Virtual Immersion: The Role of CAVE and PC Technology

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ABSTRACT

Given the reality that computer games are ubiquitous in everyday life, researchers (Godwin-Jones, 2005; Purushotma, 2005) are touting the potential of making use of them in the second language classroom. In the current paper, we situate virtual reality (VR) technology within an L2 pedagogical framework and argue that it is a viable resource for enabling students to experience the target culture in ways that are impossible through the use of other technologies. In addition, we present the results of a pilot project in which we compare the effectiveness of two VR environments (CAVE and PC technology) on a variety of measures of student engagement: cultural awareness, collaboration, and overall experience. We argue that although the CAVE technology is perhaps the more exciting and immersive medium, its exorbitant cost and large scale make it an unfeasible prospect for most schools. The PC version of the game is readily accessible, can be run at no additional cost to the end user, and provides a positive and potentially more engaging experience for students.

KEYWORDS
Virtual Reality Technology, CAVE, PC Technology, L2 Pedagogical Framework, Student Engagement

INTRODUCTION

Despite educators’ misgivings, computer games may be the next important trend in language learning-technology (Chun, 2007; Godwin-Jones, 2005; Purushotma, 2005). Simpson (2005) states that “games are empowering, motivating, individualized differentiated learning environments with set rules which value the efforts of the individual” (p. 20). Buckingham (2006) reports that computer games represent the fastest growing sector of the media and entertainment industries, and the National Institute on Media and the Family (2006) cites research showing that 83% of 8- to 18-year-olds have at least one video game console (e.g., PlayStation, Xbox, Wii) in their homes. Given the prevalence of video and computer games in our students’ lives and the possibility to create and modify them to align with pedagogical goals, it behooves us as educators to bring more realistic educational, or serious,¹ computer games into the classroom (e.g., Buckingham, 2006). In the current study, we situate virtual reality (VR)—or virtual world—technology within an L2 pedagogical framework and examine the linguistic and experiential outcomes of making use of a video game in a high school German classroom.

**VR Technology**

Video games make use of VR technology. This technology is an "immersive environment that completely surrounds the participant in which sights and sounds ... are stable and locatable in three-dimensional space" (Winn, Hoffman, & Osberg, 1995, p. 2). As opposed to watching videos, participants in VR have the chance to experience the situation. In addition to this sense of 'presence' (Winn et al.) that differentiates VR from other forms of technology, Whyte (2002) states that VR stands apart from other forms of computer technology in three ways:

1. interactivity (participants are actively involved in the experience),
2. spatiality (the world is presented in three dimensions), and
3. real time (users receive immediate feedback).

In today’s marketplace, software exists that enables relative neophytes to create virtual worlds. Simple interactive worlds using stock characters and scenes can be made using relatively inexpensive applications like 3D Gamemaker (http://t3dqm.thegamecreators.com/?f=feature) and RPG Maker (http://www.enterbrain.co.jp/tkool/RPG_XP/eng). In addition to constructing virtual worlds, however, game designers must also write scripts; create and animate characters, scenes, and objects; record audio tracks; and program behaviors and navigation. The creation of video games similar to those students play in their free time is an expensive and time-consuming endeavor in which we can expect few language pedagogues to take part.

PCs and game platforms provide excellent environments for game play. In the current study, both PCs and a CAVE were used as testing environments. A CAVE is a multiscreen projection system that provides users with a high level of immersion (see Figure 1). CAVEs are built around a stereo projection system, giving users a 3D experience. Other features of a CAVE can include head tracking of the subject and surround sound. The most common applications of CAVE technology are in military training, medical education, manufacturing, and design. Their costs can range from $100,000 for a low-end commercial installation to several million dollars, not including the space required for equipment. Given the tight funding for most computer labs, acquiring resources for a CAVE is probably outside the funding envelope of most educational institutions.  

Figure 1  
CAVE with a Group of Three Students
**VR in the Classroom**

VR has been utilized in classrooms for teaching biological concepts (Bakas & Mikropoulos, 2003) and properties of water (Trindale & Fiulhais, 2000) and has allowed students to experience environments such as rain forests and space stations (Winn, 1995). Schwienhorst (2002) argues in theoretical terms that VR is ideal for the L2 classroom because it “can support learners in becoming more autonomous language learners who can select and organize their own learning resources” (p. 197). In spite of the optimistic outlook, researchers have not yet examined the effects of utilizing VR for learning a second language and specifically the target culture.

Simpson (2005) lays out general aspects of computer games that make them ideal for the classroom. A number of these features are closely linked to pedagogical approaches and research themes in the L2 classroom (see Table 1). None of the L2 pedagogical counterparts has been tested via VR technology.

<table>
<thead>
<tr>
<th>Aspects of video games (Simpson, 2005)</th>
<th>L2 pedagogical counterpart</th>
</tr>
</thead>
<tbody>
<tr>
<td>Object of the game</td>
<td>Task-based language teaching (e.g., Willis, 1996)</td>
</tr>
<tr>
<td>Trial and error</td>
<td>Corrective feedback (e.g., Ellis, 2006)</td>
</tr>
<tr>
<td>Collaboration</td>
<td>Social-interactive view of language learner (e.g., Vygotsky, 1978)</td>
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<tr>
<td>Autonomy</td>
<td>Learner autonomy (e.g., Little, 1995)</td>
</tr>
<tr>
<td>Availability of various tools</td>
<td>Learning styles (e.g., Skehan, 1991) and strategies (e.g., Oxford, 1990)</td>
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Simpson (2005) notes that video games present students with a problem requiring a solution. In the language classroom, many educators have embraced the idea of task-based language teaching in which “the target language is used by the learner for a communicative purpose (goal) in order to achieve an outcome” (Willis as cited in Littlewood, 2004, p. 321). Thus, completing the task takes precedence over the manipulation of language forms. Doughty and Long (2003) provide examples of a number of materials—both authentic (e.g., CyberPatient) and CALL—that support the principles of task-based language teaching. One such case in point is a computerized simulation in which students play roles, through writing in English, in various situations.

Simpson (2005) also points to the importance of trial and error: “failure is a learning experience, not an end to a result” (2005, p. 19). In the language classroom, we have seen the importance of allowing students to experiment with the target language and make mistakes as well as the effectiveness of providing students with corrective feedback on L2 production errors (for an overview, see Ellis, 2006; see also, e.g., Karlstroem, Cerratto-Pargman, Lindstroem, & Knutsson, 2007; Sachs & Polio, 2007). A number of possibilities exist for providing students with feedback in CALL. These range from explicit comments (e.g., “Try again!”) and repetition to rephrasing and help screens. A range of CALL studies (e.g., Heift, 2004 for grammatical errors; Tsubota, Dantsuji, & Kawahara, 2004 for pronunciation errors) examine the effectiveness of various types of error correction. Heift, for example, found that feedback that both highlights and provides an explanation of the error is the most effective.

In her discussion of the collaborative nature of video games, Simpson (2005) points out that collaboration exists in a symbiotic relationship with competition, which together pro-
vide the motivation that participants need to succeed. This correlates well with the social nature of language learning and Vygotsky’s (1978) notion of the zone of proximal development (ZPD): “the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving … in collaboration with more capable peers” (p. 86). Therefore, it is hypothesized that students achieve higher performance levels when they work meaningfully with their peers than when they work on their own. Studies examining the effectiveness of computer-mediated communication (e.g., Vandergriff, 2006) often appeal to the ZPD when interpreting measures of student success.

While video games are on the one hand collaborative efforts, they do offer students the opportunity to work independently at their own rates. Little (as cited in Schwienhorst, 2002, p. 197) defines autonomy as “a capacity—for detachment, critical reflection, decision-making and independent action” and stresses the importance of knowledge transfer and applying what is learned to new situations. Researchers such as Blin (2004) and Hémard (2006) have examined the notion of learner autonomy in CALL, and Hémard bemoans the fact that what is often perceived of autonomy in CALL research is actually unguided, repetitive, and teacher-independent. Both authors point out that when care is taken on the part of the pedagogues, students can truly work autonomously in CALL settings.

Finally, the availability of various tools in video games appeals to different learning styles, or “general predisposition[s], voluntary or not, toward processing information in a particular way” (Skehan, 1991, p. 288). Teachers also realize that students possess and are able to learn new strategies to be successful language learners (e.g., Oxford, 1990). Barr, Leakey, and Ranchoux (2005) found those CALL environments that are differentiated according to learning styles are the most effective, and computer software can also assist students in the development of learning strategies (Vinther, 2005).

Although research has not been performed in the area, we argue, based upon the match between L2 pedagogical goals and the aspects present in video games, that the language classroom is the ideal setting for the utilization of VR technology. Students participate in a motivating experience with a clear goal, receive feedback, are able to work autonomously while making use of the types of tools that best fit their personal learning styles and rely upon one another when necessary.

**Culture in the L2 Classroom**

Levy (2007) reminds us that the notion of culture has been interpreted and defined in a variety of ways over the last three centuries. Tseng (2002, p. 13) argues that culture learning should be approached as a dynamic process “rather than an external knowledge to acquire incidental to the ‘facts’ of language” (see also Robinson-Stuart & Nocon, 1996). While we recognize that no definition of culture can encompass all aspects that the term entails, for the purposes of the current paper we take direction from Levy (2007), who relies on Kramsch’s definition of culture: “culture can be defined as membership in a discourse community that shares a common social space and history, and common imaginings” (as cited in Levy, p. 105). This definition allows for the inclusion of negotiation of meaning and understanding of differences in perspective set forth by Furstenberg, Levet, English, and Maillet (2001) as a goal of cultural understanding and takes into consideration the background of the individual in defining culture.
Policymakers stress the necessity of cultural understanding for language learners. The Standards for Foreign Language Learning in the 21st Century (1996, 1999, 2006) include culture as central to language study and define the goal of cultural understanding in two standards:

Standard 2.1: Students demonstrate an understanding of the relationship between the practices (italics added) and perspectives of the culture studied (2006, p. 50); and

Standard 2.2: Students demonstrate an understanding of the relationship between the products (italics added) and perspectives of the culture studied (2006, p. 51).

Three aspects of the target culture are included within these Standards: the behavioral practices (i.e., “patterns of social interactions” [2006, p. 47]) such as forms of discourse and the use of space), philosophical perspectives (i.e., “meanings, attitudes, values, ideas” [2006, p. 47]), and both tangible and intangible products (i.e., “books, tools, foods, laws, music, games” [2006, p. 47]). For the purposes of this paper, we will focus on cultural products and practices.

Dubriel (2006) notes the importance of CALL for bringing the target culture to foreign language learners, as opposed to second language learners: “it offers students immediate access to images and native speakers” (p. 243). Chun (2007) notes that culture is among the hot topics featured in two of the major CALL journals, the CALICO Journal and Language Learning & Technology. Researchers have shown the value of CALL for intercultural learning (Furstenberg et al., 2001; Ware & Kramsch, 2005). Among the researchers, Hager (2005) studied the use of German websites to develop cross-cultural understanding in German courses, and Liaw (2006) looked at the use of e-forums for intercultural discussions. In his examination of five CALL projects and their effectiveness for the teaching of culture, Levy (2007) expresses the sentiments of many researchers; for culture learning to be successful, the teachers must manage CALL resources with a great deal of care.

Dennen and Branch (1996) recommend that VR be used “[w]hen a setting that would otherwise be inaccessible is involved” (p. 105). LeLoup and Ponterio (2004) discuss the possibility of making use of online VR museums in the language classrooms, which allow students to “explore … cultural perspective[s] instead of just memorizing names and dates associated with works of art” (p. 3). Godwin-Jones (2005) and Purushotma (2005) put forth a number of VR resources that can be manipulated for use in the L2 classroom. Most of these games (e.g., SIM Copter), however, have not been created for language learners and therefore may not meet their specific pedagogical goals. Godwin-Jones does, however, mention a project by W. L. Johnson and his colleagues (http://www.isi.edu/isd/carteg/proj_tactlang). The virtual world they describe has been created to assist learners of Arabic in the acquisition of “tactical languages,” that is, a set of mission-specific skills that are required by soldiers who are deployed to new environments. Although cultural skills are targeted, the researchers have focused their effectiveness studies on the acquisition of linguistic abilities, especially as they pertain to pronunciation, which is evaluated by the software’s speech recognizers. Thus far, studies on the use of VR in the classroom have not focused on what we argue are the two main benefits of this medium: the acquisition of cultural knowledge and the evaluation of various forms of VR available to the end user (CAVE vs. PC technology). These are the foci of the present pilot project.
**Virtual World**

The virtual world experienced by students in the current study was created in a 3D modeling environment (StudioMAX). It is based on photos, drawings, and maps of Salzburg and Vienna. The completed 3D model was imported into Virtuools, a game-making application for building interactive worlds. Students took part in the adventure in one of two possible environments: in the computer lab, in which students sat in front of their own PC, or with a group of classmates in the three-dimensional CAVE setting described above. At the outset of the game, students are informed that the mayor’s daughter is missing and that it is their goal to find her. They are given a series of clues—mostly commands—and are instructed through the city center and the marketplace to find the kidnapped daughter. Clues take a number of forms including spoken commands given directly to the participants, television and radio announcements, written clues, and cell phone messages. In addition, lost students are directed to find the police, who give them instructions to return to the point of their last clue. Figures 2 and 3 give examples of the types of clues used.

Figure 2
Interaction Between Characters Provides Students with an Auditory Clue
The game is complete when students successfully find the missing girl and receive their €1000 reward.

Two major research questions guide the current study:

1. Are there differences in students’ linguistic gains (i.e., the ability to follow commands) in the CAVE versus computer lab environment?

Since no previous studies have examined the ramifications of the use of VR technology on students’ language ability, we cannot base our hypotheses on previous research; however, given the more interactive and immersive nature of the CAVE environment, and the results of studies that indicate that immersion in the target culture can have a positive impact on language gains (e.g., Huebner, 1995; Spenader, 2005), we expect that students who experience the world in the CAVE format will show greater linguistic gains on a language posttest.

2. Do students experience the reality differently, depending on whether they are in the CAVE versus computer lab?

Dennen and Branch (1996) call for studies to look at the effectiveness of different types of virtual environments. In this study, we assess the differences between the CAVE and PC subjects’ experiences on three measures: mentions of cultural products versus practices, degree of collaboration, and general evaluation of the VR. Based on a study examining the retention of cultural information from journalistic videos (Herron, Dubreil, Corrie, &
Cole, 2002), which showed that students remembered more cultural practices than products, we expect our students to remember more cultural practices. In addition, we expect those in the CAVE environment to notice more cultural practices because they have more of an immersive experience. Buckingham (2006) notes that studies of game playing have one serious limitation: "[f]ew effects studies pay attention to the social interaction that characterizes most game playing: they are solely concerned with the interaction between mind and screen" (p. 81). We attempt to address this shortcoming and hypothesize that, due to the collaborative nature of the groups in the CAVE environment, students who make use of that technology will (a) interact more with each other, regardless of language spoken; (b) speak more of the target language; and (c) complete the game in less time than students who play it on the PC. In addition, we expect that students in the CAVE will generally rate the experience more positively, given the novelty of the experience.

**METHODOLOGY**

**Subjects**

Subjects in this study were high school students in their first \( n = 42 \) and third \( n = 33 \) semesters of German \((L1 = \text{English})\) from two high schools in a large urban center in western Canada. Students in one school took part in the virtual world experience in a group setting in the CAVE \( n = 23 \), and those from the other made use of the PC version \( n = 52 \) of the game on their own in the language laboratory.\(^5\) Students ranged in age between 15 and 18 years; the mean age was 16.12 years. Students reported a range of grades in their German courses \((70\%-95\%)\); the average current grade was 84.37\% \((SD = 8.066)\). Students stated that they were quite motivated to learn German: the mean motivation rating was 5.3 \((SD = .957)\) on a 7-point scale in which a rating of seven indicated that students were ‘extremely motivated.’ There were no significant differences in student average grades or level of motivation by grade level or by VR environment.

Students in the study were avid game players. Of the 75 students, 20 play video games at least once a day, and a further 16 play at least once a week. Only 10 of the students noted that they either never play or have played a game only once in the last year. On average, students who play video games play them 12.4 hours per week. Most report playing video games because they are fun \((21 \text{ students})\), challenging \((14 \text{ students})\), or interactive \((8 \text{ students})\). When students were asked to list their favorite educational video games, 19 of the 75 students listed video games, although the educational value of such games \(\text{(e.g., those based on television trivia games or popular board games)}\) is questionable. Interestingly, 26 of the students indicated specifically that they either do not have a favorite educational game, that they do not know of any educational games, or that they do not play such games. When asked, students reacted favorably toward using video games in the classroom, providing an average usefulness rating of 5.72 \((SD = 1.341)\) on a 7-point scale. Those who believe they should be used noted most often that video games are fun, entertaining, or interesting. Some of the students made the following comments:

- [playing games] provides for escape from the monotony of the everyday classroom;
- students are very interested in games, [and they] will be more attentive;
- [making use of video games] would be [a] break from general monotony and boredom;
With the amount of time people spend on games, it could help them be actively engaged in the class; and we are a technological generation.

On the other hand, those who were opposed to the idea made the following remarks:

Video games are expensive to develop and buy due to school budgets. It wouldn’t be effective ... video games can’t give the same interactions as a teacher; it’s hard to ask a game about something you don’t understand; and I think they will help some students understand some concepts but most education games are boring.

Our data supports Chun’s (2007) assessment that “we cannot ignore the fact that many of our students spend inordinate amounts of time playing video games, and, if we could integrate some aspects of gaming with language learning, we might at least increase our learners’ time on task with the L2” (p. 241). We, like Schwienhorst (2002), share her optimism about the role that games can play in the language classroom. The subjects in the study are of the “video game generation” described in Simpson (2005) and Buckingham (2006). Most play games regularly, which means that they will likely approach the experience with a critical eye, but they are open to the possibility of using games in the classroom. This group is, therefore, an ideal test group for this initial study investigating the potential benefits of the technology.

Tasks

On the day before the VR experience, students were taught the basics of the grammatical focus of the game: German commands (formal for students in the first-semester class and informal for students in the third-semester class). Following the lesson on this new grammar point, through a series of partner tasks, they were introduced to the basics of the marketplace vocabulary that would be used. Students were then given a pretreatment map task in which they were expected to follow a series of commands in German. At the end, they were given a pretreatment questionnaire (see pretreatment questionnaire in Appendix A) in which they were asked questions about their goals for learning German and their habits and attitudes surrounding video games.

On the following day, students experienced the virtual world in one of the settings (CAVE or PC) described above. They were expected to follow the auditory and written commands they were given by navigating via directional keystrokes through the virtual marketplace. Afterwards, students completed a posttreatment map task similar to the pretreatment map task. Again, they were given a series of commands and were asked to mark their routes and specific locations. Following this, they were asked to answer a series of free-response questions in a posttreatment questionnaire about the experience and to rate the VR environment (see posttreatment questionnaire in Appendix B).

Data Analysis

The pre- and posttreatment map tasks were rated in the following manner: students were given one point for reaching the final destination and one point for each of the commands they
successfully carried out. Student scores on the pre- and posttreatment tasks were analyzed by group via a series of one-way ANOVAs. In order to determine retention of cultural information from the experience, we analyzed student responses to the following free-response prompts:

What do you think was the goal of the activity you just performed?
Please write down any aspects of the world that you can remember.
How is the world similar to an experience you might have in a Canadian city?
Please list as many items as you can.
How does it differ from a Canadian city? Please list as many items as you can.

The replies to the free-response questions were analyzed according to the objective criteria set out by Herron et al. (2002). That is, students were given 1 point for mentioning any cultural information that appeared in the VR environment. As Herron et al. note, “[t]his system has the advantage of giving students equal credit for every item they remembered as opposed to penalizing them for missing what the teacher deemed important” (p. 45). As such, the general concepts given as responses to questions 2, 3, and 4 above were classified into categories (i.e., “categories that stand for phenomena,” Strauss & Corbin, 1998) and then differentiated along the cultural-product versus cultural-practice continuum. Those items that had to do with game playing (e.g., the 3D aspects, the speed of movement) or that could not be classified as cultural (e.g., answers such as “people” without descriptors) were removed from analysis. We remind readers of the definitions for these concepts provided in the Standards for Foreign Language Learning (2006): behavioral practices are defined as “patterns of social interactions” (p. 47), and tangible and intangible products include, for example, “books, tools, foods, laws, music, games” (p. 47). Thus, objects such as clothing or even architecture are classified as products, whereas any mention of daily living patterns such as hand shaking or the use of formal vs. informal pronouns are classified as cultural practices. This classification was independently performed by two researchers, and the researchers agreed with each other 87% of the time. The remaining 13% of cases were resolved through discussion. Each student’s score was calculated by dividing the number of responses the student provided by the total number of cultural responses recalled by all students for each question. For example, when students were asked to write down what they remembered from the VR, they came up with 268 responses, 238 of which were cultural products. Therefore, a student who mentioned 3 cultural products and 1 cultural practice would receive the following scores: 4/268 or .015 for cultural utterances, 3/238 or .013 for cultural products, and 1/30 or .033 for cultural practices.

Finally, we provide researchers’ observations of students’ interactions during participation in the experience.

RESULTS
On the pretreatment questionnaire, students were asked to rank which aspects of German language and culture are most important to them in their studies. They ranked two aspects of the language as most important: vocabulary and general fluency. It is interesting that the three aspects that they ranked lowest were related to culture: knowledge of geography, history, and daily life of German speakers.
**Language Gains**

In general, students did well following the commands on both the pre- and posttreatment map tasks. The results of a series of one-way ANOVAs indicate that students did not differ by treatment group on any linguistic measures: there were no significant differences between the groups on the pre- or the posttreatment tasks, both in terms of the students by group who reached the final destination (pretest $F = .476$, $p = .493$; posttest $F = .289$, $p = .592$) as well as in terms of the commands students followed correctly (pretest $F = .068$, $p = .795$; posttest $F = .347$, $p = .558$).

On the posttreatment questionnaire, students noted that they found the VR experience useful. Just more than half of the students (38 students) stated that they believed that this experience improved their knowledge of German. Students’ comments regarding why this activity improved their German did not differ greatly according to environment. Students in both groups indicated that they were able to apply their knowledge while playing the game. In addition, they noted that the game was more fun and interesting than regular class work and homework. When students were asked to rate the usefulness of the software for learning various aspects of German, they noted that the software was especially helpful for improving their listening skills (mean of 5.89 on 7-point scale, $SD = 1.075$). Again, there were no significant differences between the groups (CAVE vs. PC).

**Reality Experience**

**Cultural products versus cultural practices**

In order to determine the VR’s potential as a viable medium through which students can experience the target culture and its cultural products and practices as well as to determine the effectiveness of the two media, we evaluated students’ responses on the posttreatment questionnaire as explained above. Data were discarded from 9 of the original 75 students who did not complete either the pretest or the posttest.

The overall means for products vs. practices were analyzed to determine whether students remembered more products or practices after they experienced the VR. Results of a paired samples $t$ test indicate that students remembered more cultural products ($M = 6.96$, $SD = 28.75$) than cultural practices ($M = 0.78$, $SD = 3.42$) ($t(66) = 1.99$, $p = .05$) after playing the game.

To determine the effect of media (CAVE vs. computer lab PC) on students’ experiences, students’ percentage scores were submitted to an independent samples $t$ test. Students’ scores regarding the aspects of the VR world they remembered did not differ by group for the total number of cultural responses nor for the number of cultural products and practices they remembered after they participated in the experience. The same is true for students’ responses regarding the differences between the VR city and a Canadian city. Where the students did differ by group, however, was in their responses to the question: “How is the world similar to an experience you might have in a Canadian city? Please list as many items as you can.” Students who took part in the PC experience noted both more similarities ($M = 0.017$, $SD = .010$) than the CAVE group ($M = 0.009$, $SD = 0.007$) ($t(64) = -2.997$, $p = .004$), as well as more similar cultural products ($M = 0.18$, $SD = .015$) than the CAVE group ($M = 0.007$, $SD = .008$) ($t(64) = -3.074$, $p = .003$). Subjects did not differ by group in their scores for the number of cultural practices in the world that were similar to those in a Canadian city.
Collaboration

Evaluation of student collaboration while taking part in the virtual world experience was done by researcher observation. Although completely quantifiable data are unavailable, we feel it is valuable to make the following comments about student interaction by environment. A summary is provided in Table 2.

Table 2
Evidence of Collaboration by Media Environment

<table>
<thead>
<tr>
<th></th>
<th>PC</th>
<th>CAVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interaction</td>
<td>general interaction with at least one other student</td>
<td>some students completely passive, in spite of group setting</td>
</tr>
<tr>
<td>Target Language</td>
<td>individual words</td>
<td>individual words, often with English translation</td>
</tr>
<tr>
<td>Average Time on Task</td>
<td>18 minutes 11 seconds</td>
<td>17 minutes 30 seconds</td>
</tr>
<tr>
<td>Other</td>
<td>participation by all students</td>
<td>not all students participated</td>
</tr>
</tbody>
</table>

It is not surprising that many of the students who worked in the CAVE environment worked as a group on the task of finding the mayor’s daughter. The 23 students were broken into four groups to play the game. In two groups (one first-semester group and one third-semester group), students clearly collaborated, as indicated by the types of verbal interactions they had with one another. For example, when the third-semester students found a clue, a student remarked: “I think it’s the one!” and when the same students went the wrong way, another student questioned, “Is that the museum?” Similarly, the first-semester German students who collaborated well said things like “Look at that arrow. Do you see it?” and “[she said] something with a brick.” In addition, these same students used a number of German words (e.g., Bäckerei and Wurststand) and then translated them into English (‘bakery’ and ‘hot dog stand,’ respectively). A further indication of the positive experience of these students can be found in the following comments: “That is cool” and “It’s incredible.”

On the other hand, two of the four CAVE groups showed little collaboration. In one of the groups, one student did not interact with the other students in the group; she did not react once to the game. Similarly, in the final group, the “driver” was the only person who interacted with the game. This student listened to each command three or more times and was given assistance from the other students only on three occasions. Only one of these times did the student follow the advice of classmates.

Therefore, although two of the groups show that this immersive CAVE environment can lead to collaboration among students, the results from the other two indicate that collaboration is not guaranteed. Moreover, it is possible for students to passively observe the experience in this environment. All students who experienced the VR in the PC computer lab, on the other hand, were actively involved in the experience. In addition, most students collaborated with at least one other student while they were playing the game. Students were observed leaning over to ask one another questions and to make comments. The following interaction took place between two students playing the PC version of the game:

Student 1: “I’m stuck again.”
Students in the lab also used some German words. For example, one student exclaimed proudly, “I found the Bürgermeister!” ‘mayor.’ While it was our intention to have students in the lab work individually, it is interesting to note that they chose not to do so.

**General Evaluation and Presence**

When asked whether they believe activities like this should be used in their classroom, students gave an average rating of 5.73 ($SD = 1.15$) on a 7-point scale in which 7 meant ‘always useful.’ There is no significant difference between the groups on this measure. Most students who believe it should be used noted that it was a fun (20 students) or interesting (9 students) experience that allowed them to apply their knowledge of German (6 students). Of the students who were opposed to using the software in the classroom, the greatest number (4 students) indicated that they prefer the traditional classroom activities. As one student stated, “It was fun but I think the educational value isn’t as high as regular teaching.” It is perhaps interesting to note that all students who indicated that they prefer classroom teaching to the VR world took part in the experience in the CAVE environment.

The experience of students in the lab lasted significantly longer than that of the students in the CAVE ($F = 11.88, p = .03$). On average, students who experienced the virtual world in the computer lab spent an average of 18 minutes and 11 seconds in the world, those in the CAVE environment spent an average of 17 minutes and 30 seconds in the world. An analysis of the log files generated from students’ experiences indicates that students who worked on their own did a great deal more exploring than did students who worked as groups in the CAVE. Based on the data we have, we cannot attribute this finding to levels of linguistic understanding or game-playing prowess. What is clear from this is that students in the PC environment had a more extensive interaction with the environment than did the students in the CAVE group.

The general evaluation of the VR provided by students in the two groups (CAVE vs. PC) differed very little. The only significant difference between these groups can be seen in the analysis of the audio levels. The results of an ANOVA indicate that students with the PC experience rated the audio levels as significantly louder than did students who were in the CAVE ($F = 10.17, p = .006$). On all other factors, the differences between the groups were not significant.

We would now like to examine the notion of ‘presence.’ Both groups of students made comments about the ‘realness’ of the VR; however, students who experienced the VR in the CAVE relied on the use of different terms to convey their experiences than subjects playing in the language lab. It may be that the CAVE environment enhanced the “wow” factor for those students who experienced it. An examination of students’ responses regarding which aspects of the game were their favorites supports this suggestion because 5 students (25%) in the CAVE environment mentioned the 3D nature of the game. It may be that their experience was more life-like, given that students in the CAVE group mentioned that it was “realistic” and that “it felt like we were there,” and they expressed amazement at “how realistic it was.” Their answers suggest that the 3D environment in the CAVE and the act of putting on active stereo glasses to view the VR contributed to the “feeling of being there.” Nonetheless, students in both groups enjoyed exploring the city (CAVE: 6 [30%]; PC: 10 [22%]). A larger proportion of students in the PC group mentioned their interactions with people (9 [20%]); only one CAVE student listed the people as her favorite aspect of the game. Only students in the PC group stated that they enjoyed applying their skills to following directions (6 [13%]) and achieving the goal of the game (4 [9%]). Subjects in both groups show evidence of being present and engaged with the target culture.
Students in the CAVE focused more on the experience of finding their way and the feeling of “being lost” than the PC group. They also commented more often on the cobblestone streets, most likely because the 3D environment allowed them to physically stand on these roads. Both of these observations suggest an increased level of interaction with the VR, which leads to a heightened sense of presence.

Although students in the computer lab refrained from using expressions like “realistic” or “it felt like you were there,” they nonetheless felt present in the VR. For example, one student from this group noted that the VR “was like a real city,” others compared the VR to cities such as Salzburg or Vienna, and yet another student believed that the buildings “look very real.” The students’ responses include various references to the “friendly and helpful people,” “the friendly environment,” and “the helpful police.” As was the case with the CAVE students, a number of the PC students believed that the experience of finding one’s way and following directions resembled interactions they might have in real life.

The conclusion can be drawn for both groups that the notion of ‘authenticity’ is evident in the students’ comments on the German language and indications that the VR characters were equated with real persons: “they spoke German” and “the fact that you walk into conversations already existing.”

DISCUSSION

The results of the current study indicate that the setting (CAVE vs. PC) has little effect on students’ experience, both in terms of linguistic gains as well as the cultural experience of the learners. A major difference between the two environments may be due to the novelty of the 3D CAVE technology. In fact, it may be that students who had a chance to experience the world on their own, while still being able to consult with other students, may actually have a fuller learning experience. This is substantiated by the fact that all students who participated in the PC version of the virtual world both spent more time in the world and pointed out more similarities overall as well as more similar cultural practices between a Canadian city and the VR city. The aspects of the VR world that students remembered are listed by group in Table 3.

<table>
<thead>
<tr>
<th>Aspects remembered</th>
<th>PC</th>
<th>CAVE</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buildings and other structures</td>
<td>28 (56%)</td>
<td>18 (81%)</td>
<td>46 (64%)</td>
</tr>
<tr>
<td>Marketplace</td>
<td>29 (58%)</td>
<td>11 (50%)</td>
<td>40 (55%)</td>
</tr>
<tr>
<td>Modes of transportation</td>
<td>23 (46%)</td>
<td>7 (32%)</td>
<td>30 (42%)</td>
</tr>
<tr>
<td>People</td>
<td>32 (64%)</td>
<td>12 (54%)</td>
<td>44 (61%)</td>
</tr>
<tr>
<td>Software/game playing</td>
<td>23 (46%)</td>
<td>8 (36%)</td>
<td>31 (43%)</td>
</tr>
<tr>
<td>Streets</td>
<td>9 (18%)</td>
<td>5 (23%)</td>
<td>14 (19%)</td>
</tr>
</tbody>
</table>

a This includes any remark about specific stores, such as McDonald’s.

As can be seen in Table 3, irrespective of the medium, students mentioned the same cultural products. The answers show that people in the VR such as the hip-hop-dancer and the police officers often intrigued game players. During their VR experience, students evidently
paid much attention to the architecture of the VR city since 56% of the PC subjects and 81% of CAVE subjects commented on buildings and, in particular, the fountains. The category ‘marketplace’ shows a similar response rate, 58% (PC) and 50% (CAVE), respectively; both are evidence for the long-lasting impression these cultural products made on students in both groups.

The students who experienced the world in the CAVE environment paid more attention to the cobblestone roads. These students had a view of the cobblestones from their seats in the theater. Likewise, the circumstances in the PC group give a feasible explanation why there is a noticeable difference in students’ responses in the category ‘modes of transportation.’ Students in the CAVE experienced the VR as a group; one player chose a path based on the group’s decision, while subjects playing on their own at the PC made use of the opportunity to simply wander around. In order to encounter buses and streetcars more closely, students had to leave the intended way and explore the VR on their own (an experience on which many students in the lab commented positively) while students in the CAVE did not make such remarks as often. Although certain medium-specific observations can be differentiated, the differences in responses are minor, and students in both groups generally commented on the same cultural products.

We will now analyze students’ responses to the question which aspects of the VR experience were similar to an experience in a Canadian environment. Most students in both groups believed that the people they encountered in the VR shared similar characteristics with people in a Canadian environment: they observed that the characters in the VR were “friendly common people” or “helpful police officers” who looked and behaved as Canadians would in similar circumstances. In addition, a relatively high number of students believed that certain experiences such as “finding one’s way,” “getting lost,” and “trying to figure out where to go” resembled experiences one might have in Canada. While 20% of students playing on the PC and 9% of students experiencing the VR in the CAVE listed buildings as a similarity, their answers suggest that this resemblance is often limited to a mere acknowledgement: that buildings exist in Germany. This observation is further substantiated by students’ responses in the category ‘marketplace.’ Subjects from both groups suggested that shops and markets were part of both a Canadian and German-speaking environment: there were “places to shop.”

Irrespective of the medium, students generally identified similar aspects between the German-speaking VR and a Canadian environment within the same categories. However, as the results of the independent samples t test indicate, a higher number of students in the PC group than those in the CAVE group classified aspects of the VR as similar to a Canadian experience. On the other hand, a greater proportion of students in the CAVE group wrote about the experience of “finding one’s way” and of “walking around a city”—an experience they classified as similar regardless of the culture. In other words, students in the CAVE focused more on the experience of finding one’s way and the emotions they experienced during this activity, namely the feeling of being “lost.” Their responses centered around the cultural practice of asking for (“you can ask police for directions”), giving (“if you are lost, people are generally helpful in giving directions”), and following directions (“looking for a place to eat that someone told you directions to”), while cultural products may have made a greater impression on students experiencing the VR sitting at their computer.

Students were then asked to comment on any differences between their experience in the VR and a Canadian environment. Interestingly, the results show that students placed the differences into the same categories in which they found similarities. However, this congruence should not be understood as meaning that students viewed exactly the same characteristics as similar and different at the same time. Rather, students’ responses demonstrate
that most subjects identified certain aspects as similar in general but then classified certain characteristics of that particular aspect as distinct. For example, students from both groups believed buildings to be similar. A closer look at the data indicates that students further differentiated; although both worlds have buildings, the ones in the VR were much "older," "the city architecture much different" from that in a Canadian city where one finds "more modern buildings" not made out of "stone." Likewise, although students felt that the police officers in the VR resembled Canadian law enforcement officers, they noted that they would most likely not meet as many and not as many patrolling police officers in Canadian cities.

According to subjects in both groups, the main difference is the existence of cobblestone streets in the VR world; one would not usually find such streets in Canada. Twenty-six percent of the students in the language lab and 36% of students playing in the CAVE recognized cobblestone streets as a distinct feature, a cultural product: "streets are not paved," "brick squares," "cobblestones." One student actually noted die Ziegelstein (the student's attempt to say 'bricks' in German).

Besides these differences in cultural products, students’ answers in both groups focus on the experience of listening and responding to German (by following, or attempting to follow, directions). For example, students listed "different language," "it wouldn’t be in German," "[characters] speak completely in German," and "the German signs" as aspects that differed; they identified language as a behavioral practice, belonging specifically to a non-Canadian environment.

To summarize, the results of this study indicate that VR is particularly quite effective in drawing students’ attention to cultural products. This result stands in contrast to those of Herron et al. (2002), who found that students recalled more information about cultural practices after watching a series of journalistic videos in French, noting that this may have been due to the features of the journalistic videos. We posit that subjects in the current study, although encountering both cultural products and practices, recalled more products due to the nature of the task at hand. Their mission was to collect clues and to find the mayor’s daughter—an assignment that forced them to concentrate on the tangible products in the virtual world. In addition, the vastness of students’ surroundings in the game may have caused them to focus more on the surroundings themselves and not what was happening within them. This finding, of course, merits further study. The students were not only able to remember such products but also to identify similarities and differences in more detail. Additionally, students focused on cultural practices to a more limited extent. The medium in which students experienced the VR did not have a profound impact on the students’ perception of cultural products and practices.

We would now like to return to the arguments for making use of video games in the classroom generally and their L2 pedagogical counterparts provided in Table 1 above. Simpson (2005) posits that video games can be useful in the classroom because participants have a goal at the outset of the game. We stated that this correlates well with task-based language teaching (e.g., Willis, 1996). Doughty and Long (2003) provide 10 methodological principles (MPs) of task-based language teaching. Of these 10 principles, a number are realized through the use of VR technology. These are summarized along with supporting questionnaire and observational data from our study in Table 4.
Table 4
Realization of MPs of Task-based Language Teaching through VR

<table>
<thead>
<tr>
<th>Methodological principle</th>
<th>Realization through VR</th>
</tr>
</thead>
<tbody>
<tr>
<td>MP1: Use tasks, not texts, as the unit of analysis</td>
<td>92% of students stated a goal to the game</td>
</tr>
<tr>
<td></td>
<td>45% stated a language-related goal</td>
</tr>
<tr>
<td>MP2: Promote learning by doing</td>
<td>All students took part in the experience, most mentioned ‘presence’</td>
</tr>
<tr>
<td>MP3: Elaborate input (do not simplify; do not rely solely on ‘authentic texts’)</td>
<td>Modified discourse provided by police officers and other characters</td>
</tr>
<tr>
<td>MP4: Provide rich, not impoverished, input</td>
<td>Variety of clues available to students (e.g., spoken commands, cell phone messages, written clues)</td>
</tr>
<tr>
<td>MP7: Provide negative feedback</td>
<td>Police let students know when they were on wrong path</td>
</tr>
<tr>
<td>MP9: Promote cooperative/collaborative learning</td>
<td>Most students worked with others</td>
</tr>
</tbody>
</table>

Doughty and Long (2003) point to the importance of “meeting the real-world needs of learners” and state that this “offers a motivating alternative to the dismal prospect of grammar-based, drill-and-practice” (p. 55) language instruction. We argue that our virtual environment allows students to feel as though they are using their language as a means to an end. When students were asked to name the goal of the task they performed, all but 6 were able to name a goal, and nearly half the students (34 students) mentioned a goal that was external to language: finding the mayor’s daughter. Of those who mentioned a language-related goal (33 students), a number had insightful comments regarding the goal of the experience:

- to learn how to understand directions and commands and follow them;
- to help us understand German in a funner, easier way;
- to test knowledge of German commands and learn about German cities; and
- to learn comprehension in a real-world situation.

Of the students who listed an aspect related to German grammar, 11 (33%) used the verb ‘understand’ in their responses, and a further 17 (52%) spoke of ‘learning.’

When discussing the importance of ‘doing’ in order to learn, Doughty and Long (2003) state the importance of real-world activities for integrating knowledge into long-term memory. As we argue in the discussion of ‘presence,’ students felt as though they participated in real-world events in the VR. While Whyte (2002, p. 43) notes that “[v]irtual reality cannot be naively conceived of as reality, as there are many ways in which virtual reality masks or distorts underlying realities,” we posit that proper follow-up tasks that remind the students to abstract away from the VR experience enables them to experience a number of aspects that would otherwise be inaccessible for many of them (Dennen & Branch, 1996). The students in both groups were, as Schwienhorst (2002) suggests, autonomous learners whose “language and linguistic awareness [was supported] through interaction, collaboration, and critical reflection” (p. 196). Based on the results that indicate that the PC students spent more time in the world while also interacting with fellow classmates, it may be that these students learned more because they were able to experience the task according to their own needs and goals.
In the virtual world, we were able to provide both modified and rich input, thereby making it more comprehensible (Doughty & Long, 2003, p. 59) to students. The police officers, who were included to provide help for students, informed them when they were on the wrong path and provided alternative versions of directions to students. In addition, the various clues—spoken commands, television and radio announcements, newspaper headlines, written clues, and cell phone messages—provided “quality, quantity, variety, genuineness, and relevance” (Doughty & Long, 2003, p. 62) to the language input the students received. Finally, we have evidence of collaborative learning from students in both media groups. As the observational data indicate, many students interacted with and received feedback from other students while they participated in the experience.

Irrespective of the medium, students positively evaluated their experiences and believed that VR may be a positive add-on to their traditional classroom learning. They spoke of the realistic aspects of the game. In spite of some variations in their responses, students experienced a similar, comparable ‘presence.’

CONCLUSION
Students were able to take part in everyday life in a German-speaking environment. They were engaged in a dynamic process of learning—not just about culture but actually experiencing the target culture. The VR, regardless of whether encountered in the lab or in the CAVE, “engage[d] the learner cognitively, behaviorally, and affectively” (Paige et al. as cited in Herron et al. 2002, p. 36). Students in the CAVE as well as in the lab felt that they participated in German culture and experienced an Austrian city by being present in this German-speaking VR environment.

As supporters of VR technology, Dennen and Branch (1996) provide us with the following words of advice: “[a]s a variable, immersion should be determined by need” (p. 104). Our study tested whether the more elaborate and indeed more expensive CAVE technology is necessary for students to exhibit greater linguistic and cultural learning, and we determined that complete immersion via CAVE technology does not provide a significantly better experience for students. Therefore, our recommendations stand in line with those of Chun (2007), who argues for the “judicious” use of technology. She posits further that “[t]echnology should not be used simply because it exists” (Chun, 2007, p. 248). VR technology holds great promise, but for the time being the investment should come in the creation of new, more realistic worlds that support classroom pedagogical goals, and not in the flashier CAVE technology.

In future studies, we hope to examine through a pre-/delayed posttest methodology whether students exhibit gains in cultural understanding as a result of experiencing the VR. Additionally, we hope to determine whether the “wow” effect experienced by students in the CAVE is simply due to the novelty or whether the effect remains over time. Finally, we hope to create additional worlds that focus specifically on the cultural practices of German-speaking people.

NOTES
1 Serious games are designed for purposes other than entertainment.
2 Personal experience has shown us that provincial and local school board representatives would likely consider the possibility of purchasing such equipment, especially considering new regulations that prohibit school-sponsored trips abroad.
Simulations, like role play, encourage students to carry out a specific role. Unlike role play, however, “participants do not necessarily consider their activity a simulation but rather a real experience” (Crookall & Oxford as cited in Kovalik & Kovalik, 2002, p. 346). Schwienhorst (2002) points out that such situational language learning is problematic for two reasons:

1. the distance to the target language culture and its speakers seem to present an insurmountable obstacle, and
2. situated learning emphasizes at its core the importance of sociocultural context for language learning. (pp. 199-200)

Virtual reality, on the other hand, actually places participants within the target context.

Readers who would like to experience the virtual world may download it at http://www.ucalgary.ca/Salzburg.

We are aware that the group versus individual game play serves to further differentiate between the environments. This difference, however, is inherent in the design of the two environments and cannot be controlled for due to a number of additional constraints including, but not limited to, time and space allocations.

This vocabulary, which included the names of shops as well as terms used when giving directions, was new for most students.

An anonymous reviewer pointed out that it “would be important to know what the relative figures for both [cultural products and practices] were” because this would enable us to quantify students’ responses as a proportion of the overall products or practices in the world. This approach is not only next to impossible given the overwhelming number of both present in the world, but this also stands counter to the data analysis employed.

An anonymous reviewer noted that the lack of significant differences between the groups may be attributable to time on task. Given the small scale of the current study, we cannot discount this possibility.

In addition, the lens of the camera used in the CAVE tends to give more prominence to the foreground. Thus, the cobblestones are more prominent in this experience.

Even though we classify the custom of asking for, giving, and following directions as a cultural practice, we do not argue that it is a culturally specific one. However, this example certainly demonstrates that the VR can be used to highlight and teach cultural practices. Another example of this fact is that students observed that the police’s responsibility in both environments, besides controlling crime, includes providing assistance to people; students from both groups commented repeatedly on their “interaction with police.”

REFERENCES


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**APPENDIX A**

Pretreatment questionnaire

**CULTURE IN THE LANGUAGE CLASSROOM: A VIRTUAL WORLD MARKETPLACE**

This questionnaire concerns your language experiences over the course of your lifetime. Feel free to elaborate where you think it would be helpful to the study. All responses are confidential.

*Thank you for your participation.*

**name:** ____________________________  **gender:** M ____ F ____

**age:** ____________________________  **current German class** ______________

**expected mark in your current German class:** ______________

1. Are you a native speaker of English?   Yes   No

   If not, what is your native language? ____________________________

2. Why have you enrolled in German classes?

3. How would you rate your motivation for learning German on the following scale?

   
   
   
   not motivated    extremely motivated
   
   1 2 3 4 5 6 7

4. On a scale of 1 (not very important) to 7 (very important), rate the importance to you (in your own German speech) of:

   
   
   
   knowledge of German history 1 2 3 4 5 6 7
   
   native-like pronunciation in German 1 2 3 4 5 6 7
   
   knowledge of German geography 1 2 3 4 5 6 7
   
   grammatical accuracy in German 1 2 3 4 5 6 7
   
   knowledge of German vocabulary 1 2 3 4 5 6 7
   
   knowledge of social aspects of German language use 1 2 3 4 5 6 7
   
   general fluency in German 1 2 3 4 5 6 7
   
   knowledge of daily life of German speakers 1 2 3 4 5 6 7
   
   being treated as an equal by native German speakers 1 2 3 4 5 6 7
   
   general cultural knowledge of German-speaking countries 1 2 3 4 5 6 7
   
   being mistaken for a native speaker of German 1 2 3 4 5 6 7
5. How often do you play video games?
___At least once a day ___ hours per week
___At lease once a week ___ hours per week
___At least once a month ___ hours per month
___More than once in the last year
___Once in the last year
___Never

6. What are your favorite video games? Please list them below.
   1. ____________________________ (Your most favorite game.)
   2. ____________________________
   3. ____________________________
   4. ____________________________
   Why do you enjoy these games?

7. In evaluating a video game what do you consider important? (Circle)

<table>
<thead>
<tr>
<th></th>
<th>not very important</th>
<th>very important</th>
</tr>
</thead>
<tbody>
<tr>
<td>Game play</td>
<td>1  2   3   4   5</td>
<td>6  7   NA</td>
</tr>
<tr>
<td>Graphics</td>
<td>1  2   3   4   5</td>
<td>6  7   NA</td>
</tr>
<tr>
<td>Audio (Sound and voice tracks)</td>
<td>1  2   3   4   5</td>
<td>6  7   NA</td>
</tr>
<tr>
<td>Story line</td>
<td>1  2   3   4   5</td>
<td>6  7   NA</td>
</tr>
<tr>
<td>Character animation</td>
<td>1  2   3   4   5</td>
<td>6  7   NA</td>
</tr>
</tbody>
</table>

8. What are your favorite educational video games?

   1. ____________________________ rank, 1 is your most favorite game of all time
   2. ____________________________
   3. ____________________________
   4. ____________________________

9. In evaluating an educational game (video only) what do you consider important? (Circle)

<table>
<thead>
<tr>
<th></th>
<th>not very important</th>
<th>very important</th>
</tr>
</thead>
<tbody>
<tr>
<td>Game play</td>
<td>1  2   3   4   5</td>
<td>6  7   NA</td>
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<td>6  7   NA</td>
</tr>
<tr>
<td>Character animation</td>
<td>1  2   3   4   5</td>
<td>6  7   NA</td>
</tr>
</tbody>
</table>

10. Have you ever experienced a 3D stereo environment? (check all that apply)
___3D Movie
___3D Video
___3D Computer Display
___3D CAVE

11. Do you think that video games can be used in classes in school?

<table>
<thead>
<tr>
<th></th>
<th>strongly disagree</th>
<th>strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1  2   3   4   5</td>
<td>6  7</td>
</tr>
</tbody>
</table>

Why or why not?
APPENDIX B
Posttreatment questionnaire

CULTURE IN THE LANGUAGE CLASSROOM: A VIRTUAL WORLD MARKETPLACE

name: ________________________________ computer #: _________________________

Please complete the following after you have completed the virtual world tasks.

1. What do you think was the goal of the activity you just performed?

2. Please write down any aspects of the world that you can remember.

3. How is the world similar to an experience you might have in a Canadian city? Please list as many items as you can.

4. How does it differ from a Canadian city? Please list as many items as you can.

5. Which kinds of clues did you follow most (e.g., spoken commands, signs, radio broadcasts)?

6. What was your favorite part of the activity?

7. What did you like least about it?

8. What features would you add to the virtual environment?

9. On a scale of 1 (least helpful) to 7 (most helpful), rate the usefulness of the software you just used:

   not helpful | extremely helpful
   ------------|-----------------|
for learning grammar | 1 2 3 4 5 6 7 |
for developing listening skills | 1 2 3 4 5 6 7 |
for learning about culture | 1 2 3 4 5 6 7 |
for learning vocabulary | 1 2 3 4 5 6 7 |
for gaining speaking fluency | 1 2 3 4 5 6 7 |
for improving pronunciation | 1 2 3 4 5 6 7 |
for improving reading skills | 1 2 3 4 5 6 7 |
for improving your ability to write in German | 1 2 3 4 5 6 7 |

10. Do you think that this activity improved your knowledge of German?  yes  no
Why or why not?

11. Do you think that activities like this should be used in your German classroom? (Circle one.)
never 1 2 3 4 5 6 7 always
Why or why not?
Please evaluate the virtual environment by answering the following questions.

1. How attractive do you consider the imagery as a whole?
   unattractive 1 2 3 4 attractive 5

2. How did the environment represent the actual audio levels?
   not accurate 1 2 3 4 accurate 5

3. Please rate the following relating to the aesthetics of the images.
   exciting 1 2 3 4 dull 5

4. How would you rate the ornateness of the images?
   ornate 1 2 3 4 plain 5

5. How would you rate the coloring?
   colorful 1 2 3 4 subdued 5

6. How would you rate the lighting?
   bright 1 2 3 4 dim 5

7. How would you rate the sound level?
   soft 1 2 3 4 loud 5

Please make any additional comments in the space below.

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