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A comparison of linear and interactive fiction on vocabulary acquisition, reading comprehension and engagement

Tsuzuki Nagai and James York, Tokyo Denki University

Abstract

There are few studies that explore the cognitive and affective benefits of interactive fiction (IF) in language learning and teaching contexts. Inspired by Neville, et al. (2009), we compared the effectiveness of IF in comparison to non-interactive, linear fiction in terms of vocabulary acquisition, reading comprehension and motivation in a university EFL context. Participants ($n = 88$) were divided into two groups. The control group read a linear story; the experimental group played through an interactive version of the same story. A pre- and post-experiment vocabulary test was employed to measure the acquisition of 16 target vocabulary words. A test based on the actions of characters within the story was also employed to measure reading comprehension. Finally, a post-test questionnaire measured student perceptions of learning with linear and IF.

This paper introduces the results of the study which are as follows. Findings revealed no significant difference in scores between the control (linear) and experimental (IF) groups for vocabulary acquisition or reading comprehension. However, an additional analysis of the data was conducted based on learners' gaming proficiency which revealed that, in comparison to high proficiency gamers, low proficiency gamers found it difficult to control the interactive version of the story. This suggests that students' level of game literacy may influence perceptions of the system.

インタラクティブ・フィクション (IF) が言語学習において認知的・感情的にどのような効果をもたらすのかを探求した研究はほとんどない。Neville (2009) にヒントを得て、大学 EFL のコンテキストにおいて、語彙習得・読解力・学習意欲の観点から、IF の効果を、非対話型の物語と比較した。参加者 ($n = 88$) を 2 つのグループに分けた。対照群は選択肢のない直線的な物語を読み、実験群は同じ物語で選択肢のあるものを読んだ。実験前と実験後に行われた語彙テストでは、物語から選ばれた 16 の語彙の習得状況を測定した。また、読解力を測定するために、物語中の登場人物の行動に基づくテストを実施した。最後に、実験後のアンケートで、直線的な物語と IF を使った学習に対する生徒の認識を測定した。

本稿では、本研究の結果を以下のように紹介する。対照群(直線的)と実験群(IF)の間で、語彙習得や読解力のスコアに有意な差がないことがわかった。しかし、学習者のゲーム習熟度に基づいてデータの追加分析を行ったところ、ゲーム習熟度の高い学習者に比べて、ゲーム習熟度の低い学習者はインタラクティブ版のストーリーをコントロールすることが困難であることが明らかになった。このことから、学習者のゲームリテラシーのレベルが、システムに対する認識に影響を与えている可能性が示唆された。

Keywords: interactive fiction, reading, game-based learning

Introduction

Whilst the use of games as teaching tools in second and foreign language education is nothing new (see Dorry, 1966; Lee, 1979), digital games are receiving increased attention as tools for language learning and teaching as their popularity as a pastime and cultural artefact grows (Mawer & Stanley, 2011). Indeed, according to a recent report, the game industry is now almost ten times the value of the music industry, and twice that of the movie industry (Richter, 2020), meaning that there is a high probability that our students are at least casual “gamers” even if they do not identify with this term itself. Implementing games in the classroom may thus be considered an imperative, allowing students to make use of the social and cultural capital they have accrued through gaming as part of their education (Walsh & Apperley, 2008; Blume, 2019)

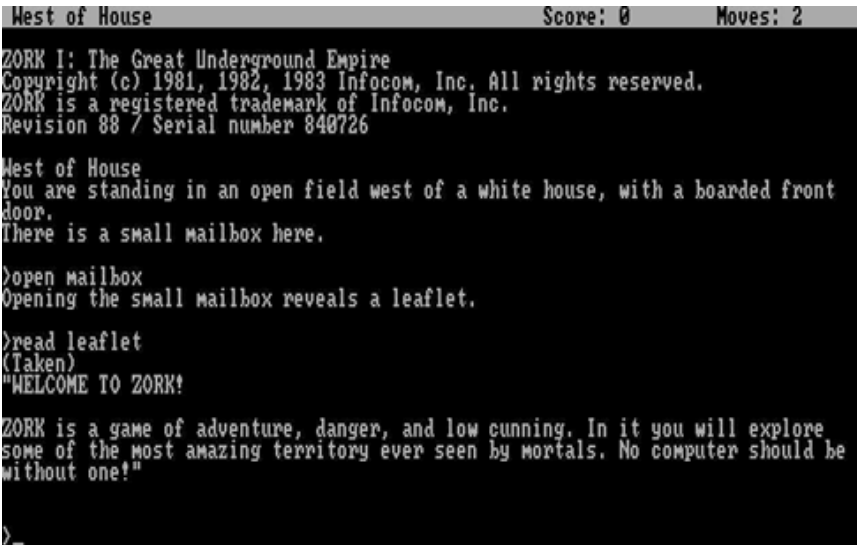
A brief history of interactive fiction

The present study focuses on a specific form of game known as “interactive fiction” which, as the name suggests, is an interactive form of fiction where the reader progresses the story in one of several directions based on their own choices. Choice is a key term here and may provoke memories of the classic interactive fiction series known as Choose Your Own Adventure (Montgomery, 1982). In these books, after reading a page (or sometimes more) of text, the reader would be given a choice to turn to other pages based on the decision they want to make. For example, and as the title of this paper states: “Turn to page 5 to enter the cave,” or “Turn to page 6 to stay on the current path.”

The original form of interactive fiction was thus paper based, where the reader had to turn to a specific page, of their choosing, to progress the story. However, this form of entertainment was also one of the earliest forms of electronic/digital games to be implemented in the late 1970s, such as in the *text-based adventure game Zork*” (see Figure 1). This game required the user to input simple text commands to progress the story such as GO, LOOK, OPEN, NORTH, and PICK UP (Lebling et al., 1979).

Figure 1

A screenshot of the text-based adventure game Zork.



With technological innovation however, these text-based adventure games developed into more graphically enriched experiences during the 1980s as pioneered by Lucasfilm Games. One of the most iconic games of this series is *The Secret of Monkey Island* (Lucasfilm Games, 1990). With the addition of graphics then, textual input was reduced, favoring “point-and-click” mechanics instead. Choice in terms of dialog did however remain (see Figure 2).

Figure 2

Screenshot of the adventure game *The Secret of Monkey Island*.

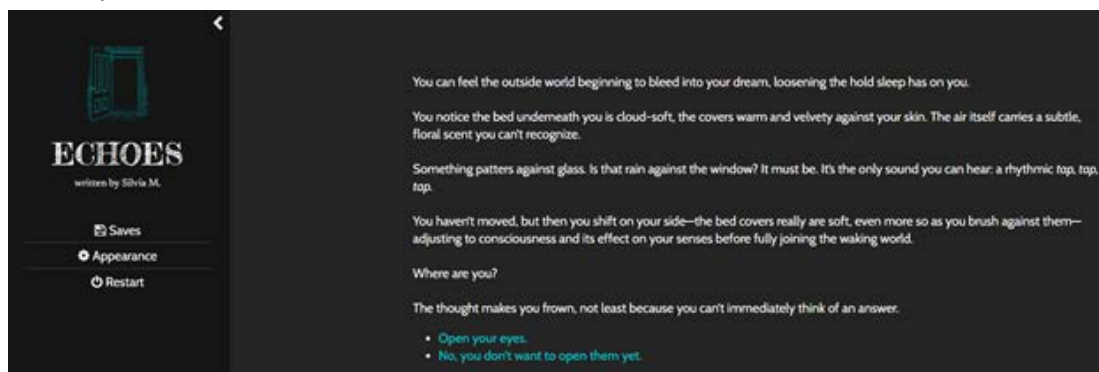


There also exists a form of *digital interactive fiction* which more closely mirrors that of its analog predecessor in that the user does not need to input commands to progress the

story, but merely choose what the protagonist does next by clicking one of several choices presented (see Figure 6). This type of digital interactive fiction is gaining in popularity with the appearance of simple-to-use interactive fiction creation tools such as Twine¹ and Renpy², meaning that the barrier to entry in terms of creating interactive fiction has been lowered significantly. Additionally, there now exists not only tools to create interactive fiction, but websites to share one's creations such as itch.io³ and fanfiction communities such as Archive of our Own⁴.

Figure 3

Screenshot of an independently made Twine game hosted on itch.io (EchoesDev, 2021).



The present study focuses explicitly on this final type of interactive fiction which features low complexity in terms of graphics, gameplay, and user interface; a large volume of text to read and requires minimal user interactivity. On a continuum from AAA games such as the popular massively multiplayer role-playing game (MMORPG) *World of Warcraft* and a linear, written novel appearing as text on a webpage, this type of interactive media falls closer to being a “story” than it is a “game.” The rationale for the use of this type of media are that 1) from a self-determination theoretic perspective, the element of player choice may increase student motivation to engage with the source material, 2) the active form of reading may improve reading comprehension and 3) there are relatively few studies which have explored the use of interactive fiction in the research literature.

Literature review

Interactive fiction in language learning contexts

Shelton (2007) considered the educational affordances of interactive fiction from a theoretical perspective. He proposes that the medium is especially suited for language learning as it may be created to align with learning goals or used alongside traditional texts to reinforce learning (p.114). As described above, the medium resembles traditional writing, but gives the reader choice, creating a uniquely active reading experience. In this way, as the reader is an active participant in the unfolding of a story, the main narrative perspective is often written in the second person where the dialog talks directly to the reader

(e.g., “*You* open the door and find a table with three items on the top, but *you* cannot make them out from the entrance. Do *you* get closer?”). Interactive Fiction may thus be beneficial in promoting motivation towards learning by immersing readers/students in the cultural and contextual situations that are aligned with the learning goals of the class (see Hubbard, 1991, 2002).

For empirical studies on IF, Neville et al. (2009) is the key source of inspiration for the present study. In their study, a standalone IF game was created to teach German vocabulary and culture as well as improve reading skills. It should be noted that the IF game featured here resembled a text-based adventure game, requiring input from the user in the form of keywords to progress the story. Due to students’ unfamiliarity with the experimental computer game, they required a tutorial on how to interact with and progress the story. Two groups of students were created where the control group read a story in German and the experimental group played through the interactive fiction game. After receiving input, both groups completed a homework assignment which consisted of: (1) a vocabulary test and (2) asked students to rewrite the story in their own words. Data was also collected in the form of student perceptions of learning with the experimental intervention.

The study was conducted with only 9 students, but results seemed to suggest that the control (reading) group considered reading and doing homework based on the reading a more effective method of developing German vocabulary skills than the experimental (IF) group. Additionally, they considered reading more relevant to their learning than the IF group, indicating that the reading activity more closely matched their preconceptions of how to study a foreign language. Finally, the control group also expressed more confidence in their mastery of German than the IF group. In terms of positive gains for the IF group, students in this group performed better on the vocabulary tests and perceived the story-rewriting homework to be less cognitively demanding than the students in the reading group. This suggests that there was less of a difference in the cognitive demand of the IF game and the homework, or, in other words, that it may be possible to prompt students to complete more difficult tasks in the L2 when using game-like systems (see also Shibata & York, 2021). Finally, the IF group also produced more of the vocabulary found in the game in their story reconstructions than the reading group. Limitations of this study were that 1) the small sample size, not allowing for any rigorous statistical analyses of vocabulary tests and student essays, and 2) the stories which the control and experimental groups read contained different content. The experimental group’s story was only based on the same scenario and vocabulary as the control group.

Outside of Neville et al. (2009), there are few studies which have explored the use of IF in language education. Similar to Shelton (2007), Pereira (2013) considers the affordances of the medium for language learning but does not present data or results of an empirical study other than several student perspectives on learning with IF where the general trend was that IF may be an engaging and useful tool for practicing reading the target language. In a follow up paper, Pereira (2013) again focused on the learning potential of IF focusing on writing, meaning focused instruction, and authenticity. This concerning trend of evaluating IF as a tool for language acquisition without implementing it in an empirical study continues in Bazinet (2015) who noted that “little research has been done on digital narratives in the L2 classroom” (p. 86). The present study thus aimed to verify the hypothetical

cognitive and affective benefits of IF in language teaching contexts. Irwin (2020) is a rare empirical example of interactive fiction use in an intact classroom where 48 students created IF using Google Slides. Results of the study suggested that students enjoyed this creative use of English, with improved motivation to write in English. Additionally, surveys suggested that the activity helped students to be able to express themselves in English, thus the project was considered a success with both affective and cognitive gains made.

Student familiarity with games

An important factor which relates to the present study is student familiarity with games and gaming culture. According to Rama et al., (2012) a participant with high gaming proficiency but low language ability performed better during a gaming task than a participant with the opposite characteristics due to familiarity with games, thus reducing cognitive load and providing motivation to play and in sum more opportunities for learning. The low-stakes environment of gaming is also thought to lower anxiety and increase willingness to communicate (Reinders & Wattana, 2014).

Research questions

Based on a review of the literature on interactive fiction in language learning contexts, the following research questions were formulated:

1. In comparison to a linear story, do the choices presented to readers in interactive fiction help improve vocabulary acquisition?
2. In comparison to a linear story, do the choices presented to readers in interactive fiction help improve reading comprehension?
3. What are students' perceptions of reading and learning with interactive fiction in comparison to a linear story?
4. Does students' familiarity with games and gaming culture affect learning and motivation?

Method

Participants

The study was carried out at a private university in Japan. 93 participants volunteered to take part in the study, however, not all participants completed every stage of the intervention meaning that the data from only 88 participants was used in the final data. All participants were native speakers of Japanese. 30 participants were in the second year of their studies, and 58 participants were in the first year of their studies. No payment was provided for participation.

Instruments

Story and vocabulary tests

First, researchers created a story where the setting was based at the university which all the participants attended. The content of the story thus related to various places within the university. This was done to create a sense of familiarity but at the same time also as

a way to introduce areas of the campus that the first-year students may not be familiar with. The story theme was designed around the mystery genre or, more precisely, a “who-dunnit” where the reader must figure out who stole students’ pencils by going to various locations around the campus and collecting clues. The story is available in its entirety in Appendix 1: The story created for this study. Unlike previous research, the story was designed to contain the same content on both systems (linear and interactive versions). Thus, they featured the same start and ending, vocabulary, characters, and photos of the university grounds. However, it should be noted that although the content was the same, due to the non-linear interactivity of the IF version, it is not ‘identical’ to the linear version in that the story develops in a different order depending on reader choices.

Vocabulary used in the story was chosen to coincide with the Eiken Level 2 test, a test which is designed to be appropriate for graduating high school students in Japan (Eiken, 2021). Among the words used, 16 were chosen for the pre- post- and delayed post-test. These were chosen based on their position in the New General Service List (NGSL) and academic word list. 16 words were chosen to be incorporated in the vocabulary test. 11 words between 1001 and 2000 on the NGSL (barber, thief, information, shout, a bottle of, normal, encourage, fold, solve, guess, quietly), and 5 on the academic word list (incident, similar, co-operation, initial, inspect).

Interactive fiction software

The software employed for creating interactive fiction in this project was Twine, an open source IF creation tool which runs in an internet browser or may be downloaded as a standalone application on Windows, Mac OS, or Linux operating systems. The simple GUI allows the user to input the prose (narrative) for a section of the story and create choices for the reader within the text (Figure 4). Text wrapped in double parentheses ([[]]) represents a choice to the reader, and will automatically create a new dialog box, showing how it connects to other boxes in the story (Figure 5). The interactivity in our system thus centred around giving readers a choice of location to visit.

Figure 4

A dialogue box in Twine featuring two choices for the reader at the bottom.

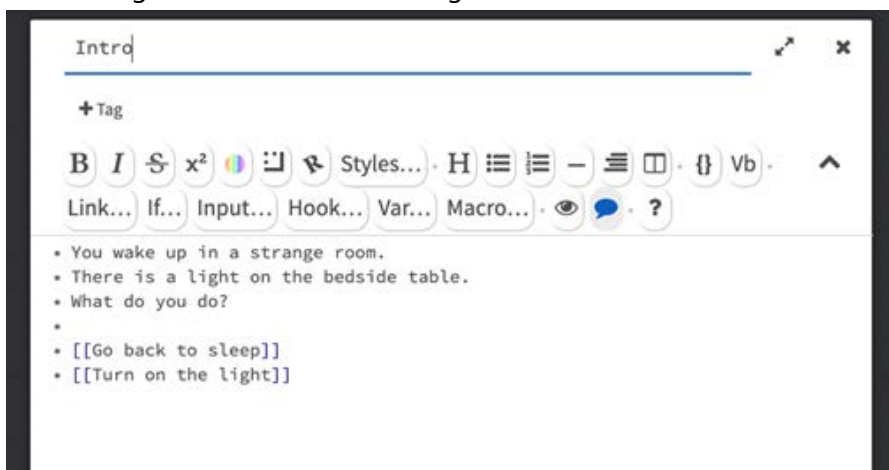
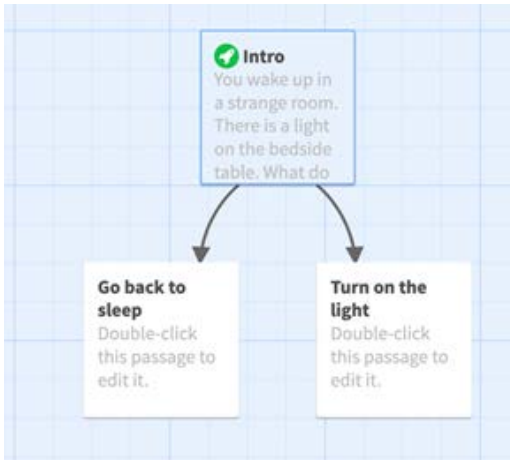


Figure 5

A screenshot of Twine showing how dialogue boxes are linked.



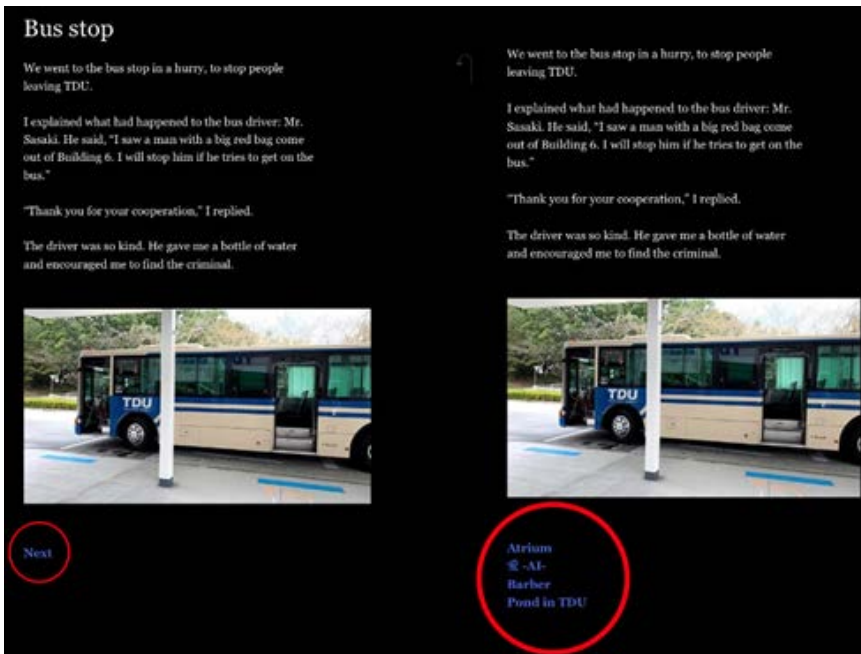
It is also worth mentioning that in order to keep the two modes of instruction as comparable as possible, unlike more traditional IF which allows the reader to experience different endings based on their performance through the story, our system featured a single ending. Player choice was thus enacted through the order in which they chose to visit the various locations.

GitHub

Upon the creation of both story types in Twine, the researchers hosted them as HTML webpages on GitHub. This allowed players/readers to access the story on their smartphones and or desktop PCs. The linear story may be accessed here: <https://kasumi21-i.github.io/HTML2/>. The interactive story may be accessed here: https://kasumi21-i.github.io/AR_Twine/. Figure 6 shows a side-by-side comparison of the two systems. The red circle shows how the interactive system (left) gave the user a choice in deciding where they went after reading the text at a specific location.

Figure 6

Comparison of the linear and interactive stories



Reading comprehension test

A comprehension test was administered after the intervention. The same test was given to each group. The test consisted of 15 questions, where two to three questions were based on each location. A full list is provided in Appendix 2. All questions were multiple choice with two wrong answers and a single correct answer.

System perceptions questionnaire

A questionnaire was designed to understand student perceptions regarding learning English with the two instructional systems. Six measures were utilized based on that of York, et al. (2021) and were weighted from 1 to 10, 10 being a strong indication of agreement and 1 disagreement with each statement. All measures are presented below:

1. It was fun to learn with this system
2. It was easy to read English with this system
3. It was difficult to control this system
4. I think this is an effective way to study English
5. The story was interesting
6. This system was easier than using a textbook

Gaming proficiency questionnaire

In order to understand whether gaming proficiency had an effect on test scores and perceptions, participants were asked about their gaming habits. Several questions were asked based on a survey created by the Computer Entertainment Supplier's Association

(CESA, 2010), however, eventually only one key question was referred to in determining a student's gameplaying familiarity: the amount of time they spend playing games each day (Question 1, below).

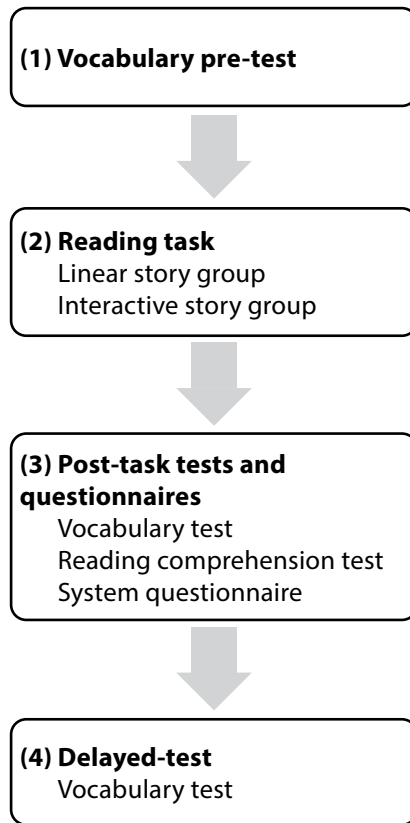
1. How often do you play games?
2. What platforms do you play games on?
3. On an average day, how long do you spend playing games?
4. What genres do you play?
5. What is your favourite genre?
6. How much time do you spend on the internet each day?
7. Have your gaming habits ever caused a problem for you?

Procedure

The experiment was an independent measures design where participants completed the reading exercise using either the control (linear) or experimental (interactive) systems. The procedure can be seen graphically in Figure 7. First, all participants completed the vocabulary pre-task (1). On completion of the tests, both groups read the story using their assigned system (2). After reading the story, all participants completed the post-reading vocabulary test, reading comprehension test and the system questionnaire (3). Finally, both groups completed the delayed task vocabulary test one week after the experiment (4).

Figure 7

The experiment procedure flowchart



Data analysis

A one-way repeated measures ANOVA was used to compare mean scores for the pre-experiment, post-task and delayed-task vocabulary scores. Secondly, T-tests were used to validate the difference in mean scores between instructional groups for the reading comprehension test. T-tests were also used to determine if participants' perceptions of the two systems were affected by mode of instruction (i.e., linear vs interactive modes). The statistical analysis software used was IBM's SPSS 24.

Finally, to explore the relationship between reading comprehension, instructional group (AR vs Interactional fiction) and gaming proficiency, a stepwise regression was run. First assumptions of normality were assessed for violations of assumptions of normality, linearity, multicollinearity, and homoscedasticity. Following this, the independent variables (vocabulary test scores or comprehension scores) and participant gaming proficiency (low, medium, high) were entered to control for any differences in gaming proficiency. Next, student membership in the instructional group was entered into the model. Finally, the interaction between instructional group and gaming proficiency was entered into the model. The results of the stepwise regressions were further analysed via ANOVA tests. R was used to generate certain plots and to run the stepwise regressions. An alpha level of $p = .05$ was set for all statistical tests.

Results

RQ1: System effects on vocabulary gains

Vocabulary gains by system

Table 1 reveals the descriptive statistics for this measure. Mean scores for both groups (linear and interactive) increased by approximately 3 points from the pre- to post-task stages, with scores staying approximately the same for both groups at the delayed task stage.

Table 1

Descriptive statistics for vocabulary scores by system.

Instructional system	Mean	Std. deviation
Linear story		
Pre-experiment	11.88	1.98
Post-task	14.44	1.45
Delayed-task	14.63	1.51
Interactive story		
Pre-experiment	11.87	2.13
Post-task	14.57	1.38
Delayed-task	14.53	1.47

Following the descriptive statistics, a repeated measures ANOVA was run on the data. Mauchly's test indicated a violation of the sphericity assumption, $\chi^2(2) = 31.36, p < .05$. Since sphericity is violated ($\epsilon = 0.784$), Huyn-Feldt corrected results are reported. Vocabulary tests scores were not significantly affected by mode of instruction, $F(1.57, 134.90) = .19, p = .77$.

RQ2: System effects on reading comprehension

Comprehension test mean scores are presented in Table 2. There is virtually no difference between the comprehension test mean scores for the two groups, and similarly, no discerning difference in standard deviation.

Table 2

Mean scores for the reading comprehension test by system

Instructional system	Mean	Std. deviation
Interactive	12.41	2.18
Linear	12.34	2.05

An independent-samples t-test was conducted to compare mean comprehension test scores between the groups. There was **no significant difference** between the mean scores ($p = .87$). This suggests that the interactivity of the experimental system did not translate into an increased depth of reading comprehension.

As a summary of RQ1, results suggest that interactivity in the system did not have a statistically significant effect on learners' vocabulary acquisition or reading comprehension.

RQ3: Student perceptions of learning with IF

A post-task questionnaire was employed to explore differences in participant opinions of learning with each of the two systems. Mean scores and standard deviations for each measure are presented in Table 3 and graphically in Figure 8. General trends suggest little difference in perceptions between the two systems. All measures showed a positive and similar response apart from the measure regarding the difficulty of controlling the system, where predictably the participants considered the linear story system easier to control. T-tests were run on the data which revealed no significant difference between mean scores for any measure.

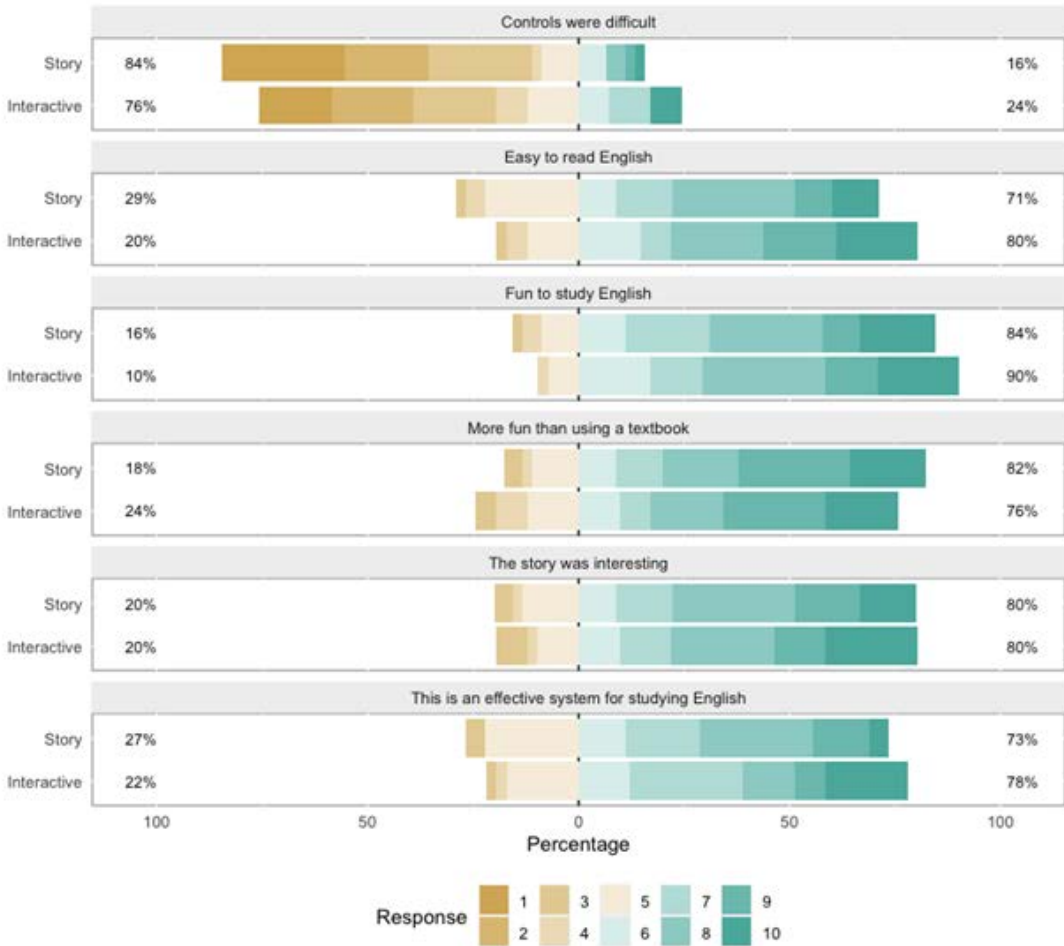
Table 3

Mean scores and standard deviations for measures on the post-task perceptions questionnaire.

Statement	Linear	SD	Interactive	SD
The controls were difficult	3.13	2.33	3.90	3.90
The system made it easy to read English	7.04	1.86	7.51	7.51
The system was fun to study English	7.47	1.82	7.73	1.66
This system was more fun to use than a textbook	7.69	1.98	7.41	7.41
The story was interesting	7.40	1.89	7.49	7.49
This is an effective study method	6.93	1.72	7.22	7.22

Figure 8

Graphical representation of post-task perception questionnaire scores.



Open-ended responses

A final section on the system perceptions questionnaire was provided to record open ended responses. 18 comments were recorded. Whilst some ($n = 2$) commented on the experience being interesting or fun, others mentioned specific positive and negative elements of the two systems. Firstly, two comments mentioned that seeing vocabulary in context helped them understand vocabulary meanings more easily:

[Linear Story 1] 物語の方が英単語を飲み込みやすく感じた。[I felt it was easier to understand the English words in the story.]

[Linear Story 2] 文章から意味の類推ができたため語彙テストより意味がわかった。面白かった。[I was able to understand the meaning better than in a vocabulary test because I could infer the meaning from the sentences. It was interesting.]

However, one comment suggested that remembering character names made learning through literature difficult, emphasizing the point that it is difficult to provide a motivating medium for all learners: **[Linear Story 3]** やはり短編だと登場人物の名前忘れますね... [As I thought, I forget the names of the characters in a short story...]

Another comment regarding the vocabulary test may provide evidence as to why the vocabulary test scores are so similar: the level of tested vocabulary being too low for the participants: [**Interactive 1**] 語彙力テストはあまり難しくなかったため難易度を挙げてもよいと思う [The vocabulary test was not too difficult, so I think the difficulty level could be raised.]

No comments specifically referenced the interactivity or choices presented by the interactive system. However, two comments mentioned that the UI was intuitive and that the black background made the text easy to read. It should be noted that neither of these elements was specific to the IF system, but a feature of both.

Finally, one comment from a participant that read the story using the interactive system mentioned that the story was long because they were not used to reading English: [**Interactive 2**] 英文を読み慣れていないせいか本文が長いと感じた。[I felt that the text was long because I was not used to reading English].

RQ4: Effect of participant gaming proficiency on learning gains and perceptions

Following the above tests to determine whether mode of instruction had an effect on learning gains, we investigated how participant familiarity with games and gaming may affect learning gains and system perceptions. In this study, gaming proficiency was calculated by asking participants how much time they spend playing games each day. The questionnaire featured a closed-ended question with the predefined responses being: None, between 30 and 60 minutes, between 1 hour and 2 hours, and so on. A participant's daily gameplaying time was taken as the mid-point of the category they selected. Thus, if a participant had selected "between 1 and 2 hours," their daily game playing time was converted to 90 minutes.

Based on this calculation, the mean daily game playing time for all participants was 126.65 minutes with a standard deviation of 74.81 minutes. As such, we defined three groups based on the amount of time they spent playing games daily. The LOW gaming proficiency group were classified as those who played for 1 standard deviation or less than the mean. The HIGH gaming proficiency group was defined as those who played for 1 standard deviation or higher than the mean. Students whose daily game playing time fell within 1 standard deviation of the mean were considered to have MEDIUM gameplaying familiarity. Thus, three groups were created. The three groups were further divided based on the system used in the experiment resulting in six groups (Table 4).

Table 4

Participant numbers based on gaming proficiency groups and system

Number of participants	Low	Medium	High
Interactive	8	20	13
Story	11	29	7

The following section thus explores RQ4: the effect of gaming proficiency on learning gains and perceptions of the two systems. It should be noted that two participants did not complete this survey, making the total number of participants 86.

Vocabulary and comprehension test scores by gaming proficiency and system

A stepwise regression was run to explore the relationship between vocabulary gains and reading comprehension scores based on gaming proficiency and instructional group (Linear vs Interactive fiction). First assumptions of normality were assessed, and it was determined that there were no violations of assumptions of normality, linearity, multicollinearity, and homoscedasticity. In the first step, students' gaming proficiency (low, medium, high) was entered to control for any differences in gaming frequency. Next, student membership in the instructional group was entered into the model. Finally, the interaction between instructional group and gaming frequency was entered into the model. As assessed by ANOVA, there were no significant differences in mean scores in R-square at any step for both vocabulary gains and comprehension scores. Table 5 shows the vocabulary test scores at each stage of the experiment by system and gaming proficiency, and similarly Table 6 shows mean reading comprehension scores.

Table 5

Vocabulary scores at each stage of the experiment by system and gaming proficiency

	Pre	Post	Delay
Low Interactive	10.38	14	13.88
Low Linear	12	14.91	14.82
Med Interactive	11.9	14.4	14.75
Med Linear	11.79	14.41	14.48
High Interactive	12.77	14.77	14.92
High Linear	12	14.71	14.29

Table 6

Comprehension test scores by system and gaming proficiency

	Low	Medium	High
Interactive	11.63 (n=8)	12.35 (n=20)	13 (n=13)
Linear	12.27 (n=11)	12.45 (n=29)	12 (n=7)

System perceptions based on gaming proficiency

Following the above statistical tests on vocabulary test score gains and comprehension test scores, the final analysis was to assess whether gaming proficiency had an effect on student perceptions of learning with each system.

Of the six questions asked of participants, only the measure regarding difficulty to control the systems revealed a significant difference in mean scores based on system and gaming proficiency ($f(80) = 3.54, p < 0.05$). Table 7 shows mean scores for this measure. Thus, and as expected perhaps, students with lower gaming proficiency struggled with the controls of the interactive system. However, as evidenced above, this perceived difficulty did not affect vocabulary or comprehension test scores.

Table 7

Control difficulty perceptions by system and gaming proficiency

	Low	Medium	High
Interactive	5.5	3.85	3.0
Linear	2.0	3.41	2.86

Discussion

This study explored the effects of interactivity and, more specifically, choice in interactive fiction on students' vocabulary acquisition and reading comprehension. Student perceptions were also investigated. Results suggested that although both groups showed gains in vocabulary test scores, there was not a statistically significant difference between means when factoring for instructional system or gaming proficiency. Similarly, there was no statistically significant difference in mean scores for the reading comprehension test based on system or gaming proficiency.

Implication for materials creators

The present study may act as a prototype or pilot study for materials creators or teachers that are interested in creating interactive fiction for their students. The IF software introduced (Twine) offers a simple GUI for creating interactive stories that may be as simple as our prototype here, or the more ambitious creator may experiment with variables, objects and multiple endings to create multimedia-rich, individualized experiences.

Implications for teachers

There is a glaring lack of teacher mediation in this pilot study. If used in a classroom, briefing and reflective activities may be implemented to ensure that any learning potential of the game is realized or at least connected to curricular goals (see York, Poole & deHaan, 2021). Another avenue of exploration for classroom implementation is students creating their own interactive stories. Indeed, work in this area has already begun as seen in the work of the FanTales project (Cornillie et al., 2020; Sauro et al., 2020).

Future research

The lack of any discernible difference in test scores between the two systems is not a cause for concern. Rather, it highlights that merely adding simple choices to an otherwise simple story is not enough to affect learning in any significant way. This inspires future research in the area of IF in language learning contexts. In a follow-up study, we plan on adding additional interactive components, more in line with text-based adventure video games, thus adding a requirement for the reader to input language in order to progress the story, where input is tied to target vocabulary.

Additionally, our original plan for this project was to have a third system to compare against the linear story and interactive story. The third system was to be an AR version of the same story, where readers would be required to go to various locations of the

university in order to unlock that part of the story. We had to cancel this plan due COVID-19 forcing us into a remote teaching context. Our rationale for including this third modality was due to the relatively few studies in the research literature which have explored location-based learning and embodied cognition in language learning contexts (for examples, see Holden & Sykes, 2012; Sydorenko et al., 2019). Therefore, a further avenue of exploration is in how reading as an embodied experience “in the wild” may affect language acquisition.

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Appendix 1

The story created for this study

Intro

One day, I entered my classroom, looked around, and saw that my classmates were confused.

"Hey. What happened?" I asked them.

Then, my friends all pointed towards the whiteboard. There was a message that said:

"I've got your important things. If you want them returned, you have to find me."

I looked in my bag, and my pen case was missing.

I shouted, "let's catch the criminal as soon as possible!"

After that, we left a note for our teacher, Mr. York, and started to try and solve the mystery.

Bus stop

We went to the bus stop in a hurry, to stop people leaving TDU.

I explained what had happened to the bus driver: Mr. Sasaki. He said, "I saw a man with a big red bag come out of Building 6. I will stop him if he tries to get on the bus."

"Thank you for your cooperation," I replied.

The driver was so kind. He gave me a bottle of water and encouraged me to find the criminal.

Atrium

I thought that the criminal could be hiding in the atrium, so we hurried there.

My friend Kai was there. He was in my English class. But today he was in the atrium... Maybe he was skipping class. I wondered if his pen case had been stolen by the criminal.

"Hi Kai. Did you skip English class today? We are looking for our pen cases because they were stolen. Do you have yours," I asked.

"Oh, hey," Kai said. "My pen case? Yeah, I have it. I also found this strange thing."

I looked down and saw that there were four cards on the table in front of Kai. Each card had something written on it:

[teacher]

[am]

[a TDU]

[I]

"Kai, where did you find these cards," I asked.

"I found them on the table after I bought some fries," Kai replied.

Who and why did someone give Kai these cards? We inspected them, they had other words on the back side of them: "From the pen case thief!"

愛 -AI-

My friend Yuka sent me a photo of the stone steps. Someone had written "To York's students" in chalk. We hurried to the stone steps.

I asked, "Yuka, what does this mean?"

She replied, "I don't really know but I think 'To York's students' means you."

There was more graffiti. It said:

'Do you want to know my name? There is a hint on AI'

"Yuka, can you see AI? What is written on there?"

Yuka climbed on top of the stone statue and found something else.

She said, "there is a capital Y on the top. I guess this is the initial of a word...?"

Barber

Toshi, who worked in the barber shop might know something because he has worked at TDU for a long time.

"Hi Toshi. Do you have time," I asked.

"Long time no see! What happened," he replied.

Toshi folded up his newspaper and looked at me.

"Do you know about the robbery in TDU," I asked, and we explained the incident.

After that he said, "textbooks have been stolen in a class before. I forget the name of that criminal, but he is still at TDU."

That incident was similar to ours. Maybe the criminal is the same person...?!

I asked, "Do you remember anything about the criminal?"

After a while Toshi said, "He does not have black hair. I was surprised."

"Thank you," I replied.

Pond in TDU

I went to the lounge to get more information. There was a sign pointing towards the school pond "Den Ike." It said, "To York's students."

This was very strange! Anyway, we went down the stone stairs to the pond, but the pond was normal. There was nothing suspicious.

"Did you get any information," Sou asked. He joined us and searched for another hint.

"I thought there would be information here, but I couldn't find any," I said.

"I wonder if it is hidden by fallen leaves," Sou said quietly.

The ground in front of the pond was covered with fallen leaves. I moved them out of the way with a broom and found the numbers: 165.

Sou shouted, "Over here I found the word 'CM'!"

165 CM... Is this height?

End

Putting all the hints together, it becomes clear that the criminal can be only one person! Head back to the classroom to find out who it was.

Appendix 2

Comprehension questions

1. What did the culprit steal?
2. Where did the bus driver say he saw the culprit come from?
3. What did the bus driver give you?
4. What color was the culprit's bag?
5. What was written on the back of the cards in the atrium?
6. How did you know Kai?
7. What was the name of the person that climbed on "Ai"?
8. What was written on the top of "Ai"?
9. Where was the photo that persuaded you to go to "Ai"?
10. What was the barbershop worker doing?
11. What did the barber say was stolen in the past?
12. What did the barber say was a unique characteristic of the culprit?
13. Why did you go to Den-ike?
14. Where was the hint hidden at Den-ike?
15. What was the hint at Den-ike?

Authors' bios

Tsuzuki Nagai is a masters student at Tokyo Denki University. He is exploring research on the use of interactive fiction and augmented reality in language learning contexts.

James York is a lecturer at Tokyo Denki University where he conducts research on ludic language pedagogy.