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Design and Evaluation of Massive Multiplayer Online Role  
Playing Games that Facilitate Second Language Acquisition

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## ABSTRACT

### Design and Evaluation of Massive Multiplayer Online Role Playing Games that Facilitate Second Language Acquisition

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Serious games that are designed for educational purposes promote acquisition of knowledge and skills that are valued in both the virtual realm and the real world. The challenge is to design serious games that leverage meaningful play to produce positive learning outcomes in the real world. I argue that serious games designed for educational purposes should follow an iterative design paradigm that integrates learning objectives with specific game tasks. Furthermore, assessment of players' knowledge before and after gameplay assists serious game designers with design modifications that support learning. I argue that video games can function as unorthodox language learning tools. Applying user-centered design techniques, I determine the feasibility of Massive Multiplayer Online Role Playing Games (MMORPGs) as pedagogical tools for Second Language Acquisition (SLA). I conduct experimental studies, allowing English as Second Language (ESL) students to playtest a commercial MMORPG. Significant results from experimental studies which include assessment of ESL students' knowledge before and after gameplay reveal the importance of in-game social interactions in the target language between native speakers and non native speakers. Furthermore, in-game social interactions offer a higher degree of engagement and motivation for learning than traditional SLA pedagogy. I conclude that in-game social interactions foster emergent collaborative behaviors between ESL students and Native English speakers, and scaffold ESL students' second language vocabulary acquisition.

and reading comprehension skills. These results inform the design of two game modules that support second language vocabulary acquisition, reading comprehension and conversational fluency. Finally, I introduce user-centered design as a framework for repurposing commercial games as serious games that produce positive learning outcomes.

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## 1 Introduction

Interactive digital media such as video games serve primarily as a source of entertainment, surpassing both the movie and music industries as the number one form of entertainment in America [30]. Popular recreational video games successfully entice players to invest numerous hours playing video games as they work diligently to improve their playing abilities and progress from one game level to the next [1, 76]. Video games are often criticized for being mindless entertainment void of educational content, yet researchers argue that video games model effective learning practices that teach us about the learning process in ways that the traditional classroom environment does not [39, 40, 71]. Begg et al. [11] differentiate between game-based learning (learning that occurs while playing a video game) and game-informed learning (learning that is motivated by game design practices such as constant feedback, increasing difficulty, and rewards), indicating that game-informed learning is the goal for educators. Gee [39] identifies principles that computer games use to engage players in active, critical thinking that informs their decisions in the virtual world. The components of gameplay such as immediate feedback, adaptability and clear goals are ideal for creating effective digital learning environments [11, 29, 39].

Learning is an active, personal experience that allows students to reflect on new knowledge (e.g. beliefs, ideas, misconceptions, etc.) and how this knowledge shapes their understanding of the world and sense of self [88]. If we replace "player" with "student," we have the model for the active, constructive learner [16, 39, 67]. Additionally, successful recreational video games engage players in mastering game objectives (e.g. racing the clock to solve a

puzzle) and create a high level of enjoyment or “flow” [27, 28]. Players as well as designers attribute “flow” to the following components:

1. Freedom to explore an immersive, virtual environment;
  2. Clear goals and objectives that determine game progression;
  3. Resources for completion of game tasks;
  4. Visual feedback (e.g. level of difficulty) that informs players’ decisions and outcomes;
  5. Adaptability of difficulty to players’ skill set;
  6. Natural progression of increased difficulty that leads to increased engagement
- [28, 39, 74].

Of course, there are additional elements that contribute to “flow,” but the six components mentioned above complement the cognitive processes associated with the learning process. Therefore, video games promote learning in the virtual world as players accomplish game tasks.

I argue that participation in complex cognitive processes embedded in video game activities can lead to learning gains in the real world. Pillay et al. [68] discuss video games as pedagogical tools that engage players in complex cognitive processes such as problem-solving tasks associated with scientific reasoning. Researchers have begun to investigate the plausibility of video games as effective pedagogical tools in both traditional and informal learning environments [29, 39, 71]. Video games have motivated computer science students to master introductory programming concepts, acquire digital literacy in terms of using computers and creating game modules, and develop social consciousness of environmental issues affecting our water sources [9, 10, 31, 85]. Because video games create gameplay experiences that closely emulate the learning process, game designers have created a new genre of video games known as

*serious game*, games that do more than just entertain [3, 4]. In contrast to recreational video games, serious games create opportunities for players to acquire and develop knowledge or skills that are valued in both the virtual and real worlds. Furthermore, they attempt to educate players about traditional classroom topics (e.g. physics, math, and business) as well as non-traditional topics such as healthcare and military training [3, 4, 50, 64]. As the serious games movement gathers momentum, game developers, educators, parents and even players are asking the million dollar question: However, few articles report positive learning outcomes associated with serious games that demonstrate transfer of virtual skills to real world applications [9, 73, 75, 86]. What is the educational value of this video game? What are players learning? How do we know? How can we better design video games that produce positive learning outcomes in the real world? The answer to this question forms the basis of my research.

Serious games designers strive to achieve the same level of engagement associated with recreational video games with the caveat that players acquire knowledge throughout the course of gameplay and apply this knowledge in the real world. Successful integration of traditional learning objectives with the elements of entertainment, play, and fun becomes the goal for the design of serious games. Because serious games are designed to demonstrate transfer of knowledge or skills developed in the virtual realm to the real world, careful evaluation of learning in video games needs to be a crucial component of the design process. Borrowing heavily from the discipline of human computer interaction, I define and apply a methodology for evaluation of video games that integrates assessment into the design process of serious games [1, 70]. Observational studies of participants playing video games make salient the cognitive processes involved in acquiring and applying new information and skills in the virtual world that

align with domain specific learning objectives. Furthermore, I argue that serious game designers must evaluate participants' knowledge or skills using both formal and informal assessments as a result of gameplay experiences. Choosing the domain of Second Language Acquisition (SLA), I identify learning objectives based on traditional second language pedagogy that correlate to gameplay activities in a commercial video game. I conduct observational studies of English as Second Language (ESL) students who play a popular commercial Massive Multiplayer Online Role Playing Game (MMORPG). Based upon an analysis of in-game social interactions, I develop game interfaces that facilitate SLA, specifically vocabulary acquisition, reading comprehension and conversational fluency. Subsequently, my research addresses the following questions:

- What characteristics of Massive Multiplayer Online Role Playing Games (MMORPGs) correlate to second language pedagogy?
- How do MMORPGs compare to traditional second language pedagogy for acquisition of second language vocabulary and reading comprehension skills?
- What in-game social interactions foster collaboration and scaffold Second Language Acquisition?
- What are the design implications of serious games that facilitate second language acquisition?



- How can we design serious games that integrate learning objectives with gameplay activities to ensure positive learning outcomes?
- What can in-game social interactions teach us about constructing virtual worlds that support globally distributed and culturally diverse users?

The answers to these questions are addressed throughout the remainder of this dissertation. Chapter two discusses previous work in the area of digital media, including video games, used for language learning purposes, traditional second language (L2) pedagogy, and the characteristics of MMORPGs relevant to Second Language Acquisition [60, 61, 79]. Chapter three presents the results from the first phase of playtesting which indicate that MMORPGs do provide sufficient motivation and opportunities for L2 students to increase in proficiency in the target language [73, 74]. In chapter four, I conduct the second phase of playtesting that includes both evaluation of the gameplay experience and assessment of Second Language Acquisition (SLA). Based upon a discussion of the quantitative and qualitative results presented in chapter four, I formalize the design of a game module that promotes communicative performance---knowing what to say and when to say it---of English as Second Language (ESL) students [75]. In chapter five, I introduce a model of in-game social interactions that support emergent cooperative relationships in virtual worlds. The model informs the implementation process of an Alpha version of the game module (mod). The purpose of the game mod is to facilitate ESL students' conversational fluency as they interact with English speaking Player Characters (PCs) during gameplay. Chapter six presents another

phase of playtesting, participatory design with an ESL instructor and ESL students who evaluate the design and functionality of the game mod. Finally in chapter seven, I introduce the concept of user-centered game design and discuss the broader implications of user-centered game design for the construction of virtual environments, emphasizing the importance of the design of user interfaces that provide built-in support for globally distributed and culturally diverse users.

## **2 Literature Review**

I propose that MMORPGs are under-utilized virtual environments that can facilitate learning in the domain of Second Language Acquisition (SLA). To support this theory, I present ideas that define the learning objectives, potential learning opportunities, the target audience, and method of assessment for designing and evaluating serious games for SLA. First, I discuss traditional computer-assisted language learning tools, and then present the characteristics of MMORPGs, and how they relate to language learning and, more specifically, to English as a Second Language (SLA).

### **2.1 Target Audience**

Standard American English remains the dominant language in the United States, and yet 14% of American students live in homes where English is not the primary language [90]. Educators face the challenge of creating inclusive learning environments for students who possess different linguistic capabilities, emphasizing the need for second language pedagogical supports in both mainstream classrooms and informal learning environments [90]. Second language pedagogy emphasizes listening, reading, writing and speaking skills for students proficient in the target language. Furthermore, second language teaching methodology values immersion in the target culture as a strategy for encouraging dialogue with native speakers of the target language [5, 17, 18, 43, 59].

### **2.2 Learning Objectives for SLA**

The first learning objective is for English as Second Language students to increase their English vocabulary. The second learning objective is for ESL students to increase their reading

comprehension skills in the target language. Second language students strive to develop communicative competence and communicative performance in a foreign language [8, 43, 59]. Communicative competence denotes foreign language students' knowledge of the target language [8, 43, 59]. Bachman & Savignon [17] extend communicative competence to include a language competency, inclusive of grammatical competence—the ability to generate and comprehend the formal structure of language— and textual competence—the ability to construct discourse. Communicative performance refers to the ability to use the appropriate response in a particular context [18]. Foreign language students develop communicative performance by actively negotiating meaning with other speakers who have some knowledge of the foreign language. The experiential pedagogical approach advocates students sharpening their second language skills as they create their own meaning, producing language to carry out a range of tasks in the target culture [5, 17, 18, 43, 59, 60]. Subsequently, second language students apply their knowledge to real-life situations in the form of conversational fluency which supports development of communicative performance in the target language.

## **2.3 Potential Learning Opportunities**

### **2.3.1 Computer-Assisted Language Learning**

Typically, foreign language students struggle with developing target language proficiency due to inhibitions about using the new language, especially in the traditional classroom setting; students become self-conscious, not wanting to make mistakes in front of their peers [42, 46, 58].

Therefore, language instructors seek ample opportunities to engage students in target language discourse as a means of helping students to build their confidence and develop competency in the target language. To assist students with developing foreign language proficiency, second language teaching methods have begun to embrace the use of technology, specifically Computer-

Assisted Language Learning (CALL) tools [19, 72]. CALL reinforces foreign language course objectives while addressing the individual needs of learners. The use of technology to supplement language proficiency covers a broad spectrum, including traditional foreign language learning software that features self-paced modules for listening, speaking, writing and reading modules [72]. Asynchronous networks of communication allow foreign language students to participate in online forums, providing written responses in the target language for the professor and others [12, 19]. Synchronous networks of communication via online chat rooms support real-time discussion between foreign language students and native speakers of the target language [25, 34, 52, 66, 89]. Online chat rooms for SLA accelerate students' reading, thinking and writing skills in the target language [13].

Research has shown that the use of computers (e.g. on-line chat rooms) to supplement language learning provides foreign language students with opportunities to practice their emergent language skills in a non-threatening, virtual environment [12, 13]. As a result, students produce more interactive online conversations that resemble normal face-face conversations in the target language [12, 13]. Additionally, online chat rooms as a supplement to foreign language instruction promote a democratic learning environment that is conducive to both introverted and extroverted learners, evolving into learner-centered environments in which students of different language levels accept more of the responsibility for developing target language proficiency. Foreign language students who interact online demonstrate an increase in their cognitive skills in the target language and perceived learning [12, 13].

Another application of computers as language learning tools is Multi-User Domains (MUDs) or Multi-user Object-Oriented (MOOs) domains [6, 34]. Backer [6] proposes a modular

approach to ESL/EFL, using schMOOze—a text-only Multi-user Object Oriented domain (MOO)—to support synchronous communication as an online chat tool. SchMOOze facilitates students' second language proficiency skills by requiring students to exclusively use text to interact with others in this virtual environment [6, 34]. For example, participants construct an identity using text to describe their character. Navigation throughout the mud is possible based on textual information giving location (e.g. "in the living room") and other MOO inhabitants' responses to your actions[16]. Extensive use of written communication serves as a mechanism for non-native English speaking students to hone their English grammatical and written communication skills. Because the interaction is text-based with no visual information and progression through MOOs requires students to learn a programming language to construct their own virtual space, students may experience difficulty attaining higher levels of functionality in the MOO (e.g. wizard) due to the need for extensive time commitments and possible lack of motivation [6, 16]. The lack of graphical representations to support textual information may result in frustrating attempts to develop second language proficiency. In comparison, interactive digital media such as video games extend the benefits of MOOs for SLA. Rather than relying solely on text as the means for providing critical information about the virtual environment, computer games leverage sophisticated graphics to generate images, sounds, gestures, and objects that take on different meanings relative to context of the game. Visual information becomes a critical part of communicative competence as players interpret meaning and respond accordingly. In addition, games furnish both intrinsic and extrinsic motivation for players in that players desire to advance levels by purposefully developing their selected character's skills and completing various tasks [39, 59, 82]. Such activities overcome the lack of motivation attributed

to text-based MOOs [6]. For these reasons, we turn our attention to video games and their role as language learning tools.

### **2.3.2 Video Games as Computer-Assisted Language Learning Tools**

If we examine how young people spend their time at home, we find that more than 84% of youth between the ages of 8 and 17 years old play video games for recreational purposes [76]. A tremendous number of young people hailing from all walks of life and with variable linguistic capabilities currently spend hours each day playing video games [30]. My research pushes the boundaries of how games can contribute to both formal and informal language learning environments. I approach this problem from the perspective of video games as an informal and under-utilized learning environment for language learning, specifically SLA. Video games include social interactions as part of the gameplay experience and become social spaces for people of different ethnicities, culture and languages to meet and communicate with one another [48, 86]. Rather than relying solely on text as the means for providing critical information about the virtual environment, computer games leverage sophisticated graphics to generate images, sounds, gestures, and objects that take on different meanings relative to context of the game. Visual information becomes a critical part of communicative competence as players interpret meaning and respond accordingly. Hubbard [46] understands that video games offer an appealing alternative to traditional CALL tools, primarily because video games possess an element of fun that causes players to repeatedly participate in game tasks. In contrast to self-paced tutorials that focus on reading, writing, listening and writing skills, video games require players to follow rules and process information to accomplish game tasks where language is just

a means to an end and not the end itself. Such activities overcome the lack of motivation attributed to text-based Multi-Object Oriented virtual environments [6, 34].

We can maximize the appeal of video games to provide motivation for development of SLA. I argue that we can design interactive interfaces that utilize audio, graphical images, displayed text and social interactions with both Player Characters (PCs) and Non Player Characters (NPCs) characteristic of video games and extend these characteristics to language learning.

## **2.4 Affordances of Gameplay: MMORPGs for Language Learning**

I argue that MMORPGs represent computer-based, highly participatory, context-specific, multi-media that requires players' personal investment in virtual character development; this creates an ideal language learning environment that encompasses investment and involvement while closing the distance between foreign language students and interaction with native speakers. Furthermore, we can design interactive interfaces that utilize audio, graphical images, displayed text and social interactions with both Player Characters (PCs) and Non Player Characters (NPCs) characteristic of MMORPGs and extend these characteristics to language learning. For these reasons, I posit that MMORPGs create the ideal learning environment for second language acquisition in addition to the social interaction among players that supports meta-thinking abilities for semantic, syntactic and contextual knowledge of a foreign language. Because MMORPGs attract players of various backgrounds, video game interfaces need to support both native and non native speakers of the target language. Game developers of *serious games* that support language learning face the challenge of designing video games that integrate



learning objectives into gameplay without sacrificing the entertainment value. I propose that playing MMORPGs affords the following benefits for SLA:

- Active learners
- Immersive learning environment as the context for Second Language Acquisition
- Online social interactions during gameplay

#### **2.4.1 Active Learners**

Second language students become active learners who continually make decisions about various game tasks during gameplay. The structure of MMORPGs supports character evolution as a means of game progression and so the first task of gameplay is the selection of a virtual character. See figure 1. Active language learners assume the role of the virtual characters they have created and consciously commit to the advancement of these characters in the virtual world. The avatar masks the true identity of foreign language students and creates less threatening social interactions with native speakers in the virtual world [13, 47, 75, 88]. In addition, avatars provide a mechanism for foreign language students to be visible in the virtual world. Visibility accommodates online social interactions [40, 56] Unlike some online communities which use a minimalist approaches (e.g. colored dots) to represent presence of members, customized, full-bodied avatars indicate one's presence in MMORPGs and help players create an identity based upon the avatar's capabilities [33]. Thus, the avatar provides a heightened level of engagement for foreign language students and forms the basis for social interactions between players of various cultural backgrounds in MMORPGs.

Additionally, video games supply authentic environments for learning, complete with sufficient opportunities for foreign language students to practice, develop and test their emergent communicative abilities. Foreign language students develop reading comprehension skills in the target language as they read Non Player Characters' (NPCs) dialogue displayed on the screen. Though NPCs share pertinent information regarding game activities, MMORPGs are designed to foster partnerships with other Player Characters (PCs). Players establish relationships via chat messages displayed on the screen. Text-based chat windows support reflective thinking as second language students compose messages read by PCs. This requires second language students to practice their conversational skills and understand cultural nuances (e.g. inventory of items) attributed to the game world, increasing communicative performance skills.

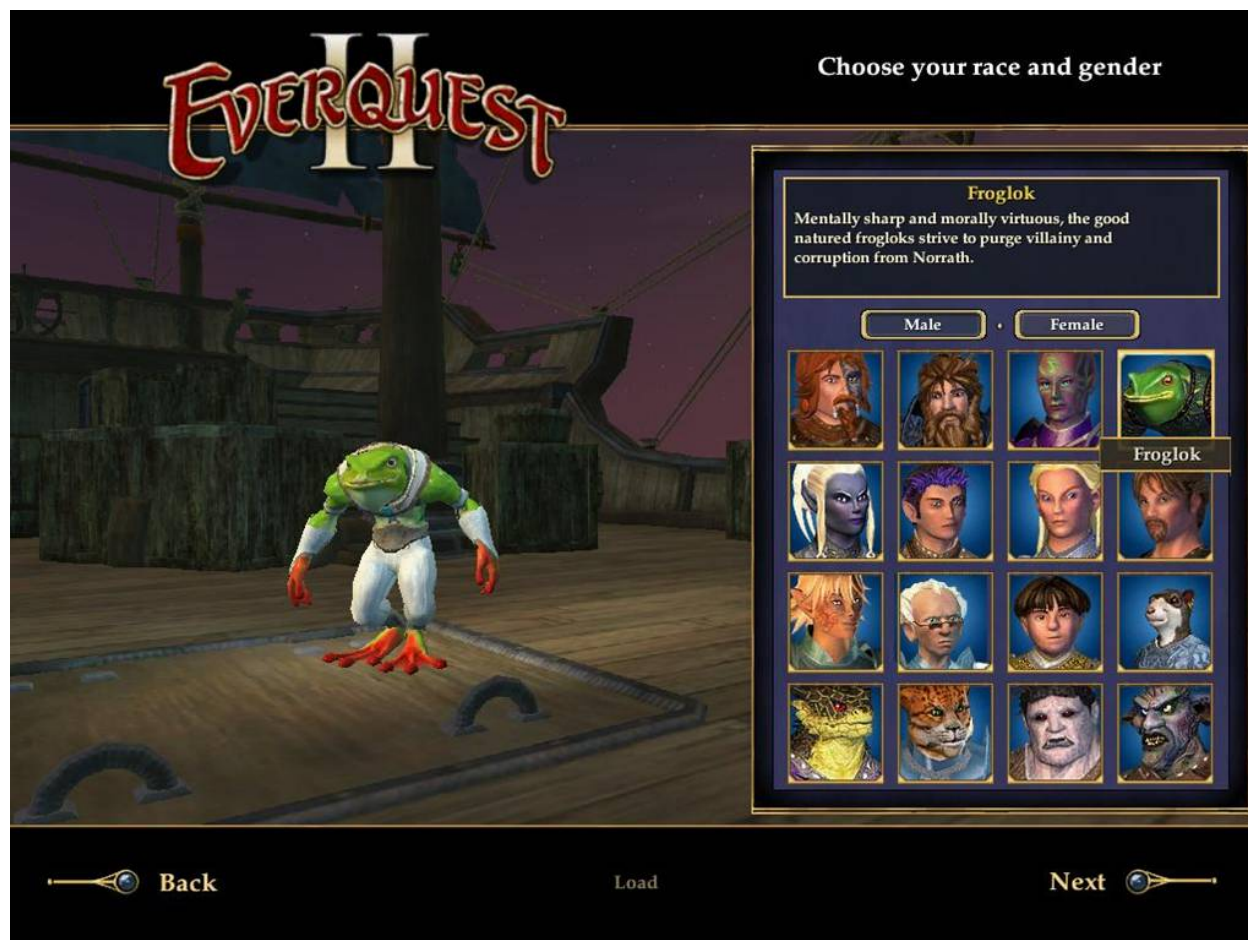


Figure 1 Overview of the Froglok character in the game of EverQuest® II.

### 2.4.2 Immersive Environments as the Context for Second Language Acquisition

Acknowledging that learning does not occur in a vacuum, context plays a crucial role in the learning process. Role-playing fantasy games motivate players, creating a virtual world as the context for foreign language students to concentrate on accurate and coherent use of the target language to communicate intent and to assist with completing game tasks. Video games emulate the experiential approach of second language acquisition by providing an immersive learning experience. Game-informed practices influence the design of interactive digital interfaces embedded in video games, leveraging context in the virtual world via animations, textual information, and sound to assist students with proficiency in the target language. Text is

displayed on the screen, giving visual cues to determine context of meaning of second language vocabulary. Three dimensional animations provide additional context for vocabulary words and cultural nuances present in the virtual world. MMOPRGs display dialogue between NPCs and PCs to assist foreign language students with syntactical structure of the target language. The combination of text and graphical images in the virtual world provides shared context of in which players of various linguistic capability can derive the appropriate meaning of potential vocabulary words [14]. The target language is spoken by virtual characters, providing foreign language students the opportunity to hear the accents and intonation specific to that language. Players select a response to NPC questions which feature potential second language vocabulary and information relevant to quests in the game (see Figure 2) [73 – 75]. Interactions between PCs facilitate communicative performance as foreign language students develop an understanding of what constitutes an appropriate response while engaging in conversations with native speakers via the chat window. The practice of producing language that is evaluated for meaning by other role-playing characters constitutes authentic dialogue between native and non-native language speakers. Video games create immersive virtual worlds for developing proficiency in a foreign language [42, 49, 73 – 75]. Thus, MMORPGs supply an immersive environment and opportunities to participate in social interactions with native speakers in the target language, creating an effective digital learning environment for SLA. As a result, language becomes a necessary component of successful gameplay.



Figure 2 Non Player Character's dialogue in French displayed on the screen.

### 2.4.3 Online Social Interactions

MMORPGs supply a social infrastructure that permits like-minded players to form groups as evident in multiple user dungeons (MUDs) and other role-playing games [6, 16, 34, 73 – 75]. Consequently, MMORPGs are designed to create and support social networks of gamers. Experienced gamers realize successful progression through the virtual world that depends on well-formed affiliations that lead to avatars that possess advanced skills needed to complete increasingly difficult game tasks. Powerful alliances play a key factor in gamers' abilities to defeat enemies and accomplish tasks that are virtually impossible to perform alone. MMORPGs sustain social interaction between players and serve as the catalyst for fostering students'

communicative performance (e.g. conversation skills) as students chat in a foreign language while playing the game (see figure 3). Quests provide common ground that fosters social interactions between players of diverse background [40, 62]. Social interaction serves as a prerequisite to students' language proficiency [18, 43]. Without social interaction, students lack motivation, opportunities for practicing target language skills, and immediate feedback; all three components are crucial if students desire to increase their communicative abilities in the target language [18, 43]. The social practices that exist in MMORPGs model cultural norms that are emphasized in gameplaying activities and define the community of players [73, 74, 61, 85]. In a similar manner, second language teaching methodology encourages foreign language students to participate in cultural practices associated with the target language [18, 43]. As a result, students develop proficiency and communicative performance in the target language as they communicate with native speakers. Online role-playing games are transformed into computer assisted language learning tools and serious games for successful second language acquisition for novice, intermediate and advance language students [73 – 75, 85 – 87].





Figure 3 Two Player Characters work together to complete a quest.

## 2.5 Method of Assessment

The goal is to develop a serious game that promotes SLA. To determine if the effects of gameplay have led to increase proficiency in the target language, I apply multiple methods of assessment. Measures of assessment include:

- a. Pre- and post-tests assessments of second language (L2) vocabulary where ESL students use L2 vocabulary in sentences to demonstrate meaning. The differences in the pre- and post-test assessment will identify learning gains related to the gameplay experience.

- b. Pre- and post-tests assessments of ESL students' reading comprehension skills using L2 vocabulary in the context of gameplay activities and outside the context of gameplay activities (assessment of transfer).
- c. A comparison of the number of chat messages generated by ESL students who use the game plug-in versus those ESL students who play EQ2 without use of the game plug-in.
- d. Qualitative analysis of the comparison of ESL students' and native English speakers' communication patterns of their social interactions with one another.
- e. Post-gameplay survey measuring the effects of the gameplay experience on ESL students
- f. Post-gameplay interview capturing the perspective of ESL students.

These measures help to determine if the MMORPG had the intended effect on increased proficiency in the target language and whether or not students achieved learning objectives.



### 3 Feasibility of MMORPGs as Language Learning Tools

The discussion of game ideas produces clearly defined game objectives and learning objectives. Playtesting for assessment purposes validates the potential learning opportunities present in the game prior to the development of a software prototype. Once designers conceive ideas for a serious game, designers should engage in the first phase of playtesting, evaluation of gameplay activities that support domain specific learning. To demonstrate the benefits of playtesting in the concept phase prior to development of a software prototype, I conducted an exploratory study of Sony Online Entertainment's Massive Multiplayer Online Role Playing Game (MMORGP) *EverQuest® II* (EQ2) to determine its feasibility as an unorthodox second language learning tool [73].

#### 3.1 Overview of *EverQuest® II*

Although I have the option of either designing and implementing an educational game that facilitates foreign language learning or using traditional language learning software, I suggest that computer games already exists that support second language acquisition. *EverQuest® II* is an example of such a game; Sony Online Entertainment (SOE) has graciously agreed to provide software licenses for *EverQuest® II* at no cost in support of our research efforts. *EverQuest® II* is a Massively Multiplayer Online Role Playing Game (MMORPG) designed by SOE. Prior to playing the game, players select a character from 16 races (e.g. dwarfs, barbarians, etc.) and 5 archetypes (e.g. mage, scout, artisan, priest, and fighter) with each race and archetype having specific abilities. Players assume the role of their character and the character is represented as an avatar on the computer screen. For example, if the player selects a cleric from the race of dwarfs who is a member of the priest class, then the player is represented

as an avatar short in height and empowered with divine magic that banishes diseases. Players are immersed in a fantasy world of beautiful 3D graphics while journeying across various terrains, including rolling hills, barren deserts, dense forests, and bustling cities. Players advance from one level to another as they successfully complete challenges/quests; *EverQuest® II* contains 60 levels. Players may form groups known as guilds that work together to complete quests or choose to play as individuals. *EverQuest® II* accommodates social interaction among players, allowing them to communicate with one another using text and audio while playing the game and participating in player forums which serve as a useful resource for sharing and discussing effective game strategies, forming relationships with other players, receiving assistance when faced with trouble, and learning how to play the game. *EverQuest® II* can be played in English, French, German, and Japanese and has an international player base.

### 3.2 Exploratory Playtesting

The study addressed the following questions:

- What are the learning objectives for second language acquisition?
- What learning opportunities are present in EQ2?
- Does EQ2 provide adequate language learning support for foreign language students of various backgrounds?
- As a result of gameplay, does EQ2 increase foreign language students' proficiency in the target language and if so, how?

- What improvements or additional tools are required to transform MMORPGs into Second Language Acquisition (SLA) tools?

### **3.2.1 Participants**

Due to the difficulty of recruiting foreign language students enrolled in German and French courses, I recruited participants from the population of English as Second Language (ESL) students. Six ESL students, two males and four females who range from high-level beginner to advanced as defined by the Basic English Skills Test (BEST) and the Test Of English as a Foreign Language (TOEFL) tests, participated in the first phase of playtesting.

### **3.2.2 Methodology**

Participants completed a pre-game questionnaire that identified their native language and evaluated their computer literacy skills, experience playing games, and their confidence level in their ESL communication skills. Students were required to spend a minimum of 4 hours per week for duration of 8 weeks and play the game in groups of two. I kept a diary of observations per session and periodically queried participants for feedback about their gameplay experiences [75]. The first week was comprised of tutorial sessions complete with documentation of game instructions, explanation of species, classes and professions of characters, and on-site assistance for exploring the EQ2. I compiled a list of gameplay instructions along with a separate list of new vocabulary words and gave copies to each participant. I reviewed the instructions for gameplay (e.g. explanation of inventory, examining objects, chatting, etc.) and asked each participant to demonstrate different game control actions. Each participant proceeded to accept their first quest, to develop his/her character's combat skills. ESL students were encouraged to

participate in combat as long as they wished and were eventually instructed to accept a second quest of their choosing. Game logs consisting of gameplay activity and chat interactions were collected for all players, including twenty hours of data per student. After eight weeks of gameplay, participants completed a post-game questionnaire which asked them about their confidence level in using English, if they thought that EQ2 improved their ESL skills, and if so, how? Perl scripts were used to analyze the game logs for word frequency count of potential L2 vocabulary words demonstrated in NPC dialogue. At the end of eight weeks, I gave each ESL student a vocabulary assessment that asked participants to define the meaning of L2 vocabulary words with frequency counts within the range of 1 to 50. Vocabulary words were randomly selected from each student's data files. I also calculated the number of chat messages generated by each participant per game session for the eight weeks to measure the level of comfort and the degree of social interactions with other playing characters.

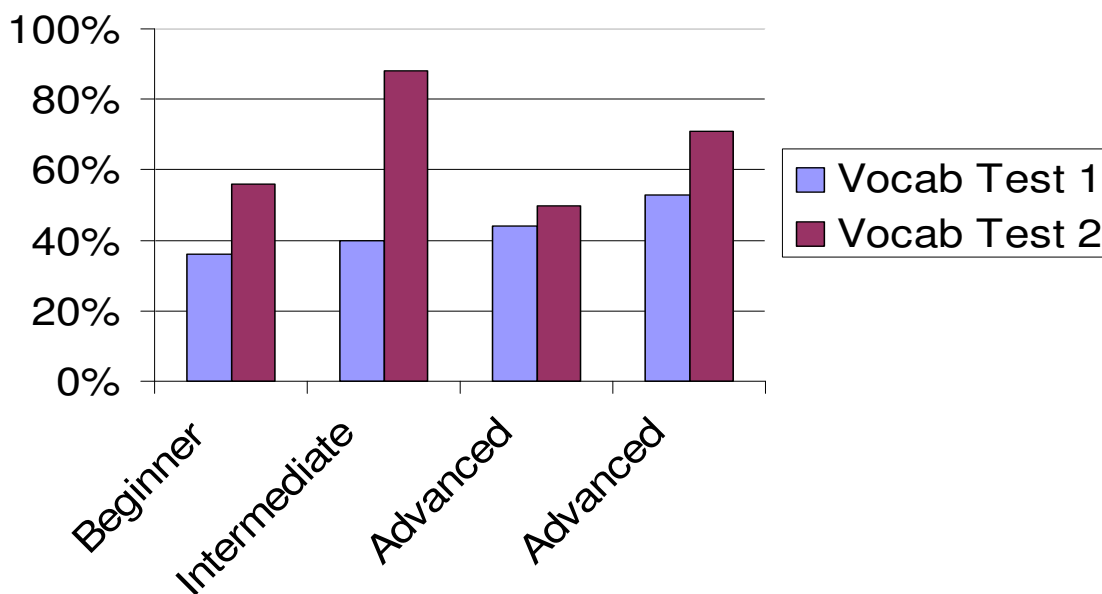
### **3.2.3 Results**

As a result of the first phase of playtesting, I developed an appreciation for the complexity of using games for second language acquisition. Because all four students indicated on the post-game questionnaire and during the wrap-up interview that EQ2 improved their English vocabulary skills, I decided to test each participant's acquisition of vocabulary words based on two factors:

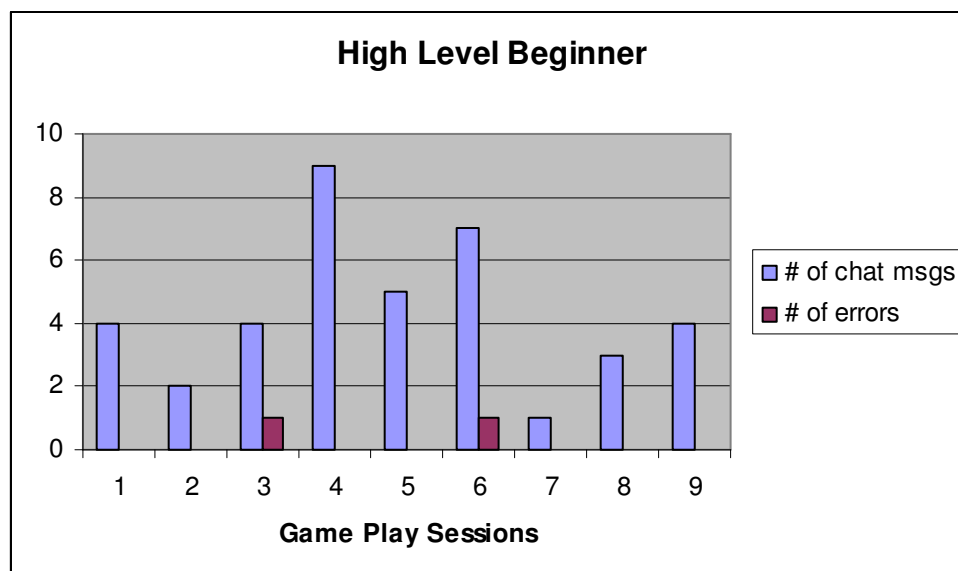
1. Vocabulary that was documented in each individual's game log activities and introduced during interactions with NPCs;

2. Word frequency counts for each vocabulary word used by NPCs. To measure learning outcomes, I compared students' understanding of vocabulary words that were used once in conversation with vocabulary words that were used more than five times in NPCs' dialogue.

All four participants accurately defined 35% or more of the vocabulary words that were introduced only once in conversations with NPCs. In comparison, participants achieved 55% or higher accuracy for words that were used more than five times during social interactions with NPCs. This suggests that the more NPCs model appropriate use of vocabulary words, the more ESL students develop the appropriate meaning in English (see figure 4).



**Figure 4** Chart of ESL students' scores for test 1 after 1 week of gameplay vs. test 2 after 8 weeks of gameplay.



**Figure 5** The number of chat messages and syntactical errors generated by the High Level Beginner ESL student.

### 3.3 Discussion

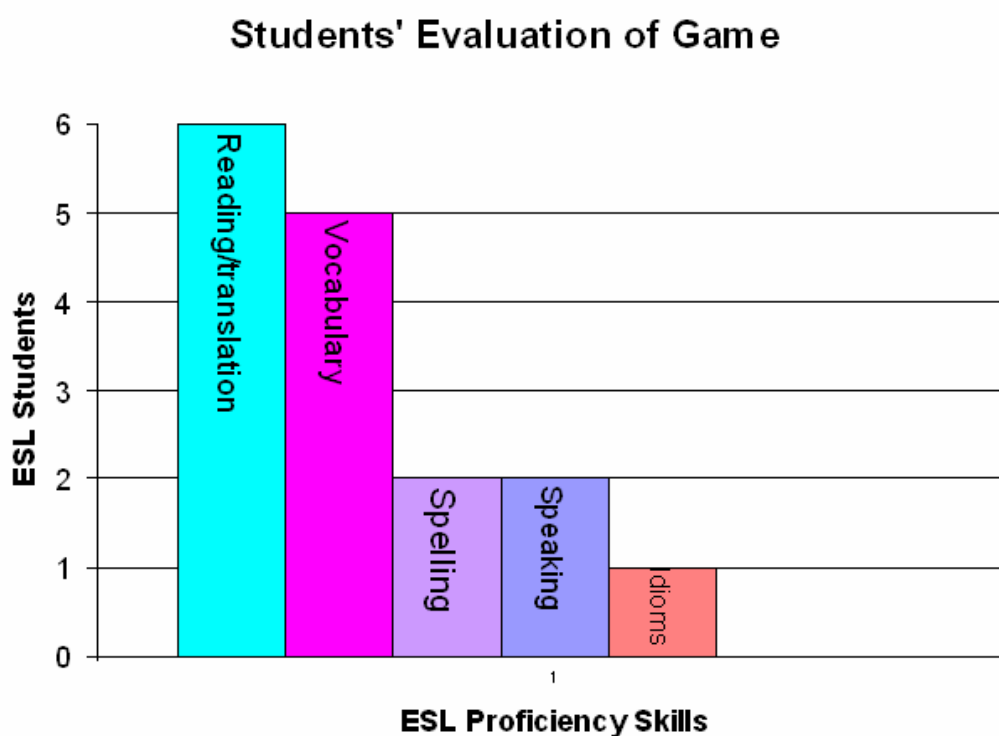
The ESL students in the study demonstrated diversity in computer literacy skills and ESL proficiency but all four had limited experience playing video games. Exposure to video games reduces the learning curve associated with manipulating game controls to navigate the virtual environment while lack of experience playing video games can often lead to frustrating gameplay experiences coupled with the task of comprehending visual, textual and aural information in the target language. One participant wrote, “This is hard,” in her chat window during the first week of the pilot study whereas an advanced ESL student gave feedback that once she became familiar with game controls she thought the game was fun.

The advanced ESL students expressed greater confidence in their English reading, writing and conversational skills during the post-game interview than their Intermediate and High Level Beginner counterparts. In fact, advanced ESL students generated 6 times more chat

messages than the high-level beginner and 2.5 times more chat messages than the intermediate student. One student in particular generated an average of 60% more messages than any other participant. The same student exhibited a positive perception of the game's ability to assist with ESL acquisition and recommended EQ2 as a pedagogical tool for ESL students. This suggests that the ESL student perceived the game in a positive manner despite her lack of experience playing computer games and took advantage of the faceless interactions to initiate questions with players outside of her group when she needed assistance. As suspected, the high-level beginner ESL student indicated low confidence level for English reading, generating an average of three chat messages per session (see figure 5).

The diverse backgrounds in the participants' ESL communicative abilities produce the dilemma of determining how well suited *EverQuest® II* is for ESL students of various levels. The ESL student who was on the border between high-level beginner and low-intermediate experienced difficulty with adapting to the virtual environment. This suggests that EQ2 fails to provide adequate supports (e.g. dictionary for translation) for even high-level beginner ESL students, leading to cognitive overload as the participant attempts to balance gameplay navigation, comprehension of information displayed on screen, and the use of a handheld dictionary for unfamiliar vocabulary. While the students were not discouraged from using dictionaries, only the high-level beginner referred to her dictionary during each gameplay session. The high-level beginner had difficulty understanding the information which hindered her enjoyment of the game. Results indicate that one student in particular generated 31% more messages than her advanced ESL peer, 73% more messages than the intermediate participant and 89% more messages than the high-level beginner ESL student. The same student exhibited a

positive perception of the game's ability to assist with ESL acquisition, specifically in the areas of vocabulary, reading comprehension and conversational skills (see figure 6). The discrepancy in ESL proficiency levels suggests that each participant brought different learning needs to the game world of EQ2, and that EQ2 does not sufficiently support all levels of ESL students. This suggests that if the ESL student is to benefit from the immersive environment represented in role- playing games, the participant should possess, at a minimum, intermediate level knowledge of the English language.



**Figure 6 Chart of ESL students' perception of EverQuest® II as a Second Language Acquisition tool.**

Students offered suggestions to improve the language learning environment. Prior to level seven, NPC interactions included few aural outputs. As two of the subjects progressed to more advanced game levels (e.g. level 10) and proceeded to leave the Isle of Refuge, students



expressed their appreciation for additional aural outputs for some of the NPCs that inhabit the virtual city known as Qeynos. Students suggested that audio be included for all NPCs as this would help them to learn the pronunciation of new words. Multi-modal inputs are vital to students' ability to develop oral proficiency in the target language (Hadley 2001). I suspect that ESL students would experience greater learning outcomes if such built-in language supports were readily available during the game. Currently, participants rely on the feedback of other PCs as a means for self-reflection. I propose that ESL students who are not co-located may participate in more online discussions and hopefully improve their conversational skills than those who are co-located. Thus, I am compelled to improve upon the design of video games as language learning tools and continue our efforts to collect data as ESL students communicate and live in the virtual world of Norrath.

### **3.4 Summary**

Results of the first phase of playtesting verify feasibility of MMORPGs as language learning tools. What are the learning objectives for second language acquisition? Based upon results of the preliminary studies, MMORPGs have the potential to support SLA, specifically acquisition of L2 vocabulary and reading comprehension skills demonstrated in NPCs' dialogue. What learning opportunities are present in EQ2 gameplay activities? The interactions between PCs and NPCs during gameplay represent potential learning opportunities for SLA. New vocabulary words are introduced in NPC dialogue as ESL students read and interpret the information presented on the screen as a precursor to completing various quests. Preliminary results indicate that ESL students are cognizant of new vocabulary words frequently used (high frequency count) in NPC dialogue and can derive contextual meanings based on NPC interactions. This suggests that MMORPGs do have the potential to function as pedagogical

tools for SLA. Does EQ2 provide adequate language learning support for foreign language students of various backgrounds? Due to the advanced vocabulary, wealth of information displayed on the screen, and reported difficulty of the high-level beginner ESL student, EQ2 may not provide sufficient support for beginner level ESL students. An in-game dictionary with textual definitions and audio to demonstrate pronunciation of L2 vocabulary would be one additional tool that can scaffold high-level beginner, intermediate and advanced ESL students' vocabulary acquisition in terms of semantic knowledge and correct pronunciation. As a result of gameplay, does EQ2 increase foreign students' proficiency in the target language, and if so, how? Preliminary results show promising signs of SLA, but the results are inconclusive since we have no data points for ESL students' knowledge of L2 vocabulary prior to gameplay. Thus, the question remains, to what extent do MMORPGs support SLA? The next chapter addresses this issue.

## **4 Positive Learning Outcomes Attributed to EverQuest® II**

### **4.1 Justification of Second Playtesting Phase**

The first round of playtesting verified the ideas generated in the concept phase of developing a serious game for SLA and ensured that the concepts adhered to the guidelines for serious games. Promising results indicated that gameplay experiences in EQ2 have the potential to lead to positive learning outcomes. However, results remain inconclusive since no control group was established to provide a baseline of learning gains attributed to playing EQ2. In addition, ESL participants did not complete pre-test assessment prior to gameplay. Therefore, I have no information concerning ESL students' knowledge of L2 vocabulary prior to gameplay and no way to ascertain learning gains attributed to EQ2. Before proceeding with the development of a prototype, a second round of playtesting becomes necessary since the goal is to demonstrate that MMORPGs increase proficiency in the target language as a result of gameplay. Furthermore, serious game designers need verification of which attributes of gameplay in virtual worlds contribute to SLA to determine the design guidelines for designing serious games that support SLA.

### **4.2 Assessment of Learning Outcomes for MMORPGs**

To determine feasibility of MMORPGs as language learning tools, I formulate the hypothesis that MMORPGs can facilitate SLA. To test my hypothesis, I conduct a between-subjects experimental design to answer the following questions: Do MMORPGs increase second language (L2) vocabulary acquisition and if so, how? Does EQ2 support other SLA skills? The

assumption is that EQ2 compared to traditional classroom instruction will provide adequate support for L2 vocabulary acquisition.

#### **4.2.1 Participants**

Eighteen Advanced English as Second Language (ESL) Chinese students were randomly assigned to three conditions: 1. Six ESL students who attended three hours of class instruction; 2. Six ESL students who played *EverQuest® II* (EQ2) for four hours; 3. Six ESL students who were grouped with Native English Speakers (NES) to play EQ2.

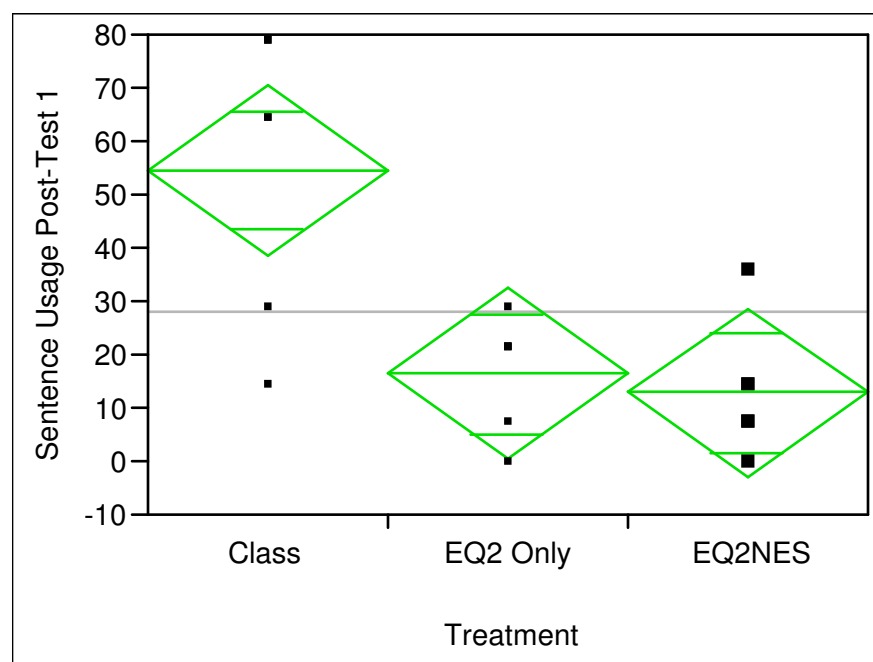
#### **4.2.2 Methods**

To accommodate the learning curve associated with understanding the game objective and maneuvering the game controls, ESL students spent an extra hour becoming familiar with EQ2. All eighteen Advanced ESL students were enrolled in an Intensive English Program at a southern liberal arts college. Prior to participation in each condition, participants took an assessment that measured their prior knowledge of L2 vocabulary words that were modeled in NPC speech during gameplay. The assessment required ESL participants to use the potential L2 vocabulary in a sentence demonstrating prior knowledge. We purposefully selected L2 vocabulary that was not specific to the game and represented college level academic words (e.g. coagulated, coalesce, fervent, revive). ESL students who attended class participated in drill and rote exercises (e.g. define the L2 vocabulary word and use it in a sentence) while the ESL students who played EQ2 were given the tasks of completing quests 1 - 8. Once both groups had completed the designated hours for the study, each participants took three assessments. The first post-test assessment asked students to use L2 vocabulary in sentences demonstrating

understanding of the word. Sentences were evaluated for appropriate use of L2 vocabulary and not grammatical correctness. The second post-test assessment used a recognition task based on gameplay scenarios where ESL participants selected the correct meaning from multiple choice options of L2 vocabulary words. The third assessment was a rational cloze assessment which measured ESL participants' semantic knowledge of L2 vocabulary words outside the context of gameplay in addition to their ability to select L2 vocabulary words based on contextual clues located in the clause, the sentence, and in the text.

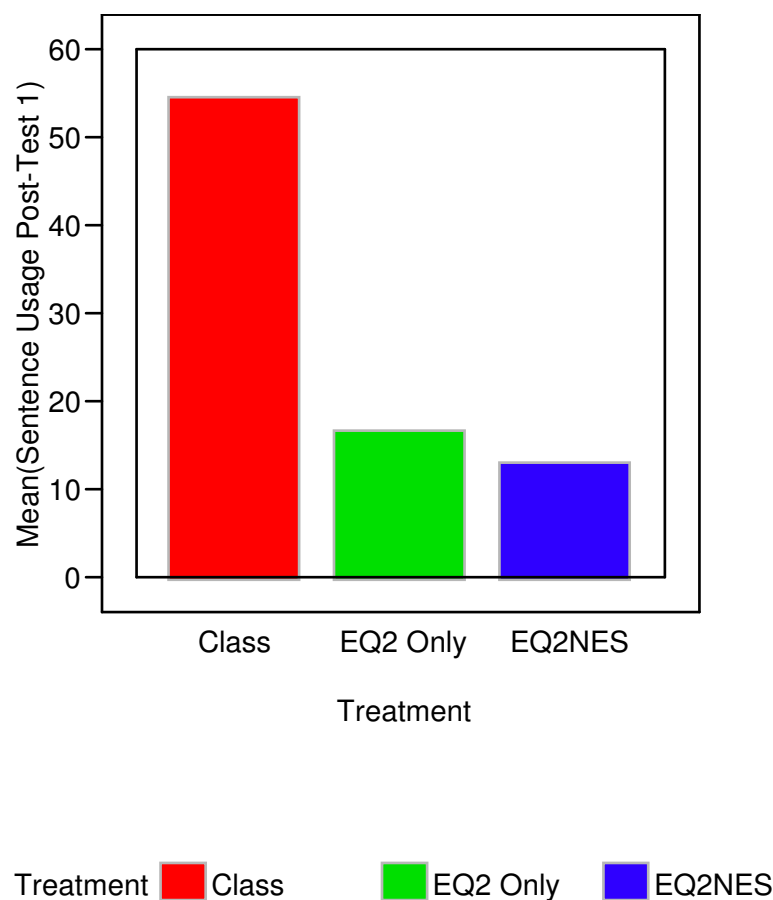
### 4.3 Data Analysis

The average pre-test score for all eighteen participants was 8.86, indicating knowledge of approximately two L2 vocabulary words prior to traditional instruction or playing EQ2. A one-way Analysis of Variance (ANOVA) of post-test scores for sentence usage revealed a significant difference in post-test scores for ( $F[2, 15] = 9.65$  for  $p < 0.05$ ) (see figure 7).

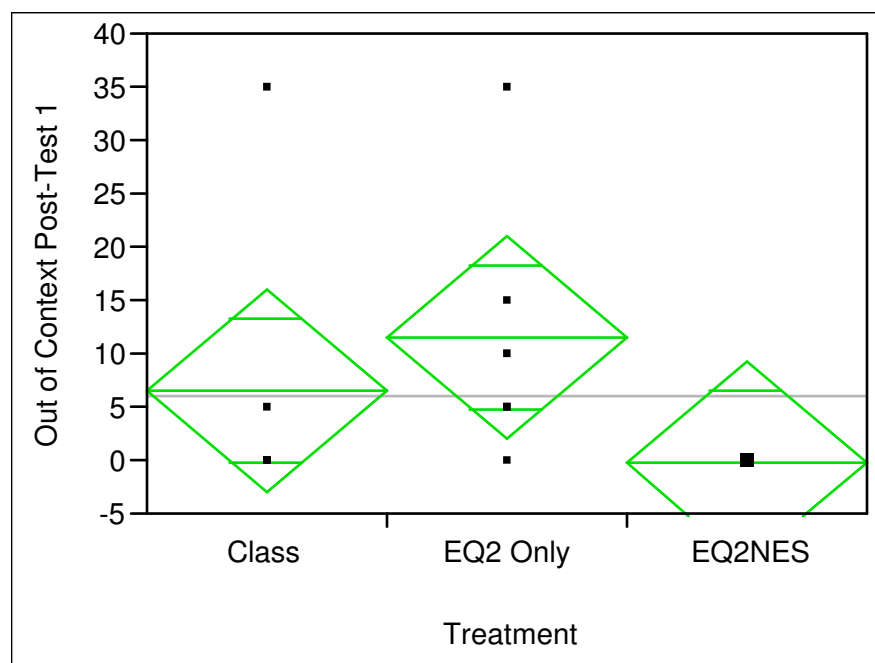


**Figure 7 One-way Analysis of Variance of ESL students' post-test scores of second vocabulary sentence usage.**

ESL students who participated in traditional classroom instruction had an average post-test score of 54.78 out of 100 compared to the average score 16.16 for ESL students who played EQ2 and an average score of 13.10 for the ESL students grouped with NES (see figure 8). No significant differences were found for the post-test for L2 vocabulary in the context of the game and transfer of knowledge of L2 vocabulary outside the context of the game (see figure 9).

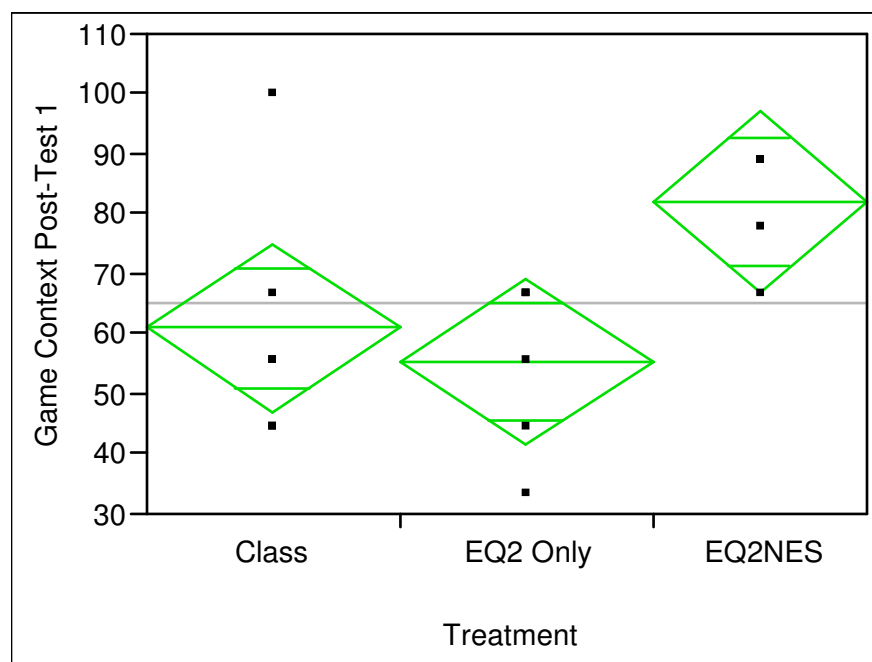


**Figure 8 Average post-test score for second language vocabulary sentence usage.**



**Figure 9 One-way Analysis of Variance of post-test scores of second language vocabulary used outside the context of gameplay.**

A one-way Analysis of Variance of post-test scores for L2 vocabulary in the context of game tasks revealed a significant difference in post-test scores for ( $F[2, 14] = 4.162$  for  $p < 0.05$ ). See figure 10.



**Figure 10 One-way Analysis of Variance of post-test scores of second language vocabulary test used in the context of gameplay.**

#### 4.4 Discussion of Post-Test Assessments

The drill and rote practices used for L2 pedagogy in the classroom instruction condition proved beneficial for post-test assessment, especially since requires ESL students to define and use the vocabulary words in sentences. Thus, the sentence usage post-test was a near task of learning for this group of participants. Though both groups of ESL students who played EQ2 did not improve significantly, the majority of participants did increase their number of L2 vocabulary from 2 words to approximately 3.5 words (see figure 10). Results suggest that gameplay experiences did not provide the same kind of support as traditional classroom instruction for L2 vocabulary acquisition. My claim is that MMORPGs can provide adequate support for SLA. The bottom line is that 82% of the ESL students who played EQ2 did show



minimal increases in L2 vocabulary. However, results do not support the expectation that MMORPGs would outperform traditional classroom instruction. Rather the question was if MMORPGs could provide adequate support for SLA? Results for the One-way ANOVA of post-test scores for L2 vocabulary in the context of game play indicate that the ESL students who were grouped with NES performed significantly better than both the traditional classroom instruction condition and the ESL students who played EQ2 alone condition. This suggests that the social interactions between native and non-native speakers played a pivotal role in L2 vocabulary acquisition. It is important to note that the performance of those ESL students who played EQ2 alone was similar to those ESL students who participated in traditional classroom instruction. Once again, the majority of ESL students who played EQ2 increased in L2 vocabulary as a result of gameplay. Therefore, these results suggest that MMORPGs show great promise as a second language pedagogical tool, provided game designers leverage the benefits of MMORPGs for SLA.

#### **4.5 Assessment of Gameplay Experiences in EQ2**

My hypothesis is that EQ2 functions as a pedagogical tool for SLA. Results discussed in section 5.4 support this theory. However, foreign language students are not necessarily gamers and so the questions are: What are ESL students' perceptions of *EverQuest® II* as an alternative second language learning tool? What aspects of gameplay do ESL students enjoy about *EverQuest® II*? Why? What aspects of gameplay frustrate ESL students? Why?

The impact of gameplay on non-native speakers offers insight as to what ESL students enjoy and dislike about EQ2. As a game designer, I need to know if MMORPGs provide a fun, challenging, and engaging experience compared to traditional classroom instruction. I collected data for non-native speakers played EQ2.

#### **4.5.1 Methodology**

Eighteen Advanced ESL students played EQ2 for two weeks for ten hours of gameplay. ESL students were grouped with native English speakers for five hours of gameplay. The remaining five hours were spent playing EQ2 solo. One ESL student chose to drop out of the study, leaving a total of seventeen ESL students who completed a post-game questionnaire.

#### **4.5.2 Data Analysis**

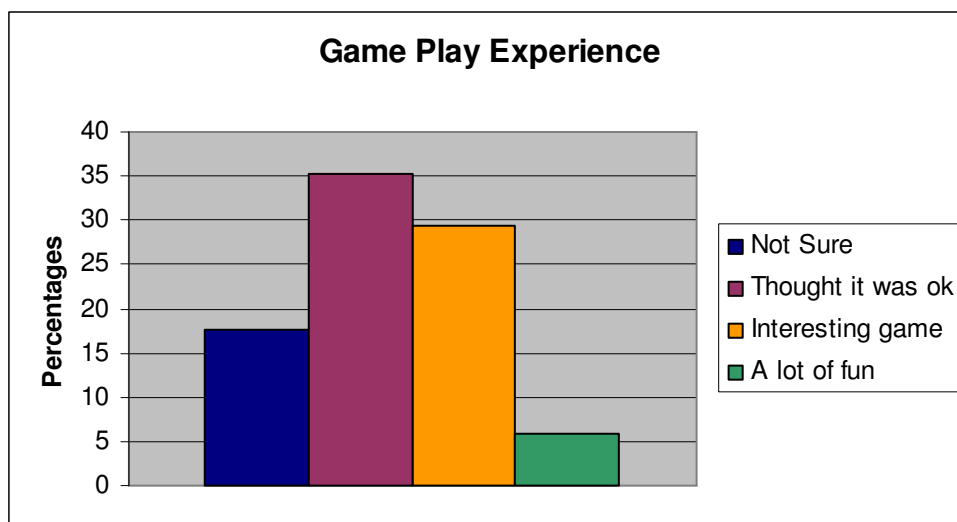
ESL students were asked to evaluate EQ2 according to the following criteria:

- Overall gameplay experience
- Most enjoyable aspect of gameplay
- Least enjoyable aspect of gameplay
- Social interactions with Native English Speakers
- Preference for playing alone vs. playing with others
- Suggestions for improving the gameplay experience

The assumption is that since 84% of young Americans between 8 and 18 years old play video games, then the ESL students in this study also grew up playing video games.

However, I found that some of the ESL students played video games and others did not play video games at all. When asked to describe the gameplay experiences in EQ2, 35.29% of ESL students typically do not play video games but thought that EQ2 was an acceptable video game. Twenty-nine percent perceived EQ2 to be interesting while another 17.65% were unsure if they

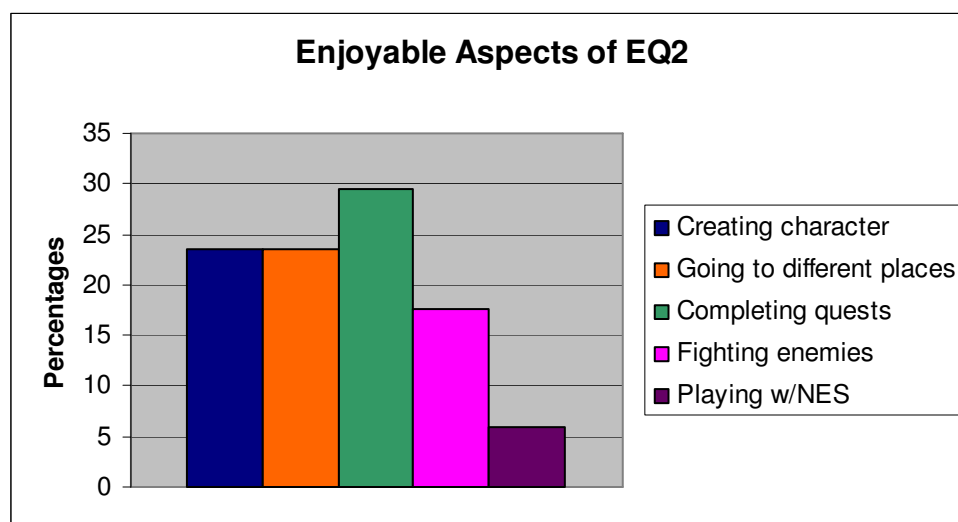
liked the game or not. Six percent of ESL students thought that EQ2 was fun and would gladly play it again. The remaining 11.76% of ESL students (2 students) preferred not to play EQ2. None of the students indicated that dislike of the EQ2. See figure 11. It appears the majority of ESL students interpreted their overall gameplay experiences to be positive.



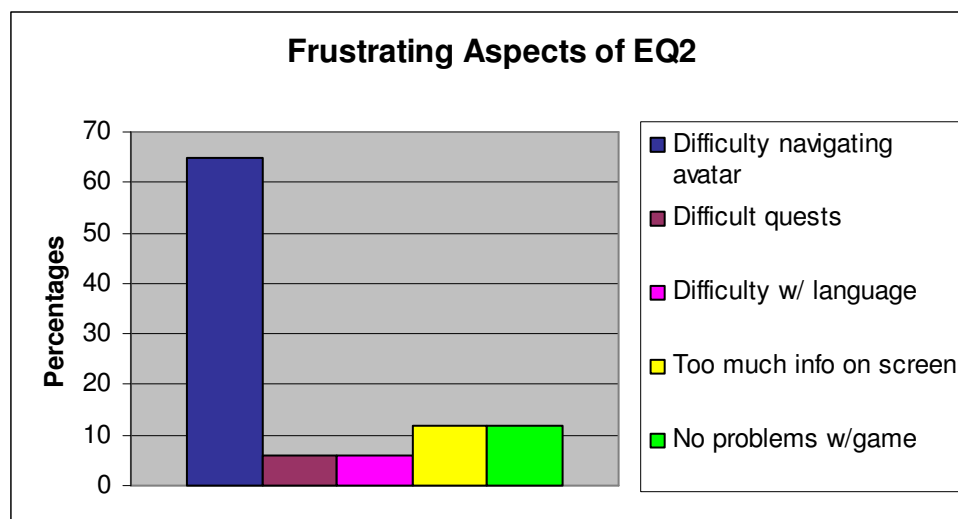
**Figure 11 ESL students' overall perception of gameplay experiences in EverQuest® II.**

To better understand which elements of gameplay were fun versus boring, ESL participants shared what they thought were the positive as well as negative aspects of EQ2. Twenty-nine percent enjoyed completing the various quests and succeeded in completing the first eight quests during gameplay. Freedom to explore the virtual world of Norrath and creating unique avatars that represented their virtual identities were equally enjoyable. However, only 6% of ESL students considered interactions with NES to be fun. See figure 12. This suggests that ESL students may have experienced frustration in their interactions with NES PCs. I pursue this line of thought in the proceeding paragraphs. The ESL students shared what they did not like about EQ2. Ten of the seventeen students had difficulty navigating their avatar.

Observational playtesting revealed that while participants could manipulate the game controls (arrow keys), the machine's response to keyboard actions was slow. Poor performance of the machine had a negative impact on the more than 60% of the ESL students' ability to enjoy the game. Four of the students (11.74%) thought the game interface was congested with too much information, making it difficult to identify which windows or icons provided useful information that enhanced gameplay. Two students experienced difficulty with understanding the language while only one ESL student indicated that the quests were not fun. Two ESL (6%) students had no problems with the game. See figure 13.



**Figure 12** ESL students' indicate the enjoyable aspects of playing EverQuest® II.



**Figure 13** ESL students share feedback about negative aspects of EverQuest® II.

I revisit the issue of the quality of interactions between ESL students and native English speaking PCs as it relates to the gameplay experience. How did the ESL students perceive the Native English speaking partners? Questionnaire results indicate that 94% of ESL students thought that the NES group members were very helpful or at times offered assistance. Despite the fact the ESL students did not rate highly social interactions with NES as being a source of pleasure during gameplay, the ESL students perceived the interactions to be positive rather than negative. Furthermore, 64.7% preferred to play EQ2 in groups compared to the 23.5% who would rather play EQ2 alone. See figures 14 and 15. The social interactions between the ESL students and NES PCs heightened the degree of engagement in the virtual world and simultaneously facilitated both L2 vocabulary and reading comprehension. Finally, 53% of ESL students reported some comfort and 11.8% indicated being very comfortable in chatting in the target language with PCs during gameplay. See figure 16. This supports the theory that language anxiety is lessened in virtual environments which mask one's true identity and makes allowances for less accuracy [12, 13, 57].

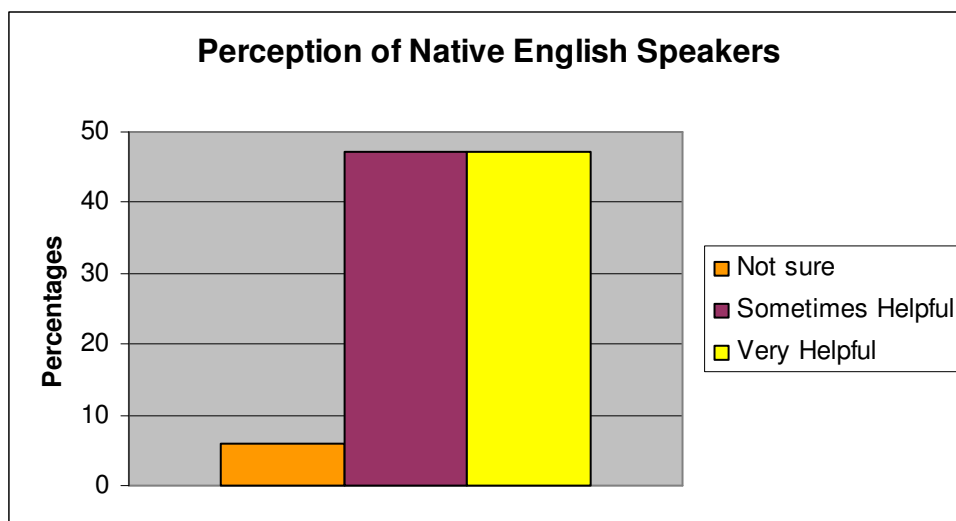


Figure 14 Chart of ESL students' perception of native English speaking Player Characters.

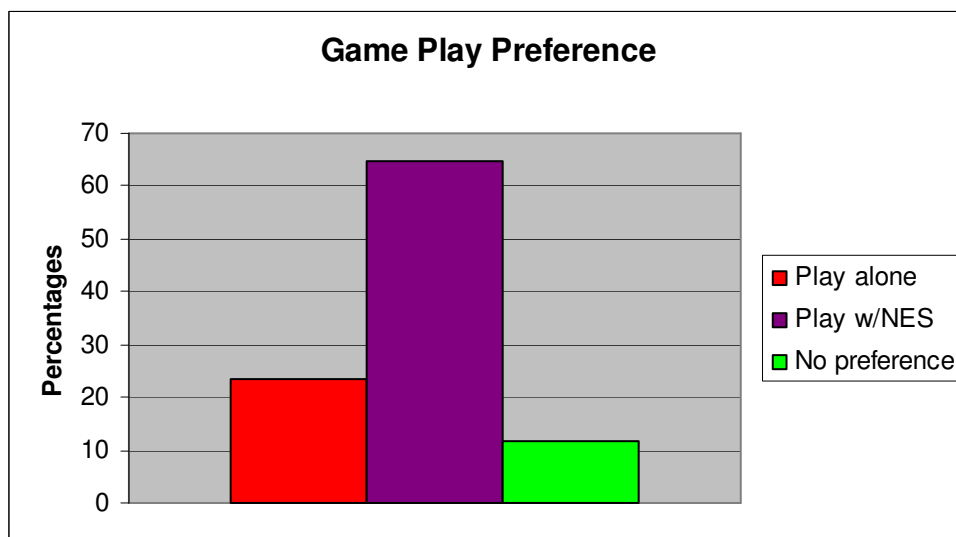


Figure 15 Chart of ESL students' social preferences for playing EverQuest® II.

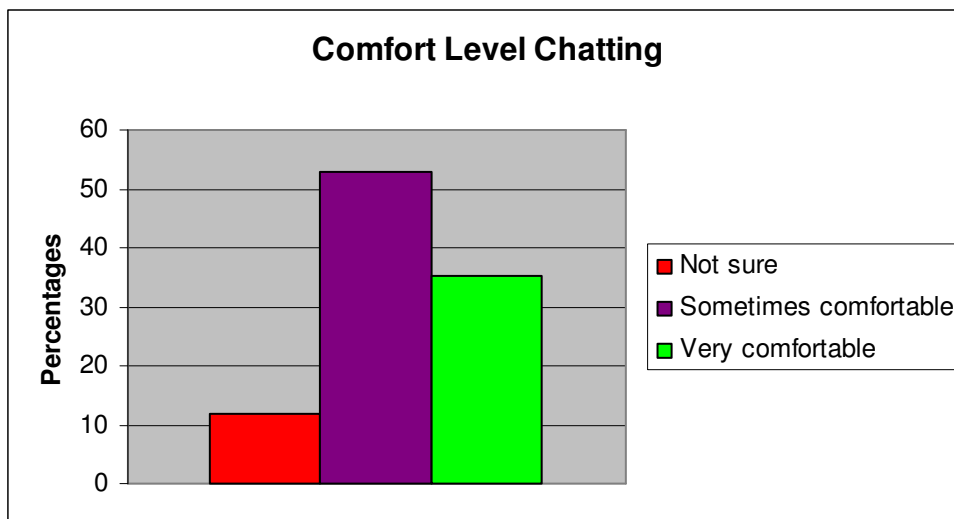


Figure 16 Chart of ESL students report comfort level chatting with English speaking Player Characters.

#### 4.6 Evaluation of Social Interactions in MMORPGs

To better understand the social interactions between PCs that support SLA, I conducted a second between subjects experimental design to test the following hypothesis: Social interactions between native and Non-native speakers in MMORPGs support L2 vocabulary acquisition.

##### 4.6.1 Participants

Twelve Advanced English as Second Language (ESL) Chinese students were randomly divided into two groups of six each. Seven Native English Speakers (NES) of African American descent and enrolled in a southern university consented to participate in the study. The one additional NES participant replaced another NES participant for the second gameplay session. Thus, there were a total of 6 NES participants per game session.

#### **4.6.2 Methodology**

Each of the twelve ESL students were randomly assigned to one of the following conditions: 1. ESL students who played EQ2 alone; 2. ESL students who formed teams of 4 people (2 NES and 2 ESL participants) as they worked together to complete quests. Both groups selected a virtual character who was a citizen of Qeynos (good character) and were told to complete quests 1 - 8. The one additional NES was to accommodate one game session when 1 NES participant could not attend and so another NES participant played the game in this participant's absence. At the beginning of the study, the ESL students completed a pre tests which measured prior knowledge of potential L2 vocabulary words. Both groups (ESL EQ2 solo players and EQ2 ESL w/NES) engaged in four hours of gameplay, exposing both groups to potential L2 vocabulary found in NPC dialogue. Upon completion of the study, three post-tests were given. The first post-test assessment asked students to use L2 vocabulary in sentences demonstrating an understanding of the word. Sentences were evaluated for appropriate use of L2 vocabulary and not grammatical correctness. The second post-test assessment used a recognition task based on gameplay scenarios where ESL participants selected the correct meaning from multiple choice options of L2 vocabulary words. The third assessment was a rational cloze assessment which measured ESL participants' semantic knowledge of L2 vocabulary words outside the context of gameplay in addition to their ability to select L2 vocabulary words based on contextual clues located in the clause, the sentence, and in the text. Results are discussed below.



### 4.6.3 Data Analysis

ESL students who collaborated with NES participants performed significantly higher than the ESL students who played EQ2 with no social interactions with NES for  $t[10] = 2.28$  for  $p < 0.05$  on the post-test assessment for L2 vocabulary in the context of gameplay. See chart 11. Despite the fact that the ESL students paired with the NES participants produced scores of zero for the post-test assessment for L2 vocabulary outside the context of the game, there was no significant difference to the low scores for the ESL students who played EQ2 alone. These results indicate that the social interactions between ESL students and NES participants involved discussion of quests, including critical information that featured L2 vocabulary words. These discussions made salient L2 vocabulary words and facilitated ESL students' increase in L2 vocabulary acquisition. Thus, results reinforce L2 pedagogy that emphasizes interactions with native speakers as the means in which second language students develop communicative competence (e.g. grammatical structure of language) and performance in the target language.

## 4.7 Qualitative Analysis of Game Logs

The framework of user-centered game design studies students as they interact in the game world. Serious game designers first need to understand how in-game interactions scaffold learning and then how to leverage in-game social interactions that facilitate learning in the design of a serious game. Moreover, what role do social interactions in virtual worlds play in language learning? Do in-game social interactions differ based upon linguistic capability? I choose playtesting that involves qualitative analysis of in-game social interactions to address these questions.

### 4.7.1 Methods

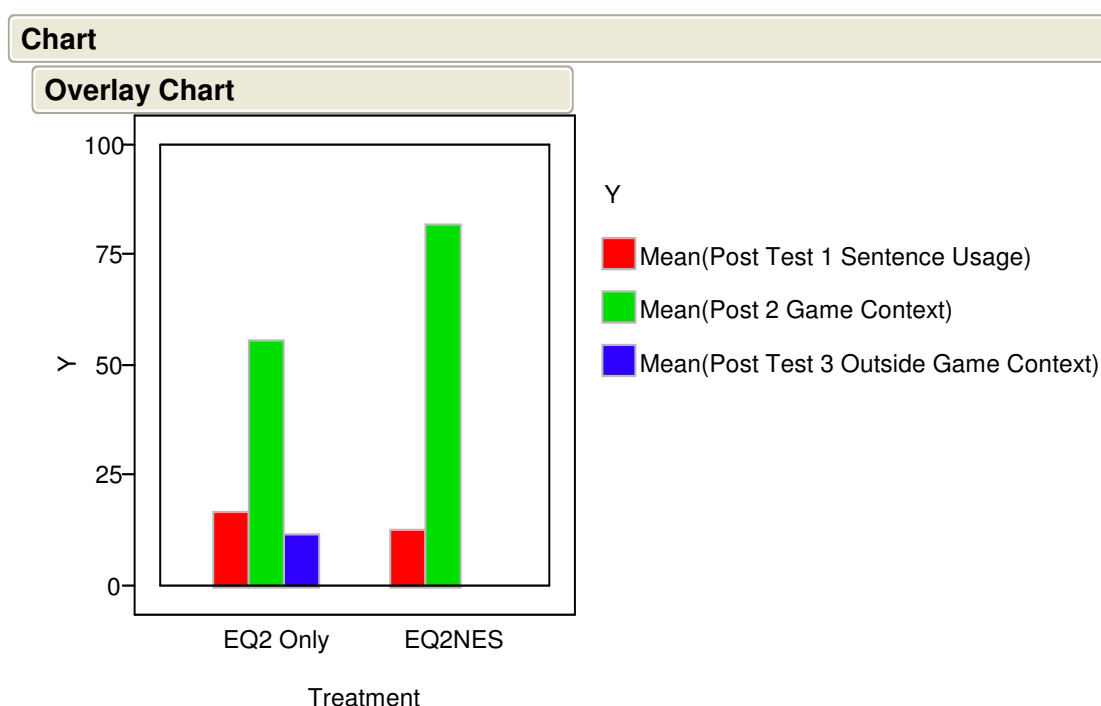
I developed a modified version of the Dialogue Acts in Several Markup Layers applicable to social interactions between Native English Speakers and Non-Native English speakers in a virtual environment [26]. See Appendix B. After achieving a Cohen's Kappa of 80% inter-rater reliability, I coded 525 chat messages for the following four categories of speech acts:

1. Request for game or personal information;
2. Assertive statements demonstrating knowledge of the game, self or the world;
3. Conversational openings & closings;
4. Player's influence on PCs' future actions in the virtual world.

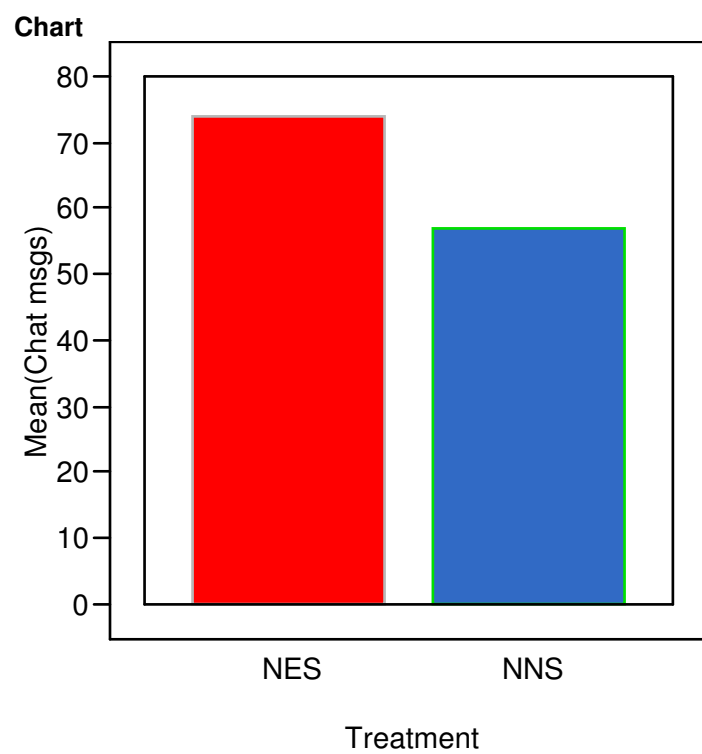
### 4.7.2 Discussion of Results

Qualitative analysis of chat logs revealed an interesting pattern of social dynamics between the NES players and ESL students. Though NES participants produced more chat messages for each of the categories, no significant differences were found between the two groups. ESL students generated an average of 57.14 chat messages compared to the NES participants who generated an average of 74.25 chat messages. See figures 17 and 18. I assumed that there would be a significant difference in the quantity of messages coded as assertive statements since the ESL students were being introduced to EQ2 and in some cases this was their first experience playing video games. Results indicate that the lack of experience playing video games or the novelty of EQ2 had small if any impact on their ability to communicate with NES participants. However, this suggests that the ESL students' Advanced Level of Proficiency in English may have contributed to their ability to match the communicative performance of their NES

teammates. Once again, both groups of participants demonstrated collaborative behaviors including discussion of strategies to complete quests (e.g. “I’ll make them follow me and u beat them.”). I posit that the data indicates that the mixed groups were able to communicate effectively to achieve some level of collaboration in order to complete game tasks. The question remains if we would see the same effect if Intermediate ESL students were conversing with NES players or would the communication patterns differ according to L2 ability? Furthermore, I did not examine the chat entries per linguistic capability for dominant personalities which portrayed roles of leadership. Dominance would be classified as speech patterns that demonstrate administration of tasks such as who should do what and when. Do NES players demonstrate more dominant behaviors as they attempt to collaborate with their ESL partners? These are questions to be explored in future research.

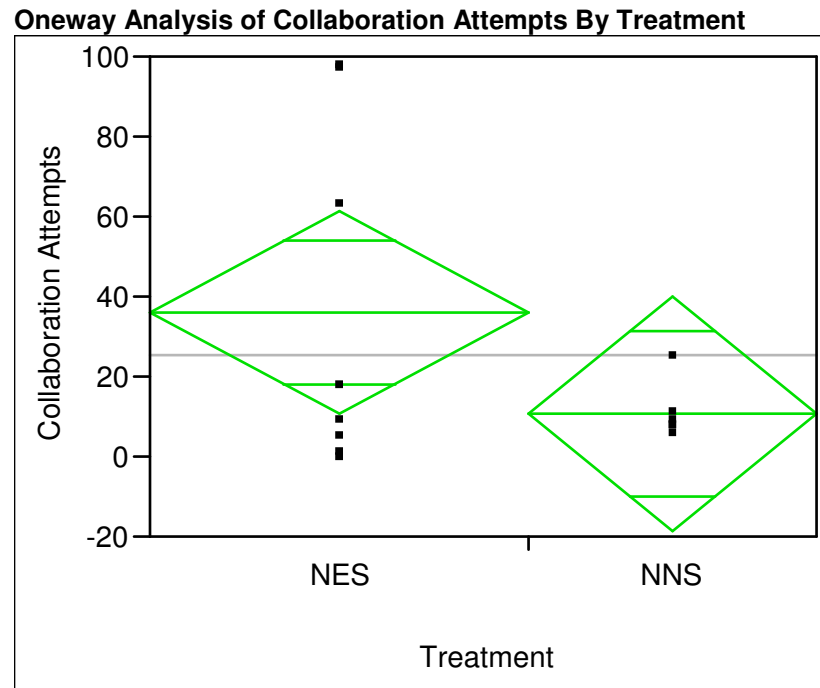


**Figure 17 Average scores of ESL students' second post-test assessment of L2 vocabulary per treatment.**



Treatment ■ NES ■ *NNS*

**Figure 18 Comparison of average number of chat messages generated by native English speakers and ESL students during gameplay.**



**Figure 19** One-way Analysis of Variance shows no significant difference in the number of collaborative chat messages.

## 5 Prototype of *EverQuest® II* Game Module

### 5.1 Original Game or *EverQuest® II*

Initially, I considered designing an original, serious game to facilitate SLA but realized the disadvantages of this approach. First, the challenge of designing an educational game containing enticing storylines or plots and the sophisticated graphics typically associated with commercial games is not easily accomplished. Effectively embedding learning tasks in meaningful gameplay experiences is an additional challenge. Commercial game development teams consists of hundreds of people, including user interface developers, game engine programmers, modelers and animators of avatars and in-game creatures [36, 78]. The product development process for a “big budget” commercial game takes, on average, 2 to 3 years to complete (Fullerton et al. 2004). Independent game developers have fewer resources available which extends the game development cycle and impacts the quality of the game. Independent serious game designers run the risk of developing a game that fails to meet the expectations of tech-savvy players who are familiar with high quality commercial video games. Failure to meet these expectations has a negative effect on the gameplay experience and definitely leads to negative learning outcomes [32]. Available resources increase the likelihood of designing a high quality serious game that meets the expectations of players.

Educational games have been critiqued for ‘dressing up’ learning objectives in fancy graphics and offering boring gameplay experiences that students prefer not to repeat [11, 32]. The learning objectives become the game objectives. If educational content supercedes creation of an enjoyable gameplay experience, then the students lose the benefits of gaming (e.g.

immediate feedback and awards, virtual collaboration, active learners, and exploratory virtual worlds). By contrast, I believe that both the learning objectives and an enjoyable game experience should receive equal attention throughout the game design process which is not trivial or easily achieved. Unlike the negative connotations of learning associated with traditional classroom settings, Barab et al. [10] argues that video games provides a meaningful context for learning where players have fun as they learn concepts. This creates a higher level of engagement as players help one another complete with game quests [9]. It is this higher level of engagement that becomes the goal for designing game modules that offer communication tools for second language students as they develop proficiency in the target language.

In addition, I noticed that participants in both the first and second rounds of playtesting expressed their enjoyment of playing EQ2 and often played the game longer than the time allotted for the game sessions. This behavior signaled a desirable level of engagement due to the various game tasks and social interactions inherent to the infrastructure of EQ2 that would be difficult to duplicate due to limited resources for an independently developed serious game. Sony Online Entertainment gives subscribers of EQ2 access to development tools for EQ2 players to design their own game modules (mods). I decided to design my own game mod to support second language learning while leveraging the meaningful gameplay experiences readily available in EQ2. The design of the two game mods resembles the model of in-game social interactions that foster emergent cooperative relationships in virtual environments. I discuss the model and the design specifications in section 6.2. Section 6.3 provides details of the implementation process of the game mods.

## **5.2 In-Game Social Interactions as Design Specifications**

The results of both observational studies discussed in chapter 5 strongly suggest that social interactions between native and non-native speakers in interactive and cooperative gameplay become an integral factor in contributing to second language acquisition. A one-way ANOVA showed significantly higher post-test scores of evaluation of second language acquisition in the context of game activities for ESL students grouped with NES participants while playing EQ2 compared to the other two treatments. Despite the fact that NES participants generated more chat messages, qualitative analysis revealed that ESL students exhibited the same communication patterns as native English speakers. This confirms our hypothesis that MMORPGs accommodate the specific L2 learning objectives of vocabulary acquisition, reading comprehension skills, and conversational fluency. These learning objectives become the specifications for the design of a serious game, specifically those game tasks that create gameplay experiences that support the development of L2 players' proficiency in the target language. Continuous playtesting assists serious game designers with first understanding the social interactions between players that accommodate learning and then allows them to better design game interfaces that capitalize on these interactions. This criterion enables designers to think critically of game activities that map to system behaviors and ultimately promote proficiency in the target language. Thus, user-centered game design provides a more effective method for integrating assessment of both learning and gameplay experiences than the traditional game design process.

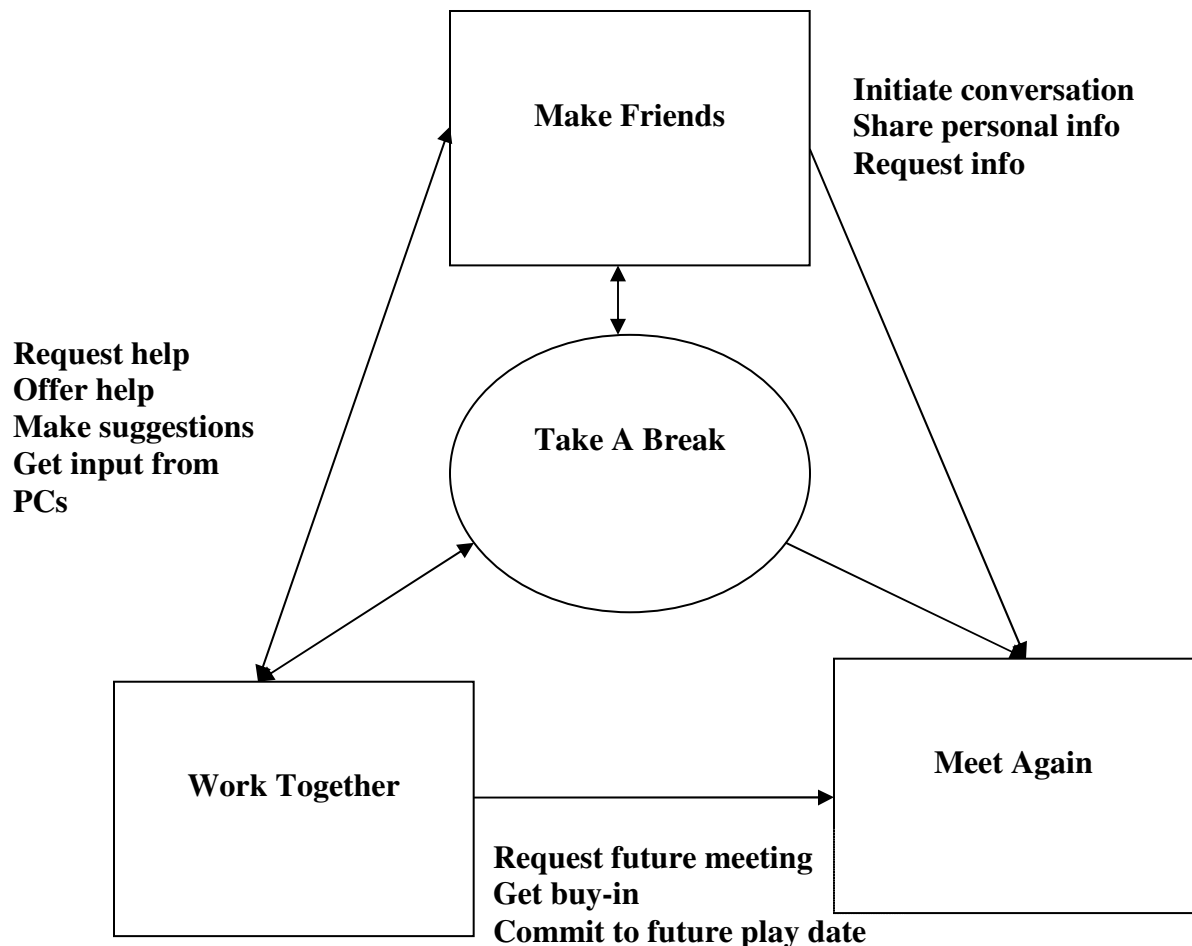
Moreover, the qualitative analysis of native and non-native speakers' chat logs collected during the second phase of playtesting helped formulate a model for in-game social interactions that foster emergent cooperative relationships. The communication patterns between PCs and indicates the PC's intentions such as requesting information, asking for assistance or introducing



oneself. The four categories of speech acts used to code the subjects' game logs serve the dual purpose of classifying the different types of social interactions between the NES players and the ESL students, and formalizing a serious game that supports communicative performance. I collapse these four categories of speech acts into three types of social interactions associated with the design of online communities yet applicable to establishing strategic partnerships in gaming environments:

1. Meeting PCs leverages visibility in the virtual world and initiates the process for establishing relationships in virtual spaces [48, 56, 84 – 87]. Communicative behaviors included initiation of conversations, sharing personal information and seeking personal information from other PCs.
2. Working together to complete quests provides common ground in virtual environment and exemplifies cooperative and collective action [40, 54, 56, 69]. Participants asked for help with game quests, offered to help PCs with difficult quests, made suggestions about strategic gameplay, and sought input from PCs regarding group decisions.
3. Scheduling future meetings supports repeated social interactions fosters emergent cooperative behaviors with PCs [40, 56]. This suggests that teamwork does encourage repeated interactions and sets the stage for emotional attachment to players in virtual worlds. I included this social interaction since future game sessions will consist of ESL students playing EQ2 solo.

These three types of social interactions characterize the primary reasons PCs chat with one another and demonstrate collaborative behavior during gameplay. Qualitative analysis of ESL students' game logs revealed that ESL students suggested game strategies, offered to help teammates, and requested assistance during gameplay. Thus, the type of social interactions provides valuable data that informs the design of the prototype and derived the model for emergent, cooperative relationships in virtual worlds (see figure 20).



**Figure 20 Model of in-game social interactions.**

Post-test scores of ESL students who were grouped with NES participants were significantly higher than both the ESL students who participated in traditional classroom instruction and those ESL students who played EQ2 alone. Therefore, interactions with other PCs leads to a higher level of engagement demonstrated by the generation of more chat messages than other ESL students. The interactions between ESL PCs and NES PCs provide sufficient opportunities for ESL participants to socialize and acquire knowledge of L2 vocabulary associated with completion of quests. Consequently, these social interactions foster emergent cooperative relationships with PCs during gameplay.

Results from the second phase of playtesting revealed that ESL students who played EQ2 alone did not chat with other PCs. However, those ESL students who were grouped with NES participants generated more chat messages and communication patterns similar to NES. Consequently, the social interactions between ESL students and NES participants played a crucial role in increased L2 vocabulary acquisition and reading comprehension. These results specify a game mod that encourages ESL students to communicate with NES PCs during gameplay. The first iterative pass of user-centered game design identifies communicative performance in the target language as the learning objective. The requirement is to design a game mod that encourages ESL students to chat with PCs thereby developing conversational fluency in the target language, one aspect of communicative performance. The game module provides examples of chat messages that correspond to in-game social interactions, including meeting PCs, working together and scheduling future game sessions. I discuss the details of the

implementation of an alpha prototype of a two customized game interfaces designed to facilitate conversational fluency in English.

### 5.3 Implementation of Game Modules

#### 5.3.1 Development Tools for *EverQuest® II* Custom Modules

Sony Online Entertainment (SOE) offers subscribers of EQ2 access to the User Interface (UI) Builder development tool, giving players the ability to create customized game modules visible during gameplay (Sony Online Entertainment 2004). The SOE UI development team also uses the UI Builder to develop interfaces (e.g. Map of Norrath, list of avatar's skills, chat window, etc.) for EQ2. The interactive graphical tool allows players with no prior knowledge of XML to rapidly create customized user interfaces featuring a library of objects and their properties including pages, style definitions and widgets (e.g. dialog boxes, text boxes, drop down menus, toolbars, etc.). Interface designers can test drive game mods using UI Builder before integrating them in the actual game. Players can also choose to eliminate existing game windows at their discretion.

#### 5.3.2 Environment Set Up

To protect against accidentally deleting game mods that provide feedback (e.g. avatar's experience) to the user during gameplay, first I created a subdirectory named *customUI* in the *C:\Program Files\Sony\EverQuest INUI* directory. I copied the files in the *C:\Program Files\Sony\EverQuest2\UNDefault* subdirectory to the *customUI* subdirectory and created a configuration file (*eq2.ini*) in the *EverQuest® II* main directory that designates the new

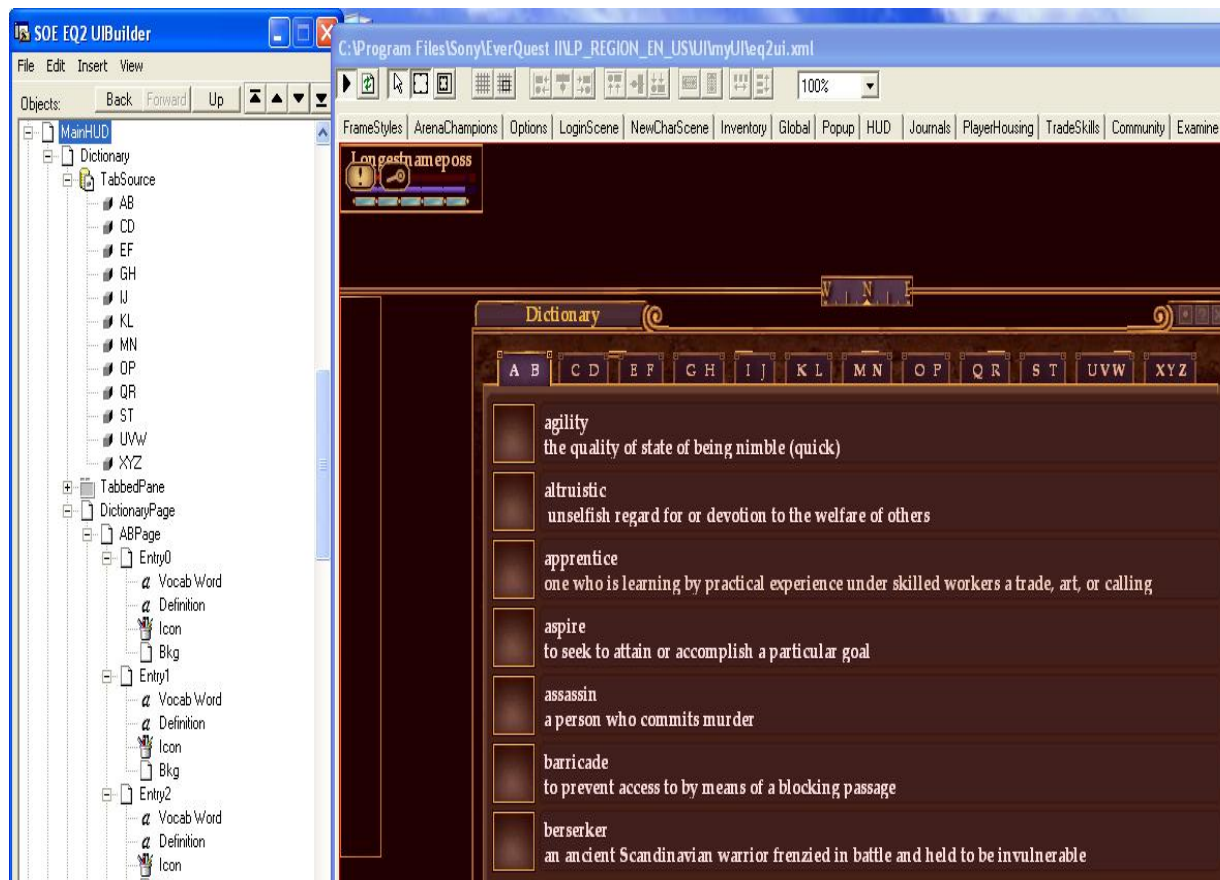
*customUI* subdirectory as the default directory upon initialization of EQ2. XML code for customized user interfaces can be found in the *customUI* subdirectory.

### 5.3.3 Consistency of Visual Design

Developers of game mods (modders) can write XML code from scratch to create new interfaces or choose to drag and drop interfaces visible in the UI Builder workspace to modify existing game interfaces. I applied both methods to assist with rapid prototyping of the Alpha version of two game modules: in-game dictionary of potential L2 vocabulary and a conversational prompt game module. I copied the *Page Group object*, pre-defined textures, background images, colors and font definitions to maintain consistency of visual design. Consistency of visual design accommodates seamless integration of customized modules that resemble the look and feel of existing game modules [81]. For example, the open and close buttons are located in the upper right hand corner for each module. I created two *Large Push Button objects* consistent with gold font text for the label and the elongated oval for the shape for any *Large Push Button* object in the *UI Builder* Library. Button image is highlighted on mouseover to indicate player can push the button to activate the window. The *Large Push Button* labeled *Dictionary* when pressed opens the in-game dictionary module and the *Large Push Button* labeled *Chat Help* when pressed opens the Conversational Prompts module. Both buttons are visible in the Main Heads-Up Display (HUD). Typical of game interfaces, players manipulate and navigate the tabbed page design of both the dictionary and the conversational prompt game modules. Details of each game module are outlined below.

## 5.4 In-Game Dictionary Module

The in-game dictionary is a *Dictionary Page object* implemented as a tree data structure. I applied horizontal prototype methodology to represent the breadth of forty potential second language vocabulary words displayed in NPC dialogue for the first 8 quests on the Isle of Refuge [74]. The Dictionary root object expands into twelve branches that represent the alphabetical index of vocabulary words. Each branch represents a tabbed window pane labeled with two to three letters (*A B* or *X Y Z*) and aligned the top edge of each tabbed window pane. See figure 20. Players navigate the tabs to search for vocabulary words in the dictionary. Each tab corresponds to page of no more than seven vocabulary words; each entry contains a definition and at least one synonym that functions as a “quick and dirty” definition while introducing another second language vocabulary word (e.g. **agility** – *the ability to be nimble; quick*). Definitions were taken from Webster’s Online dictionary (<http://merriam-webster.com>) and the Dictionary website (<http://dictionary.com>).



**Figure 21** Tabbed window pane design of in-game dictionary for second language vocabulary words.

## 5.5 Conversational Prompts Module

Remember that the analysis of game logs helped to derive a model of in-game social interactions that foster collaborative relationships between PCs during gameplay. Therefore, the physical layout of the conversational prompts module actually represents the model of in-game social interactions and serves as a communication tool. I wrote XML code for the tabbed pane design of the chat prompt interface [70]. See figure 23. Each tabbed pane or page demonstrates vertical prototyping, offering a variety of conversational prompts for each type of social interaction [70]. Subsequently, each tab represents one of the three categories of social interactions attributed to emergent cooperative relationships in virtual spaces and scaffolds ESL students' ability to engage native English speakers in conversation.

### 5.5.1 Chat Prompts for Meeting Other PCs

The first tab, labeled *Make Friends*, offers conversational prompts that encourage the player to introduce his/her self to other PCs during gameplay. Directions are listed at the top of the tabbed page and instruct the player to meet other PCs by greeting other players using the chat window. Introducing oneself to others is a social skill valued in the real world. However, EQ2 makes use of full-bodied avatars that are labeled, so introductions identifying one's name are not necessary. It is more important to greet PCs and engage them in conversation. The *Make Friends* page consists of common greetings (e.g. "Hi. How are you?" ) followed with a question in an attempt to meet PCs and engage them in conversation. See figure 21.

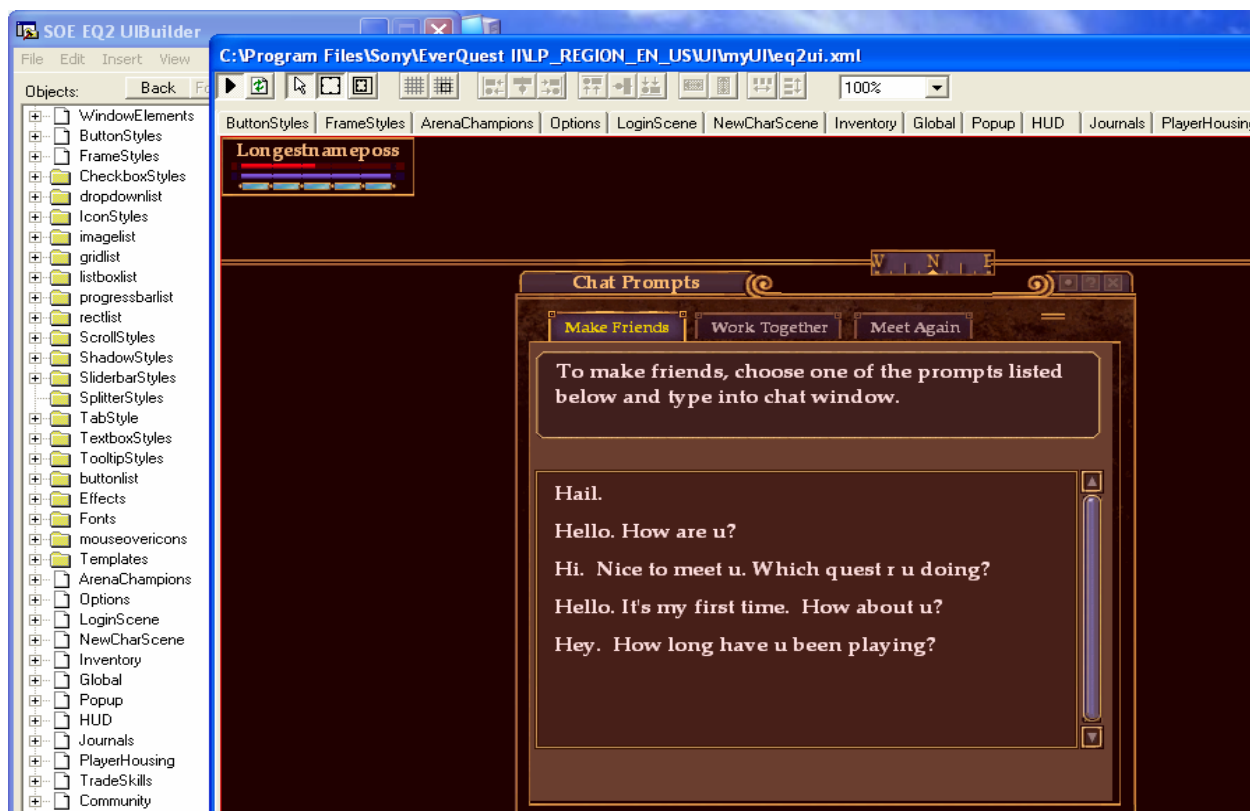


Figure 22 Tabbed window pane design of chat prompt module that assists ESL students with making friends in the game world.

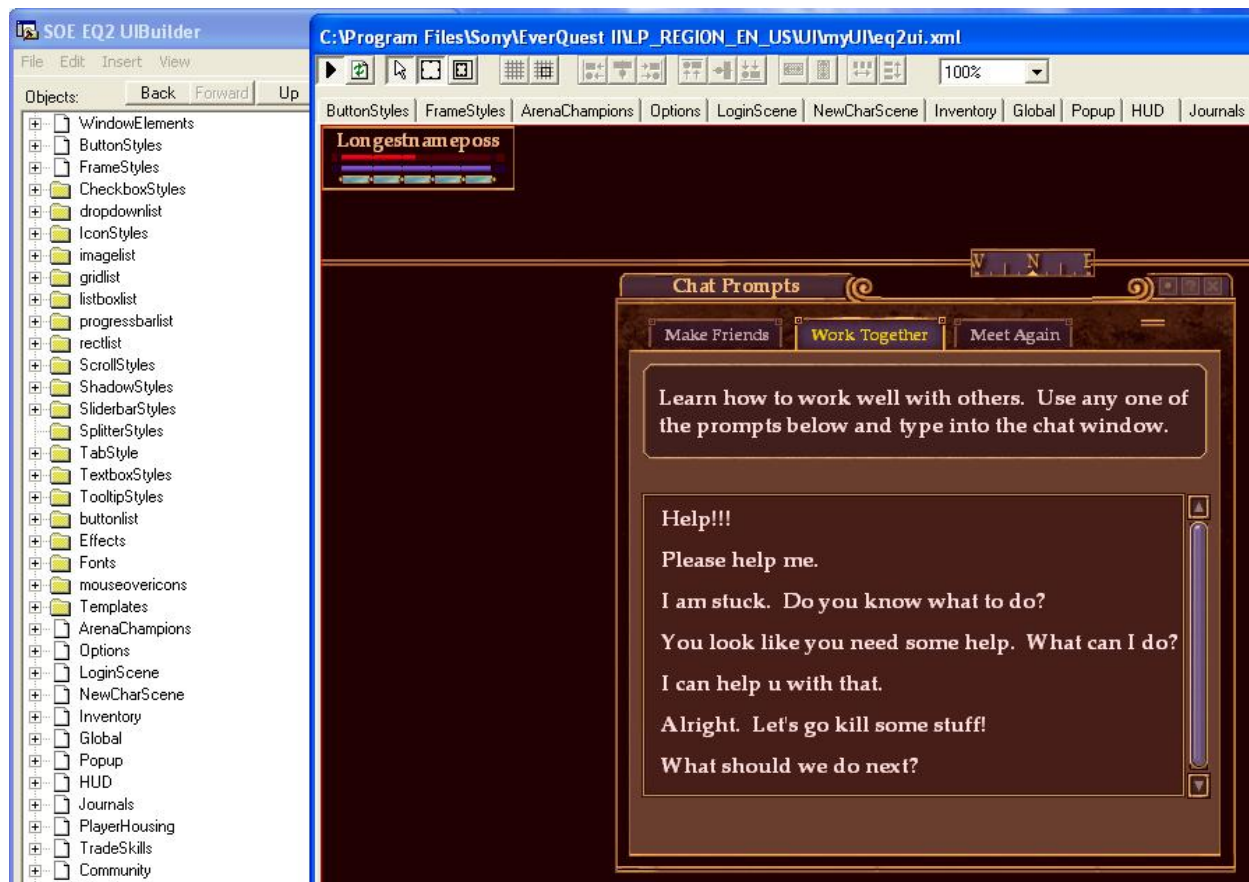


To assist with this effort, the *Make Friends* page lists possible greetings that can be typed in the chat window. Each greeting includes a question (e.g. “How are u?”) as a means for engaging other PCs in conversation. This is the first step towards forming strategic relationships during gameplay and a common social practice in many cultures. Remember that the learning goal is communicative performance in the form of conversational fluency and not correct syntax (e.g. use of “u” for the word “you”). I made a conscious decision to implement conversational prompts typical of online social interactions in an attempt to expose ESL students to culturally appropriate behavior in virtual spaces, including use of abbreviated words and letters in place of correctly spelled words. This choice utilizes another learning opportunity for a different form of communicative performance, the ability to appreciate cultural nuances and respond appropriately. This does not mean that technology should not reinforce correct syntax. Rather, the learning objective determines the appropriate design and use of technology. Thus, the plug-in supports the overall learning objective of communicative performance using two sub goals: 1. conversational fluency in target language and 2. the ability to appreciate cultural differences and respond appropriately.

### **5.5.2 Chat Prompts for Collaboration**

The second tab, labeled *Work Together*, list instructions at the top of the page, emphasizing the importance of learning to work with others. The list of conversational prompts can be divided into logical groupings of collaborative social dialogue based on a modified version of Core and Allen’s DAMSL code system (1997). The first category is *request for assistance*. The first two chat prompts (“*Help me!!!*” and “*I am stuck. Do you know what to*

*do?”*) fall into this category (see figure 22). The PC reaches out to others in an attempt to solicit help with a quest, behavior that engages other PCs and leads to joint efforts to complete a game task. ESL students need to understand that it is common practice for players to ask for help and should be comfortable doing so. The second category represents offers of assistance (*“You look like you need some help. What can I do?”*). This social behavior demonstrates the PC’s willingness to help and facilitates an attitude of team work. The third category refers to the PC’s ability to influence the future actions of others (*“Let’s go kill some stuff.”*). The use of collective pronouns like *“we”* or *“us”* suggests a spirit of team work and helps establish cooperative relationships in both the virtual and real world. The last category refers to the PC’s ability to solicit input from others (*“What should we do next?”*) while empowering others to lead. Good leaders understand the importance of getting buy-in from team members and sharing the responsibility of group decisions with others [22, 55]. I do make the assumption that the ESL student will be able to determine which prompt to use based upon the desired collaborative behavior. For example, ESL players will first need to know that they need help before choosing the chat prompts that request help (*“Please help me,”* or *“Help me”*). Playtesting of the game module will verify if this is a valid assumption.

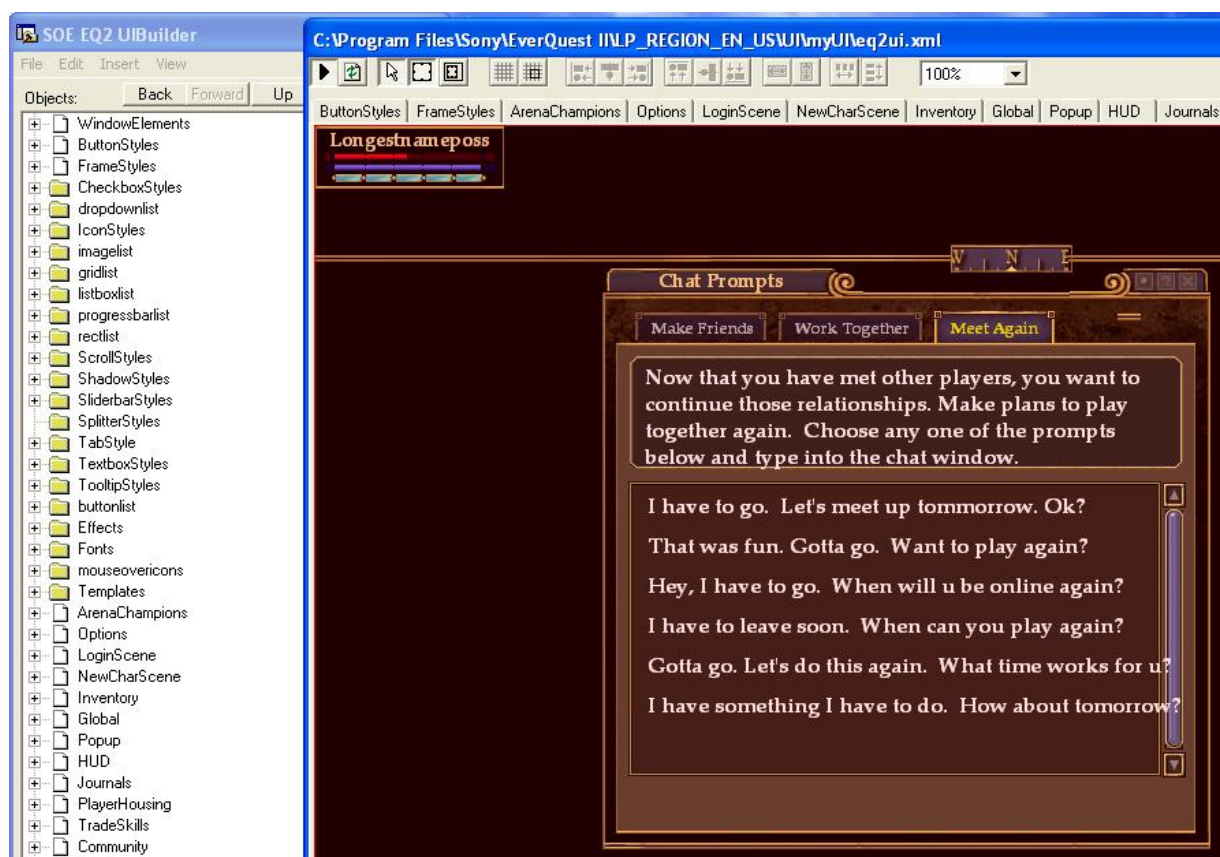


**Figure 23** Tabbed window pane design of chat prompt module that facilitates collaborations between players during gameplay.

### 5.5.3 Chat Prompts for Establishing Long Term Relationships

Two-tabbed pages (described in the previous section, 6.3.5) encourage foreign language students to meet and learn how to work with other PCs, social skills that are relevant to virtual environments and face-to-face social interactions. However, the challenge in virtual environments is maintaining relationships that may not extend beyond the virtual world of Norrath and yet exists in an ever-changing virtual environment of newbies, challenges, and adventures. How do PCs establish connections with other PCs that lead to continuous,

collaborative relationships? The same way people do in face-to-face interactions; PCs make commitments to meet again to play the game. Thus, virtual meetings exemplify repeated in-game social interactions that foster long-term relationships. The third social interaction involves ESL students' ability to negotiate future meetings with other PCs to play EQ2. Negotiation is a desired skill set of communicative performance and team work. The third tabbed page suggests a list of chat prompts that assists with scheduling future play dates. See figure 23. Each conversational prompt indicates that the ESL student will be logging out soon but would like to meet again and play the game. The goal is to solicit agreement from the PC about a future time to collaboratively play EQ2.



**Figure 24** Tabbed window pane design of chat prompts that solicits future meeting times for gameplay with PCs.

## 5.6 Participatory Design with ESL Instructor

Having completed the Alpha version of the game prototype, I sought the expert opinion of an ESL instructor who uses technology to supplement classroom instruction. The first goal was to evaluate the design of the dictionary interface. I asked the ESL instructor to talk aloud as she navigated the dictionary module. Whenever she became silent, I would ask questions to resume the process. The ESL instructor disliked the design of the dictionary module, rating it a 2 for *Somewhat Designed But Lacking*. While the design was visually consistent with other game windows in terms of background colors, window frames, and text fonts, she considered the design to be dull and not visually appealing due to use of dark greys and browns. Her first suggestion was to add color to emphasize the vocabulary words and their parts of speech (e.g. red for verbs, green for nouns). I had not considered color-coding the parts of speech, but took her suggestion under advisement. Though she could easily navigate the tabs to find entries, the instructor thought the window due to its 5 inch width would be a distraction during gameplay. Instead, the ESL instructor suggested interaction labeled items or people in the virtual world. For example, if the game depicts a blacksmith training his *apprentice*, the player should be able to click on the player and the definition of *apprentice* is displayed. I thought this was an excellent way to make sure of information already available in the game without distracting players from their surroundings. Interestingly enough the ESL instructor did not suggest pictures. When questioned if graphical images would assist with language learning, she identified images as being a potential source of confusion, especially in instances where images represent abstract nouns (i.e. *altruistic*). Graphical images for concrete nouns would be a better approach.

The second goal of participatory design was to verify L2 pedagogy with the content in the chat prompt mod while the third goal verified the game module's ability to scaffold conversational fluency. I used the interview method featuring open-ended questions to solicit the ESL instructor's evaluation of the conversational prompts module to determine functionality and ability to support L2 conversational fluency. The ESL instructor responded to the following questions:

1. *What do you think about the idea of representing each category of social interactions as a separate page of conversational prompts?* Answer: The labels of each of the tabs define the context for using the list of prompts. This serves as a guide to ESL students, instructing them when it is appropriate to say and use the list of prompts.
2. *Is each tabbed appropriately labeled in a meaningful way that indicates the context in which players use the conversational prompts?* Answer: The labels clearly communicate the purpose of using the prompts. I cannot think of a better way to label the categories at this time.
3. *Are there additional social categories that should be added to better support ESL students?* You need a category to indicate pauses in the game like when the person wants to grab a snack.

4. *What do you think about the various prompts listed for each category of social interaction?* I like the variety for each type of social interaction. Typically in the classroom setting, ESL students only learn one or two ways to same something. The interface gives them options and I like that.
5. *What additional functionality would you like to see?* If you make those changes, then that's fine. I am concerned about the screen being too busy. Limit the number of windows on the screen so students are not overwhelmed with information.
6. *On a scale from 1 (Not Well Designed At All) to 5 (Very Well Designed), rate the design of the game module.* I would rate the interface a 4.

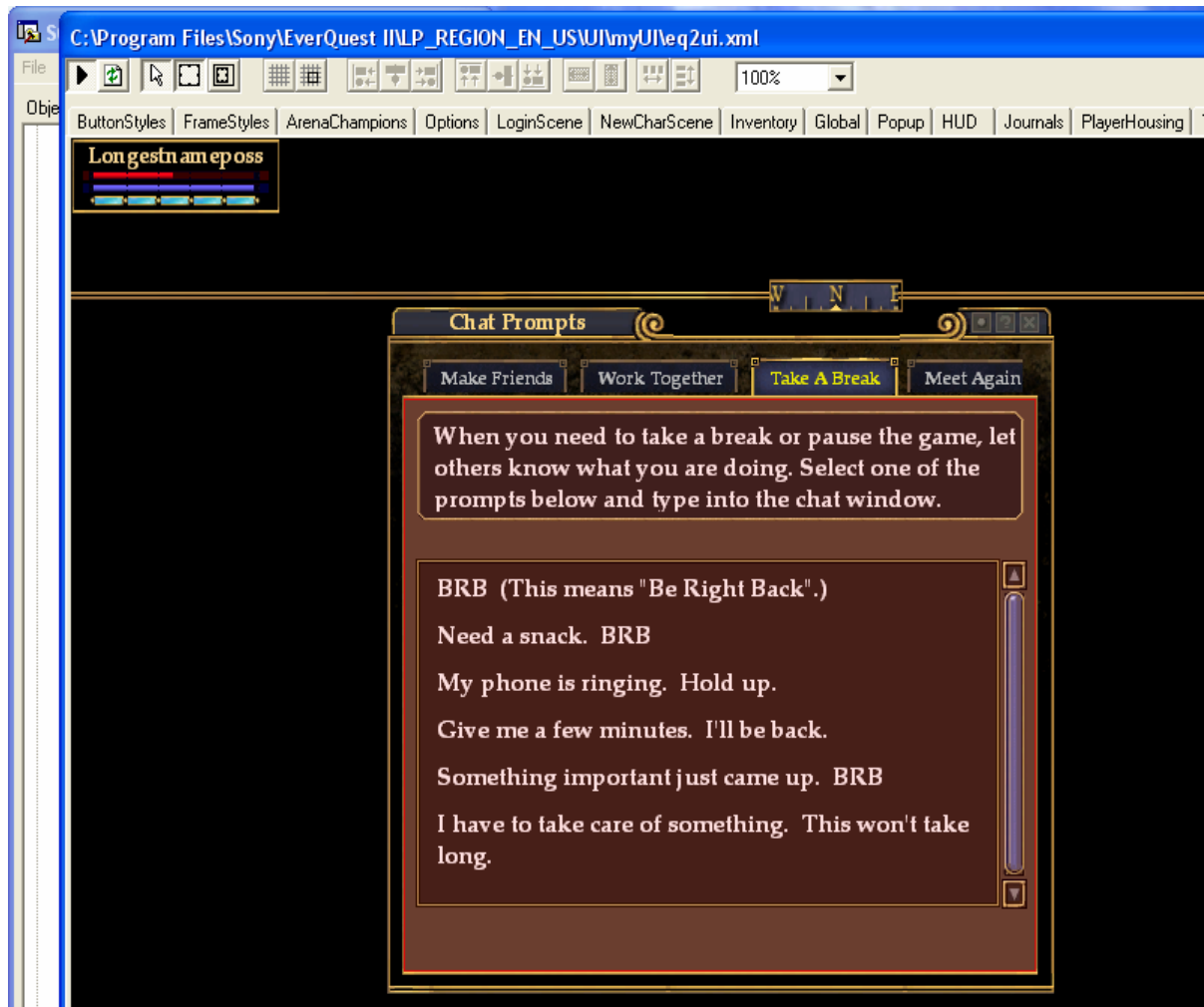
## 5.7 Beta Version of Two Game Modules

I modified the font type and color for the second language vocabulary words in the dictionary. I chose yellow to draw attention to each entry and an 18-point font for the each word and synonym; I used an 15-point font for the definition.

The ESL instructor's feedback led to two design changes for the conversational prompts game interface. The first design change involved adding another tabbed window pane that indicated the pause in gameplay activities. I classified the category of paused gameplay as the social interaction of *taking a break* and labeled the tabbed window pane *Take a Break*. The ESL

instructor recommended this social category be included in the design to suggest that the ESL student should communicate to other PCs the need to be temporarily absent. It is important that PCs do not interpret lack of response as indication of being ignored as this could hamper collaboration. While I had overlooked the need to accommodate this functionality of speech as an important indicator of paused gameplay, I did recall during the playtesting an incident in which an ESL student went to the bathroom but did not communicate temporary absence. This led to the NES participant repeatedly asking the ESL student for status (“What r u doing?”). The ESL student did not realize the common practice of typing “BRB” (“Be right back”) in the chat window to indicate temporary absence. I considered this to be a great suggestion and added the *Take A Break* tabbed pane with alternative options for indicating temporary absence. See figure 24. I added additional prompts (“Have u played this game before?”) to the Make Friends tabbed window pane to supply more alternatives to engage PCs in conversation in an attempt to meet PCs.





**Figure 25** Tabbed window pane design of chat prompts that notify Player Characters of need to pause gameplay.

I made two additional design changes at my discretion; I added the icon designated for emoticons to communicate availability of the conversational prompt game mod to the Main HUD. Players can press the icon to open the chat prompt game mod. No additional game interfaces appear on the screen unless the player chooses to open the window. This addresses the ESL instructor's concern about busy screens. However, there are no constraints on the number of windows an ESL student can open. Secondly, I changed the font color of incoming chat

messages from PCs to the color green. The idea is to make salient incoming chat messages so that ESL students notice new chat messages and respond promptly.

## **5.8 Summary**

The Beta version of the game module consists of four tabbed window panes, each representing a specific type of social interaction. The first tabbed pane lists chat prompts for making introductions to PCs and engaging users in conversation by asking them a question (“How are you?”). The second tabbed pane lists chat prompts (“Help me!”) that help second language PCs forge collaborative relationships with other PCs. The third tabbed window gives examples of chat prompts that notify PCs of temporary pause in gameplay (“BRB”), and the fourth tabbed window pane assists PCs with establishing continuous collaborative relationships by soliciting future meeting times for gameplay with PCs. The last step in the concept phase involves another iteration of playtesting to determine effects of game mod on ESL students’ SLA.

## **6 Playtesting Game Modules**

### **6.1 Playtesting to Verify Initial Design**

This round of playtesting focuses on evaluation of the conversational prompt and dictionary modules rather than assessment of ESL participants' second language skills. As the author of the game module, I need answers to the following questions:

1. Do ESL participants use the dictionary module? Why or why not?
2. Can ESL participants navigate the dictionary module to find the information they need?
3. Is the dictionary module self explanatory or confusing?
4. Can participants find definitions of vocabulary words in the dictionary module?
5. Can ESL participants navigate the conversational prompts module to find the information they need?
6. Is the conversational prompt module self explanatory or confusing?
7. Are all of the tabbed window panes representing types of social interactions used or just a select few?
8. Do ESL students find it useful for generating conversation with PCs during gameplay?

Thus, this phase of playtesting represents a usability study to determine basic functionality of both game modules.

## 6.2 Evaluation of Game Modules

One Intermediate ESL student playtested both the dictionary game module and the conversational prompt module to determine if the modules are easy to use, provide useful information and enhance gameplay.

### 6.2.1 Methodology

The formal usability study was used to collect data from the ESL participant. The participant completed a questionnaire that collects information about their background prior to gameplay. Additionally, the ESL student was asked to talk aloud, indicating what he was looking at, what he was thinking and what was confusing, as he completed each task [70]. The investigator kept a journal of observations as the ESL participants played EQ2. The ESL participant was given a series of structured tasks to complete [70]. The tasks measured the participant's ability to:

- find vocabulary words in the dictionary
- use the dictionary to aid in second language acquisition during gameplay
- use the conversational prompts to chat with other PCs
- evaluate preferences of chat prompts;

See figure 27 which lists the structured tasks.

Once users complete each task, they completed a post-game questionnaire to collect data about their experiences using the game modules. The questionnaire asked:

1. What did you not like about the dictionary?
2. What did you find confusing or difficult about the dictionary?
3. How would you suggest improving the dictionary?

4. What did you like about the conversational prompts?
5. What did you not like about the conversational prompts?
6. Did conversational prompts distract from gameplay?
7. Did the conversational prompts enhance gameplay?
8. What did you find confusing or difficult about the conversational prompts?
9. How would you suggest improving the conversational prompts?

The Intermediate ESL student's responses are discussed in the next section.

### **6.2.2 User Evaluation**

Overall, the ESL participant expressed a neutral opinion about the dictionary; he preferred not to use the dictionary. The ESL participant suggested an interactive interface that would allow the user to mouse over potential vocabulary words; the mouse over would display the definition of the text on the screen. It was his opinion that this was better use of space than the 5 x 5 in-game dictionary. I took this under serious consideration, because this was the second time I had heard this. If you recall section 6.6, the ESL instructor shared the same opinion. This raised a red flag that the in-game dictionary appeared to be out of place in a virtual world where 3D objects glowed on the screen when the users moused over them and had the option of clicking on objects to examine their properties. Similar to the ESL instructor's feedback, the ESL student did not think highly of the design of the in-game module. When I asked him about his confidence level in his English proficiency skills, he admitted that his vocabulary for academic papers was better than his ability to carry a

conversation with Native English speakers. I took advantage of this information to segue way into the evaluation of the conversational prompts module.

The participant expressed a more positive response to the conversational prompts module. He like the colors (purple background for the window title and scroll keys, marble grey for the window backdrop and gold frames that outlined the tabbed panes and window. Note, these are similar colors used for the dictionary with the exception of purple. The ESL student had difficulty initially navigating the tabs because he did not understand what they were for. I simply asked him to introduce himself to someone in the. The conversational prompt remained on the screen as he typed in his chat window, but the ESL student did not rely on the chat prompts to communicate with PCs. I asked how often does he chat and he replied that he chats every day. However, the participant does not play video games and prefers physical activity over sitting for hours in front of a computer screen. The participant is a Computer Science graduate student, so his preference is not related to dislike of computers.

He asked me if I played EQ2 and what was its attraction. I explained it was a social game that consisted of various quests. We role played where I gave him an imaginary quest and asked him to use the conversational prompts to complete the quest. Once again, the participant was lost, because he did not know what a quest was. Once I explained a quest to him and showed him the game journal, he immediately replied that he would not want to sit and read all of the information. The ESL student indicated that he did not think favorably of the game. I changed topics and asked him to select his favorite prompt for each type of

social interaction. I noticed that he used the Work Together prompts, Meet Again, and Take a Break. He was very comfortable saying hello to strangers and did not use the Make Friends conversational prompts. I then asked if he was comfortable talking to strangers; he said yes when necessary. His favorite conversational prompt to use for working with others is “Help me.”; the ESL student said it was short and simple. He selected, “Hello. How are you?” as his preferred conversational opener. This chat prompt also represented the shortest introduction. His favorite *Meet Again* prompt is “Gotta go. Let’s play again. What time works for you?” “Give me a few minutes. I’ll be back” was the preferred choice of *Take A Break* prompt. This last selection did not represent the shortest prompt (“BRB” was the shortest prompt for the category of *Take A Break*.) I suspected the ESL student did not appreciate the meaning of “BRB.” When questioned, he replied that “Give me a few minutes. I’ll be back” was a more appropriate choice that could be used for a variety of situations, even those situations which may take longer than planned. He also indicated that chatting was hard to do and perhaps voice chat would be a better option for gameplay. The ESL student made two suggestions for design modifications: 1. Create a short cut to drag the chat prompts rather than having to type them in the chat window. 2. Create intelligent NPCs that can engage in conversation should the PC need information relevant to game tasks.

### 6.3 Design Modifications of Game Modules

Because both the ESL instructor and the ESL student shared the same opinion that an in-game dictionary was not the best method for scaffolding second language vocabulary acquisition, I considered replacing the dictionary with interactive text that

when moused over, the definition would appear on the screen. Since I do not have access to the game engine that generates the objects displayed on the screen, I would need to a third party application to parse text displayed on the screen. However, EQ2 does not support third party applications. In lieu of this dilemma, I have not made a final decision to remove the game module. I am investigating the possibility of using the L2 vocabulary words in the journal. I added pictures for the concrete nouns and examples of vocabulary words in sentences. As a result of the ESL student's evaluation, I designed the list of chat prompts to include static and dynamic chat prompts. Static chat prompts represent common conversational dialogue. For example, game logs show that if a PC desires to make the acquaintance of another player, one PC may share game information relevant to his/her progress. This social interaction falls within the category of making friends. The game mod was re-designed to reflect static prompts that assist with friendship. For example, a static prompt is "Hi, I'm a newbie. How about you?" In contrast, a dynamic chat prompt uses specific information about the player (i.e. player's level) to generate a chat prompt that reflects this information for a specific purpose. For example, if the ESL student wishes to make friends, then the game mod displays the player's level as an optional dynamic prompt for making friends. See figure 25. For the category of social interactions labeled *Working Together*, the game mod displays the quest the ESL student is currently doing (e.g. "I'm stuck. Do you know anything about *In the Name of Prestige?*"). See figure 26. Here the goal is to provide an interactive and responsive game interface that is customized per player and yet scaffolds second language students' ability to engage in meaningful conversation centered around game tasks and social interactions with other PCs that support emergent cooperative behaviors.



## 6.4 Summary

In summary, user-centered game design focuses on the educational needs of students who play serious games. User-centered game also emphasizes the effects of gameplay on the user and seeks continuous feedback from the user throughout the game design process. As such, serious game designers are constantly evaluating the design of a prototype that over time becomes the realization of a serious game that creates an enjoyable, educational experience. Feedback from the user produced design changes that enhance the gameplay experience and still align with the learning objectives of the game.



Figure 26 Game interface displays static and dynamic conversational prompts for making friends in EverQuest® II.



Figure 27 Static and dynamic conversational prompts for collaboration among PCs.

## **7 Conclusions**

### **7.1 Overview**

Serious games create meaningful play that translate to knowledge and skills valued in the real world. However, to achieve pleasurable gameplay experiences that generate positive learning outcomes is no trivial matter. How do serious game designers balance both pleasure and learning? What evidence supports the theory that serious games produce knowledge and skills valued in the virtual world that translate to real world capital? What role does assessment play in the serious game design process? Moreover, how do game designers create a serious game that facilitates second language acquisition (SLA)? My research addressed these issues and offered a solution based on the design and evaluation of Sony Online Entertainment's Massive Multiplayer Online Role Playing Game (MMORPG) *EverQuest® II*. I discuss the contributions, broad implications, and future trends of my research in sections 8.2 through 8.4.

### **7.2 Contributions**

My research has proven to be interdisciplinary, encompassing game design, Human-Computer Interaction, social computing and learning sciences..

#### **7.2.1 User-Centered Game Design**

In traditional game design, playtesting serves the purpose of evaluating the player's experience in terms of what is enjoyable or frustrating about the game. I incorporate usability studies, a user-centered design technique attributed to human computer interaction and a form of

playtesting, into the initial stages of serious game design. Furthermore, user-centered game design requires a thorough understanding of how users interact in the game world. User-centered game design involves quantitative and qualitative analysis of in-game social interactions as a means for identifying potential learning opportunities present in the virtual world. I apply user-centered game design to determine the potential of video games, specifically Massive Multiplayer Online Role Playing Games (MMORPGs) as unorthodox language learning tools. Despite the positive learning outcomes attributed to *EverQuest® 2* was designed for entertainment purposes and does not represent a serious game. I acknowledged this dilemma and asked the question how can the gameplay experience be enhanced to better support SLA? Which second language acquisition skills should be addressed in the design and why? In response to these questions, I defined a new design paradigm for serious games, *user-centered game design*, and applied user-centered game design techniques to repurpose *EverQuest® II* as a serious game for SLA.

User-centered game design allows game designers to focus on the needs of the player, in this case, the needs of ESL students. Thus, game designers are encouraged take a more human-centric approach. User-centered game design integrates assessment early in the design phase to ensure that serious games will lead to positive learning outcomes. The iterative process of user-centered game design introduced the concept of *evolutionary playtesting*.

*Evolutionary playtesting* refers to the iterative process of using a variety of methods such as observational studies, post-game questionnaires and analysis of game logs to evaluate different aspects (e.g. learning gains, frustration, pleasure, etc.) of players' gameplay experiences throughout the game design process. Data collection and analysis (e.g. pre- and post-tests

assessments) of serious games for educational purposes supports the theory that video games can function as effective digital learning environments. Evolutionary playtesting incorporates assessment of players' knowledge which is crucial for serious games designed for educational purposes. Consequently, I conducted the first phase of playtesting for the purpose of identifying the appropriate level of English proficiency for potential learning opportunities relative to game tasks, and learning objectives prior to the development of a prototype. I conducted a second phase of playtesting of ESL students' vocabulary acquisition and reading comprehension skills, including post-game questionnaires and tests, to confirm *EverQuest® II*'s ability to support SLA. ESL students' perceptions of their gameplay experiences and social analysis of game logs informed the design process of two customized game interfaces (dictionary and conversational prompts) for SLA. In the last phase of playtesting, I conducted usability studies to evaluate the functionality of the prototype to determine revisions for the two game modules. I conclude that user-centered game design incorporates a holistic approach to serious game design, specifically playtesting that places equal emphasis on assessment of players' knowledge and on evaluation of their gameplay experiences.

### **7.2.2 Characteristics of MMORPGs That Support Second Language Pedagogy**

My research demonstrates that MMORPGs are under-utilized virtual environments that possess characteristics linked to second language acquisition. I identify three characteristics that make MMORPGs ideal, immersive environments for SLA:

1. Virtual identities (avatars) that mask second language students' real identities and alleviate language anxiety associated with traditional classroom instruction [41, 45, 57, 88].

2. Multimodal virtual worlds rich with contextual information via text, graphical images and audio that assist with the development of second language vocabulary and reading comprehension skills [74, 75, 84]; Multimodal environment provide a shared context of meaning for diverse groups of users;
3. Social interactions with Player Characters (PCs) that increase level of engagement and provide opportunities for second language students to develop communicative performance---knowing what to say and when to say it--- in the target language.

These three characteristics are the predominant ones that correlate to second language pedagogy. In the context of learning sciences, understanding the affordances of technology helps educators make informed decisions of how technology can be used to reinforce learning objectives. Therefore, virtual identity, context for second language acquisition and social interactions with PCs provide justification for using MMORPGs as Computer-Assisted Language Learning tools in both informal and formal learning environments.

### **7.2.3 A Model of In-Game Social Interactions of Collaborative Relationships**

NPCs' dialogue introduced potential L2 vocabulary during gameplay. L2 vocabulary was displayed on the screen and in some cases accompanied with audio. I completed a one-way analysis of variance of the post-test scores of L2 vocabulary in the context of gameplay for three treatments: traditional classroom instruction, ESL students who played EQ2 alone and ESL

students grouped with NES participants; I discovered that ESL students grouped with NES participants scored significantly higher than the other two conditions. In-game social interactions between PCs in MMORPGs attributed to the significantly higher post-test scores of ESL students who formed teams with NES participants to complete various quests. During these interactions, ESL students used the L2 vocabulary in dialogue with NES PCs (see figure 26). Results strongly suggest that social interactions between PCs provide a deeper level of engagement that supports ESL students' development of semantic knowledge of second language vocabulary words.

Though no significant differences were found in the number and type of chat messages generated by ESL students compared to Native English Speaking (NES) participants during gameplay, I can conclude that ESL students emulated the communication patterns of NES participants. Closer examination of game logs reveal that ESL students shared cultural information about themselves, asked and offered assistance during gameplay, and in one exchange, expressed interest in continuing the relationship beyond the parameters of the study (see figures 26 – 27). These communication patterns indicate attempts made by ESL students to befriend, collaborate and establish emergent cooperative relationships with their English speaking teammates. The *Take A Break* category of social interaction communicates to other PCs that the player is temporarily unavailable. This notification is typical of the gaming culture and indicates that the player is not purposely ignoring PCs. Such notification keeps the lines of communication open once the player returns to the game. Thus, each window of the conversational prompts module, *Making friends*, *Working Together*, *Scheduling Future Meetings* and *Taking a Break*, provides a model for in-game social interactions that foster emergent cooperative relationships.

#### **7.2.4 Design Principles for Serious Games for SLA**

The working definition of evolutionary playtesting includes a variety of methods used to test prototypes during different phases of game development to solicit players' feedback of their gameplay experiences and assess players' knowledge. As a result of the first phase of playtesting, I identified three characteristics of MMORPGs that accommodate SLA: virtual identity, multimodal context for language learning, and communication tools to support social interactions with PCs. These characteristics define the first three design principles of serious games for SLA. The second phase of playtesting included assessment of English vocabulary acquisition and reading comprehensions skills. Significant learning outcomes attributed to social interactions with PCs verified that MMORPGs can function as pedagogicals for SLA. Another design principle of serious games is early assessment of learning objectives relative to gameplay experiences. Low post-test scores of ESL students who played EQ2 solo revealed the need to implement scaffolds for vocabulary acquisition and reading comprehension. As a result, I designed a prototype of an in-game dictionary to support this learning objective. Finally, qualitative analysis of in-game social interactions provided a model for the design of a second game module to scaffold communicative performance. The two game modules represent the design principle of built-in scaffolds. In summary, game designers need to follow these guidelines for designing serious games for SLA or language learning in general: to ensure that the desired learning outcomes are achieved:

- Use of virtual identities to mask students' real identities
- Multimodal virtual environments that use multiple senses for interaction
- Communication tools that support social interactions with PCs



- Built-in scaffolds to assist students with vocabulary acquisition and reading comprehension skills in the target language;
- Playtesting that includes evaluation of gameplay experience and assessment of students' knowledge according to the learning objectives of the game;

Until now, no guidelines for designing educational video games for language learning existed.

ESL PC 1 says to the group, "i need to examine the **parchment** scrap to see if i can decipher anything"

NES PC 1 says to the group, "click on the white message box"

ESL PC 1 says, "Hail"

NES PC 2 says to the group, "from the spiders?"

NES PC 1 says to the group, "and select group"

ESL PC 1, "how to do this **quest**"

NES PC 1 says to the group, "nice, you're using group chat"

NES PC 2 says to the group, "just kill a bunch of spiders and you'll get what you need"

ESL PC 1 says to the group, "ok "

**Figure 28** Dialogue between one ESL student and two NES PCs that demonstrates collaborative behaviors that support acquisition of potential vocabulary words.

### 7.3 User-Centered Game Design

I posit that designers of serious games for educational purposes need a different design methodology that integrates assessment of learning objectives with the elements of play early in the design process. The purpose for which we want to utilize games and repeated assessment of their effect on the player determines the focus of user-centered design. I define the criteria for

serious games designed for educational purposes and introduce user-centered game design as a framework for designing serious games.

#### **7.4 Understanding the Process of User-Centered Game Design**

Similar to traditional game design, user-centered game design begins with the generation of game ideas, including identification of the learning objectives, proceeds with playtesting to verify these ideas, followed by the development of a prototype and concluding with repeatable playtesting of the prototype [36]. Because playtesting occurs early in the design phase, paper-based prototypes or storyboards can be used to evaluate the user experience and determine potential learning opportunities present in the virtual world. Observational studies, a form of playtesting, can be repeated at this phase of the user-centered game design for the purpose of making sure the game activities align with the learning objectives. This is similar to human-centered game design which emphasizes ethnographic studies of users in their natural environment as the initial phase of game design [1]. However, user-centered game design is unique in three aspects:

1. User-centered game design begins with the generation of game ideas, not observational studies.
2. User-centered game design studies human behavior in the context of understanding in-game interactions that support learning [75].

3. Playtesting includes both the evaluation of the effects of the game play experience and assessment of learning outcomes [75].

The playtesting phase in user-centered game design measures various aspects of gameplay (e.g. pleasure, frustration) and involves multiple methods of assessment, (e.g. qualitative analysis of game logs, usability studies, ethnographic studies, and formal measures of assessment (see figure 1). In comparison, traditional game design utilizes playtesting to evaluate the user experience. The results of the first phase of playtesting, observational studies, identify potential learning opportunities available in the virtual world and confirm ideas for the game activities that correspond to learning objectives. Once game ideas have been confirmed, we compose a game sketch specification to formalize the requirements of the game [77]. The next step is to develop a prototype, a software-based version of the game. User-centered game design concludes with playtesting which uses participatory design, input from experts and users as an evaluation method, to make modifications to the prototype. User-centered game design ensures delivery of a serious game that has quantifiable learning gains and creates an enjoyable experience for the user.

### **7.5 Design Criteria for Serious Games**

User-centered game design addresses three basic criteria of serious games:

- Identification of learning objectives
- Affordances of gameplay
- Assessment of learning outcomes as a result of gameplay experiences

### **7.5.1 Identification of Learning Objectives**

Remembering that serious games create experiences that promote the transfer of skills in the virtual world to the real world, the first component of user-centered game design requires identification of learning objectives. Identification of learning objectives early in the game design process defines a subset of game objectives which correlate game tasks with the player's ability to demonstrate knowledge or apply a desired set of skills during gameplay [2, 3]. The answers to these questions identify the learning objectives of any serious game. What is the domain of learning or subject matter? What learning opportunities should the game offer the player? Is learning defined as a mental calculation or demonstration of physical dexterity [36]? Does the video game simulate a natural disaster that trains players to think quickly and respond to life threatening situations or does the video game promote physical interaction as an alternative to cardiovascular activity?

### **7.5.2 Affordances of Gameplay**

Additionally, game designers need to understand the benefits that games provide the player in the role of the student. What does the gameplay experience afford the player that the same experience in the real world does not? Is a particular genre of video games better suited for the specific application, and if so, how? User-centered game design recognizes the benefits of gameplay early in the design phase, allowing game developers to implement these advantages into the core behaviors of the game system. Secondly, learning does not happen in a vacuum, but includes social interactions that support the learning process. Previous research indicates that games are ideal for collaborative learning, creating opportunities for players to work together to accomplish game tasks [20, 31, 50, 86]. Game designers should examine the advantages of

social interactions in virtual spaces that support learning and design games that leverage these social interactions as part of the learning process during gameplay [84, - 86]. No formal model of collaborative learning in the context of gameplay currently exists. User-centered game design defines a model of collaborative learning that drives the design of game interfaces that support social interactions between Player Characters (PCs) as well as Non Player Characters (NPCs). I discuss the details of collaborative learning in the next chapter.

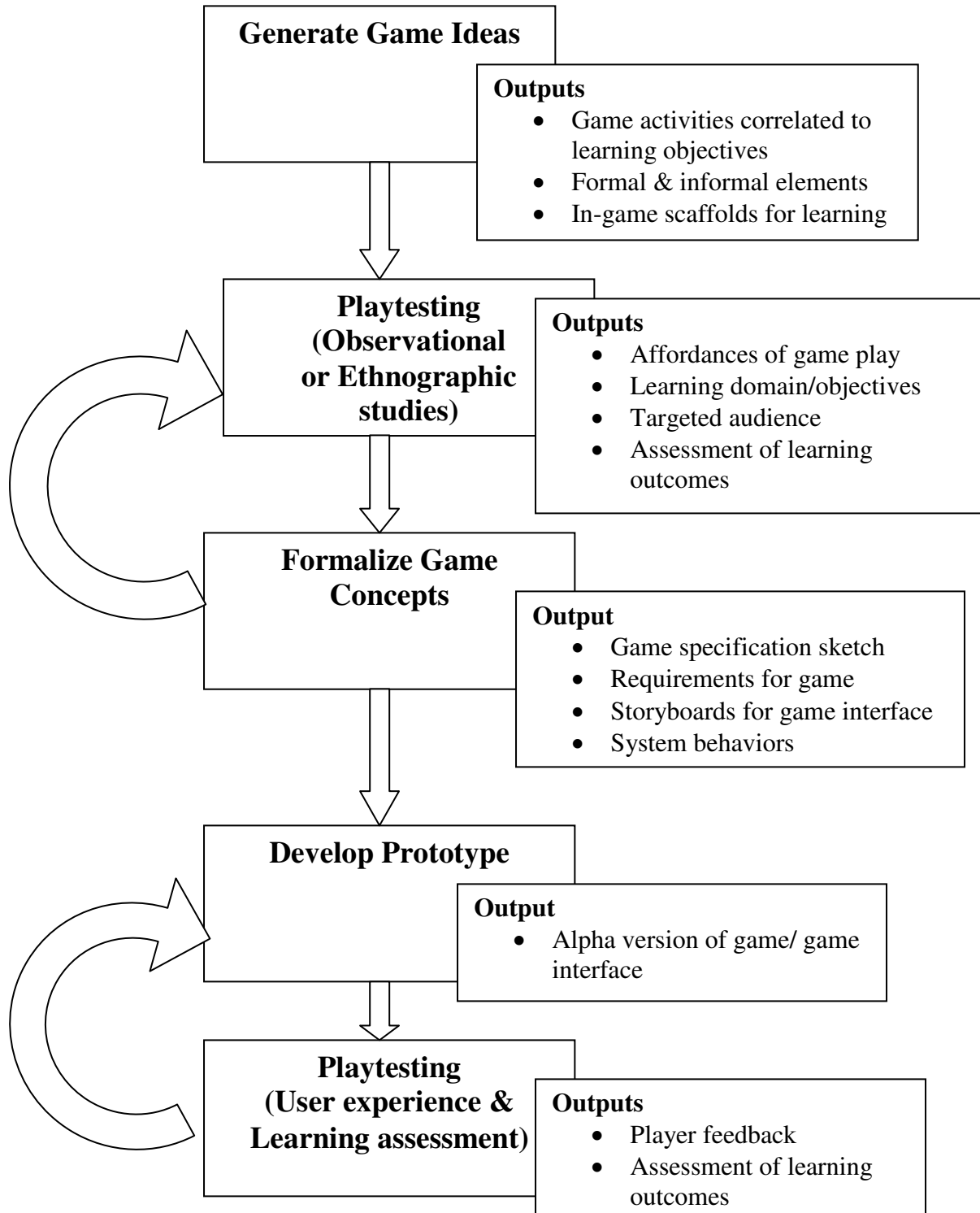
### **7.5.3 Assessment of Learning Outcomes as a Result of Gameplay**

While one can speculate about the benefits of games, I present methodology that provides substantial evidence of the positive or negative learning outcomes attributed to gameplay. Equally important, designers of serious games need to strategically build games that provide a pleasurable experience for players and create a commercial market for serious games. This means that assessment of the gameplay experience is required to determine the effects of gameplay on players. Whether this involves formal assessment (e.g. exams) or informal assessment (e.g. the players' ability to complete a game task that maps to a specific learning objective), designers of serious games need to account for assessment early in the design process. The practice of measuring the effects of gameplay early in the design process increases the likelihood that game designers can actually create a serious game that produces a positive experience for the user and positive learning outcomes. Hence, the criticism is that assessment of the user experience must be continuously measured, be it quantitatively or qualitatively, and interwoven on multiple levels throughout the development process of serious games. Instead, it becomes a video game that one hopes accomplishes a specified goal that has meaning or value beyond the context of gameplay. Lofty goals and lack of assessment address the game

designer's intentions but intentions alone do not adequately define the genre of serious games.

Without understanding the effect of gameplay on the user, the game designer attempts to create a game that he/she hopes accomplishes its goals without evidence that the game actually does so.

User-centered game design positions playtesting, including both evaluation and assessment, as the primary focus of serious game development.



**Figure 29** User-centered game design emphasizes integrated assessment.

## **7.6 Implications of Research**

The goal of serious games is to create gameplay experiences that promote knowledge and skills that transfer to real world applications. What can the design of serious games teach us about the construction of virtual worlds? What is the broader impact of this research? I discuss these details below.

### **7.6.1 Multilingual Interfaces That Emphasize Salient Information**

The results of the first observational study indicated that the effect of traditional L2 pedagogy on post-test scores far outweighed the effect of ESL students playing EQ2. However, the majority of ESL students who played EQ2 did increase their knowledge of English vocabulary words, so gameplay experiences produced positive though minimal learning gains. How do we critically account for the difference in performance of the ESL students who participated in traditional classroom instruction, the ESL students who played EQ2 alone, and the ELS students who were grouped with NES participants during gameplay? If we closely examine the practices involved in traditional L2 instruction, we find that the instructor provides guided instruction, repeatedly making salient the key points of interest such as semantics of L2 vocabulary. In comparison, games represent open-ended exploration, giving the player the freedom to do as she wishes. This contrasts with L2 classroom instruction and introduces the possibility of students overlooking important information such as potential L2 vocabulary. One implication for educational technology for language learning is to design multilingual interfaces that support foreign language students' vocabulary acquisition and reading comprehension. For example, user interfaces that display highlighted text in multiple languages on the screen draw



users' attention to vocabulary in the target language. Multilingual interfaces can be considered one example of universal usability, user interfaces that effectively support diverse groups of users [81]. Therefore, we need to design user interfaces that support cross-cultural communication (e.g. conversational prompts in multiple languages) and make salient information relevant to completion of tasks in virtual worlds.

### **7.6.2 Virtual Worlds as Cross-Cultural Bridges**

Qualitative analysis of game logs indicates that video games can serve as cross-cultural bridges, providing opportunities for players to exchange personal information about each other as they build emergent cooperative relationships. The exchange of pleasantries and personal information is the first step to establishing partnerships in virtual worlds. Our studies revealed that regardless of cultural backgrounds, both ESL students and NES participants exchanged personal information and sought common ground prior to working together to complete quests (see figure 27). I formulated the idea of implementing a game module that suggested chat prompts for engaging PCs in conversation as a means of making friends. The excerpt in Figure 27 shows that virtual worlds mask the cultural, ethnic and linguistic differences that exist between the Chinese students and African American students who participated in the study. Furthermore, game activities provide a shared context of meaning that overcomes cultural differences, creating a common ground for understanding [14]. In this way, video games facilitate cross-cultural communication [9].

The next social interaction demonstrates a power struggle between a Native English speaker (NES) and an ESL student. A NES participant uses gestures to try to get the attention of

one of the ESL students. The ESL student expresses physical hunger and desires to move on to the next quest. This implies he wants the group to follow his lead. The ESL student does not notice the gestures of the first NES PC. However, the NES PC tells the ESL student to wait as another Native English speaking PC joins the group. This indicates the first conflict within the group. Both the ESL student and NES student are males who are competing for the leadership position. It is typical in Chinese and American culture for males to assume leadership roles and we see this gender dynamic even in the virtual world. However, the ESL student responds to this request by chatting in Mandarin to the entire group. The ESL student maintains his position of leadership and solidarity with his female Chinese teammate (NNS PC 2). Interestingly, she responds by laughing at the American students' ignorance of what the Chinese student has said. This second conflict represents cultural dissonance, the distance between one's native culture and the target culture [15]. Power struggle and cultural dissonance are real issues in both the real world and virtual worlds. What is promising about this social exchange is the American student's ability to turn a potentially negative incident (e.g. ridicule of the Chinese students) into a positive experience for all. Instead of becoming offended, the American student asks what the Chinese student said. Even the second ESL student joins the exchange to confirm the interpretation and correct the American student's syntax. This particular exchange ends with the American student learning the Mandarin phrase for "I'm hungry" and showing respect for Chinese culture (e.g. "cool") (see figure 28). The balance of power remains unthreatened and both players save face in the process. The ability to respect differences and establish common ground is a valued skill set in both the educational sector and in industry.

Qualitative analysis of in-game social interactions allows me to investigate issues such as power, ethnicity, gender and socio-cultural norms exhibited in virtual environments. This

portion of my research has ramifications for social computing, particularly designing for democratic virtual worlds that embody respect for all people regardless of differences (e.g. gender, race, culture, etc.) [10]. Furthermore, virtual worlds function as training grounds for developing leaders capable of communicating effectively to a diverse audience [16].

NES PC 1 says to the group, "how was your meeting?"

ESL PC 1 says, "finished"

ESL PC 1 says, "conversational partner"

ESL PC 1 says, "where r u ?"

NES PC 1 says to the group, "tennessee"

ESL PC 1 says, "not far from here"

ESL PC 1 says, "i mean my place"

NES PC 1 says to the group, "not at all"

ESL PC 1 says, "you know what?"

NES PC 1 says, "i like you"

ESL PC 2 says to the group, "she looks just like her character"

ESL PC 1 says, "WOOOOOOOW!!!!!!!!!!!!!!"

NES PC 1 says to the group, "you're cool too"

ESL PC 2 says, "how nice girl"

NES PC 2 says to the group, "can we go back to queynos and fight"

**Figure 30 Dialogue between NES PCs and ESL PC as they exchange personal information.**

NES PC 1 tries to get Keleev's attention.

NNS PC 1 says, "hungry"

NES PC 2 says, "be patient keleev"

NNS PC 1 says, "wo er la"

NNS PC 2 says, "hehe"

NNS PC 2 says, "Hail"

NES PC 3 has joined the group.

NES PC 2 says, "what does that mean?"

NNS PC 2 says, "haha"

NNS PC 1 says, "means hungry"

NNS PC 2 says, "yes"

NES PC 2 says, "wo er la?"

NNS PC 1 says, "yep"

NES PC 2 says, "cool"

NNS PC 1 says, "wo e la"

NNS PC 1 says, "let's go"

NNS PC 2 says, "yes that correct"

NES PC 2 says, "wo e la"

**Figure 31** ESL students teach an African American student the Mandarin phrase for "I am hungry."

## **7.7 Future Work**

This body of research represents one aspect of designing virtual worlds that assist with cross-cultural communication. More work remains if serious game designers hope to build virtual worlds that achieve synergy amongst diverse inhabitants. I outline future research thrusts in the proceeding sections.

### **7.7.1 Additional Experimental Studies**

Though I was able to conduct playtesting of the game mod, the small sample size makes it difficult to draw conclusions applicable to the general population. An experimental study with a large sample size (e.g. a minimum of 10 or more ESL students) will provide external validity that the game mod actually increases ESL students' proficiency in English. In addition, I would like to extend the time frame that ESL students interact with NES participants during gameplay. Longer game sessions allow researchers to collect a large corpus of data that can be used for study and construct serious games that support collaborative learning. Analysis of game logs and recorded computer screen interactions will give researchers the opportunity to scrutinize group dynamics and understand which communicative acts build relationships in virtual worlds and which ones hinder cooperation among PCs.

In the course of conducting these studies, I will introduce foreign language instructors to the benefits of participatory design as we work together to create game modules for foreign language learning. This will open the door to investigating other foreign language populations such as French, German, Japanese and Russian supported by EQ2. Foreign language instructors will share their content knowledge and provide valuable insight during the conceptualization

phase of serious game design. Participatory design of game modules for language learning will promote digital literacy, and the ability to use game development tools to create game modules [87]. Participatory design will help to eliminate some of the skepticism of video games as effective pedagogical tools and reinforce the important role instructors play in digital learning environments.

### **7.7.2 Examination of Cultural Biases in Virtual Worlds**

I chose English as the second language, because it is the dominant language in America. Because the game is developed by an American company, EQ2 embodies cultural biases associated with American culture. While this is a benefit for students learning English, it may pose a problem for students playing EQ2 to learn a different language. This raises several questions. Does EQ2 provide adequate support for students developing proficiency in a target language other than English? Do the social interactions with PCs who speak a different native language reveal the cultural differences between foreign language students' culture and the target culture? Is there a universal gaming culture that overrides cultural differences associated with nationality, linguistic capability or ethnicity? This particular line of research explores designing inclusive virtual environments for diverse groups of users and leveraging the elements of play for collaborative interactions [10]. I posit that it is not enough to simply design a serious game that is available to anyone who chooses to download and play it as a means of creating an inclusive virtual world. Rather, design-based research facilitates a framework for inviting cross-cultural communication in virtual environments and sublimely endorsing a democratic virtual world [9, 10]. Additional experimental studies of native English speakers who are learning a foreign language and paired with native speakers of the target language will derive answers to these

questions. Furthermore, the design of intelligent interfaces that provide cultural information about users in the virtual environment can foster cooperative behaviors among diverse globally distributed users.

### **7.7.3 Real-Time Conversation with Intelligent Non Player Characters**

One contribution of this body of work emphasizes the role in-game social interactions play in ESL students' communicative performance and vocabulary acquisition. This suggests that game designers can leverage social interactions by designing intelligent Non Player Characters (NPCs) that are capable of engaging in adaptable conversation with PCs and are knowledgeable of cultural norms associated with the target language. NPCs' real-time responses to PCs' questions would function as in-game scaffolds that support conversational fluency and cross-cultural communication. Thus, the goal is to design intelligent NPCs that generate real-time conversation based on their knowledge of cultural norms associated with the target language and communicative behaviors that foster collaborative relationships with foreign language students in virtual worlds.

## **7.8 Conclusions**

In summary, user-centered game design provides an alternative but effective solution to serious game design. Its effectiveness lies in its ability to integrate assessment of learning objectives early in the serious game design process. Playtesting serves as the connecting bridge between the multiple phases of game development. My research supports the claim that MMORPGs can function as pedagogical tools for second language acquisition. I define user-centered game design and the role of evolutionary playtesting in the game design process. Moreover, I develop two game modules, an in-game dictionary that accommodates second



language acquisition and a game interface that facilitates communicative competence (what to say and when to say it) to foster emergent, cooperative relationships in virtual worlds. My research provides the basis for designing virtual worlds that integrate communication tools to support globally distributed, diverse teams.

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## **Appendix A**

### **Game Specification Sketch for EverQuest II Plug-In**

I identify the specifications of the design of a serious game that facilitates the cognitive processes associated with Second Language Acquisition:

1. Concept or theme of the game: The concept is to design a game plug-in for EverQuest II (EQ2) that improves English as Second Language (ESL) students' SLA skills as a result of social interactions experiences during gameplay.
2. Learning domain and objectives:
  - a. The domain is Second Language Acquisition (SLA).
  - b. The first learning objective is for ESL students to increase their English vocabulary.
  - c. The second learning objective is for ESL students to increase their reading comprehension skills in the target language.
  - d. The third learning objective is for ESL students to improve their English communicative performance skills, specifically their ability to hold a conversation with native English speakers.

3. Game activities that represent potential learning opportunities:
  - a. Vocabulary words introduced in Non Player Character speech concerning information about various quests provide the context for ESL students acquiring additional English vocabulary words. This game task also fosters ESL students' English reading comprehension skills.
  - b. EQ2 offers ESL students easy access to native English speakers. Social interactions with native English speakers via chat logs assist ESL students with a deeper understanding of the semantics of English vocabulary words.
  - c. The activity of ESL students chatting with native English speaking Player Characters (PCs) in English as they establish strategic partnerships gives them plenty of opportunities to improve their conversational skills.
  - d. The display of typed text in chat window allows ESL students to correct syntax and think about semantics of message, engaging them in reflective thinking as they engage in conversation with PCs.
  - e. The game plug-in scaffolds these social interactions by offering conversational prompts that support ESL students engaging in conversations with PCs. The conversational prompts are classified

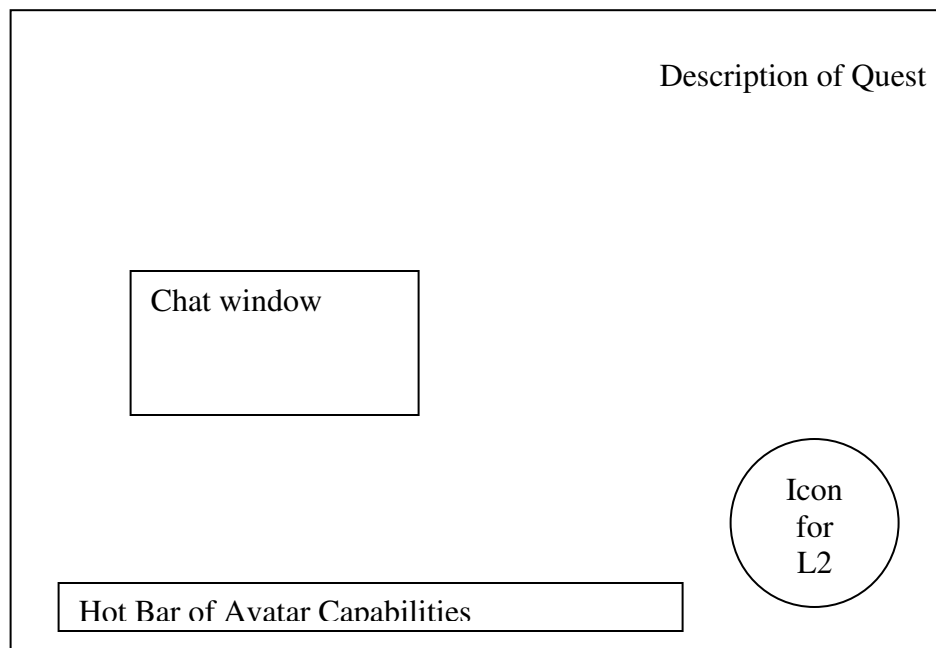
according to three communication tasks typical of social interactions in EQ2---meeting PCs, collaboration on quests, and establishing long-term relationships with PCs.

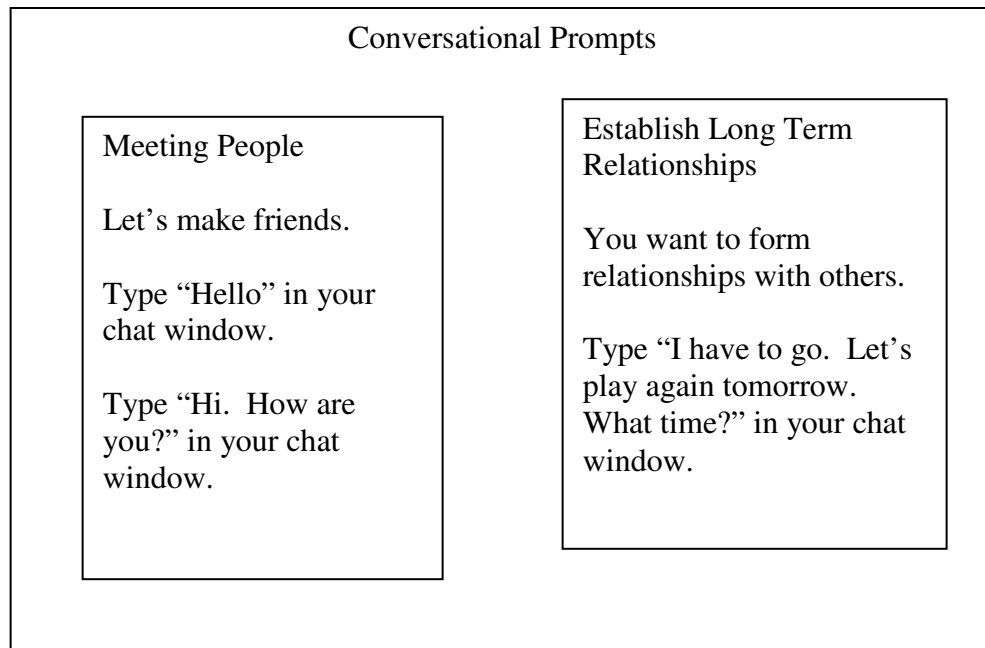
4. Method for assessment of learning outcomes:

- a. Pre and post-tests assessments of second language (L2) vocabulary where ESL students use L2 vocabulary in sentences to demonstrate meaning. The differences in the pre and post-test assessment will identify learning gains related to the gameplay experience.
- b. Pre and post-tests assessments of ESL students reading comprehension skills using L2 vocabulary in the context of gameplay activities and outside the context of gameplay activities (assessment of transfer).
- c. A comparison of the number of chat messages generated by ESL students who use the game plug-in versus those ESL students who play EQ2 without use of the game plug-in.
- d. Qualitative analysis of the comparison of ESL students' and native English speakers' communication patterns of their social interactions with one another.

- e. Post-gameplay survey that measures the effects of the gameplay experience on ESL students
- f. Post-gameplay interview that captures the perspective of ESL students

5. Mock-ups of game interface & plug-in





6. Game controls including mouse, keyboard and menu controls:

- a. Arrow keys on the keyboard manipulate text in the chat window up, down, to the right and left.
- b. Players use the keyboard to enter text in the chat window.
- c. The plug-in is an optional window that players assess through the Options menu. The plug-in consists of three tabs that represent different categories of social interactions (e.g. Meet PCs, Work together, and Form Relationships). See Mock-up above. Players can click on the upper right corner to close the conversational prompts.

7. Desirable system behaviors of game plug-in:

- a. Visibility: an icon that indicates game plug-in is available to user if needed (So how do we let the user know that language supports are available for use during gameplay?);
- b. Intuitive: user does not need a manual to understand how to use plug-in;
- c. Multi-modal capability: text & speech output in both target language and user's native language.

## Appendix B

### Code Cookbook for *EverQuest® II* NNS/NES Language Studies

#### 1. Overview of Game Study

We conducted an experimental study to gauge the effects of social interactions with Player Characters (PCs) and Non Player Characters (NPCs) on English as Second Language (ESL) students' English proficiency skills as they played Sony Online Entertainment's Massively Multiplayer Online Role Playing Game (MMORPG) *EverQuest® II*. *EverQuest® II* provides opportunities for PCs to explore the virtual world of Norrath as they complete quests that enable successful character evolution (e.g. health, knowledge, abilities) of their personally created avatars. The study was conducted for a total of three weeks as collaboration between Tennessee State University Research & Sponsored Programs and Mississippi College Intensive English Program. Eighteen ESL students from Mississippi College participated in the study while seven Native English Speakers (NES) were recruited from the Tennessee State University (TSU) student population to participate in the study. Each ESL student participated in two conditions: 1. Participants played *EverQuest® II* alone and 2. Participants were divided into groups with NES and played *EverQuest® II* (EQ2). Game logs were collected for each ESL and NES participant.

#### 2. Content Analysis of Game Logs

Chat messages served as the primary means for communicating with other PCs during gameplay activities. Game logs include chat messages, a sequential record of game events

(e.g. interactions with NPCs, physical encounters with enemies, newfound abilities, etc.).

The purpose of the study was to examine the social interactions and compare the communication patterns of NES participants to ESL students. To accomplish this task, we modified the Dialogue Act Markup in Several Layers (DAMSL) created by Allen & Core [68]. Using the *Forward Looking Function Layers*, we chose to analyze units of independent clauses in terms of their effect on subsequent social interactions. Because DAMSL was developed for spoken dialogue more so than written and our research examines social interactions in MMORPGs, we extended the DAMSL code scheme, defining specific categories of social interactions affiliated with chat messages and providing examples below.

### **3. DAMSL Forward Looking Function Layers**

The purposes behind an utterance are very complex. This dimension characterizes what effect an utterance has on the subsequent dialogue and interaction. For instance, as the result of an utterance, is the speaker now committed to certain beliefs, or to performing certain future actions? Note it is often difficult to determine what actions the speaker intended to perform with an utterance. The effect that an utterance has on the subsequent interaction may differ from what the speaker initially intended by the utterance. For this reason, annotators are allowed to look ahead in the dialog to determine the effect an utterance has on the dialog. Several decision trees are presented that instruct annotators on how to make labeling decisions. The decision trees ask questions about the speaker's actions but the annotator may need to see how the listener responds to the speaker in order to determine the speaker's intent. Often, there are many different effects simultaneously achieved by an utterance. To allow for this, the coding in this dimension allows eight different aspects of every utterance to be



coded. Specific constraints on how many aspects you can code at a time and the criteria for choosing between cases where several seem applicable will be specified in the domain-specific annotation instructions. As a default case, you can assume that you should code all aspects that are applicable.

### **Forward Looking Function**

- Statement
  - Assert
    - World
    - Self
    - Others
  - Reassert
    - World
    - Self
    - Others
- Influencing Player Character's Future Actions
  - Open Option
  - Action Directive
- Info Requests
  - Questions
    - Personal info
    - Game activities
  - Info

- Personal info
  - Game activities
- Other
- Committing Player Character to Future Action
  - Offer
  - Commit
- Conventional Conversation
  - Openings
  - Closings
- Explicit Performative
- Exclamation
- Other-Forward-Function

### 3.1 Statements

Core & Allen [68] defined statements to be messages that make claims about the world. These statements are classified as Asserts, Reasserts, and Other Statements.

Asserts are the sender's attempt to change the receiver's beliefs. We modify this category to include Asserts about the world (e.g. "This is so boring."), self ("I cannot talk right now.") and others ("She needs to go talk to NPC Tayil N'Velex."). As a rule, the content of statements can be evaluated as being true or false. For the category of *Asserts-Self*, the sender makes explicit claims about self that are assumed to be true unless the receiver has personal knowledge about the sender that can challenge the validity of the *Assert-Self* (e.g. Sender says, "I am not feeling well." The receiver accepts the sender's message as

being true unless the Receiver has reason to suspect the sender is not sick.) Thus, it is not necessary that annotators judge the statements as true or false. The primary purpose of statements is to make claims; this can also be accomplished by answering questions. This classification also includes weak forms of statements such as hypothesizing or suggesting that something might be true. The sender does not have to be strongly claiming that something is true or false. Therefore, we would not code “It is true that she is the leading candidate for the position,” as an *Assert-Others*. We define *Assert-Others* to be claims made about others (e.g. “She had something she had to do.”). As an intuitive test as to whether an utterance makes an explicit claim, consider whether the utterance could be followed by “*That's not true!*”

*Reasserts* are defined as statements that represent previously made claims. These are easily detected as repeated chat messages or independent clauses within one chat entry. Once again *Reasserts* can be evaluated as true or false. See table 1 for examples.

Statements	Asserts	Reasserts
<b>World</b>	“This is so boring.”	1 <sup>st</sup> time: “I can’t the parchment.”
	“Stupid game.”	2 <sup>nd</sup> time: “I can’t find it.”
<b>Self</b>	“I do not like this game.”	1 <sup>st</sup> time: “I’m lost.”

Others	“I don’t know how to add you to the group.”	2 <sup>nd</sup> time: “Hey, I’m lost!”
	“I am from China.”	
	“I am hungry.”	
	“I’m studying business.”	
	“We live in Chicago.”	
	(in answer to a question)	
	“R u done?” “Yes”	
	“They need to level up.”	1 <sup>st</sup> time: “They keep killing us.”
	“She’s very beautiful.	2 <sup>nd</sup> time: “Keep killing us over and over.”
	“u have to attune ur weapon.”	

**Table 1 Statement Categories with examples from game logs.**

### **3.2 Influence on Player Character’s Future Actions**

Group dynamics involve members influencing other members to work together to accomplish a goal. Influencing others’ actions is a critical component of collaboration and critical to team work. There are many verbs in English that describe variations of these acts that differ in strength, including acts like command, request, invite, suggest and plead. Influence on the Player Character (PC), the receiver, refers directly to the contents of the sender’s chat message influencing the receiver’s future non-communicative actions (“Follow me.” and “Go talk to that guy over there.”). If the Sender specifically requests that the PC perform a specific action (“Let’s go.”), we

categorize this as *Action Directive*. *Action Directives* usually require cooperation or agreement (e.g. PC follows the Sender in response to “Let’s go.”) from the PC who represents the receiver or an indication that the PC will not complete the action. Careful examination of the PCs subsequent actions in the game logs indicates if the Sender complied or refused to cooperate. If the Sender is suggesting a course of action regarding gameplay (“Shall we go?”), then the chat message is labeled *Open Option*. *Open Options* do not require agreement or cooperation from the Receiver. Rather the Sender is hoping to influence the PC using a more subtle approach. See table 2 for more examples.

<b>Influence on PC’s Future Actions</b>	<b>Action Directive</b>	<b>Open Option</b>
	“Follow me.”	“Shall we go?”
	“u have to attune ur weapon.”	“Maybe we should just pick another one.”
	“Come on.”	"Aight, lets go fight some real stuff"
		“Are y’all ready to go?”
		“U need to invite Sally to the group.”

**Table 2 Influencing Player Character’s Future Actions.**

### **3.2 Info Requests**

The *Info Request* aspect is simply a binary dimension where questions and other requests for information are marked. Chat messages that introduce an obligation to

provide an answer should be marked as *Info Request*. In the context of gameplay, *Requests* are made in two formats: 1. The PC asks questions to get information. 2. The PC commands that information is given. Thus, we have two categories: *Questions* and *Information*. *Info Request* includes all questions, including yes/no questions (e.g. “Are u the leader?”) and Wh-questions (e.g. “Where r u from?”). Chat messages that are labeled as *Request -Information* are not in question format. Examples include “Tell me where NPC Tayil N’Valex is?” or “Show me where the Lost Soldiers r?” *Requests-Information* obligates the Receiver to provide information. Both the *Questions* and *Request Info* categories have two subcategories: *Personal information* and *Game Activities*. Personal Information includes questions about details of personal life (“What r u eating for dinner?” or “Tell me y u moved to California.”) while Game Activities refers to requests for information regarding quests or team strategies related to game events (“So where do u want to go next?”). See table 3 for more examples.

<b>Info Requests</b>	<b>Questions</b>	<b>Request</b>
Personal Info	“Where r u from?”	“Tell me her name again.”
	“What school?”	
	“????”	
	“huh”	
Game Activities	“Does anyone know how to swim?”	“Show me where Assassin Vamir is?”

	“Which quest r u on?”	“Tell her to go back to the boat.”
Other	“How do you say ‘I’m hungry’ in Chinese?”	

**Table 4 Examples of Info Requests and its subcategories.**

**3.3 Committing Player Character to Future Action**

The defining property of Committing Sender to Future Action chat messages is that they potentially commit the PC (in varying degrees of strength) to some future course of action. Core & Allen [68] define two subcategories: *Commit* and *Offer*. The only distinction made between the two subcategories is whether the PC’s commitment is dependent on the Receiving PC’s agreement or not. Commitments of future actions that are conditional on the Receiver’s agreement include what are called offers in English where the speaker indicates willingness to commit to an action if the PC accepts it (*Offer*: “*I will distract him while you run to the other side.*”). The prototypical case of a *Commit* not dependent on listener agreement is a promise, although this category may include other weaker forms of commitment such (*Commit*: “I’ll probably leave soon.”). The Sender is not making an offer here; He/she is just not making a very strong commitment. We believe commitment on the part of the Sender facilitates individual contribution to team efforts. For this reason, we want to evaluate PC chat messages for commitment to complete some future action. See table 5.

Committing Sender to Future Action	Offers	Commits
	“I’ll make them follow me and u beat them.”	“I will go find her.”
	“Shall we go?”	“I’ll make them follow me.”
		“I am getting ready to leave.”
		"Aight, lets go fight some real stuff"
		In response to Action Directive:
		<b>“Okay.” (committing the speaker to future action)</b>
		<b>“We’ll figure it out.” (We includes speaker so it is a commitment to a future action.)</b>

**Table 6 Examples of Committing Sender to Future Action.**

**3.4 Conventional Conversations**

Conventional Conversations refers to chat messages that initiate (*Openings*: “*Hail*” or “*Hello*”) conversation or end (*Closings*: “*C u later*” or “*Bye*”) conversation with other PCs. The key word here is “Conventional.” Thus, *Openings* and *Closings* are typical phrases used in virtual environments as well as phrases used in face-face interactions to start or end a conversation.

Conventional Conversations	Openings	Closings
	“Hail”	“Bye”



“Hellooooo”	“C u later”
“Hi”	“Goodbye”
“Hey”	“Later”
“How u doin?”	“Gone”
"What's up"	“I'm out.”
	“TTYL”

Table 8 Examples of Conventional Conversational Openings & Closings.

### 3.5 Exclamations & Explicit Performatives

*Exclamations* convey emotions (e.g. “OMG”). Exclamation points typically are used for *Exclamations* but are not required. *Explicit Performatives* include words that then when written perform an action. The chat message “Thanks,” performs the action of expressing gratitude. Note: the act of writing certain acronyms (e.g. “LOL” for Laughing Out Loud”) instantiates the act.

<b>Exclamations</b>	<b>Explicit Performatives</b>
“OMG”	“LOL”
“Help me!!!”	“hahahaha”
“No, no, no”	“hee hee”
"Cool "	“LMAO”

Table 7 Examples of Exclamations and Explicit Performatives.

### **3.6 Other Forward Functions**

This refers to chat messages that do not fit any of the above categories.

## Appendix C

### Sample of Assessment for Second Language Vocabulary

#### Word Bank

Choose one word to fill in the blanks in the paragraph below. You may only use the word once.

- |               |                  |                |
|---------------|------------------|----------------|
| 1. aggression | 2. agility       | 3. arcane      |
| 4. assassin   | 5. berserker     | 6. coagulated  |
| 7. condemn    | 8. consciousness | 9. constrict   |
| 10. corpse    | 11. encounter    | 12. erudite    |
| 13. fervent   | 14. formidable   | 15. necromancy |
| 16. quest     | 17. parry        | 18. periodic   |
| 19. riposte   | 20. sentry       | 21. stance     |
| 23. stealth   | 24. subjugated   | 25. writhed    |

As she gained \_\_\_\_\_, the young \_\_\_\_\_  
 (noun) \_\_\_\_\_ (verb) in pain as she lay before her opponent posed as a  
 \_\_\_\_\_ by the front door after her failed attempt to \_\_\_\_\_  
 her target's defensive blows. Sharon revisited the \_\_\_\_\_ in her mind and  
 tried to understand what had gone wrong. This was an unusual \_\_\_\_\_,  
 requiring \_\_\_\_\_ devotion and commitment. Under strict orders from the  
 colonel, Sharon had \_\_\_\_\_ her body to immense pain to prepare for this  
 crucial assignment, increasing in \_\_\_\_\_ due to \_\_\_\_\_ intense  
 training sessions for the past six months. She had underestimated her target's strength  
 and was unable to \_\_\_\_\_ when the target responded to her \_\_\_\_\_  
 knife thrusts. Though she did not believe in the use of dark arts, Sharon despised her  
 target's political \_\_\_\_\_ on mystical issues, denouncing  
 psychics as followers of \_\_\_\_\_ and arresting them for  
 communicating with those who no longer walked on this side of eternity. Therefore, she  
 accepted this assignment with a deep felt derision for the target. Sharon considered  
 herself to be a(n) \_\_\_\_\_, definitely not your typical

\_\_\_\_\_. After all, she could not afford to make mistakes or her  
\_\_\_\_\_ would wind up at the morgue. It was crucial that  
Sharon \_\_\_\_\_ the flow of the warm liquid  
\_\_\_\_\_ in a pool on the floor. Now she wondered if she had made  
a fatal mistake.

Thank you for completing the questionnaire!!!