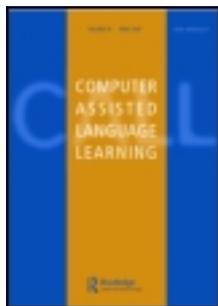


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Publisher: Routledge

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Computer Assisted Language Learning

Publication details, including instructions for authors and subscription information:

<http://www.tandfonline.com/loi/ncal20>

Cybertext redux: using digital game-based learning to teach L2 vocabulary, reading, and culture

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Available online: 19 Nov 2009

To cite this article: David O. Neville, Brett E. Shelton & Brian McInnis (2009): Cybertext redux: using digital game-based learning to teach L2 vocabulary, reading, and culture, *Computer Assisted Language Learning*, 22:5, 409-424

To link to this article: <http://dx.doi.org/10.1080/09588220903345168>

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Cybertext redux: using digital game-based learning to teach L2 vocabulary, reading, and culture

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The essay reports on a mixed-methods study using an interactive fiction (IF) game to teach German vocabulary, reading, and culture to university students. The study measured knowledge retention and transfer, and evaluated the attitudes of students toward the game. The results tentatively indicate that contextualized, immersive role play may have helped students to learn. Nevertheless, most students were apprehensive about the game as a learning platform given the departure from traditional instruction. New research findings related to the software design and development process, and student involvement in this process, are also discussed.

Keywords: digital game-based learning (DGBL); CALL; instruction of reading, vocabulary, and culture

Introduction

Digital game-based learning (DGBL), currently not ubiquitous in second language acquisition (SLA) programs in higher education, is becoming more commonplace (see Johnson, Levine, & Smith, 2007). Our study followed the implementation of an interactive fiction (IF) game created to teach German vocabulary, reading, and cultural skills to beginning university students. The game required students to assume the persona of an American foreign exchange student living in Germany, to navigate a fictional train station while preparing for a weekend excursion, and to interact with non-player characters (NPCs) located in and around the train station (see Figure 2 for a map of the game space). By using an IF game to immerse students in a second language and simulated foreign culture, the authors of the study hoped to outline the possible application of DGBL in foreign language pedagogy, highlight areas of potential difficulty that this application may present, and suggest practical ways in which to make second language (L2) education more contextual, persuasive, and student-centered. Seen more broadly, we attempted to predict possible student reaction to loosely structured, digital, and immersive learning environments.

Although small *N*-numbers made it difficult to glean statistically significant data, the study nevertheless provided guidelines for future development of DGBL

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environments intended for SLA and demonstrated the effect that DGBL can have on students' comfort level, sense of self-efficacy, and knowledge transfer and retention. Furthermore, we believe our research findings provide useful insights into the development process for DGBL software, the role that the learner plays in this process, and the types of learning tasks that can reasonably be expected from this software (Chapelle, 2003). To encourage further research in this direction, we are releasing the IF game described in this article for free use under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License at: http://cle.usu.edu/CLE_IF_AUSFLUG.html.

Theoretical and instructional background

As many DGBL environments simulate complex real-life social networks, they can be aligned with theories of situated cognition, schema theory, and interactional cognitive development. These theories underscore the importance that cognitive apprenticeships and learning communities play in the development of higher mental processes and the acquisition of knowledge (Brown, Collins, & Duguid, 1989; Lave & Wenger, 1991; Vygotsky 1978; Wertsch, 1998). Furthermore, DGBL has also been found to be amenable to instructional approaches utilizing situated learning, anchored instruction, and discovery-based learning (Brown & Adler, 2008; Gibson & Aldrich, 2007; Van Eck, 2006a, 2007). Finally, evidence of effective learning in DGBL environments has been noted across numerous topics and subjects, ranging from history and engineering to mathematics (Shaffer, Squire, Halverson, & Gee 2004; Shaffer et al., 2004; Squire & Barab, 2004). One promising application of these games in the context of SLA, which we explore in this article, is in support of beginning L2 students who are learning new vocabulary, reading skills, and cultural facts. As a new and entertaining media form that promotes reflection, active inquiry, and dynamic problem-solving techniques, DGBL may be highly desirable for L2 education.

Interactive fiction

IF is a game format that relates a story through text-based description of locations, NPCs, and events (Shelton, 2007). The game player, who is inserted into the story as one of its characters, interacts with the narrative through a computer program that parses player input and advances the game accordingly (see Figure 1). As the progression of the game is entirely dependent on player input, the digital medium becomes an integral component of the literary dynamic (Aarseth, 1997). Traditional IF games come in the form of "text adventures" such as the *Zork* (Infocom, 1980) trilogy and *Hitchhiker's Guide to the Galaxy* (Infocom, 1984), and typically involve a series of puzzle-solving scenarios that help the player to advance within the narrative. The nature of IF, which opens an explorable world experienced completely through the medium of digital text, not only provides the potential for students to experience traditional texts in new ways, but also helps to immerse them in cultural and contextual situations that can be pedagogically scaffolded in line with the goals of the game itself. This type of immersive gameplay lends itself well to SLA by providing contexts in which students must balance the goals of the game with the specific language acts necessary to achieve those goals (Baltra, 1990; Jordan, 1992; Meskill, 1990; Taylor, 1990; Verdugo & Belmonte, 2007). CALL research has suggested that engagement with play and the assumption of a character identity in an

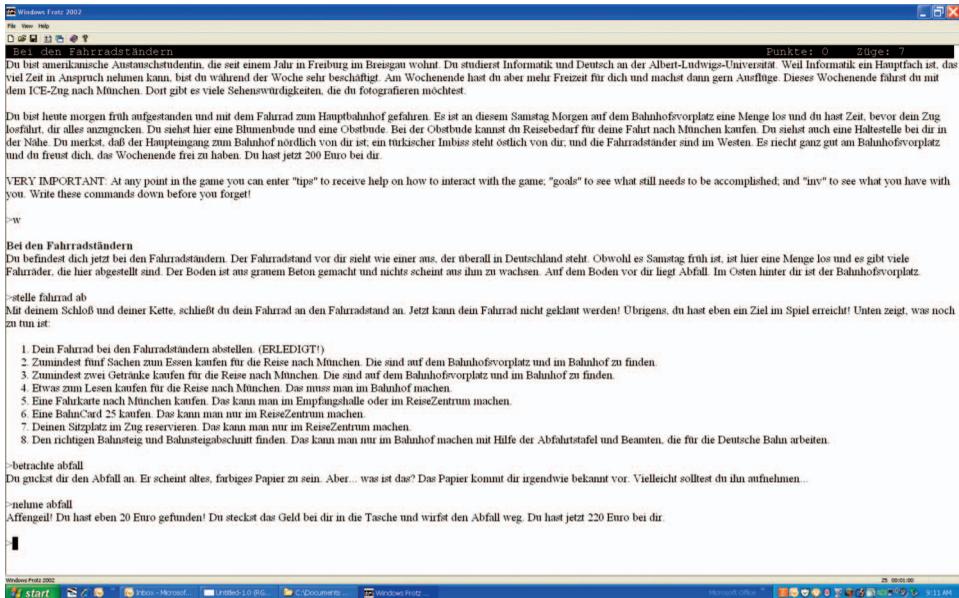


Figure 1. The *Ausflug nach München* interactive fiction interface, toward the beginning of the game.

engaging interactive participatory drama motivate learning (Hubbard, 1991, 2002; Shield, 2003).

Shelton (2007) and Scoresby and Shelton (2007) have observed that IF can provide successful learning experiences with English texts by reinforcing and augmenting the instructional aims of a first language (L1) classroom. Noting that IF enhances opportunities for reading comprehension, language fluency, and literary analysis (including character motivation, examination of narrative, and investigation of plot structure), they have also seen that explicit pedagogical goals are frequently augmented by incidental learning outcomes that can benefit the player. Incidental learning outcomes of note include enhanced problem-solving skills, spatial reasoning, and increased confidence. Ladd (2006), who used a project-based IF game to teach programming fundamentals to beginning computer science students, witnessed similar positive outcomes. It may be possible that these characteristics of IF can also be beneficial for SLA. Finally, the portability of IF makes it highly scalable, allowing it to be incorporated into existing classroom activity, group-work, or as a stand-alone product for an individual. Through application of different learner strategies, an IF game can be applied at an individualized level just above competence (Hubbard, 2004; Krashen, 1982). After an initial exposure to the game, it can be replayed in variations to hone basic skills in high-frequency linguistic tasks (DeSmedt, 1995; Hubbard, 2004).

Second language acquisition

In the 1980s, researchers discovered that adult L2 learners were especially successful in acquiring a foreign language when existing conceptual and discursive capabilities, or mental schemata, were involved (Bernhardt, 1984; Carrell & Eisterhold, 1983; Swain, Gass, & Madden, 1985). Researchers in the field of situated cognition theory

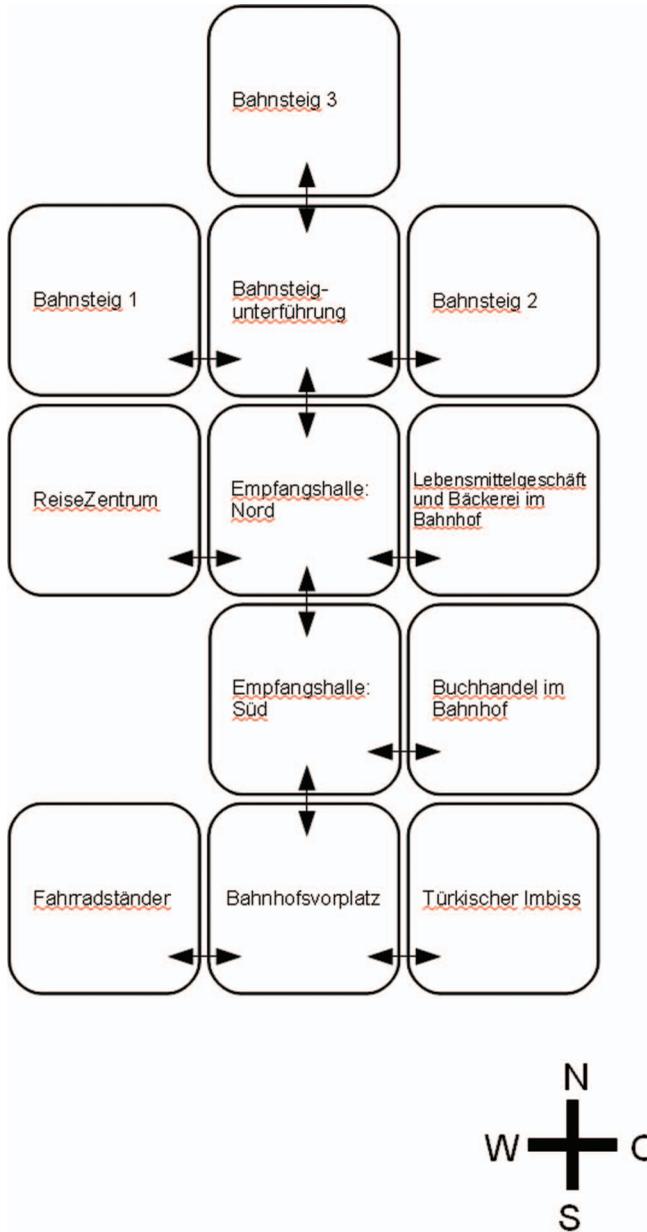


Figure 2. The map of the game space, based in a German train station.

have made similar findings. Brown et al. (1989) posited that all knowledge, similar to language, is inextricably bound to the activity and situations in which it is produced, which in turn suggests that “learning is a process of enculturating that is supported in part through social interaction and the circulation of narrative [whereby] groups of practitioners are particularly important, for it is only within groups that social interaction and conversation can take place” (p. 40). Furthermore, the types of problem spaces associated with communities of practice tend to be extremely complex

and ill-structured, allowing for the development of highly schematized knowledge that can be transferred to parallel contexts, including cultural and linguistic ones (Jonassen, 1997). The trend, then, has been to move instruction to environments that embody constructivist principles by offering a means for students to align new experiences with their existing understandings, forcing them to reconcile new information with what they already “know.” IF is an example of a learning environment that allows for these types of complex, ill-structured situations with a focus on reconciliation of understanding through linguistic mechanisms.

Seeking to develop schematized knowledge in students, specialists in SLA have argued for moving from grammar-based to content-based L2 curricula (Omaggio, 1986; Swaffar, 1988). A content-based approach requires students to “learn how to mean” by focusing their attention on discourse semantics. At the same time, by requiring a higher-level analysis of meaning, content-based language learning can simultaneously help develop L2 lexical and grammatical skills (Mohan & Beckett, 2003). The reading of L2 texts plays a key role in a content-based curriculum as reading well-constructed texts teaches mature students language and reasoning ability in L2 (Maxim, 2006; Swaffar, Arens, & Byrnes, 1991). Furthermore, reading in L2 facilitates the transmission of linguistic and factual knowledge, as well as social knowledge and cultural values, thereby providing access to multiple literacies (Byrnes, 1998; Swaffar & Arens, 2005). Finally, a content-based curriculum nurtures these literacies by allowing students to create, convey, and test knowledge; to create social, intellectual and moral communities; and to act as an agent and member within communities.

Points of theoretical and practical contact

The IF research project described here builds on the developments in DGBL and SLA outlined earlier. In line with DGBL theory, the IF game encourages students to access existing schemata in their native culture and to apply them toward navigating a foreign cultural context in L2. Embodying principles consistent with current SLA theories, especially those that emphasize the importance of reading in the process, the IF game models well-constructed discourse in a textual form. At the same time, the game promotes hybrid forms of speaking and writing, the “think-text” and “talk-text” common in object-oriented, multi-user domains (MOOs) (Pennington, 2000; Shield, 2003). As an interactive cybertext, the game mediates the experience of preparing for rail travel in Germany and transmits cultural values by engaging spending practices, travel preferences, and interaction with minority cultures. The game thus combines communicative structures and sign systems and provides an experimental space to observe the important “interaction of linguistic forms and social meanings” that shapes the contours of culture (Kramsch, 1993, p. 11).

These capabilities make DGBL particularly attractive to current pedagogical approaches in SLA, which stress the importance of cultural context during the learning process. The instructional use of IF for SLA was examined in the 1990s but has, perhaps due to the emergence of visually rich graphical user interfaces (GUIs) for computer games, seen less usage in recent years (Howell & Douglas, 1990; Tillman, 1997). Yet because IF is capable of simulating cultural contexts and complex real-life social networks, we posit that it should be revisited by the CALL community and ways sought to develop it as an integral component of culturally contextualized L2

instruction. Given the correct interface design, it may be possible to make IF more accessible to and enjoyable for a wider range of students (Pope, 2006).

Methods

Our study goals were to determine whether an increased measure of player presence and engagement in the game world would equate to an increased sense of student immersion in the German culture, whether this immersion resulted in increased vocabulary retention scores, and whether this immersion more easily enabled transfer of learned knowledge to parallel tasks. Also of interest was the amount of cognitive load imposed by the IF game. We relied on player self-estimates of cognitive load, which Clark, Nguyen, and Sweller (2006) note “are effective and are the most pragmatic way to assess mental effort” (p. 22).

The consideration of cognitive load in our methodology is important as numerous researchers in cognitive load theory (CLT) identify engagement in learning with the germane cognitive load of interacting with instructional media (Brünken, Plass, & Leutner, 2003; Sweller, 1994). In addition to quantitative measurements of vocabulary retention, qualitative measurements were also gathered to determine whether students found the instruction to be relevant to their study of German, whether it increased their confidence with the language, and whether they were satisfied with the quality of the instruction. The ARCS (Attention, Relevance, Confidence, and Satisfaction) model developed by Keller (1983) suggests that gains in these areas will result in better learning outcomes.

Data collection and analysis

Design and development

As learner involvement in the earliest stages of game design is essential for the development of effective student-centered software (Hémard & Cushion, 2006; Ward, 2006), we invited students and teachers to participate in the design and development process. The feedback they supplied not only improved the final quality of the game but also provided valuable design guidelines, which we examine here.

Observation of students’ interactions with the game revealed that sudden immersion into the game environment was not conducive to the learning process and disrupted the sense of flow. We also noted that the open-ended nature of the game, coupled with an unfamiliar computer interface and unclear game objectives, created a sense of learner uncertainty. The detracting freedom of action and new interface have proven similarly challenging in MOOs and other CALL applications (Sanders & Sanders 1995; Shield, 2003). Finally, another problem that emerged during the design and development phase is that students saw the game as a series of points to be gathered and objectives to be performed, rather than seeing the game as an environment to be explored.

To address these issues, we opted to equip the game with in-game resources that kept track of students’ progress, listed objectives that still needed to be accomplished, and provided tips for gameplay. In line with student experience with contemporary 3D computer games, we also included a game orientation and interface training phase as current CALL theory suggests (Hubbard, 2004). The interface training phase was a scaffolded English/German environment that helped

players to learn how to interact with the command line prompt, navigate the game space, and become accustomed to affordances and limitations provided by the game. Our recent use of the game in an instructional setting suggests that in-game training must also be complemented with in-class game training.

Although we considered it important to align gameplay with existing paradigms, we were also aware of the importance of maintaining a balance between gameplay that is included purely to entertain, and therefore potentially distracts from the learning objectives of the game, and gameplay that is purely instructional in nature, and therefore could potentially be perceived by the students to be boring. Sanders and Sanders have noted the general tendency that a complex game is much more engaging than a complex language model (1995). Many other researchers have noted various models for effective gaming motivation (e.g. Malone & Lepper, 1987; Shelton, 2007) that include aspects of challenge, uncertainty, proclivity, and social interaction. The point here was that the game design was required to be aligned with learning objectives, to ensure that progress through the game would result in addressing of learning issues. Including explicit motivational elements within the game design was not of primary concern. Rather, the researchers relied on extrinsic motivational factors for students' willingness to play and complete the gaming exercise – the primary extrinsic factor being that the game was included as part of an assignment for a graded class. That is to say, we are not claiming that the game was tedious for the students, rather, that most recognized gaming motivational factors were overtly not attended to within the game design. We also realized that the game is not a stand-alone instructional platform, but rather must be complemented with in-class debriefing strategies that would prompt the students to reflect on their game experiences more deeply and with a critical focus on cultural differences and context-based language performance. A complete summary of all findings made during the design and development phase can be found in Table 1.

First study

The researchers, who consisted of two professors of German and one professor of instructional technology and learning sciences at a state university, randomly assigned eight students in a third-semester German language course to the control (print-based text) group. Students in the control group were required to read a story of 550–600 words in German, complete homework exercises based on the vocabulary presented in the text, and write a short essay. Seven students in the German course were randomly assigned to an experimental (IF) group, which played an IF game that covered the same scenario presented in the story and made use of the same vocabulary. The experimental group was required to do the same homework assignment as the control group. The homework for both groups, which contained matching, fill-in-the-blank, word field, and essay composition components, also contained quantitative assessment instruments in the form of self-reported Likert scales to assess the apparent complexity and difficulty of the assigned task, mental effort spent on the task, sense of immersion in the German culture, enjoyment of the task, and the degree to which the task engaged and retained attention.

In class the next day, both the control and experimental groups were required to complete an assessment that measured both retention and transfer of the vocabulary. The in-class assessment instrument that recorded vocabulary retention was the same

Table 1. Design and development findings.

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1. Include students from beginning in the development and beta-testing processes.
 2. Incorporate brief training sessions into the game whenever new and unfamiliar material is introduced; a training module for new players should be completed before gameplay can begin.
 3. The in-game training module should be complemented with an in-class training session.
 4. Pay attention to contemporary computer games for affordances with which students are familiar and would expect in a computer game.
-

as the homework exercise that students in both groups completed the night before. To gather qualitative data, both groups were asked to comment on their learning experience during an informal debriefing interview with the researchers, which was conducted after the in-class assessment was completed. The debriefing interview was recorded with a digital audio recorder and used to review researcher notes, as well as substantiate paper-based assessments.

Second study

Although structurally similar to the first study in terms of homework assignments and in-class quantitative and qualitative assessments, the second study varied in that it was run over the course of three days and included an in-class debriefing and a lesson on train stations in Germany. The in-class lesson on train stations featured an introductory series of photos of the indoor and outdoor spaces of the central station in Freiburg in Breisgau. This photo essay was intended to give the students a visual and spatial framework for the various parts of the train station their homework had required them to imagine.

Not only important for data collection, the debriefing phase of DGBL is essential to maximize learning and encourage development of mental schemata (Thiagarajan, 1993). When engaged in contextual learning activity, like those within simulated and virtual environments, students are not afforded time to reflect on what is happening and the consequences of their decisions. Debriefing, therefore, allows students to share in others' experiences and compare them with their own, while allowing the instructor to hit key issues encountered within the simulation. Hertel and Millis (2002) go so far as to contend that "debriefing is the most important [activity] from a learning perspective" (p. 27). We found that the important role of in-class debriefing for DGBL in SLA was not given enough attention during the first study and its inclusion during the second study was an attempt to further aid student comprehension.

Findings

Observed quantitative trends: first study

Despite the limitations of small *N*-numbers, which prevented statistically significant data from being obtained, we observed interesting statistical trends that might be corroborated through further research on DGBL for SLA. We also recognized that a study conducted over the course of three days cannot determine the long-term impact that a curriculum designed around DGBL will have on SLA methodologies. We suggest, therefore, that further longitudinal studies with larger population

samples be undertaken to determine the statistical significance of the findings we report here. As we will only be discussing observed trends generally, and not reporting specific statistical findings, we will forgo the details of N , standard deviation, and standard error.

More than the IF group, the print-based group apparently perceived the combination of reading and then doing homework to be a more effective way of developing German vocabulary skills than the IF group. The print-based group also felt that the traditional approach of print-based reading and homework was more relevant to their learning than the IF group. Perhaps as a result, the print-based group expressed more confidence in their mastering the German language as a result of the reading and homework than the IF group and also expressed greater levels of satisfaction with the instruction than the IF group. Actual performance of the print-based group during the assessment, however, indicated that this confidence and satisfaction may be misplaced. The combination of reading and fill-in-the-blank homework exercises apparently did not help the print-based group in vocabulary retention on the same section of the assessment. The IF group, on the other hand, performed better in this section both on the homework and the assessment.

Compared to the print-based group, the IF group may have exerted less mental effort on completing the homework. This discrepancy could possibly be attributable to the increased mental effort the IF group exerted while playing the game compared to the print-based group, resulting in more firmly established mental schemata that could later be transferred to the homework. In addition, the IF group may have found the task of writing the homework essay to be a less difficult task than the print-based group. Again, the prolonged exposure to the IF game, with its immersive and interactive environment, may have developed richer mental schemata that could be more easily abstracted and applied to the writing of the essay.

Observed quantitative trends: second study

Findings from the second study revealed that the print-based group expressed more confidence in their form of instruction than the IF group. However, the combination of reading and fill-in-the-blank homework exercises for the print-based group again did not seem particularly helpful with regard to vocabulary retention during the assessment. The print-based group did much more poorly on the fill-in-the-blank section of the assessment as compared to the same section on the homework. We also noted that the combination of reading and word-field homework exercises for the print-based group was apparently less helpful with regard to vocabulary retention during the second study. It is surprising that the IF group, whose interaction with the game would seemingly contextualize vocabulary within thematic areas, did even worse than the print-based instruction on the assessment.

When combined with data from the first study, the print-based group found the assessment to be markedly more difficult than the homework. The combined IF groups, on the other hand, found the assessment to be not much more difficult than the homework. These findings seem to suggest that the difficulty inherent in DGBL may be useful in preparing students for exams and could be implemented in SLA curricula shortly before test dates as a means of reviewing and solidifying mental schemata. We also discovered that the IF group in the second study exerted more

mental effort while playing the game, and found it more difficult than the print-based group did while reading the text. When combined with data from the first study, the IF groups still exerted more mental effort on the game than the print-based group on the text. We found that the IF group, which invested greater mental effort into the game, in the end had to invest less mental effort into doing the homework, unlike the print-based group. In addition, the IF groups still found writing the homework essay to be less difficult than the print-based group.

Finally, the IF group also seems to incorporate more vocabulary words in the assessment essay than the print-based group, seems to write larger assessment essays than the print-based group, and seems to have a higher ratio of vocabulary words to total word count than the print-based group. Such was also the case with homework essays, although not as pronounced. A complete list of all quantitative trend findings can be found in Table 2.

First study: qualitative analysis

The qualitative analysis was conducted in the last 20 minutes of class, after the students had completed the in-class assessment. Students in the IF and print-based groups were invited to reflect on their instructional experience and respond to qualitative assessment questions in a semi-structured fashion. We discovered that the scaffolding in the game may not have been sufficient to guide the learners through the instruction. Students generally expressed frustration about the goals of the game and their inability to make noticeable progress within the game space, despite scaffolded hint features. Many students also felt that the game was too difficult for their level of language expertise. Of particular interest were the comments revealing that the IF game did not fit into contemporary pedagogical approaches. Students seemed to feel more comfortable with the linearity of learning for test mastery

Table 2. Observed quantitative trends.

-
1. Students are more accustomed to print-based instruction than DGBL. Implementation strategies must be developed that capitalize on students' prior knowledge of existing computer games and gradually introduce DGBL into SLA curricula.
 2. Students appear to have more confidence in, and satisfaction with print-based instruction. Strategies to demonstrate the pedagogical worth and efficacy of DGBL to students must therefore be formulated.
 3. Print-based instruction does not foster high knowledge retention and transfer rates, especially in the areas of matching and fill-in-the-blank exercises. L2 instructors must look beyond these traditional approaches to new approaches that may work better.
 4. Students invest more mental effort into playing the game, which equates to greater ease in completing the following assessment. DGBL may therefore be pedagogically useful in SLA review strategies.
 5. Students utilizing IF seem to write larger homework and assessment essays including more topic-specific vocabulary. DGBL may therefore prove useful as a means of encouraging students to write longer and more sophisticated essays that make use of less "filler" words.
 6. In several instances, IF seems to perform just as good – or even slightly better – than print-based instruction. These findings suggest that traditional print-based pedagogical approaches may be safely substituted with DGBL approaches. However, more longitudinal studies with larger population samples should be undertaken in order to verify the instructional gains and to help devise best pedagogical practices.
-

compared to the open-endedness of digital game spaces that allow free exploration. Nevertheless, several students felt that they would be more comfortable with a 3D game interface instead of a text-based interface.

Second study: qualitative analysis

Compared to students in the first study, students in the second study expressed more comfort while playing the game. We attribute this to the additional time students had to interact with the game and the debriefing lesson that allowed them to reflect on their experience, draw connections to prior cultural and operational knowledge of Germany and its transportation infrastructures, and to communicate with other students regarding their game experiences. Indeed, many of the students reported being stymied in the game until receiving help from their fellow students, which suggests that external learning communities should play a larger role in any further use of DGBL for SLA.

Students in the print-based group reported being comfortable with the story as it was presented in a familiar format, although one student complained that he felt his attention was divided between the vocabulary sheet and the printed text. Several students in the IF group also reported this split-attention effect (Ayres & Sweller, 2005), which could potentially be alleviated in future experiments through interface-based help menus for the IF game and NPCs that act as teachers or more capable peers.

Finally, students in the print-based group felt that the story did not help them learn German culture as much as it did vocabulary, whereas students in the IF group remarked that the game not only helped them to learn vocabulary but also the application of this vocabulary in specific physical spaces helped them to localize the vocabulary within cultural contexts. Anticipating that the inclusion of virtual 3D learning environments will only strengthen the connection between vocabulary and localized culture, enabling students to develop transferable mental schemata that can be abstracted and adapted to other learning tasks, we have begun to work on developing a similar adventure-based language learning game in 3D format (<http://digibahn.blogspot.com>). All of the students indicated that they would be interested in taking a course in which games were used to teach a foreign language. A complete list of all qualitative assessment findings can be found in Table 3.

Discussion and significance

Our research suggests that immersive DGBL learning environments, with their contextual, persuasive, and student-centered instruction, could possibly help to revise the manner in which foreign languages are taught at the college and university levels. At a time when many foreign language departments are facing declining student enrollment and also struggle to legitimate their curricula in the changing environment of higher education, DGBL may be especially useful in demonstrating that learning a second language can be both fun and challenging, current with the times and technology, and adaptable to student input.

Before DGBL can become fully integrated in SLA curricula, however, additional research and development need to be completed. Reading our quantitative data in light of the qualitative data reveals some interesting insights important for future development. Although students may generally feel more confident about traditional

Table 3. Observed qualitative trends.

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1. Students are excited about the possibility of DGBL and express great interest in taking courses that utilize this methodology.
 2. Allow students more time to become accustomed to the interface and experience.
 3. Utilize in-class or small group debriefing strategies to draw connections between the DGBL experience, classroom exercises, course curricula, target culture, and L2 grammar topics.
 4. Design scaffolded instruction to integrate the DGBL experience into course curricula; simply inserting students into a DGBL environment will not guarantee that they will learn.
 5. Design close parallels between instructional objectives in the course and challenges in game play.
 6. Incorporate all help materials within the game environment either through the interface or by including NPCs that act as a teacher or guide.
 7. To prevent student attrition, make the game a required element of the course instead of a peripheral instructional component.
-

pedagogical paradigms and consider these sufficiently satisfactory for their learning needs, our study seems to suggest that these approaches manifest lower levels of both knowledge transfer and retention. Furthermore, the linear approaches common in traditional L2 instruction may not best prepare students for taking tests on the material – the assessments were reported to be significantly more difficult than the homework.

Surprisingly, participants who learned from the IF game were more adept during the homework phase to abstract their knowledge of learned vocabulary and transfer it to free-form writing assignments. This finding, which certainly deserves further study, can perhaps be attributed to participants' attempts at formulating sentence fragments in German during gameplay, even if they did not reflect on this experience as being truly helpful. The analysis may indicate that DGBL students generally performed better than students in the control group both in areas of transfer and retention. DGBL students reported lower levels of difficulty with the assessments than students in the control group, and also exerted less mental effort during their assessments. It is also interesting to note that the DGBL students wrote longer essays, used more pertinent vocabulary words in the essay, and manifested a higher vocabulary to non-vocabulary ratio. It seems contradictory, therefore, that DGBL was considered by the experimental group to be less pedagogically valuable than traditional print-based approaches and not directly relevant to learning a foreign language. Despite their reports to the contrary, DGBL students may have done better than they thought.

These findings, however, should not be interpreted as a plea to discard all traditional print-based pedagogical approaches in favor of emerging digital forms. Rather, as the qualitative feedback powerfully suggests, students who are unfamiliar with the open-ended nature of these free-exploration environments most likely will be unsure how to use them to their advantage. In sum, if we build it, they may not learn. As Land and Hannafin (1997) have demonstrated with other open-ended learning environments, it cannot be safely assumed that simply dropping students into a DGBL environment will produce the types of pedagogical results that we expect. Rather, our findings suggest that these virtual environments should be carefully introduced into the curriculum either by scaffolding them into existing, more familiar, instructional approaches or by designing instruction exclusively

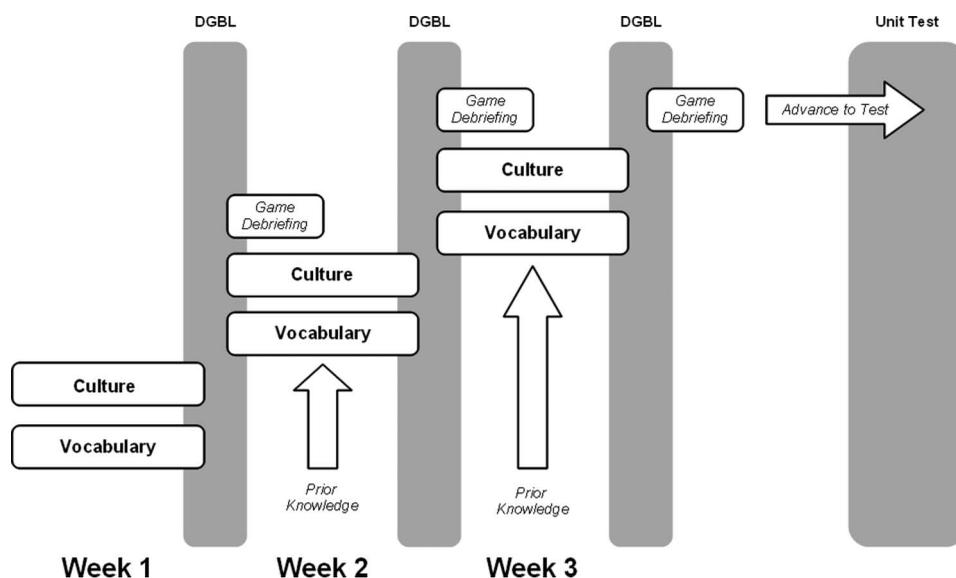


Figure 3. Possible scaffolded use of DGBL in a SLA curriculum.

around the game experience so that game activity can be seamlessly blended with classroom activity and homework assignments (Purushotma, 2005; Roschelle, Pea, Hoadley, Gordin, & Means, 2000). An example of possible scaffolded use of DGBL in a SLA curriculum is described in Figure 3. Issues of student motivation should not be overlooked when introducing DGBL into learning environments; differences in game genre, topic, social interactions and audience-appropriate material are all design factors that require consideration to reduce student attrition. We propose that DGBL may be a useful component for the template-based or template-enhanced SLA environment described by Rüschoff and Ritter (2001). Finally, we also suggest that DGBL in L2 language curricula may help to serve as a capstone for a unit, module, or chapter experience by solidifying knowledge, abstracting mental schemata and preparing these for transfer, and lowering the perceived difficulty of assessment instruments.

Notes on contributors

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