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# *Digital Game-based Learning (DGBL) in the L2 Classroom: The Impact of the UN's Off-the-Shelf Videogame, Food Force, on Learner Affect and Vocabulary Retention*

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## **ABSTRACT**

This mixed-methods study explored the impact of *Food Force (FF)*, a UN-sponsored off-the-shelf videogame, on learner affect and vocabulary learning and retention in a Japanese as a second/foreign language classroom. The videogame was integrated into an existing curriculum and two studies were performed. In Study 1 ( $n = 9$ ), new vocabulary was embedded in task sheets. Study 2 ( $n = 11$ ) introduced *FF* vocabulary explicitly and included a graded unit test. In both studies, participants took three *FF* vocabulary tests (pre-, post-, and delayed) and an end-of-unit affect survey. Study 2 also included textbook vocabulary tests and interviews. Results indicated positive impact on learner affect and a preference for game-mediated activities over conventional exercises. Within-subject repeated-measure analysis revealed that participants in both groups recalled new *FF* vocabulary five weeks later at the same rate as immediately after the unit, while they significantly forgot words from the textbook. Study 2 resulted in better learning of *FF* words than Study 1. No gender difference was found in vocabulary test results. Positive *FF* effects may be evidence that digital game-based learning facilitates deep learning. Though there was significant positive effect on average, individual differences were found in students' attitudes and vocabulary retention.

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## **KEYWORDS**

*Food Force*, Digital Game-based Language Learning, Vocabulary Learning, Affect, Japanese as a Second Language

## **INTRODUCTION**

Digital gaming is familiar to many of today's learners as a way to have fun, socialize, and express oneself. A videogame rich with multimodality (text, image, sound, and multi-player interaction) and interactive gameplay with scaffolded challenges has powerful potential to give learners a complex semiotic learning experience that is qualitatively different from a 2D textbook. When framed in this interactive, contextualized, semiotically complex digital environment, learning can become more engaging and transformative. Current research views videogames as potentially beneficial to students' learning outcomes (Gee, 2007; Papastergiou, 2009; Prensky, 2006; Squire, 2003). Various forms of Web 2.0 technologies, including digital gaming, allow us to move forward from the 19<sup>th</sup> century industrial model of paper-and-pencil instruction to more interactive, meaningful, and immersive digital classroom activities. This type of learning has the potential to better prepare today's students for the rapidly changing 21<sup>st</sup> century global economy (Thomas, 2011; Trilling & Fadel, 2009).

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While positive anecdotal evidence and conceptual studies are abundant, empirical evidence of the effects of videogame use *in classrooms* is scarce. The paucity of such research is even more pronounced in the context of the second language (L2) classroom. Though there has been a rise in interest in videogame use in L2 learning in recent years (Cornillie, Thorne, & Desmet, 2012; deHaan, 2011; Neville, Shelton, & McInnis, 2009; Peterson, 2010a, 2010b, 2012; Reinders, 2012; Sykes & Reinhardt, 2013; Thorne, 2008), research on game-based language learning and teaching remains in its infancy (Reinders, 2012). According to Cornillie and colleagues (2012), "Few empirically supported studies have emerged that relate gaming experience to, for instance, gains on standard proficiency measures of L2 development" (p. 245). Most digital game-based language learning (DGBLL) research has been conducted either outside the classroom or in the laboratory, with little research on the integration of videogames into an existing L2 curriculum (Thomas, 2012).

To fill this gap, this study explored the implementation of videogame-based instruction in a university Japanese language classroom with *Food Force* (FF), an off-the-shelf videogame developed by the UN World Food Program (UNWFP). Reinhardt and Sykes (2012) classified language learning using videogames into two types: "game-enhanced" learning, where vernacular games afford learning, and "digital game-based" learning, where the synthetic immersive gaming environments are intentionally designed for learning purposes. While we classify the present study as "game-enhanced" language learning, we use the broader term "digital game-based learning" (DGBL) throughout this paper to include both types of learning with videogames.

In the following sections, we first discuss why DGBL has potential for second language acquisition (SLA), and how attributes of good videogames parallel SLA theories. We follow this with a description of the impact of *Food Force* on learner affect and vocabulary learning and retention. We conclude with a discussion of the contribution of this paper to the small but growing amount of empirical evidence on the impact of videogames in L2 classroom learning, and to the limited literature on the intersection of Japanese as a second/foreign language (JSL) and Web 2.0 (Wang & Vásquez, 2012).

## **RATIONALE FOR DIGITAL GAME-BASED LEARNING (DGBL) IN L2 LEARNING**

This section highlights the attributes of videogames that are particularly conducive to L2 learning. We discuss the importance of interaction and how videogames can both afford and mediate interaction, and we classify this interaction as multimodal; that is, it allows for "safe" experimentation in the target language and is infinitely repeatable. In addition, we frame the use of videogames in the L2 classroom as a deeply engaging sociocognitive process that connects interaction, narrative, agency, and content to promote learner motivation.

### ***Interaction in Videogames for L2 Learning***

Videogames provide for ample interaction. SLA theory has long postulated that human interaction and linguistically comprehensible input play critical roles in the development of L2 proficiency (Doughty & Long, 2008; Ellis, 1984; Krashen, 1985; Long, 1985, 1996). Empirical studies have demonstrated that interactive negotiation for meaning enhances the comprehensibility of input, which in turn supports L2 acquisition (Mackey, 1999). The last two decades of SLA research have further extended the interactionist approach of Vygotskian sociocultural theory (Vygotsky, 1978), highlighting the importance of social context in language learning (Atkinson, 2002, 2011; Warschauer, 2005). From this perspective, language learning is promoted by interaction involving collaboration, negotiation, and scaffolding among interlocutors and co-construction of knowledge. Research also demonstrates the importance of the *zone of proximal development* (ZPD) in learning (van Lier, 1996). The ZPD is the difference between what an individual can accomplish independently and that which can be accomplished with assistance from members of a community. Learners benefit when they learn from a mentor and as part of a

learning community (Foster & Ohta, 2005; Lantolf & Thorne, 2006). However, providing engaging and interactive contexts in L2 classrooms can be a challenge. We argue that the challenge of providing students collaborative linguistic contexts can be moderated by using videogames. Videogames can provide language learners meaningful contexts with ample opportunity for interactive negotiation (see Tolia, Exadaktylos, & Slattery, 2004). Similar to virtual environments, the virtual medium of videogames “can bring language learners closer to the target language community and its speakers while also providing an array of tools for awareness raising activities and critical reflection” (Schwienhorst, 2002, p. 206). Indeed, this technology may prove superior in some ways to the traditional language classroom in affording communicative interactivity (Lau & Lee, 2012).

Moreover, the interaction that happens in videogames is safe. Krashen maintained that when learners experience less anxiety and their affective filter is low, acquisition is facilitated (Krashen, 1982). From the point of view of this affective filter hypothesis, videogames have the potential to be an ideal environment for language learning. L2 learners’ social blunders and failures while gaming are contained in the virtual medium, with little consequence or negative impact in the real world. L2 learners can safely interact in the target language without worrying about and being inhibited by the consequences of a social faux pas. This is particularly important to development of L2 communicative competency, as experimentation and hypothesis testing in the target language are fundamental to acquisition. And videogames allow for infinite repetition. If an L2 learner makes mistakes while working through a task, she or he can repeat the task as many times as needed to remedy the mistakes. This also promotes mastery learning when progress to the next task is not possible until mastery of the current task is demonstrated.

### ***Sociocognitive Process in Videogames for L2 Learning***

We view SLA as a situated, integrated, and sociocognitive process. As Atkinson (2002, 2011) suggests, we argue for going beyond SLA research’s traditional domains of engagement by taking SLA theory into the sociocognitive domain. Atkinson claims that past SLA research had an “impoverished” cognitive view of an L2 learner as decontextualized, autonomous, and analogous to a “lonely cactus” in the desert (2002, p. 526). Instead, he proposes framing SLA by “action” and “participation” in activity-in-the-world. The attributes of videogames afford learners the ability to participate and take action in simulated activities-in-the-virtual-world. Situated cognition theory stipulates that learning is inseparable from context (Gee, 2010; Lave & Wenger, 1991) and learning happens when a learner attempts to solve problems (Barab, Gresalfi, & Ingram-Goble, 2010; Hung, 2002). Language use in videogames is contextualized or situated in the story and gameplay. Language is used to solve problems or tasks embedded in gaming activities. L2 learners need to watch, listen, read, talk, and write in making decisions to pursue the game. Thus, language is used with tasks and goals in mind. These activities are inherently authentic (unless the game was created for non-native speakers for the purpose of language education) in that native speakers would play in the same manner as L2 learners (Kronenberg, 2012, p. 59).

### ***Narrative in Videogames for L2 Learning***

Situated, integrated, sociocognitive processes are promoted in videogames by the use of narrative. Narrative is essentially an organizational scheme expressed in story form (Polkinghorne, 1988). Narrative is better understood and far better remembered than expository representations, and it helps to connect and organize knowledge and skills, personal goals, perception, memory, activities, processes, contexts, events, and agents (Bruner, 1990). To be sure, stories are the oldest and most natural form of sense making—the “means [by] which human beings give meaning to their experience of temporality and personal actions” (Polkinghorne, 1988, p. 11). Humans appear to have an innate ability and predisposition to organize and represent their experiences in the form of stories. Stories help us to learn, to conserve memory, or to alter the past, and allow us to embark

on the authentic exploration of experience from a particular perspective. Videogames are framed in a narrative where players co-create a story as they play. The plot may be pre-determined but each player still has a small part in the story creation and outcome. The game player co-creates "immediate-level stories," scenario operations housed under "the high-level story" or the cover story that the game author created (McDaniel, Fiore, & Nicholson, 2010). Co-creating a story's scenario operations is a stronger motivator than the cover story (DeMarle, 2007). The method of embedding L2 learning in narrative and co-constructing a story with another entity, be it computer or person, is in line with how people acquire language (Bruner, 1977).

### **Agency in Videogames for L2 Learning**

A critical attribute of a good videogame is choice given to the player. The perception of control is a more important motivator than actual control (Habgood, Ainsworth, & Benford, 2005). The game player is an active participant in the virtual gaming community. Within the game, the target language is used by the player not only to create a story but also to take action in the gameplay. The player is not a passive observer but, instead, an agent taking action to develop his/her own story of the game. This is an important aspect of videogame play that differentiates videogames from other multimedia. The student's motivation within the gameplay is to move toward completing tasks. When a student is in control of the action within the videogame narrative and actively participates in the activity, the student is empowered and thus more intrinsically motivated. Taking action in the game therefore promotes deep engagement in learning (Cordova & Lepper, 1996; Deci, 1975). Related to this, learners can be motivated by the videogame's embedded linguistic content. When the amount of complex information in the narrative is appropriate to the learner, the gap between known and unknown information arouses curiosity at both sensory and cognitive levels: "Users are motivated to fill in the gaps and locate discrepancies in information" (Wilson et al., 2009, p. 233). Hence, the linguistic content of the videogame narrative is as important as other learning attributes of good videogames.

We argue that the attributes of videogames discussed in this section, combined with the familiarity of videogame environments for today's learners, could contribute to a number of learning benefits for L2 learners. Videogames afford interaction that provides a context in which learners can negotiate meaning. The interactive contexts of videogames are meaningful and contextualized, providing for learning modalities that are deeply engaging. The interaction in videogame environments is safe and infinitely repeatable with no overt adverse consequences. Further, videogames have the potential to a) promote learning processes that are situated in meaningful, authentic narratives, b) integrate experience and action in virtual activities that mimic the real world with a high degree of fidelity, and c) allow the L2 learner-as-player to be a decision-maker in her learning trajectory. We view these affordances as conducive to the underlying cognitive processes that promote L2 acquisition. However, clear empirical evidence to support this claim has yet to emerge.

### **Relevant DGBLL Vocabulary Research**

Prior DGBLL research on vocabulary learning reports mixed results. For instance, Miller and Hegelheimer (2006) and Ranalli (2008) used *The Sims* with positive results for ESL university students. However deHaan, Reed, and Kawada's (2010) results from a laboratory-based experiment with a music videogame, *Parappa the Rapper*, were less promising. Participants were asked to learn lyrics from the videogame, with one person playing while a partner watched. Vocabulary from the game was tested immediately and two weeks later. The player of the game recalled less vocabulary than the watcher, and there was a significant decrease for all participants after two weeks. The authors argue that extraneous cognitive load—simultaneously playing the game and learning the lyrics—negatively impacted learning.

DeHaan and colleagues' (2010) study shares similarities with the present study, but differs in both purpose and method. Both looked into vocabulary learning and attitudes

toward the use of videogames, involved a stand-alone single player action game lasting 20 minutes, and tested retention of newly learned words at a later date. Our study took place not in a laboratory setting but in situ, as part of an existing classroom-based curriculum, with the purpose of exploring how a digital game could be integrated into a classroom. To prepare for using the game, participants engaged in various scaffolding tasks. Vocabulary new to learners was introduced in a more contextualized manner. And, finally, *FF* focused on world events relevant to learners' lives, which we discuss in the following section.

### UNITED NATIONS WORLD FOOD PROGRAM (UNWFP) *FOOD FORCE* VIDEOGAME

*Food Force* is a non-violent, educational, humanitarian videogame developed by the UN World Food Program (UNWFP) in 2005 to raise the awareness of school children and adults about world hunger. The Japanese version was developed by Konami and is available for download with no regional restrictions at <http://www.foodforce.konami.jp/download/download.html>.

According to the digital games typology proposed by Sykes and Reinhardt (2013, p. 143), *FF* is an action-adventure game with strong arcade elements (Table 1). The gameplay is set on a fictitious island, *Sheylan*. The player assumes the role of a new member of a UNWFP mission to combat hunger. Six game missions teach how the UNWFP fights world hunger. Mission 1, "Air surveillance: Locating hungry citizens in a helicopter," is a classic "find-em" game. The player pilots a helicopter to count hungry people against the clock. Mission 2, "Packing balanced food," is a combination guessing game and simulation to create a balanced diet with limited funds. The four other missions are "Air drop: Air dropping food supplies in a target zone from a helicopter," "Locate and dispatch: Procuring supplies within a budget around the world and delivering the supplies where needed," "Food run: Leading a food convoy to a depot," and "Future farming: Building a self-sustainable village." All six missions (Figure 1) can be played in about one hour.

**TABLE 1**

Typological Parameters of the Japanese Version of the Food Force Videogame

Platform	Memory Hard Disk	Cost	Player Configuration	Type	Genre
Computer (PC Windows XP above) Stand-alone	256 MB 320 MB	Free of charge	Single player Not-networked	Casual	Action- Adventure (with time constraint)

**FIGURE 1**Six Missions of the *Food Force* Game

1. Air surveillance to find refugees



2. Packing balanced food



3. Air dropping food supply



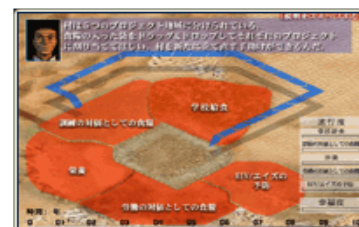
4. Procuring the food supply



5. Leading a food convoy



6. Rebuilding a village



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Unlike a “hard core” traditional game, *FF* does not require much effort to play the game successfully, nor does it require knowledge of videogames, or *game literacy* (Gee, 2007). The *FF* gameplay is basic, and the interactivity between the player and the story is limited. The player may complete the game without fully understanding the story and can move to the next game regardless of points. Choices offered to the player within scenarios are limited. However, the player receives feedback (audio and text) and coaching from game characters while playing the mission and scoring points. In addition, how fast the player flies the helicopter (Mission 1), how the player mixes the optimal combination of nutrients in a food pack (Mission 2), and which route the food convoy truck can take (Mission 5), for instance, are left to the player to decide. Therefore, though *FF* lacks the interactivity of more complex games such as *The Sims* and *World of Warcraft*, players still have some level of interactivity and can experience a sense of agency while playing the game.

Before each mission, a character from the game narrates the mission’s background and explains how to play. Each game lasts several minutes. At the end of each mission, the points the player gained are displayed, and the player can choose to play the mission again or proceed to the section that explains the actual activities of the UNWFP on the topic of the mission. For example, after Mission 2, where the player has just attempted to find a perfect nutritious combination of food ingredients for 30 cents per day, the pertinent game character describes how children are susceptible to malnutrition and how the UNWFP attempts to provide food packages suited for particular regions. The information the game provides in these narratives is authentic and thought-provoking to both young learners and the general audience.

## Research Questions

The following research questions guided this project:

1. How can a videogame be used as sound teaching material for L2 classrooms, and how can we best implement the videogame in an existing curriculum? (Implementation)
2. How do students perceive and respond to the introduction of a videogame in the L2 classroom? (Affect)
3. How does the use of *FF* impact vocabulary learning and retention compared to textbook reading? (Vocabulary retention)

## METHOD

### Participants

Participants in Studies 1 and 2 consisted of two classes of intermediate high to advanced low level Japanese at a US university, with a total of 20 participants (Study 1,  $n = 9$ ; Study 2,  $n = 11$ ). Only the data from those students who participated in the *FF* unit activities and completed all three vocabulary tests and the affect survey were analyzed. Participants' average age for Study 1 was 22.33 years old (7 males, 2 females), and for Study 2 was 19.1 years old (2 males, 9 females). All participants were pursuing a Japanese degree or certificate. Though their Japanese proficiency levels varied, no participants were eliminated from the analysis as long as they fully participated in both the *FF* and data collection activities. No participants had played a videogame in a foreign language classroom before, and almost none of them had prior knowledge of the UN's mission to address world hunger.

### Procedures and Tasks

Five 50-minute class sessions were assigned for the *Food Force* activities for each study. Classes were conducted in a computer lab where students were assigned to computers connected to the Internet at a 1-to-1 student-to-computer ratio. Students were seated in groups of two or three as assigned by the instructor. They were encouraged to help each other and use Internet resources to complete the tasks. In Study 1, the *FF* unit was tied to the textbook unit on global environmental issues (Kamata, Toyama, Miyatani, & Yamamoto, 1998). In Study 2, the *FF* unit was integrated into the food unit that covered the story of the Japanese inventor of the cup noodle (Oka et al., 2009). The tasks and activity procedures of Studies 1 and 2 were almost identical except in how the *FF* vocabulary was treated in the activities and whether an end-of-unit test was given. Seven short narrative video clips (1–2 minutes) were created from the first two missions of the *Food Force* game. Students watched these short videos, listening to the game character's narrative in order to complete task sheets as homework or as group work in class.

In Study 1, no vocabulary list was given to students, but new key words were embedded in the task sheets, and there was no end-of-unit test for the *FF* unit, which students were clearly told at the beginning of the unit. The *FF* activity was supplementary to the textbook unit with no implications for students' grades. Teaching of new *FF* vocabulary was minimal in Study 1. Upon encountering unknown words, students were left to either infer the meaning or look it up on their own. No instruction on how to handle unknown words or *kanji* writing practice was given.

In Study 2, the treatment of the *FF* new vocabulary was similar to the traditional method and more focused than in Study 1; a list of 32 new key words such as *nutrition*, *hunger*, *war*, *food supply*, and *crisis* was provided at the beginning, along with *kanji* writing worksheets of these words. Students took a vocabulary pop quiz and an end-of-unit test. The *FF* unit was part of students' course grade. In addition, the study compared learning and retention of *FF* vocabulary and textbook vocabulary, and participants were interviewed about their opinions on the *FF* unit and their language background.



Students engaged in various activities related to the *FF* content to promote their sense of global citizenship over five days. They first examined their own eating habits, and conducted a search for facts on world hunger in small groups. During the first four days, participants engaged in scaffolding tasks created by the instructor based on two missions of the *FF* game. On the fifth day, they played the two missions "Air surveillance" and "Packing balanced food" for 20 minutes, for the highest score that they could obtain within the time limit. The highest scoring three students were awarded an extra credit.

## **Instruments**

### **Affect survey**

An 11-item 7-point Likert affect scale was developed, part of which was adapted from a study on the implementation of social networking site usage in a language classroom (Hitosugi, 2011). The survey asked students 11 questions regarding their *FF* unit experience, prior knowledge on world hunger, and their desire to see digital gaming in future class activities (Table 2). The survey asked participants to choose a response on the 7-point scale ranging from "disagree completely" to "strongly agree." The affect instrument was found to be highly reliable ( $\alpha = .89$  for Study 1,  $\alpha = .86$  for Study 2).

**TABLE 2**  
Affect Instrument

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1.	I liked playing <i>Food Force</i> very much.
2.	I would like to play this game again in class.
3.	The level of Japanese language used in <i>Food Force</i> was just right for me.
4.	The level of Japanese language used in <i>Food Force</i> was difficult for me.
5.	I was actively engaged in completing tasks assigned by the teacher.
6.	I enjoyed this kind of language exercise more than regular traditional classroom activities such as reading Japanese text and translation.
7.	Not only did I gain knowledge of the Japanese language, I also learned about the world hunger that <i>Food Force</i> presented.
8.	Before playing this game, I knew nothing on the topic that <i>Food Force</i> was based on.
9.	I gained lots of knowledge on the topic that <i>Food Force</i> was based on.
10.	Playing this game made me want to know more Japanese words so that I could understand what the characters in the game were saying.
11.	I would like to see more activities using videogames like <i>Food Force</i> in Japanese class.

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### **Vocabulary tests**

Seventy words from the first two missions of the *FF* story narrative were selected to create the *FF* vocabulary test. The same set of vocabulary was tested three times: before, immediately after, and five weeks after the *FF* unit. The word order was changed for each test. Study 2 also tested 25 new words introduced in the corresponding textbook unit at three times (before, immediately after, and five weeks after the unit). Students wrote the English equivalents of Japanese words in the test, completing as many items as they could within the time limit of six minutes for the *FF* list and two minutes for the textbook list. Each Japanese vocabulary item was given in both *hiragana* (syllabary) and *kanji* (Chinese characters). A summary of methodologies and results for these two studies is found in Table 3.

**TABLE 3**

Summary of Studies of the Food Force Unit

Demographics & Procedures		Study 1	Study 2
Participants		University students in a low advanced Japanese class ( <i>n</i> = 9) 7 Males, 2 Females Avg. Age 22.3	University students in a low advanced Japanese class ( <i>n</i> = 11) 2 Males, 9 Females Avg. Age 19.1
Class hours (50 min. each) used for <i>Food Force</i>		5 class hours	4.5 class hours Not including test hour
# of missions covered		Two missions	Two missions
Scaffolding exercises		8 activities	8 activities
<i>Food Force</i> vocabulary treatment		Embedded as “useful expressions.” No vocab quiz.	Vocab list provided. Vocab quiz. Unit test. Kanji words writing practice
<i>Food Force</i> unit test		None	Paper & pencil test that included listening
Data Collection Methods & Results			
Vocabulary Test on <i>Food Force</i> Unit			
Recognition	Pretest	Yes	Yes
	Posttest	Yes	Yes
	Delayed test	5 weeks later	5 weeks later
Vocabulary Test on Textbook Unit (7 class hours)			
Recognition	Pretest	n.a.	Yes
	Posttest	n.a.	Yes
	Delayed test	n.a.	5 weeks later
Affect Survey		11 items 7-point Likert scale	11 items 7-point Likert scale & Interview
Results of attitudinal survey: Preferred videogame over conventional unit & wanted more videogames in class		Definite Yes (6.00, 6.56) <sup>1</sup>	Mostly Positive (4.36, 4.91) <sup>2</sup>
Vocab Recognition Test Results (Difference in mean scores $\bar{x}$ , no gender difference found)			
FF Post – Pretest		8.0*	11.36*
Textbook Post – Pretest		n.a.	11.18*
FF Delayed – Posttest		- .1	.82
Textbook Delayed – Posttest		n.a.	- 3.00*
FF Delayed vs. Pretest		7.89*	12.18*
Textbook Delayed vs. Pretest		n.a.	8.18*

\* The mean difference is significant at the .05 level.

1, 2 The scores are the results of Questions 6 &amp; 11 from the affect survey.

## RESULTS

Students played *FF* on the fifth day. They played Missions 1 and 2 for the highest scores they could obtain within the time limit. They were given an optional task sheet to complete while they played, but only one student turned it in. The other students were very engaged in playing the game, and did not seem to be interested in another task sheet.

### *Affect Survey Results*

The affect survey results showed participants' positive attitudes toward the *FF* unit, but in general the mean scores in Study 2 were not as high as in Study 1. The highest mean score among 11 questions in Study 1 was  $M = 6.56$ ,  $SD = .73$  for Q11 that asked whether a student would like to see more activities using videogames in Japanese class, while the highest mean score for Study 2 was  $M = 5.36$ ,  $SD = 1.12$  for Q5 that asked whether they were engaged with the *FF* activities. Participants in Study 1 clearly indicated their preference for videogame-related activities over traditional activities (Q6.  $M = 6.00$ ,  $SD = 1.12$ ). Many students agreed that they not only gained knowledge of the Japanese language but also learned about world hunger (Q7. Study 1:  $M = 5.67$ ,  $SD = .87$ ; Study 2:  $M = 5.00$ ,  $SD = 1.18$ ).

The correlational matrix of affect survey questions revealed the relational patterns of the two studies to be slightly different. For Study 1, "no prior knowledge on world hunger" (Q8) strongly correlated with "want to learn more Japanese" (Q10.  $r = .91$ ,  $p < .001$ ), "more engaged in activities" (Q5.  $r = .79$ ,  $p < .01$ ), and "wished to play it again" (Q2.  $r = .80$ ,  $p < .01$ ). When they liked *FF* (Q1), they wanted to "play it again" (Q2.  $r = .73$ ,  $p < .01$ ), "liked activities over traditional activities" (Q6.  $r = .92$ ,  $p < .001$ ), and "learned knowledge on the topic of world hunger" (Q7.  $r = .83$ ,  $p < .001$ ), and they wanted to see "more activities like *FF* in Japanese class" (Q11.  $r = .80$ ,  $p < .01$ ). Interestingly, Study 1 student perceptions of *FF* vocabulary difficulty had no significant correlation with any other question at a level of  $\alpha = .05$ .

Students in Study 2 felt the Japanese used in *FF* was difficult (Q4), but this perception was not related to any other question except for Q10, which asked whether they "want to know more Japanese words so that they could understand what the characters in the game were saying" ( $r = .67$ ,  $p < .01$ ). Rather than language difficulty negatively affecting how much students liked the game, or their engagement with *FF*, the language difficulty appeared to have motivated students in Study 2 to want to learn more. Other points of interest in the correlational matrix were: 1) when students liked *FF* (Q1), they liked it better than traditional class activities (Q6.  $r = .80$ ,  $p < .001$ ), and they wished to see more activities like *FF* in class (Q11.  $r = .73$ ,  $p < .01$ ), and 2) when students reported that they had no prior knowledge of world hunger (Q8), they reported that they wanted to play the game again (Q2.  $r = .62$ ,  $p < .05$ ), that they learned about world hunger (Q7.  $r = .59$ ,  $p < .05$ ), and that they gained knowledge on the topic (Q8.  $r = .69$ ,  $p < .05$ ).

In sum, the affect survey showed that students enjoyed playing *FF* in class, that they would like to see more videogame-related activities in class, and that they found the *FF* language somewhat difficult, but this did not affect their enjoyment of *FF* activities. Also, students reported that they gained a good knowledge of world hunger.

### *Vocabulary Test Results*

For both *FF* and textbook units, there was a significant vocabulary gain on the students' mean scores on the posttests. On average, students in Study 1, where vocabulary teaching was not the focus, could correctly write the meanings of eight more Japanese words in the 70-item vocabulary test upon completion of the *FF* unit. And they could still recognize 7.89 newly learned words five weeks later. Students in Study 2, who were given a list of new vocabulary and had a vocabulary test, could correctly write the English equivalent for an additional 11.36 words on average at the end of the *FF* unit. Surprisingly, five weeks later, they could correctly produce the English meanings of 12.18 newly learned *FF* Japanese

words. Students in Study 2 *also* took a similar vocabulary test for the textbook unit. They could newly identify 11.18 words on average when they had finished the textbook unit and 8.18 words five weeks later. In sum, students in Study 2, on average, remembered four more new *FF* words over textbook vocabulary five weeks later.

A one-way within-subjects repeated measures ANOVA was conducted to compare the effect of the videogame unit on retention of vocabulary over five weeks. Factors used were before, immediately after, and five weeks after the completion of the *FF* unit. The dependent variable was the vocabulary test scores. The means and standard deviations for the vocabulary recognition test scores are presented in Table 4. There was a significant effect of the *FF* unit in both studies (Wilks' Lambda = .20,  $F(2, 7) = 14.41$ ,  $p < .01$  for Study 1; Wilks' Lambda = .10,  $F(2, 9) = 39.42$ ,  $p < .001$  for Study 2). The *FF* vocabulary pairwise comparisons indicated a significant difference in scores in Study 1 and Study 2 for the pretest and the immediate posttest, and the pretest and the delayed test, but *not* for the immediate posttest and the delayed test. In other words there was no loss in five weeks for the *FF* unit vocabulary, indicating that participants learned a significant number of new words in the *FF* unit and did not forget these words even after five weeks.

**TABLE 4**

Descriptive Statistics for the Three Vocabulary Recognition Tests Results

	Food Force Unit (70 items)		Food Force Unit (70 items)		Textbook Unit (25 items)	
	Study 1 ( $n = 9$ )		Study 2 ( $n = 11$ )		Study 2 ( $n = 11$ )	
	Mean	Std. Deviation	Mean	Std. Deviation	Mean	Std. Deviation
Pretest	14.44	5.15	14.36	10.2	4.64	4.13
Post test	22.44	5.70	25.73	13.4	15.82	4.83
Delayed test	22.33	6.08	26.55	13.45	12.82	5.08

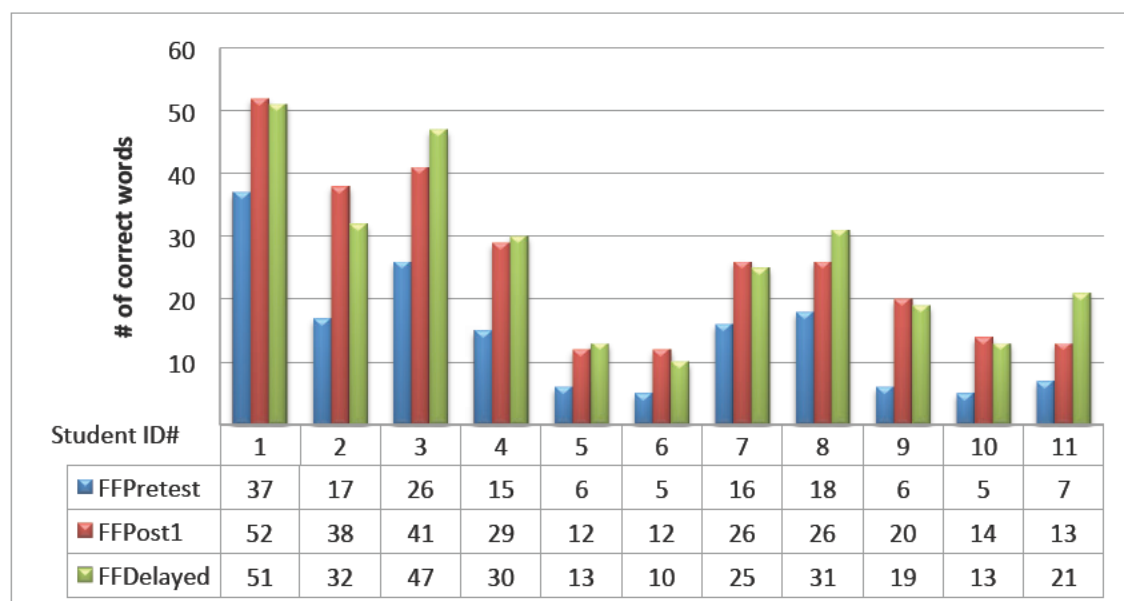
For the textbook unit, participants could correctly write the English meanings of, on average, only 8.18 newly learned words five weeks later (Wilks' Lambda = .07,  $F(2, 9) = 59.01$ ,  $p < .001$ ). This is a statistically significant loss at  $p < .01$  from the number of words (11.18) that they could newly identify immediately after the textbook unit. In sum, they forgot the meanings of three newly learned words in five weeks, while their memory of *FF* words was statistically intact after the same length of time.

Additionally, upon examining individual vocabulary scores, we found that some students' scores (ID #s 3, 4, 5, 8, & 11) in Study 2 on the *FF* vocabulary were higher five weeks later than immediately after the *FF* unit (Figure 2). On the other hand, some students (ID #s 5 & 7) retained newly learned textbook words better (Figure 3).

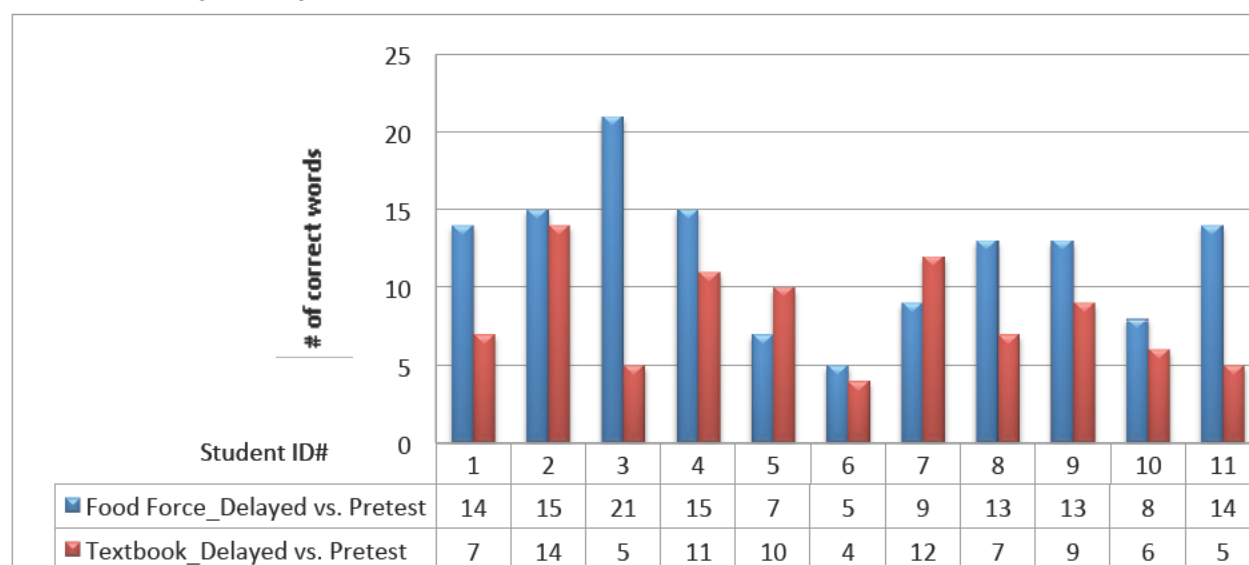
To summarize, vocabulary test results indicated that, on average, participants from both studies remembered almost all — or even more — newly learned words from the *FF* unit five weeks later, while they forgot three words from the textbook unit. Further, participants with explicit vocabulary instruction learned more new words than the participants whose new vocabulary was simply embedded in the task sheet and not focused on in class (7.89 words vs. 12.18 words). In addition, there were individual differences in the vocabulary outcomes. Some did better with textbook instruction, though the majority fared better with the videogame unit.

**FIGURE 2**

Study 2 Actual Number of Words Correctly Recognized in *Food Force* Vocabulary Test ( $n = 11$ )

**FIGURE 3**

Study 2 Actual Number of Vocabulary Newly Learned & Retained in 5 weeks: *Food Force* vs. Textbook ( $n = 11$ )



### Gender Difference

Males are reported to be more enthusiastic than females about computer games, and more males than females play computer games as a leisure activity (Boyle & Conolly, 2008; Chou & Tsai, 2007). Sylvén and Sundqvist (2012) found gender differences in vocabulary learning in their extramural study of 86 Swedish students, with videogame usage positively correlated with vocabulary learning in favor of male students.

When implementing DGBLL *in classrooms*, we need to be aware of how gender differences may play out in L2 learning outcomes. Our study had an uneven gender

distribution of participants. Study 1 had seven males and two females. Study 2 had two males and nine females. We combined both studies and performed 2-sample *t*-tests ( $N = 20$ ). There were significant effects for gender in several affect survey questions, numbers 3, 5, 6, 10, and 11 (#3:  $t(18) = 3.37, p < .01$ , #5:  $t(18) = 2.37, p < .05$ , #6:  $t(18) = 2.49, p < .05$ , #10:  $t(18) = 3.74, p < .001$ , #11:  $t(18) = 2.77, p < .01$ ), in which males' scores were higher than females'. More male students thought the level of the *FF* language was appropriate; they were more engaged and more of them preferred the *FF* unit over the traditional unit compared to the female students. Also, male participants were more motivated to learn new Japanese words in order to understand the game and wanted to see more activities using videogames in Japanese class. Regardless, no significant effect for gender was found in the three (pre-, post-, and delayed) *FF* vocabulary test results. While these data are interesting, given the small number of participants, further research in this area is warranted.

## DISCUSSION

We set forth three research questions upon starting this project. RQ1 concerned implementation, asking how a videogame can be used as sound teaching material for an L2 classroom and how it can best be implemented in an existing curriculum. Various considerations were taken into account to select a videogame that could be used in a Japanese language classroom. While thousands of videogames in Japanese are available for various platforms such as Nintendo DS, Wii, and Xbox, not all students owned the necessary devices, and neither did the instructor. The game needed to be able to run on computers in the institution's computer lab, where all students could play. The game had to be simple and easy to play with almost no learning curve. There was no time within the tightly scheduled curriculum to learn how to play the game itself. Commercially available games that have been used in past research, such as *The Sims* and *World of Warcraft*, did not fit our criteria in terms of the price or simplicity of the gameplay; and the popular *World of Warcraft* is not available in Japanese. No funding was sought for this project, so the game needed to be available for free or at a nominal cost. The content needed to be educational and non-violent. Although rudimentary and lacking some of the interactive features that Gee (2007) maintains comprise "good videogames," *Food Force* was an ideal choice for this study, considering our selection criteria.

Students learned about the topic of world hunger in ways that were relevant and meaningful to them, not as a language exercise per se, but as authentic personal learning. Various scaffolding tasks were created along with the seven video clips from the game's narratives. These tasks prepared students for gameplay on the fifth day. The *FF* unit concluded with students writing a short essay. Many students wrote of their surprise at the extent of world hunger, their appreciation of their life of abundance, and what they could do to end world hunger.

RQ2 asked, "How do students perceive and respond to the introduction of a videogame in the L2 classroom? (Affect)." The answer is, remarkably positively. Responses to the questionnaires indicate enthusiastic, positive perceptions of the videogame-enhanced unit. While we were initially concerned about the difficulty of vocabulary in *FF*, as it was developed for general audiences in Japan and our students were in intermediate high to advanced low Japanese language courses, this concern was ultimately unwarranted. The perceived difficulty of the language used in *FF* had no impact on how much the students liked *FF* activities. Rather, the language challenges were associated with students wanting to learn more Japanese. When students felt language used in *FF* was difficult, they were more engaged rather than being turned off. The reason could be that the multimedia modality of delivery motivated students to challenge themselves and engage deeply in the activities. The level of narrative complexity seemed to be appropriate for students to be able to "fill in the gaps" of their knowledge and locate discrepancies in information (Wilson et al., 2009, p. 233). This could indicate that appropriately scaffolded tasks successfully prepared students to play a game created for the Japanese general audience. The finding

that difficulty of language did not negatively impact participants' enjoyment or engagement in activities resonates with Chik's (2011) report of students in Hong Kong who enjoy videogames even in languages in which they do not have much proficiency. They exercise some degree of learner autonomy to overcome linguistic shortcomings because of their enjoyment of gaming. Though we found individual differences in the affect survey, on average, learners enjoyed the *FF* unit more than the conventional unit despite the difficult vocabulary.

RQ3 concerned vocabulary learning and retention in the *FF* unit in comparison to a textbook unit. Although the results indicated that students recalled almost the same number of newly learned words from the textbook unit and the *FF* unit at the time of the immediate posttest, vocabulary acquisition and retention after the *FF* unit were superior. This finding is in line with the multimedia theory that students learn and retain better through words and multimedia rather than through words alone (Mayer, 2002) and is consistent with other, anecdotal reports of L2 acquisition using commercial, off-the-shelf videogames (Thorne & Fischer, 2012).

Although statistical results indicated overall positive effects of the *FF* unit on vocabulary retention, some students (mostly those with less proficiency) did better with the textbook. Furthermore, some students gained higher *FF* vocabulary test scores on the later test than the immediate posttest—an interesting finding seen in both studies. Rather than forgetting newly learned *FF* words over time, they recognized more words after five weeks. The students who showed this pattern tended to be high proficiency, but this was *not* always the case.

The interviews conducted in Study 2 gave us some insight into this finding. One participant described her perception that "even if I do not get the meaning now, I know I will encounter the same word sometime in the future, so I will sort of remember or place those words somewhere in my brain." Such students seem to have a sense of self-direction and responsibility for their own learning, having strong metacognitive awareness of their language learning process. A videogame that gives ample authentic linguistic input, situates learning, and contextualizes the use of language could be more powerful as a learning tool for these students than for students who lack similar metacognitive awareness.

For students who did better with textbook words, the rich media content in the videogame may have caused cognitive overload, thus hindering their processing of the newly introduced words (Clark, Nguyen, & Sweller, 2011; deHaan et al., 2010). Some low *FF* vocabulary scores may also be due to issues with technological self-efficacy. As one student said in the interview, "Computers and me do not mix well. I do not learn anything well on the computer." Students like this one may unintentionally block opportunities to learn due to low technology efficacy or perhaps an increased affective filter (Krashen & Terrell, 1983). However, as various segments of our daily interactions are moving into the digital world, whether they like it or not, today's learners will benefit from learning diverse digital tools. Exposure to DGBL may provide an opportunity to develop technology efficacy that can be transferred to other areas. The *FF* program is publicly available; students can download it on their own computer, become familiar with it, and play it at their leisure. An instructional unit centered on *FF* can be developed with the reasonable expectation that students can complete homework on the game at home. Bridging between school and home should be easily accomplished with this type of videogame.

The findings of this study indicate that students' retention of videogame vocabulary was superior to their retention of textbook vocabulary. The results of the study suggest that the use of videogames situates learning in a highly contextualized space and grounds learning in deeper cognitive engagement; learning is thus woven into a deeper level of students' cognitive system (Gee, 2007), and may induce "deep vocabulary knowledge" by involving learners' affect and activating vocabulary networks (Corrigan, 2007).

### Limitations

Given that this study was conducted in a real-world classroom context, it has some associated limitations. The small sample size ( $n = 9$ ,  $n = 11$ ) affects generalizability. Nonetheless, a sample size of 20 is relatively large for L2 DGBLL empirical research, where many studies are ethnographic in nature and have fewer than ten participants. In addition, the two different studies demonstrated similar effects, adding some validity to the findings. Repeatedly testing the same list of words may have limited this study. Although the words were reordered each time, students might have become sensitized to the test, resulting in artificially increased scores. However, textbook vocabulary was tested similarly, using the same 25 words each time, yet participants remembered *FF* vocabulary better than textbook vocabulary. Also, as the tasks in the *FF* unit involved intensive listening, the evaluation test could have employed listening instead of paper-and-pencil, which might have resulted in different test scores in the *FF* unit.

### Future Implications

This study explored vocabulary learning and retention and effects on learners' affect and engagement using content about global issues. We found that the use of DGBLL positively impacted students' learning outcomes, but found differing effects among individuals. Further research is necessary to investigate the interplay between learner characteristics and types of digital gaming associated tasks. Proficiency in the target language, technology efficacy, and metacognitive understanding of one's own learning process might be contributing factors in these differences. Individual differences are worth exploring in future studies, as they may point to ways we can guide learners to make the most of DGBLL for better outcomes. In addition, past DGBLL studies have investigated areas such as the development of collaboration and negotiation (Peterson, 2012), language socialization (Thorne, Black, & Sykes, 2009), pragmatics (Sykes, 2009), sense of presence and motivation (Peterson, 2006), willingness to communicate (Reinders & Wattana, 2012), and negotiation for action (Zheng, Young, Wagner, & Brewer, 2009). We find few studies on vocabulary *production* or learners' syntactic inter-language development in existing DGBLL research. How DGBLL can be deployed both in and outside of the classroom to teach specific linguistic features in L2 development may be of interest to future L2 researchers. Further, the Japanese writing system presents a special challenge to students, as its orthographic systems are difficult to master for many learners (e.g., Kondo-Brown, 2006). How effectively DGBLL can be employed to overcome this challenge would be an interesting and pertinent research area in Japanese language research. Finally, 3D gaming and digital games developed specifically for language learning will likely be an important research area in coming years (Kronenberg, 2012; Neville, 2010; Sykes & Reinhardt, 2013). It is clear that DGBLL has potential to bring about promising outcomes and new learning experiences for learners. As empirical evidence on videogame use in L2 classrooms has just started to be compiled, L2 DGBLL is wide open for future research.

### CONCLUSION

This study attempted to find empirical evidence of the efficacy of videogame use in an L2 classroom. Most existing DGBLL research has been done either outside the classroom or in a laboratory. The *Food Force* educational videogame developed by the United Nations World Food Program was integrated in an existing Japanese curriculum. Five days were spent on the digital game-based language learning (DGBLL) unit. Learners engaged in various scaffolding tasks for the first four days and played the *Food Force* videogame on the last day.

This was a preliminary study, yet it clearly points to the potential of videogame use in a second language classroom. Vocabulary retention using *FF* was significantly better than with the conventional method, *regardless* of how vocabulary was introduced. Furthermore, the difficulty of the *FF* vocabulary had no statistical impact on the enjoyment of the DGBLL



unit. The use of the *FF* videogame is considered to have offered students a “deep” learning experience, which a textbook might not easily accomplish. The majority of students reported that they enjoyed the *FF* unit more than the traditional unit. They were motivated and engaged. No gender difference in vocabulary learning was found, despite the fact that male students were more enthusiastic than female students about classroom videogame use. This study provides evidence that DGBLL that frames learning in videogame-mediated activities motivates students. Individual differences in outcomes were also found. The use of *FF* seemed to be particularly conducive for learners with high proficiency rather than those with lower proficiency. *FF* particularly seemed to benefit those who have good metacognitive awareness of their language learning.

We have demonstrated in this paper the idea that the potential of DGBLL can be harnessed in a small way by integrating videogames in an existing curriculum without “disrupting” the institutional structure. The implementation of *FF* in this study is not meant to bring about “transformational” language learning, and may even be an “insertion” of technology (Thomas, 2012) that did not fully realize the potential of the technology. However, we consider it a step toward better student outcomes and learning experiences. We presented an implementation example so that practitioners who wish to use videogames in their classrooms can use this study as a reference point. It is our hope that the small steps we collectively take will bring about transformational learning experiences for students and all stakeholders involved in education.

Last, but not least important, this study contributed to the small body of Web 2.0 and Japanese language learning literature. Most Web 2.0 second language research is conducted on EFL/ESL (58%), Spanish (21%), and German (9%) (Wang & Vásquez, 2012, p. 419). Currently, few studies exist on the intersection of the Japanese language and videogame use in a classroom.

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