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ARTICLE

Activate space rats! Fluency development in a mobile game-assisted environment

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Abstract

Activities that promote fluency development or the automatization of speech are often ignored in second language classes because they do not teach new things; instead, they focus on speeding up language use (Nation & Newton, 2008). Anxiety also decreases chances for fluency development, as learners are less willing to produce output (Gregersen & MacIntyre, 2014), consequently hindering language development (Swain, 2000). One way of minimizing the impact of these limitations is to motivate students to speak intelligibly and fluently, preferably beyond the constraints of the language classroom. In this study, we investigated the pedagogical use of Spaceteam ESL, a mobile game that requires intelligible and fluent computer-mediated oral exchanges among players. Participants (N = 20) were low-intermediate English as a second language (ESL) students divided into two groups: the treatment group, which played Spaceteam ESL as a 15-minute warm-up activity for six weeks, and the control group, which engaged in comparable non-gaming activities. Pre-tests, post-tests, and delayed post-tests measured changes in oral fluency (i.e., syllables produced per minute and judges' ratings) and interviews addressed factors related to anxiety and willingness to communicate (WTC). Findings indicated that learners who played Spaceteam ESL outperformed the control group in judges' ratings for oral fluency and that the gameplay might positively influence anxiety and WTC.

Keywords: *Mobile Learning, Game-Based Practice, Pronunciation*

Language(s) Learned in This Study: *English*

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Introduction

Promoting fluency development in second language (L2) learners "is important at all levels of proficiency" (Nation & Newton, 2008, p. x), as it motivates learners to speed up and automatize language use. However, activities that promote fluency development are often excluded from language classrooms, possibly due to time constraints or the fact that they involve repeating structures that students have already acquired and, consequently, do not teach anything new (Nation & Newton, 2008). The development of L2 fluency may be further hindered by language learning anxiety or a low level of willingness to communicate (WTC) in learners (Horwitz, Horwitz, & Cope, 1986). To address these issues, this article investigates the use of a digital collaborative mobile game, Spaceteam ESL, for L2 learning. To play the game, players must engage in real-time computer-mediated interaction with other players, during which they must intelligibly produce and carry out time-sensitive oral instructions to navigate a spaceship.

A 4-week pilot study was conducted in which the game was used as a warm-up activity in an English conversation class (Grimshaw, Cardoso, & Waddington, 2015). The study showed promising results: participants indicated that they felt more energized after playing the game and, as one participant stated, it helped to open their mouths, preparing their vocal tract articulators for use in their conversation class. Their teacher also noted that a positive mood carried over from gaming sessions, "creating an overall pleasant

atmosphere" (p. 105). Participants also commented that they felt more comfortable and familiar with classmates after gameplay, and the instructor reported that students were more active in class. The results of this pilot study suggest that the game may help to reduce language anxiety and increase WTC in students. As low levels of anxiety and higher levels of WTC encourage fluency development, the current study further addresses how these issues may be influenced by Spaceteam ESL and how the game's other features may contribute to L2 fluency development.

The current study used a mixed-methods approach for data collection and analysis, in which quantitative data were used to examine the influence of Spaceteam ESL on fluency development, while qualitative interviews explored student perceptions of the game as a pedagogical tool. We hypothesized that the combination of in-game interaction and peer feedback would provide students with the necessary scaffolding to develop pronunciation skills (Chapelle, 2003), with a focus on fluency, while also reducing anxiety and raising WTC.

Literature Review

Fluency Development

The development of oral fluency is largely concerned with temporal aspects of speech such as rate and pause length (Derwing, Munro, Thomson, & Rossiter, 2009). Nation and Newton (2008) summarize the features of fluency as language use that involves real-time processing and "does not require a great deal of attention and effort" (p. 151). According to the authors, the ideal language course should include a balance of (1) meaning-focused input, (2) meaning-focused output, (3) intentional attention to aspects and features of language (focus on form), and (4) fluency development activities in order for students to develop language skills. The fourth strand, fluency development activities, involves the use and practice of what students already know across "the four skills of listening, speaking, reading and writing" (Nation & Newton, 2008, p. 2) with the explicit purpose of speeding up production and encouraging automaticity. As such, fluency development activities should only include previously acquired language structures and vocabulary to encourage automatization. Because of the repeat and recycle nature of these activities, language teachers prefer to use classroom time to teach new vocabulary or other language features rather than spending time on automatization.

While aural perception and non-verbal aspects are both important components in overall fluency (Götz, 2013), production (or output) plays a vital role in oral fluency development. According to Swain (2000), learners produce output to test their hypotheses about the language, to learn from error, and to see how the target language functions. Without producing output, language learners cannot practice language, nor can they automatize their language skills. Producing output and interacting with other speakers is therefore vital for oral fluency development as learners experiment with pronunciation, vocabulary, and oral grammar, among other language features.

L2 learners who do not have the opportunity to develop fluency in class may experience a further reduction in output production when faced with additional barriers such as speaking anxiety or a low WTC. If learners are unable to produce output, they cannot fully engage in language development (Gregersen & MacIntyre, 2014). These two important issues are addressed in the following section.

Anxiety and WTC

According to Dörnyei (2005), *trait anxiety* expresses a "predisposition to become anxious" in a variety of situations, whereas *state anxiety* is a "moment-to-moment experience of anxiety as an emotional reaction to the current situation" (p. 198). These anxieties have the potential to negatively impact acquisition in language learners (Baran-Łucarz, 2014; Dörnyei, 2005; Gregersen & MacIntyre, 2014; Horwitz et al., 1986). However, while trait anxiety is difficult to control, state anxiety can be more easily addressed in the L2 classroom due to its ephemeral nature (Gregersen & MacIntyre, 2014).

It has been shown that anxiety can have a negative impact on student WTC (Dörnyei, 2005; Gregersen &

MacIntyre, 2014; MacIntyre, Dörnyei, Clément, & Noels, 1998), particularly when students experience pronunciation anxiety (Baran-Łucarz, 2014). Contrary to popular belief, WTC does not simply transfer from a learner's first language (L1) to his or her L2 (MacIntyre et al., 1998). For instance, a student who has a high WTC in their L1 may not experience the same level of WTC in their L2. Low WTC in the L2 is commonly caused by the reduced rate of self-confidence experienced by students in the classroom (MacIntyre et al., 1998). In particular, students who experience pronunciation anxiety often feel as though they have a bad accent, resulting in embarrassment when speaking and therefore lowering their WTC (Baran-Łucarz, 2014). Similarly, students with communication apprehension experience a sort of performance anxiety when speaking or listening in their L2 (Horwitz et al., 1986). This apprehension also contributes to a reduced WTC, as students do not wish to perform in front of peers.

As anxiety and feelings of apprehension lower WTC, students are less likely to engage in language production (Gregersen & MacIntyre, 2014). Without opportunities for language output, students cannot advance their language skills (Nation & Newton, 2008; Swain, 2000). Two methods that have been suggested to help reduce anxiety in L2 learners or increase their WTC are outlined below in relation to the scope and goals of this study.

Methods to Reduce Anxiety and Increase WTC

There have been a variety of techniques proposed in the literature to reduce communication anxiety and increase WTC. These include, but are not limited to, the following: introducing relaxation techniques and explicitly addressing anxiety in the classroom (Gregersen & MacIntyre, 2014), identifying sources of anxiety (Baran-Łucarz, 2014), engaging in teamwork activities (Dörnyei & Kormos, 2000), and using technology as a medium of communication (AbuSeileek, 2012; Arnold, 2007; Baralt & Gurzynski-Weiss, 2011; Reinders & Wattana, 2014). The latter two methods are present in Spaceteam ESL gameplay and are further described in this section.

Teamwork

Group cohesiveness may increase verbal performance in students, encouraging them to participate in conversations and discourse and thus increasing WTC. Dörnyei and Kormos (2000) suggest that "individuals [who] spend extended time together, pursuing shared goal-directed behaviour in a context with well-defined boundaries" (p. 279) are more likely to feel as though they belong to a group and are therefore more likely to communicate within the group—they experience a positive level of WTC. Through teamwork, participants may also become familiar with their teammates, and as the degree of acquaintance with an individual can positively impact WTC (MacIntyre et al., 1998), cooperation may help to increase student WTC.

A study conducted by AbuSeileek (2012) combined teamwork with computer-mediated communication (CMC) to examine whether positive interdependence (in which group members work together to complete a task) or individual accountability (in which group members are responsible for completing their own individual tasks to achieve a common goal) had an impact on students' communication skills. The results suggested that participants in the individual accountability group significantly outperformed those in the positive interdependence group: individual accountability participants felt more responsible for their own role in their team's success and were therefore more willing to communicate and participate in the task. This task type might also have contributed to feelings of group solidarity, playing a role in increasing levels of comfort in the classroom, raising learner WTC, and lowering communication anxiety.

Computer-Assisted Language Learning and Computer-Mediated Communication

Recent efforts to incorporate digital technologies into language education have shown that tasks relating to computer-assisted language learning (CALL) can be pedagogically beneficial; however, they must be carefully regulated. CALL tasks should ideally provide opportunities for input exposure, interaction, and output production to be considered well-rounded language learning activities (Chapelle, 2003). Research has shown that properly structured CALL resources may not only help to improve grammar, vocabulary,

and pronunciation (Chapelle, 2003), but may also increase student motivation (e.g., Ducate & Lomicka, 2009). Similarly, various forms of CMC have the potential to decrease learner anxiety (Arnold, 2007; Baralt & Gurzynski-Weiss, 2011) and increase WTC (Reinders & Wattana, 2014).

In the studies conducted by Arnold (2007) and Baralt and Gurzynski-Weiss (2011), students engaged in either CMC or FTF communication. In both studies, CMC was introduced in an attempt to reduce communication anxiety. Participants in CMC groups either communicated via chat-rooms (Arnold, 2007) or social media (i.e., Facebook or MySpace; Baralt & Gurzynski-Weiss, 2011). Participants in FTF groups completed similar tasks, but interacted with each other directly. Although neither Arnold (2007) nor Baralt and Gurzynski-Weiss (2011) found significant differences between CMC and FTF groups, both studies shed light on the potential of CMC. For example, while the CMC groups showed decreased nervousness and increased self-confidence, one of the participants in the study by Baralt and Gurzynski-Weiss pointed out that the CMC tasks lacked the necessary pronunciation practice that builds confidence in language learning. Another participant made a similar observation: she "felt that she was not really forced to address or correct her mistakes in the CMC modality as much as she was in the FTF modality" (p. 215). While written CMC can provide students with extra time to carefully consider their output, it does not give them the chance to communicate orally. CMC should therefore also ideally provide the opportunity for oral production with some form of feedback.

Although Reinders and Wattana (2014) suggest that an online CMC gaming environment may increase learner WTC, the gameplay described in the study is not practical to implement in a typical L2 classroom. The massively multiplayer online role-playing games (MMORPGs) adopted in their study often require a strong and reliable Internet connection (a non-existent feature for many public institutions) and access to desktop computers. Arranging lab time, planning activities, and connecting students is time-consuming, taking up valuable class time. The ideal tool for students and teachers would therefore be something that is easily accessible and involves short, but effective, opportunities for communication. Mobile-assisted language learning (MALL) may offer a solution to this problem.

Mobile-Assisted Language Learning and Gaming

With the increasing popularity of smartphones and other mobiles devices, MALL may offer a more accessible alternative to desktop computer-based CMC (Ogata & Yano, 2003; Stockwell, 2007). Despite the use of mobile devices for L2 learning showing promising results (e.g., Grimshaw et al., 2015; Stockwell, 2007) and the many language applications, or apps, for mobile devices available for download around the world, little research has been conducted into the use of mobile gaming as a tool for language development.

Gaming has been used for a variety of purposes in L2 learning. It has been used, for example, to aid with L2 writing (e.g., Allen, Crossley, Snow, & McNamara, 2014) and oral proficiency (e.g., Kim, 2014; Lan, 2014) and to increase WTC in students (e.g., Reinders & Wattana, 2014). Commercial games that involve multiplayer interaction, such as World of Warcraft and Second Life, have also found a place in L2 practice (Godwin-Jones, 2014), as these games create an immersive language environment accessible from anywhere with a reliable internet connection. With the high volume of English-language multiplayer games currently on the market, students often choose to play these games on their own time with little intent, if any, to learn language from the experience (Chik, 2014).

While non-mobile digital games have been used successfully in L2 education, they are not readily accessible in most classroom environments. Mobile devices "[increase] learners' capability to physically move their own learning environment with them" (Ogata & Yano, 2003, p. 2), unlike desktop computers needed for platforms such as the MMORPG in the study by Reinders and Wattana (2014). Instead, "mobile devices can connect to Internet with wireless communication technologies, and enable learning at anytime and anywhere" (Ogata & Yano, 2003, p. 2). MALL also has the "potential […] for creating advanced, immersive games that do not require a room full of computers" (Godwin-Jones, 2014, p. 10), offering a more accessible alternative to traditional digital gaming and thus mitigating the problems of portability and accessibility.

Mobile Gaming as a Means to Promote Fluency Development, Reduce Speaking Anxiety, and Increase WTC

As mentioned earlier, Nation and Newton (2008) suggest that L2 activities should include a balance of all four strands for effective L2 learning, including fluency development. Fluency development activities involve putting into practice previously acquired language features (e.g., known vocabulary and pronunciation) in a fast but comprehensive manner (e.g., speed speaking and listening without a language focus in mind). To date, little research has investigated the use of mobile devices and digital gaming in oral fluency development. While Papadima-Sophocleous (2015) examined the use of iPads in the development of reading fluency, results cannot be generalized to other aspects of fluency outlined by Götz (2013), such as spontaneous production, perception, and non-verbal fluency.

The current study uses Spaceteam ESL, a game that is portable and easily accessible, to examine its role in oral fluency development. The study combines the abovementioned features of the game (e.g., communication mediated by technology, recycling and practice of known vocabulary, time-sensitive interaction) to examine the effectiveness of accessible, easy-to-implement gameplay, and its potential to create a fun and non-threatening learning environment (e.g., via teamwork and CMC) for students to practice the target language. It was anticipated that, by creating a safe atmosphere via gameplay, the participants might experience a lower level of speaking anxiety and an increased level of WTC, thus producing more output—a necessary part of fluency development.

Spaceteam ESL: The Current Study

Spaceteam ESL is a free interactive gaming app played on mobile devices. The game was developed by Cardoso and Waddington of Concordia University and was based on the original Spaceteam mobile game created by Sleeping Beast Games (Smith, 2012). In the game, players in teams of two or more must share instructions with each other to achieve an end goal: piloting a spaceship. Each team member is presented with a unique panel of buttons and dials and is provided with a unique set of instructions. Each member's instructions correspond with a knob, button, or dial on one of the other team member's panels. In order to complete the series of tasks, players must interact orally with team members to communicate instructions. Teams have a limited amount of time to communicate and carry out these instructions. An illustration of the interface of Spaceteam ESL is provided in Figure 1 (the left-hand screenshot was taken from a mobile phone, whereas the right-hand screenshot was taken from a tablet).

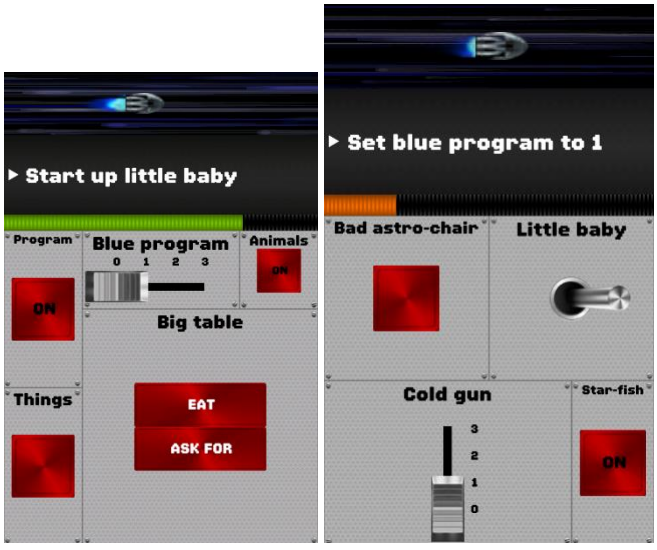

Figure 1. Screenshots of Spaceteam ESL, as seen by two different players on the same team.

The instructions that players had to convey in Spaceteam ESL were randomly generated following verb +

modifier/noun + prepositional phrase/noun combinations using vocabulary from most-frequently-used word lists (e.g., *Save brown space chicken*, *Set blue program to 1*, with the latter example illustrated in Figure 1). This allowed for practice using more familiar words, a requirement of fluency development activities. As game levels increased, so did the complexity of the vocabulary (in terms of word-level frequency and pronunciation difficulty). Players therefore had to be fluent (i.e., both intelligible and fast in speaking), so that their teammates could successfully receive and interpret the instructions within a pre-specified timeframe (usually a few seconds, depending on the level of difficulty).

Players had to work together as a team to succeed in the game, and each player was individually accountable for carrying out his or her actions to ensure the team's success. However, actions by individuals remained anonymous as the players did not know which team member completed which action, therefore potentially removing some performance anxiety (as suggested in AbuSeileek, 2012). The format of the game also allowed players to interact via CMC. While players were present in the same room, playing the game via a mobile device helped to remove the pressures of FTF communication and provided opportunities for oral production with peer feedback. The most common form of peer feedback observed in the pilot study appeared in the form of recasts. For example, if a misunderstanding occurred, the student-interlocutor often repeated a mispronounced word to confirm whether it was the intended one, such as *shut down* instead of *shoot down*. The written commands on the screen provided additional clues to the student-interlocutors for interpreting their teammates' commands. The student-interlocutors could then provide peer feedback based on what was heard and read. The command-giver could then, ideally, recognize and repeat the correct form, as the vocabulary should already have been familiar to them.

Spaceteam ESL fulfilled the requirements of a fluency development activity as outlined by Nation and Newton (2008), as it encouraged players to interact through a meaningful activity (working together to pilot a spaceship) and to speed up language use. The main goal of the game was focused "on receiving or conveying meaning" and, at the same time, on providing learners with "a large amount of input or output" practice (p. 7). As Spaceteam ESL did not explicitly target new or specific language features, the game fulfilled another requirement of the fourth strand of fluency development by Nation and Newton, "where all language items are within their previous experience," and provided players with "support and encouragement … to perform at a higher than normal level" (2008, pp. 152–153). The game also fulfilled the requirements of a well-rounded CALL task, as outlined in Chapelle (2003), as it provided enhanced input (via the practice feature), interaction (via gameplay), and ample chances for practice.

The study addresses the following two research questions:

1. Does playing Spaceteam ESL affect fluency development in English as a second language (ESL) learners?
2. What are learner perceptions of Spaceteam ESL as a tool to reduce anxiety and increase WTC?

To answer the first research question, quantitative data were analysed to assess fluency development, as measured by a combination of syllables-per-minute (SPM) counts and judges' ratings (see discussion below). For the second research question, qualitative data, collected from semi-structured interviews, were examined to create categories for further analysis (based on the scope of the current project and results from a pilot study, reported in Grimshaw et al., 2015). It was predicted that playing the game as a warm-up activity for L2 classes would have a positive effect on oral fluency development. It was also hypothesized that the game would be perceived as fun and engaging, with the potential to provide a variety of learning opportunities. Although not created as a tool to teach language, Spaceteam ESL can be considered a pedagogical game as it allows students to practice L2 interaction in an entertaining and non-threatening manner.

Method

Participants

The participants were 20 ESL students (10 males and 10 females) attending a college in Quebec, Canada.

The mean participant age was 21.4 (*SD* = 0.69), and all spoke French as their L1. All participants were placed at the same proficiency level (high-beginner) by the institution. The participant pool was comprised of two different ESL classes at the same school, both of which had the same instructor. The instructor was a Canadian L1 English speaker who specialized in teaching beginners. One class acted as the treatment group, and the other acted as the control.

Design

An experimental design was used, consisting of two groups: treatment and control. The treatment group engaged in gameplay as a warm-up activity for 15 minutes at the start of each class, held once a week, for a period of six weeks. The control group, on the other hand, completed paper-based, interactive, and timed activities, such as info-gap and story retelling, that practiced the same skills as a warm-up (e.g., listening, speaking, and reading). Although the control group tasks differed from the treatment group, these tasks were more similar to typical classroom fluency development activities.

The study followed a mixed-methods, between-groups design. Quantitative data were collected via pre-tests, post-tests, and delayed post-tests, in which participants were required to record themselves speaking about their summer vacations. The recordings were then analyzed for measures of L2 fluency. Temporal measures such as the computation of the number of syllables produced per minute (SPM) are one of the most common measures for rating oral fluency and, for this reason, were adopted in the current study. Previous studies measuring L2 fluency rely strongly on these types of temporal measures (e.g., Blake, 2009; Hird & Kirsner, 2010), presumably because these measures relate to the definition of fluency given by pronunciation researchers (e.g., Derwing et al., 2009, who established oral fluency via a combination of rate of speech and pause length). In this study, speech samples were measured via the calculation of SPM and judges' assessment of related measures (speech rate, pauses, and overall fluency). SPM was coded manually twice by one of the researchers (intraclass correlation coefficient between SPM calculations was high at the pre-test: r = .996). Any scores with a difference of more than 2 SPM were examined a third time; differences were then averaged.

10 L1 English and 10 L2 English speakers, all of whom had experience teaching ESL, rated 60 10-second clips from each speech sample (one for each participant from each test) on 6-point Likert scales. Samples were rated based on overall fluency and temporal measures (speech rate and pauses). The overall fluency scale ranged from *very dysfluent* to *very fluent*. The temporal measure ranged from *very unnatural* to *very natural* (see Figure 2).

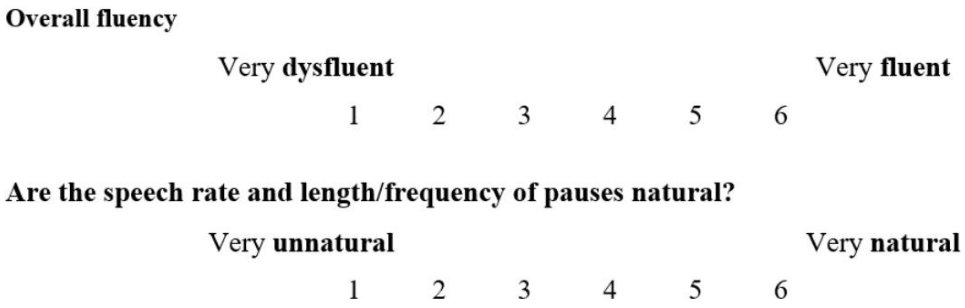

Figure 2. Rater scale for overall fluency and speech rate and pauses.

For the qualitative analysis, transcripts of the semi-structured interviews were analysed to generate categories based on topics that emerged in relation to themes in the literature and scope of the study, as well as themes from the pilot test (Grimshaw et al., 2015). These categories are further analysed below to answer the second research question.

Results

Syllables per Minute

A repeated measures factoral design test was conducted to measure the difference between the treatment and control groups on the pre-test and the two post-tests, in which the independent variable was the treatment and the dependent variable was SPM. Results indicated that there was not a significant difference in improvement between groups over time (see Table 1), as $p = .395$ ($\alpha = 0.05$).

On average, the treatment group improved slightly from pre-test ($M = 108.27$, $SE = 8.36$) to post-test ($M = 111.09$, $SE = 8.76$; see Table 1). However, a Wilcoxon signed-rank test indicated that there was no significant difference between the pre- and post-tests ($Z = -0.31$, $p = .755$); there was also no significant difference between the pre-test and delayed post-test ($Z = -1.78$, $p = .075$). The control group, on the other hand, decreased in performance from pre-test ($M = 112.67$, $SE = 10.21$) to post-test ($M = 101.78$, $SE = 7.71$). A Wilcoxon signed-rank test again shows no significant difference between the pre- and post-tests ($Z = -1.49$, $p = .137$) nor between the pre-test and delayed post-test ($Z = -1.01$, $p = .314$).

Table 1. *SPM for Storytelling Task*

	Pre-Test		Post-Test		Delayed Post-Test	
Group	***M***	***SD***	***M***	***SD***	***M***	***SD***
Treatment	108.27	27.72	111.09	27.71	120.27	25.82
Control	112.67	30.63	101.78	23.13	123.78	29.59

Judges' Ratings

The intraclass correlation coefficient for L1 and L2 English judges at the pre-test showed high agreement for speech rate and pauses and overall fluency ($r = .933$ and .911, respectively).

Overall Fluency: Judges' Ratings

Judges' ratings for the category of overall fluency (see Table 1), were examined during the pre-tests, post-tests, and delayed post-tests. A repeated measures factoral design test was conducted for each test. Results indicated that there was not a significant difference between the treatment and control groups over time ($p = .11$; see Table 2).

Table 2. *Overall Fluency Ratings for Storytelling Task*

	Pre-Test		Post-Test		Delayed Post-Test	
Group	***M***	***SD***	***M***	***SD***	***M***	***SD***
Treatment	3.57	0.54	3.71	0.48	3.85	0.51
Control	3.51	0.46	3.14	0.36	3.52	0.70

On average, judges rated the treatment group higher on the post-test ($M = 3.71$, $SE = 0.14$) than on the pre-test ($M = 3.57$, $SE = 0.15$). A Wilcoxon signed-rank test showed no significant difference between pre-test and post-test ($Z = -0.76$, $p = .485$). However, there was a significant difference between pre-test and delayed post-test results for the game-playing group ($Z = -2.09$, $p = .035$). The control group scores on this measure, however, decreased from pre-test ($M = 3.51$, $SE = 0.15$) to post-test ($M = 3.14$, $SE = 0.11$). A Wilcoxon signed-rank test showed a significant difference between the pre-test and post-test ($Z = -2.03$, $p = .047$). There was no significant difference between pre-test and delayed post-test ($Z = -0.12$, $p = .930$).

Speech Rate and Pauses: Judges' Ratings

A repeated measures factoral design test was conducted and results showed that there was no significant difference between groups over time, according to judges' ratings of speech rate and pauses (p = .122; see Table 3).

On average, judges rated the treatment group slightly higher on the post-test (M = 3.51, SE = 0.18) than on the pre-test (M = 3.32, SE = 0.18). However, a Wilcoxon signed-rank test showed no significant difference between pre-test and post-test (Z = -0.94, p = .372); there was also no significant difference between the pre-test and delayed post-test (Z = -1.96, p = .052). The control group scores on this measure, on the other hand, decreased from pre-test (M = 3.35, SE = 0.14) to post-test (M = 3.00, SE = 0.10). A Wilcoxon signed-rank test showed a significant decrease between pre-test and post-test (Z = -2.67, p = .004), but no significant difference between pre-test and delayed post-test (Z = -0.42, p = .734).

Table 3. *Speech Rate and Pause Ratings for Storytelling Task*

	Pre-Test		Post-Test		Delayed Post-Test	
Group	***M***	***SD***	***M***	***SD***	***M***	***SD***
Treatment	3.32	0.60	3.51	0.56	3.72	0.55
Control	3.35	0.42	3.00	0.31	3.26	0.93

Learner Perspectives

To answer the second research question regarding learners' perceptions of Spaceteam ESL as a pedagogical tool to reduce anxiety and increase WTC, seven participants from the treatment group completed semi-structured interviews after the post-test in week 6. Categories were created based on analyses of the themes that appeared in the interviews (for a more extensive selection of themes, see the Appendix).

Anxiety

Most participants reported that they felt less anxious than usual in class after playing the game: "[I feel] a little more [comfortable] than I am normally." "I feel good, it's funny. For this I feel relaxed." Some participants commented that the game helped to reduce the level of embarrassment they felt in class: "It's more embarrassing before I play the game, but after … I am [embarrassed] but it's slowly less." "I just have to read, I think it's not embarrassing, you just game in group." In addition, participants also perceived that the game reduced feelings of anxiety, allowing them to practice their pronunciation with peers: "I feel relaxed, the game is funny, and to [speak] with other people at the same level, it's ok." "[I] feel good … because we practiced to tell the word we don't know." In other words, although the oral output was forced during gameplay, the fun aspect of the experience helped to reduce anxiety and therefore encouraged pronunciation practice. The CMC element of gameplay also appeared to have reduced communication anxiety: "It's more easy to speak to other people when I don't see this, when I see the screen."

WTC

The time constraints on output production imposed by the game seemed to have encouraged students to produce more output than in normal classroom activities: "I use more English in [a short period of] time … because in class I never speak because I don't like." However, any higher levels of WTC experienced during gameplay did not appear to influence WTC in the classroom context when not playing Spaceteam ESL, as some participants suggested that they felt the same in class after playing the game. One student stated, "I'm comfortable if I don't speak [in class]" and therefore continued not to participate in class.

Teamwork

Participants readily recognized that success in the game was dependent on teamwork. Not only did players need to work together to succeed, but they were reliant on each other for feedback on their pronunciation.

If a player's teammate misunderstood a command, then they knew that they had made a pronunciation error: "If you tell a sentence and the other people don't understand … you need to have a good [speaking] and a good [listening]." When players recognized their errors, they would often repeat the words, playing with or modifying their pronunciation: "If it's my word that not are completed, I will repeat … if I don't understand that another person tell, yes, I will ask him to repeat." One participant found the teamwork aspect of the game to be particularly motivating, stating that success in the game "[is] not for me, it's for team spirit, it's not just me, it's all my team to try to learn English." Each team member therefore contributed to the learning experience of their peers.

Familiarity

Some participants reported that playing Spaceteam ESL helped them to get to know their classmates: "It made me work with a people I never talked, so we are laughing and that's fun." Players also mentioned that the experience helped to facilitate interaction with peers to create a comfortable learning environment: "I talk when I play on the iPads … and after we talk [about] the game. [It helps me] to have communication with other people in my class." "I was probably more comfortable to talk with them [during the game]." It was unclear, however, if this had an impact on their interactions in class after gameplay.

Discussion

This study investigated the effects of playing the mobile team building game Spaceteam ESL on fluency development and examined participants' perceptions of the game as a tool to reduce anxiety and increase WTC. Two research questions were addressed: (1) Does playing Spaceteam ESL affect fluency development in English as a second language (ESL) learners? (2) What are learner perceptions of Spaceteam ESL as a tool to reduce anxiety and increase WTC?

For the first research question, the only significant difference observed involved the game-playing group, which displayed a significant improvement from pre-test to delayed post-test according to the judges' ratings of fluency. On the other measures (SPM and judge's ratings of speech rate and pauses), results showed no significant difference between the treatment and control groups. However, results show a trend for these two measures, as the treatment group consistently outperformed the control group from pre-test to post-test, although not significantly. For the second research question, data collected from participant interviews revealed that the game was perceived as a means to lower anxiety and encourage pronunciation practice; results regarding WTC were inconclusive.

Fluency Development

While results suggested that there was no significant difference in improvement between SPM scores for the treatment and control groups between the pre-test and the two post-tests, the results did show a slight trend favoring the group that engaged in gameplay. This trend, observed in SPM results for the storytelling task (Table 1) suggests that, although there was no significant improvement over time, the scores of the treatment group did appear to improve between pre- and post-tests, whereas the control group scores remained the same or even decreased between the tests (with a significant decrease in speech rate and pauses from pre-test to post-test). Participants in the treatment group continued to improve through the delayed post-test. The control group, interestingly, also improved from pre-test to delayed post-test, despite their decline in performance at the post-test.

In the judges' ratings (Table 2 and Table 3), we see another story. Judges' ratings for overall fluency show that the judges perceived the treatment group as improving significantly from pre-test to delayed post-test, although not significantly from pre-test to post-test. As in the SPM results, the treatment group showed steady improvement while the control group's performance decreased in the post-test, significantly so in the case of speech rate and pauses. Judges' ratings overall reiterated the suggestion by Derwing et al. (2009) that speech rate and pauses play a significant role in the definition of fluency. Judges' ratings for overall fluency and rate of speech and pauses between tests were correlated: as fluency ratings increased (or

decreased), so did scores for speech rate and pauses as rated by judges. Therefore, as students' fluency increased, their speech rate and pauses became more natural, and vice versa.

These trends in fluency development observed for the treatment group may agree with the predictions of Swain's (2000) output hypothesis. As discussed earlier, Swain suggests that students learn through output and production practice in their L2, as they need to experiment with their hypotheses regarding the language and its structures, to see how the language functions, and to learn from trial and error. When playing Spaceteam ESL, players were forced to produce output: if they did not say their commands orally, their team would not be successful. Players were therefore held accountable for their actions and were thus more likely to work harder (AbuSeileek, 2012). This forced output also allowed players to experiment with pronunciation and receive peer feedback based on success or errors, thereby supporting Swain's (2000) output hypothesis.

Output (i.e., oral production) is also a requirement for fluency development (Nation & Newton, 2008). Not only were players required to produce output to be successful, but they had to do so in a limited amount of time. In the current study, participants were encouraged to increase the game speed as they progressed through game levels over the treatment sessions (users had the ability to control the game speed). This attention to the speeding up of language use might have contributed to the treatment group's progressive increase in SPM scores, as well as judges' ratings for overall fluency and both speech rate and pauses. While participants in the control group also had to produce output in a limited amount of time to complete their tasks, there was not the same amount of time pressure or need for feedback as in Spaceteam ESL. These students might therefore not have felt the need to perform efficiently. However, as the results for the treatment and control groups were not significant, a longer treatment period for both groups is required to help better understand the relationship between mobile games such as Spaceteam ESL and fluency development.

The timing of the post-tests and delayed post-tests may provide an explanation for the statistically insignificant results of the treatment group and the decline in performance for the control group. There were a number of factors that were out of the researcher's control. Most significantly, there was a week's break between the treatment sessions in Weeks 5 and 6 for the institution's spring break, during which participants had little exposure to English. Participants also had a mid-term oral evaluation which preceded the post-tests and delayed post-tests, further distracting them from their testing performance. Additionally, due to the oral evaluation and other time constraints, the length of the last treatment in Week 6 was reduced to 5–10 minutes.

Despite the unfortunate timing of the post-tests and delayed post-tests, participants in the treatment group displayed an overall pattern of improvement, albeit not statistically significant for two of the measures. This suggests that Spaceteam ESL has the potential to be used as an effective warm-up activity. Unlike traditional classroom activities, Spaceteam ESL offers students and teachers a pre-packaged fluency development activity (as outlined by Nation & Newton, 2008). It encourages players to speed up their use of familiar language items. It also requires little preparation and planning, unlike paper-based or conversation activities prepared by the teacher. Spaceteam ESL does not require access to a computer lab and is readily available on mobile devices. This increases the portability and accessibility of the game as a fluency development activity.

In addition, the game may be used by students outside of the class to continue oral production practice with friends or family members. Although Quebec college students study English for approximately eight years prior to admittance, they often do not make significant progress over the course of their language learning training, possibly due to their limited exposure to the target language and the lack of distributed and retrieval practice, as recommended by Roediger and Pyc (2012). Nation and Macalister (2009) call for teachers and curriculum developers to "work within the constraint" or "[overcome] the constraint" (p. 20) of time in the classroom to maximize the learning experience. By encouraging and motivating students to continue practicing the L2 outside the classroom, language teachers can compensate for limited class time and learners can become more proficient and fluent in a shorter period of time. Spaceteam ESL may therefore

serve as a tool to encourage students to practice oral production outside the classroom, contributing to their fluency development and compensating for gaps in class time.

Learner Perspectives

Interviews with participants suggest that Spaceteam ESL was positively perceived by the treatment group, and participants generally experienced feelings of comfort while engaging in gameplay. For one participant, gameplay made him "feel a little more [comfortable] than [he is] normally." As seen in the literature, the CMC element of the game may have contributed to the creation of a comfortable atmosphere, reducing the pressure and anxiety of FTF communication by allowing students to focus on the device's screen, gameplay, and the giving and receiving input and output, rather than on how others may perceive their performance. Another participant expressed this idea clearly: "It's more easy to speak to other people when I don't see this, when I see the screen," corroborating the findings of other studies addressing anxiety and CMC (e.g., Arnold, 2007; Baralt & Gurzynski-Weiss, 2011). The fun aspect of mobile gaming may also help to reduce anxiety: "it's [fun], for this I feel relaxed."

Participant comments also suggest that the teamwork aspect of the game was beneficial in two different ways: it helped to increase familiarity between peers and provided players with peer feedback. This corroborates the position of Dörnyei and Kormos (2000) and MacIntyre et al. (1998) that group tasks can contribute to a sense of belonging and increase familiarity between group members, which can, in turn, increase student WTC. As one of the participants pointed out, "I was probably more comfortable to talk with [my peers]" during gameplay, suggesting that WTC levels were higher during gameplay than in other tasks. The fun aspect of gameplay, as suggested earlier, may also encourage players to participate and use English. One participant admitted that the game was "more fun than English class, we can learn when you play so it's fun." Warschauer and Healey (1998) suggest the fun aspect of gameplay may be motivating for language learners and thereby encourage participation.

It is not clear, however, if the benefits of gameplay influenced student WTC in other contexts, in or outside of the classroom. While participants expressed feeling more comfortable and less anxious after the experience, they did not admit speaking more often in class. It is possible then that the predictions for raised WTC in the classroom after gameplay may have been misplaced. J. Steele (personal communication, April 22, 2016) pointed out that while WTC might have increased while participants played the game, WTC levels could not be expected to carry over into a completely different task setting. Players might have been more willing to produce language during gameplay, but the gaming environment was very different from the classroom or testing environments. It is therefore unclear whether the WTC experienced during gaming sessions carried over into class, contrary to what was suggested by the pilot study. Despite this, participants still experienced the forced output required by Spaceteam ESL, which required them to produce and use language in an intelligible manner and under a time constraint.

Conclusions

Spaceteam ESL offers a combination of features that encourages fluency development. Not only does it address all requirements for a fluency development activity as outlined by Nation and Newton (2008), but it also provides the safety of CMC with opportunities for oral output and immediate (peer) feedback, addressing the missing component of previous CMC studies (e.g., Baralt & Gurzynski-Weiss, 2011). The game also offers a fluency development activity that is pre-prepared and ready for use in the language classroom, requiring little preparation from the teacher. Although the treatment group only showed significant improvement from the pre-test to the delayed post-test on judges' ratings of overall fluency, the data suggest that playing Spaceteam ESL as a warm-up activity may also affect related aspects of speech, such as rate of speech and frequency and duration of pauses. Further research, under more controllable circumstances, is needed to determine how much the game can truly influence the development of oral fluency.

Several factors may have contributed to reduced levels of anxiety. As participants reported in the interviews,

participating in gameplay increased feelings of comfort with English in general and encouraged familiarity among peers, contributing to a favorable learning environment. Participants were also able to practice their pronunciation and receive feedback from peers in a non-threatening manner as a result of the teamwork aspect of the game. Players were not judged for errors, and teammates frequently helped one another. Further investigation is required to determine the impact of gameplay, if any, on student levels of WTC, as this was not explicitly addressed by participants in the interview data.

There were several limitations in the study, some of which were technical in nature, others methodological. Focusing on the technical limitations first, there were some difficulties at the institution (e.g., the malfunctioning of some iPads), resulting in some delays during class. Also, as the class only met once a week, participants only had a total of 90 minutes maximum of exposure to the treatment, which may not have been enough to produce significant results. The instructor was not as strict with the timing of the control group activities, but attempted to keep within the 15-minute time frame. Another significant limitation was the timing of the post-tests and delayed post-tests, mentioned earlier. Because the testing took place after a week of vacation and following mid-term oral evaluations, some participants commented that they were tired and were not eager to participate. This is reflected in the quantitative results, as the results of some individuals (in both groups) decreased from pre-test to post-test. The final treatment session in Week 6 was also shortened (to 5–10 minutes) due to time constraints implemented by the instructor. In future studies, the researchers are keen to replicate this investigation over a longer period (i.e., a full school semester) and under more controllable circumstances.

As seen in previous studies (Grimshaw et al., 2015; Papadima-Sophocleous, 2015; Stockwell, 2007), the implementation of mobile devices has been successful with language learners. Digital gaming has also shown promise and has been used to develop a variety of language skills (Allen et al., 2014; Kim, 2014; Lan, 2014; Reinders & Wattana, 2014). Despite the limitations faced in the study, results suggest that mobile games such as Spaceteam ESL may be beneficial to encouraging oral fluency development while reducing learner anxiety. Spaceteam ESL, like many other mobile apps, offers a ready-made language practice activity that can be used anywhere by anyone. With its endless possibilities, mobile gaming in L2 education may prove to be invaluable to language development.

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Appendix. Participant Responses

Participant	Category	Comment
1	Familiarity	"[I talk to] maybe 2 or 3 people … a little because it made me work with a people to I never talked, so we are laughing and that's fun"
	Anxiety	"I'm not stressed … I'm relaxed [while playing the game]" [in class, after gameplay]
	Anxiety	"[I feel] comfortable, just a little more than I am normally"
	Pronunciation	"yeah maybe, but that's not a big help, but it's a little help … with the pronunciation of words, but only specific words like asteroid or wormhole"
	Teamwork	"because if we only read the thing we need to do we can't do all the job because sometimes the things is on the other iPad"
	Pronunciation	"we repeat the word [when a misunderstanding occurs]"
2	Pronunciation	"The game is very good and I think it's best practice for [repeating] the same words."
	Anxiety	"I feel good, it's funny. For this I feel relaxed."
	Anxiety/ Pronunciation	"I feel relaxed, the game is funny, and to spell with other people at the same level, it's ok"
	Pronunciation	"I like practice and repeat the words"
	Anxiety / WTC	"It's more easy to speak to other people when I don't see this, when I see the screen"
	Teamwork	"It's a team, it's very team because if you tell a sentence and the other people don't understand, it's very team, you need to have a good telling and a good reception."
	Pronunciation	"[If there's a problem] I repeat the word"
	Pronunciation/ Anxiety	"The pronunciation, and remove the [embarrassment]"
3	Familiarity	"The contact with the people"

	WTC	"It's fun, it's more fun than English class, we can learn when you play so it's fun"
	Pronunciation	"The word, the new word, and the pronunciation"
	Teamwork	"Because we can practice communication and that's it, so you can speak in English"
	Pronunciation	"I say that if he can repeat"
	WTC / Anxiety	"I'm comfortable if I don't speak [in class]"
	Pronunciation	"With the new words, and the team"
4	Familiarity	"Yes, I know them, because I talk when I play on the iPads"
	Familiarity	"Because the game, and after we talk [about] the game and all this to have communication with other people in my class"
	Other	"It's a game, it's the same to play with my phone on another game, it's just talking in English with another person"
	Anxiety	[regarding comfort, stress] "it's just fun"
	Anxiety	"it's more embarrassing before I play the game, but after it's … I am [embarrassed] but it's slowly less"
	Teamwork	"because it's spirits, it's game spirts, it's not for me it's for team spirit, it's not just me it's all my team to try to learn English"
	Pronunciation	"I try to help … I try to search the word, or try another [way of pronouncing]"
	Pronunciation	"it's the same word but yes, it helped me to talk more, but not only to talk more, it's the word we have in the game, my pronunciation is more good, but the other words don't help me to explain, to say the other words, it's just the word in the game that I pronunciate more"
	Other	"I like the movement and it's easy so it's fun … it's not complicated"
5	Other	"but I really like to speak in English and play this game, it's really fun"
	Pronunciation / WTC	"I use more English in more small time … because in class I never speak because I don't like"
	Familiarity	"I just play the game with them"
	Anxiety	"I didn't pay attention about my nervousity in English"
	Other	"I really like this game, it's easy it's not hard"
	Teamwork	"it's not a solo game, it's a spaceship team"
6	Anxiety	"I was probably more comfortable to talk with them [through the game]"
	Anxiety	"comfortable, relaxed, you just had to read [in the game]"
	Teamwork	"it's teamwork, you know, you need to work to do it in team, to go to the next level and advance"
	Pronunciation	"first of all I repeat the sentence, and after if he make a mistake, it happened"
	Teamwork	"we work in team to advance"
	Pronunciation	[English improvement] "yes, a little bit, for the pronunciation of some words"

	Anxiety / Pronunciation	"It will help you to become more comfortable in English, it will help you to pronounce some words"
7	Anxiety / Teamwork	"Good. Very good, I just have to read, I think it's not embarrassing, you just game in group, it's ok, it's very good."
	Anxiety / Pronunciation	"Feel good [i.e. comfortable after gameplay] … yes because we practiced to tell the word we don't know so it's good to practice English"
	Other	"because it's simple, so we just have to read and the other person just have to complete, so I think it's simple, so if we're not good in English it's easy"
	Teamwork	"because if you tell the words, the person complete, and if you don't tell … and if I tell the word, and my team don't put the button, so the time runs out, so I think it's a team"
	Pronunciation	"we repeat … if it's my word that not are completed, I will repeat but because my time … if I don't understand that another person tell, yes I will ask him to repeat"
	Pronunciation	"we take more time to pronunciate words, because like individual, in the game you practice how to separate the word, so it's helped to do it again with other words"

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