary, speaking, and listening by offering in-app multimodal instruction and exercises, and *discrete-skill apps* (e.g., Rivet) which focus on the development of one or two language skills by including instructional content and exercises.

Students were invited to select apps (depending on their language needs) and use them throughout the semester. Their choice of apps (in number and type) was not controlled for two reasons. First, considering the differences in learning styles and strategies and the learning needs of each individual, it was expected that different apps might be of use for different students. Second, it was expected that the diversity in the choice and use of apps would provide the researcher with an opportunity to obtain a more comprehensive range of content and design features in language learning apps. Only those students who identified themselves as constant users of one or more language learning apps for at least three months (for a daily average of 20-30 minutes for at least four days a week) were grouped as the experimental.

During classroom meetings, the structured use of language learning apps was welcomed. Students could use their apps to check the meaning of words or to find information about technical concepts introduced in the reading passages. The meanings and explanations were usually shared with peers.

The second phase of the study comprised interviewing the students and administering the post-test. In the final session of the 15 courses, the instructor distributed 450 interview forms among the students. Those students who had the experience of using at least one language learning app throughout the course were invited to fill in the interview form, write their responses to the interview question, and hand in the completed form on the day of the final exam. Afterward, during the same session, a semi-technical

English language post-test was administered.

Data Analysis

Of a total of 450 interview forms distributed, 241 were completed and 209 not returned, giving a response rate of 53.5% and indicating the total number of students across the 15 courses who used language learning apps throughout the semester. After discarding the missing data (i.e., forms without information on the type of apps used by the participants), 227 valid interview responses were retained for the analysis.

Table 1: Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Experimental	**Pre-test**	10.55	209	3.22	.22
	Post-test	16.41	209	2.53	.17
Control	**Pre-test**	10.79	209	2.62	.18
	Post-test	15.17	209	3.03	.20

During the first phase of analysis, paired sample t-test results were used to check the homogeneity of the control and experimental groups and also to explore the effect of supplementary app-based language learning on students' language achievement. The 209 students who did not use language learning apps were grouped as the control. Of the 227 students with valid interview responses, 209 were randomly selected and assigned to the experimental group (see Tables 1 & 2).

Table 2: Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. D.	Std. Error Mean	95% Confidence Interval of the Difference				
					L.	U.			
Experimental	Pre-test-Post-test	-5.86	1.58	.10	-6.08	-5.64	-53.54	208	.00
Control	Pre-test-Post-test	-4.38	1.23	.08	-4.54	-4.21	-51.14	208	.00

Assumption testing was conducted to explore whether paired sample t-test can be used. Given that the pre- and post-test scores across the two groups were independent data rows (i.e., continuous variables) and the difference scores between the variables were normally distributed—with $p>.05$ in Shapiro-Wilk test results: .938 and .960 for the control and experimental groups, respectively—the two assumptions for conducting paired sample t-test were met.

Table 3: Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	MD	SED	95% Confidence Interval of the Difference	
									Lower	Upper
Post-tests	EVA*	7.37	.07	4.52	416	.00	1.23	.27	.69	1.77
	*EVNA			4.52	403.24	.00	1.23	.27	.69	1.77

*EVA = Equal variances assumed

*EVNA = Equal variances not assumed

To explore if the performance of students who used language learning apps throughout the course differed from that of the students who did not experience using language learning apps, an independent sample t-test was conducted on post-test results (see Table 3). The normality of distribution in the data and a p-value equal to .07 (p>.05) in Levene's test, suggesting the equality of variance, indicated that the test assumption tests were met.

To address the third research question regarding the essential content and design features of language learning apps from students' lens, their responses to the interview question were explored. First, descriptive statistics (i.e., frequency and percentage) were calculated for the apps listed under each category of app-types in the interview form. The researcher also searched and found the listed apps in online inter/national app stores (i.e., Google Play, Sibche, Café Bazaar, and App Store). The type of activities, exercises, and services offered by each app was explored (see Table 4). In what follows the overall structure and content focus of the three most frequently mentioned apps under the three categories of lexical, whole language, and discrete skill apps are discussed.

Table 4: Descriptive Statistics of App Types and Participants

App Types			Names	Freq.	%	In-App Language Learning Features
Lexical apps	Dictionary apps	Monolingual dictionaries	Longman / Webster / Oxford	330	85.05	words, phrases, and meanings (easy-to-understand definitions written using only 2000 common words) + additional corpus examples + integrated collocations dictionary + integrated Thesaurus with synonyms, antonyms, word origins and search for idioms and phrasal verbs
		Bilingual (or multilingual) dictionaries	PICoDIC / Google Translate /Blue dic / Abadis / Guya / King dic English / Persian dic / Dictionary mohandesi / Sepanta dictionary / araDic / Intelli dic / Mdict / Dictionary-lite / iFarsi / Best dic / Indic / cDic			Bilingual and/or multilingual translation (meanings for the searched items) + pronunciation feature + sample sentences + synonyms (antonyms) + parts of speech + common grammatical mistakes + favorite words bookmarking

Table 4: Continued

App Types			Names	Freq.	%	In-App Language Learning Features
Lexical apps	Dictionary apps	Vocabulary practice apps	seven tick, 1100, 504 tick, Leitner box, 504 words	27	6.95	Vocabulary learning graded lessons (beginner, elementary, intermediate, advanced) Vocabulary flashcards Use of images for faster memorization Synonyms/antonyms
		Whole Language Apps	Memrise	10	26	6.70	video clips of native speakers (listening), speaking with locals, vocabulary and dictation exercises (e.g., *Memrise*) Speaking, reading, listening and writing practice with games, vocabulary and grammar exercises (e.g., *Duolingo*)
			Duolingo	7			
			Rosetta stone	4			
			Busuu	2			
			Learn English	1			
			English phrases in Use	1			
			English to swallow	1			
		Discrete Skill Apps	100 famous stories	1	5	1.30	Audio-narrated and animated stories for *reading* and *vocabulary practice* (can be used offline)
			English listening	1			Fill in the blank, what is in the picture, listening to famous quotes, and short listening passages for *listening practice*
			English Flashcards	1			Picture, meaning, example hints for *vocabulary practice*
			English conversation	1			500 daily conversation dialogs for *speaking* and *pronunciation practice*
			Listen English Full Audio	1			Audiobooks and dictation exercises for *listening* and *writing practice*
Total				388	100.00	

Oxford Dictionary of English (ODE) was the most commonly named smartphone app listed in the interview forms. As a free lexical app, ODE features a very comprehensive vocabulary and expression database with

350,000 entries, meanings, and phrases, 75,000 audio pronunciations, advanced search tools with autocomplete features to save users' time, and enhanced speed searching and voice search possibility, and a user-friendly interface. The learning tools offered in the app move beyond merely a mere vocabulary search app to a vocabulary learning one. Users can create vocabulary learning folders through the *Favorites* option to custom their learning on a daily or weekly basis. The *Word of the Day* feature, similarly, offers meaning for less commonly known words. The free version of the app, however, contains ads and requires an Internet connection.

Memrise was amongst the most commonly listed whole language learning apps. It offers opportunities for learning 19 languages including English. Users can practice the language of their choice by chatting with a local native speaker. The app also features practice games that aim at learners' listening and vocabulary skills. The speech recognition technology helps learners improve their pronunciation. Recording their voice, users can check the accuracy of the pronunciation. One of the useful built-in features of the app is the possibility of downloading a course to be used in an offline mode. To have access to all content and courses, users need to subscribe. The app, however, offers in-app purchase possibility implying that users can have access to the content for free but need to pay for a more sophisticated and add-free version.

The most commonly listed app under the category of discrete skill was *100 Famous Stories* which is designed for listening practice. Featuring 100 classic English children's stories, the app offers audio and animated-video sections. It is not only useful and entertaining for kids but also engaging for students with limited English language proficiency. Users can watch the story completely or go through it in smaller sections to better learn the content. The words addressed in the stories along with their pronunciation can also be practiced through follow-up listening exercises.

After reviewing the features of the apps listed in the interview forms and calculating descriptive statistics (Table 4), students' responses to the interview questions were analyzed following a qualitative content analysis

strategy. The content analysis draws on a codification strategy to identify meaningful categories from a data source (Blair, 2015). Rather than imposing a priori codes, *open coding scheme* which emerged from the content (i.e., students' words and responses) was applied to grasp the focus of participants. Interview responses were re/read to identify and extract conceptually related texts which ranged from a single sentence to the whole message (Strauss & Corbin, 1998). In other words, rather than an arbitrary line by line coding in Blair's (2015) terms, chunks with the same focus were taken as related units and grouped.

Through a careful analysis of the content of the interview responses and several rounds of re/reading, seventeen codes were extracted and labeled drawing on participants' words. Once the codes were finalized, the similar ones were grouped under the same category. Of the 17 extracted codes, two (i.e., user interface and the loading speed) were grouped under one category, nine extracted units related to the essential build-in features and functionalities of a smartphone app from students' perspective were grouped, and six units with a focus on language skills addressed in an app, reliability of content, practicality of content, content comprehensiveness, content presentation, and learning evaluation were grouped (see Table 5).

Inspired by Mostakhdemin-Hosseini's (2009) categorization of mobile learning app usability factors, the three final categories were labeled as smartphones, app design, and pedagogical content features. Once the thematic units were finalized, descriptive statistics (i.e., the frequency and percentage) was calculated for each category and subcategory. Table 5 summarizes the categories, sub-categories, and related descriptive statistics. To ensure the intra-rater reliability, the process of extracting, codifying, and calculating the descriptive statistics of the thematic units was repeated after one month by the researcher. A Cronbach's alpha of .92 indicates high intra-rater reliability.

Table 5: Categories of Essential Language Learning App Features

Main categories	Sub-categories		Total Frequency		Total Percent	
Smartphone features	User interface		14	20	4.3	
	Loading speed		6			
App design features	System language	English only	11	24	5.2	
		Persian supported	13			
	User engagement	Attractive graphic	15	21	4.6	
		Fun factor	5			
		Bonus	1			21.8
	Ease of use and user-friendliness		17	17	3.7	
	Cost-effectiveness	Free or affordable	10	12	2.6	
		Add free	2			
	Updatability		10	10	2.2	
	Offline access		8	8	1.7	
	Speech recognition software		3	3	0.6	
	User inter-connectivity		3	3	0.6	
	Feedback generation and error correction		3	3	0.6	
Pedagogical content features	Language focus	Knowledge of English vocabulary	86			
		Listening skill	18			
		Knowledge of English grammar and structure	17	185	40.0	
		Speaking skill	11			
		Reading skill	9			
		Writing skill	2			73.9
		All language skills	42			
	Content presentation	Graded, sectioned, scheduled	47	91	19.6	
		Compact	10			
		Multimedia & images	34			
	Reliability of content		25	25	5.4	
	Practicality of content		23	23	5.0	
	Comprehensiveness		11	11	2.4	
	Learning evaluation and self assessment		6	6	1.3	
Total			462		100.0	

RESULTS

In what follows the results of data analyses conducted to address each of the three research questions are presented.

Research Question One

To explore the possible effect of supplementary app-based language learning on students' language achievement, the results of paired sample t-tests conducted on app-using and control groups' pre- and post-tests were focused on. As indicated in Table 2, the post-test mean scores were significantly higher in both groups compared to the pre-test scores with $t(208) = 51.14$, $p<.05$ (control group), and $t(208) = 53.54$, $p<.05$ (experimental group). This suggests the effectiveness of conventional and app-based language learning for the control and experimental groups. As shown in Table 1, there was a significant difference between the mean scores of the pre-tests (10.55 and 10.70) and post-tests (16.41 and 15.17). The findings also revealed that both groups were homogeneous at the onset of the course as the mean scores of the pre-tests were 10.79 and 10.55 for the control and experimental groups, respectively.

Research Question Two

The results of an independent sample t-test conducted on post-tests of the two groups were applied to explore the extent to which the language knowledge of the students, who used language learning apps throughout the course, differed from the control group. As indicated in Table 3, $t(209) = 4.52$, $p<.05$. A t value of 4.52 implies that the Mean Difference of 1.23 is 4.5 times larger than Std. Error of Difference of .27, suggesting a statistically significant difference in the performance of the two groups in the post-test. A review of the post-test mean scores (see Table 1) yields a similar meaning with the experimental group's mean score begin 16.41 out of a total of 20 while the mean score of the control group was 15.17, about 1.4 points less than the students who used language learning apps.

Research Question Three

As indicated in Table 4, of a total of 388 listed language learning

applications, 92% were lexical apps (i.e., 85.05% mono/bilingual dictionaries plus 6.95% vocabulary practice apps), 6.70% were apps commonly used for English language learning (i.e., 8 distinct whole language apps with *Memrise* and *Duolingo* being the most popular apps with 10 and seven users, respectively), and 1.30% related to apps used for learning particular language skills. All participants had at least one dictionary app in their smartphones.

Of a total of 462 units identified in interview responses, 341 (73.9%) focused on the content features required for the design and development of effective language learning apps. The focus of 101 (21.8%) extracted codes was on app features and the remaining 20 (4.3%) codes were about the smart device in which an app is installed.

Pedagogical content features

Comments on app content qualities focused on six areas. These included: the language focus (40.0%), content presentation (12.4%), reliability of content (5.4%), practicality of content (5.0%), content comprehensiveness (2.4%), and the assessment and evaluation possibilities in an app (1.3%).

Comments grouped under *language focus* mostly highlighted the need for apps covering vocabulary (technical, practical, and frequently used) among other skills. For instance, Nima wrote that an app should "*include the most frequent words and meanings… that are commonly used by native speakers.*" Such comments were almost always accompanied by an emphasis on the importance of "*precise pronunciation and meanings related to the word*" with correct stress patterns and sample sentences.

In addition to vocabulary, forty-two students called for apps covering all language skills: "*The available application*[s] *mostly focus on listening and can only improve our listening comprehension. It is better that they focus on other skills as well.*" In a number of comments, students highlighted the need for developing apps with a focus on a skill other than vocabulary. One student wrote: "*An app must focus on improving listening*

from the beginning" and "*it should dedicate separate sections completely to grammar*."

In addition to language focus*, the presentation, reliability, practicality*, and *comprehensiveness of the pedagogical content* were discussed by students. In 91 comments, students noted that app content would be more productive if appropriately graded, sectioned, scheduled for step-by-step learning, and presented in a compact mode (content presentation) with the use of high-quality multimedia and images. Sarah noted that a useful app usually has a "*time-table for scheduled learning for example… weekly assignments*." The possibility of providing users with reinforced content which is matched with their identified proficiency level, according to Hamed, makes the content "*adjustable to users' learning need… When it has different sections, we can progress from one level to another*."

In addition to the above quality, 34 comments under this category highlighted the importance of using high-quality multimedia features (animation, video, music, and audio) and images for app content presentation (see Economides, 2008). Talking about the required characteristics of a vocabulary teaching app, one wrote: "*teaching English words would be better presented in auditory format and story-based using video and audio examples for each word*."

About 5.4 and 5.0% of the comments respectively focused on *content reliability and practicality*. Sima wrote: "*I prefer to use an app that contains reliable English texts with standard reading comprehension questions*" (content reliability). Listing the characteristics of an effective language learning app, another participant noted: "[a well-designed app] *needs to contain quality reading and provides the users with a practical and quality learning environment*" (content practicality). The focus of 2.4% of the comments was *content comprehensiveness*. One participant emphasized that no matter if an app covers one or all language skills, "*being comprehensive is the most important factor because most of the language needs of user can be satisfied.*" This runs counter with Economides' (2008) argument regarding the essence of MLA content being comprehensive by covering all

main concepts at all levels. The need for the inclusion of a well-planned assessment/evaluation procedure in an app (1.3%) was the fifth theme in this category: "*It must offer a self-assessment test for evaluating one's learning… It must enable users to review and practice what they have learned.*"

App design features

Nine different design qualities which were addressed by students as essential for the design of language learning apps comprised 21.8% (freq. = 101) of the extracted comments. The comments highlighting distinct design qualities were grouped and labeled according to their focus. Considering their focus on the design of smartphone applications, all nine groupings were categorized together and labeled as App Design Features. Of the 24 comments focusing on an app's default language, 11 highlighted the need for an English language learning/teaching app to have "*an all-English environment*" (Iraj's comment). One of the students stated: "*I prefer it has English as the only and default language.*" The remaining 13 highlighted the importance of providing users with an opportunity to use multiple system languages including Persian. It should be noted that these comments were all made with reference to vocabulary and dictionary apps. It appears natural to expect an app that is designed for learning/teaching different words to support users' native language to facilitate the process of using the app and learning.

Consistent with Ganapathy et al.'s (2016) participants who, reviewing the limitations of a grammar learning app, called for more graphical features, 21 students in this study highlighted the importance of engaging app users via featuring an attractive graphic, fun factor, and bonus (see Table 5). Farhad wrote: "*Each user must have a profile and achieve bonus based on his/her performance to cause competition between users like Sololearn which is for learning programming language.*" Due to his experience in using computers and working with apps as a student majoring

at Computer Engineering, this student considered a bonus factor useful for engaging users in productive competition and thus promoting engagement with the app. Leyla addressed fun factor as a required feature for achieving user engagement: "[Apps] *must be attractive and attract the audience using fun and different strategies*." Similar comments were made regarding the potential of interesting graphics and attractive outlook for enhancing user engagement: "*It must be attractive concerning the outlook… using relevant graphics… When it is designed attractively with high quality graphic, it will be more interesting*."

Ease of use and user-friendliness in app design was addressed in 17 comments. Discussing what she called *"the building blocks"* of an English language learning app, Susan picked "*user-friendly and a good UI* [user interface]" as the most crucial feature for an app. Reviewing students' interview responses it was observed that students preferred to use either free or inexpensive apps. In addition, Mina and Kaveh found advertisements in free apps a challenge for their effectiveness: "*I believe apps must not contain advertisement like many of the available ones*."

In 10 (2.2%) comments, students noted that an effective app needs to be "*regularly updated*" to provide users with the most recent information on the topic and fix possible software bugs. Considering the evolving nature of the language, this feature is particularly important for dictionary and vocabulary apps. In addition to updatability, apps, according to one participant, must "*be usable both online and offline in a way that recovers new words from the Internet in online mode.*"

Three students highlighted the essence of including speech recognition feature in language learning apps due to its potential for explicit and immediate recognition and evaluation of their speech input, particularly "*speakers' pronunciation*". Sanaz wrote: "*apps that provide opportunities for users to interact in spoken form, especially those that are used by native speakers, are really useful over time.*" In addition to user inter-connectivity, the possibility of feedback generation and error correction was considered an important feature of an effective app. This is reflected in Afrouz's

comment: *"I believe… when we produce sentences, it must be able to determine the grammatical accuracy of our sentences."*

Smartphone features

The comments which addressed user interface (UI) and the loading speed of the smartphones were grouped. Given their reference to the hosting device (i.e. smartphones), the resulting category was labeled as Smartphone Features. Reviewing students' responses, it was observed that, when talking about UI, the following adjectives were commonly used: *good, user-friendly, effective, appropriate, simple, strong, fast, attractive*, and *interesting*. In addition, students highlighted that smartphones need to "*have high loading speed*" so that working with the app would be easy and fast. Economides (2008) classified these qualities as the technical requirements of MLAs. The above adjectives reflect Economides' description of UI as being usable, accessible, effective, personalized, and organized with the relevant layout; and featuring help, multimedia, and navigation functions. Usability means that the functions of MLA need to be simple, easy, and convenient and not distracting for users.

DISCUSSION

Contrary to previous research on language learning apps that have been mainly concerned with teacher-led intervention to explore the productivity of one or two selected apps (Ma, 2017), the study reported in this paper explored the productivity of using language learning apps of students' choice as supplementary learning materials in general English courses. That students who were using language learning apps had a better performance in the post-test may be attributed to the ubiquity of the smartphones that enhance practice time and access to the learning content beyond the confines of the classroom (Kukulska-Hulme & Shield, 2008). As noted by Nami (2020), "by facilitating anytime any place access to a wide range of learning resources and educational applications, mobile devices encourage a

situated self-regulated computer-mediated learning experience" (p. 83; also Cavus & Ibrahim, 2017).

Consistent with Sandberg et al. (2011), it is argued that practicing language learning and even checking the meaning of words in smartphone apps positively contributes to learners' vocabulary and language knowledge development. This was reflected in the present study as almost all of the participants who used language learning apps reported having a lexical or dictionary app in their smartphone. Moroz (2013), similarly, found that dictionary apps were the most popular among the students.

Consistent with Bibby (2011), it was observed that students largely valued dictionary and vocabulary learning apps as their lexical guide for learning English words. This; however, runs counter with Ma (2017) whose participants widely used apps for listening and speaking practice, which might be attributed to the large difference in the number of participants in the present study and that of Ma's. This popularity of dictionary/vocabulary apps among students might also reflect their learning needs. Given that all participants were non-English major students attending a course with a focus on technical vocabulary in technical passages; it appears natural to find them use vocabulary/dictionary apps to satisfy this learning need. Two third of the questions in the final exam of the GE courses in this university relate to vocabulary and the rest address structure and reading comprehension. In addition, instructors' attitudes toward using smartphone apps during classroom meetings for looking up the meaning of the new words in the reading texts and exercises might have influenced students' choice of dictionary apps.

While this focus on vocabulary reflects students learning needs, it might also be attributed to their experience in using dictionary apps more than other app-types and their better understanding of the constraints/affordances of such apps. As discussed earlier, participants needed the knowledge of technical words not only for reading and understanding English texts in their field but also for successful functioning in GE exams. Hence, it was anticipated to find the majority call for the

"*design and development of sophisticated dictionaries for different majors*" (Hamed's comment). This is also reflected in Bahram's comment: "[the app] *must… introduce expressions and technical terminologies that are needed by the university level students.*" Furthermore, this call for designing better vocabulary apps, despite their abundance in online app stores, reflects Sandberg et al.'s (2011) claim that augmenting "an already existing learning context, either within a school or e-learning course" (p. 1336) in many of the apps limits their usability as the content, method, or format might only address the learning needs of a particular group of learners not all of them.

The infrequency of comments on the potential of apps for developing users' speaking, reading, and writing; however, can be taken as an indication of students' lack of belief in improving such skills via app-assisted language learning: "*I believe including reading passages and comprehension questions might help our reading but an app cannot improve our speaking ability at all*" (Mahsa's comment). This might be attributed to students' limited experience in using apps other than vocabulary practice ones.

The fact that students addressed the presentation, reliability, practicality, and comprehensiveness of the pedagogical content in addition to language focus indicates their attention to the technical features of language learning apps. Discussing the technical requirements of mobile learning apps (MLAs), Economides (2008) similarly notes that MLAs should be tailored (or personalized) to different users' learning needs. According to Moroz (2013), providing users with content that can be catered to their learning needs and styles is one of the most significant requisites of a language app. This way, students are expected to be situated in a learning context that is or can be personalized to meet their learning needs (see Comas-Quinn et al., 2009; Hung & Chen, 2001).

Students also asked for "*content* [being] *presented for user in a compact mode*" (Shiva's comment). This underscores claims regarding the essence of designing concise and compact information packs and learning materials. Cluttering different parts and pages with lengthy texts or

redundant information hinders student learning; since, accompanied by small screen size, it makes concentration difficult (Cavus & Ibrahim, 2017).

Students' attention to the multimedia features of the apps is consistent with Bradley et al.'s (2009) claim that in addition to the educational value, audio-enhanced content is fruitful in that it replaces a large amount of texts in apps; thus, reducing the amount of information presented on a small screen and the cognitive load. As noted by Hariri Asl and Marandi (2017), multimedia turns computer-mediated communication more hyperpersonal. The same argument applies to the use of images to facilitate the process of learning by helping concepts "*better stick to mind*" (Mona's comment). As Dashtestani (2016) puts, multimodal features facilitate the process of learning the content for students, resulting in more effective learning. This reflects Mayer's (2003) dual channel hypothesis, implying that individuals can concurrently process information and create deeper and richer constructs in their memory drawing on varied channels or sources of presentation.

These comments might indicate students' awareness of the potential of multimedia features and images for facilitating the teaching and learning of different language skills. Students' particular attention to multimedia features might also confirm Sandberg et al.'s (2011) claim that the available apps are mostly text-based. Working with and using mostly text-based apps might have enhanced students' consciousness of the importance of multimedia features in educational apps. A text-only app may bore users and decrease their attention to the content. Cavus and Ibrahim (2017), similarly, note that for making the content more engaging, different modes of media should be included in the design of the app.

Students' attention to the fun factor in the design of language apps contradicts Liaw's (2007) observation that system usefulness rather than enjoyment appears to be more significant for Asian students compared to the European ones. Participants, in this study, appeared attentive not only to the overall usefulness of the app but also to its attractiveness and design.

The findings are in line with research on users' acceptance of and

engagement with mobile devices. Learner playfulness (i.e., engagement and joy in using mobile devices) is considered a determining factor in engagement with new technology. If students enjoy using technology, they spend more time with it. With a special focus on electronic dictionaries, Huang et al. (2012) explored users' resistance to change and self-management of learning using mobile technologies. They reported a positive correlation between perceived playfulness and students' use of and engagement with mobile devices for learning.

Designing user-friendly apps that are easy to use from students' perspective should be of prime significance for app designers and developers, given that what they assume as user-friendliness and ease of use in an app might not necessarily match with students' perception (Moroz, 2013). Students' preference for free or inexpensive apps reflects Dashtestani's (2016) observation that the cost factor is an important issue for Iranian students. Kukulska-Hulme and Shield (2008), similarly, acknowledge that "cost to the end-user is a major consideration and can be a barrier to successful uptake when using mobile devices" (p. 282). As Economides (2008) notes, economic feasibility and costs of buying, upgrading, repairing, and/or replacing an app must be kept low and users should be provided with different types of contracts to choose from to make MLA use cost-effective.

The possibility of offline use of an app appears to be crucial for the sustainability of use. Such comments may also reflect students' concerns about connection costs. Given that free broadband Internet connection is not usually available in public places in Iran, users draw on their cellular connection for which they need to pay on a weekly, monthly, and/or an annual basis. Consequently, they prefer to use apps that are accessible in offline mode and need the Internet only for updating.

Cavus and Ibrahim (2017) note that, since pronunciation appears to be the most difficult skill for learners of the English language to acquire, it has received significant attention. From among various functionalities and features embedded in smartphones, automatic speech recognition, according

to Ahn and Lee (2016), "is the most promising feature that enhances language learning, especially regarding speaking and pronunciation" (p. 780). Furthermore, while the attention to feedback generation highlights students' preference for corrective feedback (see Azizi & Nemati, 2018), it might indicate the absence of this functionality in many of the available apps (see Sandberg et al., 2011).

CONCLUSION AND IMPLICATIONS

With the emergence of new mobile technologies including mobile phone apps that are particularly designed for language learning, more students draw on these technologies as tools that mediate or scaffold and personalize foreign language learning beyond the conventional time and space limitations of the traditional classrooms. The study reported in this paper focused on the effectiveness of using language learning apps and students' choice of such apps along with the features/qualities they perceived essential for developing apps. These findings empirically support much of the literature on app-assisted language learning and design, which meantime provide insights into the productivity of apps and the features that might enhance their pedagogical effectiveness from the users' perspective. The wide range of features addressed by students signifies the need for what Sandberg et al. (2011) call *a tight coupling* between an app, smartphone, and pedagogical content features to enhance the effectiveness of the app and user motivation to apply this technology for learning purposes.

Considering the attention students dedicated to both the language content and design features of apps, it is concluded that using language learning apps, they have developed an awareness of the potential of such technology to play a mediating role and offer personalized language learning opportunities to different groups of learners (see Lantolf & Throne, 2007; Ma, 2017). The findings, hence, can bring language educators and educational app designers and developers closer to understanding the factors that users find essential in the design of language learning apps.

To attain this goal, a number of pedagogical implications need to be addressed. Although it might not be possible to offer a one-size-fits-all solution and design for all of the educational applications for users at different levels and disciplines, app designers and adopters must gain an understanding of the functions and features that turn mobile phone apps more convenient and enjoyable for students (Huang et al., 2012). Given the determining role of users' acceptance and perception of a technological tool in its uptake, researchers should strive to address not only students' but also teachers' concerns by exploring their app-use experience and viewpoints. So doing, learners would be provided with an app that appropriately mediates between the individual and the learning process.

The present study focused on the experience and perspectives of a group of learners in a particular research context. However, as Dashtestani (2016) acknowledges, "further research is required to identify a wider range of benefits of mobile learning from the perspectives of all educational stakeholders" (p. 14). Considering the determining role of teachers in promoting the effective use of apps for language learning purposes, future studies should explore teachers' perspectives on the essential features for an effective language learning application. Consistent with Ng and Nicholas (2012), it is suggested that pedagogical sustainability with any technology including language learning applications largely depends on teachers' proficiency in and knowledge of the application and the best way(s) to apply it for instruction. Furthermore, future studies should draw on language learners at different age ranges to find out the qualities that work better for apps that are designed for kids as well as young and adult learners. To gain a better understanding of what is crucial for designing language learning apps, future studies should also explore "pedagogical premises that underpin the design of current mobile apps and to suggest improvements. For example, are language learning apps being developed based on narrow interpretations of language pedagogies and theories" (Steel 2012, p. 879).

Participants' perception of apps might have been largely shaped by their use of, mostly free, vocabulary and dictionary apps and their learning

needs. Have they experienced using other types of apps with more sophisticated features, other results might have been obtained. This factor should be addressed in future studies. In addition, it should be noted that students' assumptions of app effectiveness might have been highly motivated by not only their knowledge of language and technology but also their learning strategies and styles. Future studies should address the way these factors impact users' perspectives and learning. As Moroz (2013) acknowledges, factors such as differences in students' learning styles, language proficiency level, and even their first language play a significant role in deciding what to integrate with a language app and what feature to add to it.

In conclusion, it is worth mentioning that the author does not claim that the features identified and discussed in this paper represent a comprehensive framework for educational app design, but that drawing on users' perception of technology can help app designers to make sound decisions about the features and qualities that should be included in the design of an English language learning application.

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