Massively multiplayer online role-playing games as arenas for second language learning

Mark Peterson [a]

[a] Graduate School of Human and Environmental Studies, Kyoto
University, Yoshida Nihonmatsu-cho, Sakyo-ku, Kyoto, Japan

Available online: 15 Nov 2010

PLEASE SCROLL DOWN FOR ARTICLE

Massively multiplayer online role-playing games as arenas for second language learning

Mark Peterson*

Graduate School of Human and Environmental Studies, Kyoto University, Yoshida Nihonmatsu-cho, Sakyo-ku, Kyoto, Japan

This article investigates contemporary research on the use of massively multiplayer online role-playing games (MMORPGs) in language education. The development and key features of these games are explored. This is followed by an examination of the theories proposed as a basis for game-based learning, and the claims made regarding the value of utilizing network-based gaming in computer assisted language learning (CALL). A critical analysis of three influential learner-based studies drawn from the literature is then undertaken. This reveals that present research is largely exploratory in nature and is subject to limitations. The analysis draws attention to the role played by learner training and indicates that for intermediate and advanced level English language learners, MMORPGs offer a motivating context that elicits engagement in beneficial forms of target language interaction. Research further suggests that learner participation in network-based gaming provides valuable opportunities for vocabulary acquisition and the development of communicative competence. This article concludes by highlighting the urgent need for additional studies and identifies areas with potential in future research.

Keywords: gaming; MMORPGs; virtual environments

Introduction

The use of computer games in education has long been a focus of interest for researchers. The potential of gaming to develop skills associated with learning has been examined in an extensive literature (Aldrich, 2009; Prensky, 2001, 2006). Influenced by this work, computer assisted language learning (CALL) researchers have investigated the potential of computer games as tools for language learning (Ang & Zaphiris, 2006). Early work focused primarily on the adaption of commercial stand alone games for use in language education (Coleman, 1990; Taylor, 1990). Although this work has continued (Anderson, Reynolds, Yeh, & Huang, 2008; Coleman, 2002), a further significant trend in research has involved the development of prototypes designed specifically for language learning (Li & Topolewski, 2002; Mich, Betta, & Giuliani, 2004). Unfortunately, development costs have somewhat restricted work in the area. However, the emergence of low cost

*Email: M.Peterson@fx8.ecs.kyoto-u.ac.jp

network-based gaming has opened up new opportunities for research (Meyer & Sørensen, 2007, 2008; Peterson, 2010). At a later stage, the findings of learner-based studies on the use of massively multiplayer online role-playing games (MMORPGs) as tools for language learning will be analyzed. In order to provide a context for this discussion, the following sections will provide an overview of the development of network-based gaming.

The development of MMORPGs

The emergence of MMORPGs can be traced back to the late 1970s, when early theme-based adventure games such as multi-user dungeons (MUDS) emerged (Bartle, 2003). These fantasy games immerse the user in text-based virtual realities where individual players can engage in real-time communication, role-play, and character customization by typing commands. The use of these commands also enables manipulation of virtual objects, navigation within a virtual geography and in-game interaction with non-player characters. The successful completion of game tasks usually requires collaboration between players and enables a degree of progression within the game hierarchy. Later developments in programming saw the emergence of object-orientated MUDs known as MOOs, which enable individual users to create new content within a MUD world (Hayes & Holmevik, 2001). The above features of online gaming retain their influence on designers of MMORPGs who have created a new generation of advanced role-playing games that utilize developments in computer technology and the dramatic expansion of the Internet. Contemporary MMORPGs retain many of the central elements of early text-based adventure games and they also incorporate a number of recent innovations. The following discussion will examine these features, and show that the latest MMORPGs are becoming an increasing focus of interest to the CALL research community.

MMORPGs: main characteristics

As was observed previously, MMORPGs incorporate many of the features of earlier role-playing games. Contemporary MMORPGs, such as the popular World of Warcraft, retain the use of fantasy themes based on character role-play, real-time communication with other players, interaction with non-player characters and progression in the game through the completion of tasks known as quests. As is the case with earlier networked-games, MMORPGs require communication and teamwork between players as they form alliances that are necessary to complete required quests. However, modern MMORPGs incorporate a number of features made possible by advances in computer technology. The use of text chat as the primary means of communication between users within a game has been supplemented by the use of voice communication tools. This development has enabled game players to utilize both visual and auditory channels during communication. The dramatic expansion of the Internet has enabled designers to vastly expand the scope of network-based games to enable very large numbers of players to interact within a game world at any given time. Current MMORPGs are large-scale permanent virtual worlds providing access to high-quality 3D graphic interfaces that are characterized by a high degree of realism and immersion.

Many of these games are in a state of constant development providing players with exposure to engaging user created content. In a further departure for earlier

network games, MMORPGs facilitate game play through the use of customizable character avatars. These 3D graphical agents enhance the sense of immersion experienced by players, supporting communication, social interaction, role-play, and the process of community formation between users (Peterson, 2006). As these features of game playing may support language learning, in recent years, the CALL research community has explored in an emergent body of work, the potential of MMORPGs as tools for language learning. This effort has been influenced by developments in theories of language learning and literacy, which, as the following discussion will show, may be utilized as a rationale for the use of network-based games in language.

The use of MMORPGs in CALL: rationales

Theories of second language acquisition (SLA) stress the important role played by interaction in language learning (Gass, 2000; Long, 1996). According to the psycholinguistic account of language learning, the cognitive restructuring involved in language development is enhanced through real-time interaction in the target language (henceforth TL). The psycholinguistic interactionist literature identifies two specific types of interaction that may facilitate SLA. The first involves the interaction engendered during communication problems. This type of interaction, which is known as negotiation of meaning, involves the use of repair strategies such as, for example, clarification checks and comprehension checks. The use of these strategies enables the resolution of a communication problem relating to unknown vocabulary or content, through the production of comprehensible input and modified TL output, a process that is perceived as facilitating SLA (Long, 1991). The second type of interaction involves a focus on form. An emphasis on specific TL forms coupled to exposure to corrective feedback during interaction focuses learner attention on problems in their linguistic output. Research suggests that this process promotes language development by fostering a conscious ability to notice problematic TL utterances (Ellis, 2005).

A further strand of interactionist research focuses on how social rather than linguistic factors may facilitate language learning during interaction. According to this account, a key influence on language development is the social nature of interaction (Lantolf, 2000). Drawing on sociocultural theory, this view of SLA claims that second language learning is facilitated through the co-construction of meaning in the TL involving collaborative dialog and the creation of zones of proximal development (ZPDs) (Lantolf & Thorne, 2006). The latter term describes interactive states where individual learners can undertake functions they could not carry out independently through collaboration with more capable peers (Donato, 1994). From the sociocultural interactionist perspective, the operation of ZPDs creates the conditions in which language learning may occur.

From the above perspectives, MMORPGs appear as promising arenas for language learning. As Table 1 shows, from the perspective of psycholinguistic research, network-based games incorporate elements that offer a number of potential benefits for language learners. In game play, learners are exposed to the TL in an authentic communication context that provides valuable practice in the four skills. The presence of network communication tools provides plentiful opportunities for purposeful real-time interaction involving TL use and reuse (Peterson, 2010). Moreover, the international nature of network-based gaming provides access to diverse interlocutors, including native speakers, providing opportunities to develop

Table 1. Hypothesized advantages of utilizing MMORPGs in CALL.

Design feature	Hypothesized advantages
Network-based real-time text and voice chat	Access to diverse groups of interlocutors, including native speakers
	Multiple communication channels provide real-time feedback
	Exposure to the TL
	The presence of text and scrolling supports monitoring
	Extensive opportunities for purposeful TL use and reuse in an authentic and engaging communicative context
	Practice in the four skills
	Opportunities to engage in co-construction, negotiation, and the development of communicative competence
	Learner-centered interaction encourages active participation
	Enhanced cross-cultural knowledge
Challenging theme and goal-based interaction	Motivation enhanced
	Enjoyment
	Situated learning
	Community formation
	Development of collaborative social relationships
Personal avatars	Enhanced immersion
	Opportunities for role-play and risk-taking
	Reduced inhibition and social context cues

communicative competence and the cross-cultural knowledge that plays an important role in language learning. The presence of native speakers creates the conditions in which communication problems may occur, providing opportunities for learners to negotiate meaning. Text and voice chat provide real-time feedback and the permanence of text coupled to the availability of scrolling facilitates monitoring, a focus on form and the resolution of communication problems. The reduction in social context cues made possible by the online nature of games and the learner-centered of the interaction, coupled to the presence of personal avatars may enhance participation and engagement (Garcia-Carbonell, Rising, Montero, & Watts, 2001).

The cooperative nature of learner social interaction during online gaming has been noted in the sociocultural literature (Bryant, 2006). Studies have shown that as MMORPs are designed to facilitate social communication and teamwork, users frequently form communities based on their in-game interaction (Nardi & Harris, 2006). Exploratory research involving language learners suggests that a friendly non-threatening atmosphere prevails, indicating enjoyment and reduced inhibition (Bryant, 2006). These are factors that may be conducive to increased risk-taking. Game communities further support the development of interpersonal relationships engendered by frequent game-related interaction and as is the case with native speakers, learner game-based communities are distinguished by a high degree of collaboration and social cohesion (Rankin, Gold, & Gooch, 2006a). Researchers have observed that during interaction in network-based games, learners also engage in the kind of collaborative interaction involving dialog, co-construction in the TL, and the creation of ZPDs, that are held from the perspective of sociocultural research, to facilitate language learning (Thorne, 2008).

In addition to interactionist theories of SLA, the new literacies movement also provides a number of constructs that may be utilized in a rationale for the use of

MMORPGs in CALL (Lankshear, Gee, Knobel, & Searle, 1997; Steinkuehler, 2007). From this perspective, well-designed computer games are perceived as supporting learning as it is argued, most notably by Gee (2008), that they embody principles essential to effective learning. The central claim made by proponents of this view, is that certain types of computer game provide contexts for challenging situated learning (Bryant, 2007). In this type of game, the learner is immersed in a simulated environment where they must utilize a virtual surrogate (avatar) in order to recognize and solve various problems encountered during play. An individual user must come to understand through feedback, trial and error, the rules of the game in order to achieve a goal. In order to complete game tasks and progress in the game, players must develop the kind of complex cognitive skills associated with solving problems. Proponents of game-based learning argue that as games engage players in authentic situated problem solving, they facilitate learning that can be transferred to other domains (Gee, 2003). Gee claims that as computer games enable language to be put in the context of dialog, they enable language to be situated. This provides an ideal environment for language learning as verbal information is given just in time and is provided in an appropriate context (Gee, 2005). Moreover, the engaging learner-centered nature of gaming coupled to the high degree of immersion experienced by users provided by the presence of personal avatars engenders a high degree of motivation, a key factor for successful language learning (Bryant, 2008; Gee, 2003).

The above views of learning and the design features of MMORPGs can be utilized to construct a credible rationale for the use of network-based gaming in CALL. Although the above accounts of learning differ in their emphasis, they share a positive view on the potential benefits of engaging language learners in the types of purposeful real-time interaction made possible by network-based gaming. As Table 1 shows, the opportunities for communication, immersion, situated learning, and social interaction in the TL made possible by well-designed network-based games would appear to provide a beneficial context for language learning. Moreover, the high levels of interest and motivation reported in the literature are challenging to replicate in traditional language classrooms (Bryant, 2006). In order to establish whether the hypothesized benefits outlined previously are realized in learner-based studies, the following discussion will examine findings from current research. Although work in this area is at an early stage, exploratory research has been conducted, and three representative studies from this body of work will be investigated. These studies are selected for analysis as they focus specifically on learner behavior during game play, and thus offer the prospect of providing valuable insights into the effectiveness of MMORPGs as tools for language learning.

Analysis of current research

A small-scale case study undertaken by Thorne (2008) analyzed interaction involving a native speaker and non-native speaker of English in the MMORPG World of Warcraft. This research focused on the analysis of the in-game and game-related interaction of the subjects who were located in America and the Ukraine. The data analysis showed that the participants engaged in beneficial forms of TL interaction. As may be observed in Table 2, a range of activities involved in language learning were identified, including extensive TL dialog, meaning negotiation, self, and other-initiated correction. Through participation in the game, the subjects formed a

Table 2. Key findings of learner-based studies on the use of MMORPGs in CALL.

Researcher(s)	Rankin, Gold, and Gooch (2006b)	Thorne (2008)	Rankin, Morrison, McNeal, Gooch, and Shute (2009)
Number and background of subjects	Five ESL students	Two gamers, an American native speaker of English located in the US and a speaker of Russian located in the Ukraine	Eight native speakers of English based in the US and 18 advanced ESL learners based in the US
Length of sessions and project duration	Four hours per week for four weeks	Thirty minutes	Six ESL learners attended three hours of classroom instruction Six ESL learners played the game for four hours Six ESL learners divided into three groups played the game with three groups of native speakers for five hours
Analysis technique(s)	Analysis of learner game play activity and chat interaction Researcher observation pre- and post-study questionnaires, post-study interviews	Case study involving analysis of the subjects in-game and game-related interaction A follow-up interview	Analysis of chat transcripts Pre- and post-test measures of 12 low frequency vocabulary items, including both game-related and college level vocabulary
Key findings	Enhanced TL output and vocabulary understanding for the majority of subjects Variations in proficiency level appeared to influence learner perceptions with higher level participants reporting positive perceptions while the high-level beginner student experienced techno stress	TL interaction involving dialog, negotiation, self, and other initiated corrections Collaborative interpersonal relationships engendered through participation in the game Game-related interaction supported motivation and enjoyment The context provided opportunities to learn outside the limitations of conventional educational environments	Post-test scores showed that the groups that took part in game play demonstrated significantly higher understanding of selected vocabulary than the other subject groups The native speakers adopted leadership roles Although the subjects experienced difficulties as the in-game interaction progressed they produced extensive TL output appropriate to the context and engaged in collaborative dialog

supportive interpersonal relationship that involved a high degree of TL collaboration on game-related tasks. The subjects' communication was characterized by the use of humor and politeness. In a post-study interview, Thorne observed that the subjects claimed that they found the game to be enjoyable and that their motivation for language study was enhanced.

These findings draw attention to the potential benefits of engaging learners in World of Warcraft. In this research, participation in TL game play and game-related communication appeared to reduce inhibition and this had positive effects on learner enjoyment and motivation; factors that have been identifying as playing an important role in language learning. Moreover, from the perspective of interactionist research, interaction both inside and outside the game appeared to engender beneficial types of TL interaction, such as negotiation and collaborative dialog that are held to be important influences on language development. The findings further emphasize that the authentic learner-centered context provided by this MMORPG has the potential to create valuable opportunities to engage in language learning outside the confines of conventional classroom environments.

A mixed-methods study conducted by Rankin, Gold, and Gooch (2006b) investigated the game and chat activity of a small group of ESL learners in the MMORPG Ever Quest II. This research was designed to explore if participation in game play and real-time interaction with player and non-playing characters would increase the English proficiency of the participants. A secondary aim was to establish if the game provided adequate language learning support for learners with diverse levels of language proficiency. In the initial stages of this research, the subjects, who ranged from high beginner to intermediate level of proficiency, were provided with an orientation session on how to participate in the game. They were then required to undertake four gaming sessions. As Table 2 shows, data analysis revealed encouraging findings. Participation in the project generated enhanced TL output. This trend was more apparent amongst the advanced and intermediate participants, who generated more chat messages than their peers. This group also reported positive perceptions. There was also limited evidence for improvements in vocabulary knowledge, with the majority of the subjects displaying enhanced understanding of TL vocabulary generated during social interactions with other players. In their feedback, the majority of participants claimed that their vocabulary knowledge, reading, and conversation skills improved as a result of playing the game and interacting with both player and non-player characters.

This study produced a number of less positive findings. Researcher observation indicated that the lower-level learner experienced difficulties dealing with multiple competencies required by the environment and experienced cognitive overload. The researchers claimed that this suggests that the Ever Quest II platform does not provide the type of learning support necessary for high-level beginner ESL students and that its use should be restricted to intermediate or advanced level learners. Learner post-study feedback led the researchers to conclude that learning outcomes could be improved if the game included built-in language supports, such as audio for non-player avatars, to support the development of pronunciation skills. Overall, the findings of this study are encouraging and revealed the benefits of utilizing Ever Quest II with small groups of intermediate and advanced level ESL learners.

A further learner-based study involving use of Ever Quest II was reported by Rankin, Morrison, McNeal, Gooch, and Shute (2009). This study investigated the in-game interaction of ESL students who were native speakers of Mandarin and eight

native speakers of English. The researchers assessed the effects on the subjects' vocabulary acquisition prior to and proceeding game play. An experienced language instructor selected 12 low-frequency vocabulary words (for example, wizard, coagulated, coalesce) that were utilized in non-player characters' speech to supply information on quests during game play. In order to measure learner acquisition of the above words, the subjects were randomly assigned into three groups after an initial orientation period. One group was provided with three hours of conventional language instruction. Another group played the game for four hours. A final group played the game with the native speakers. As Table 2 shows, in a positive finding, analysis of post-test scores revealed that the groups, which played the game by themselves and with the native speakers, demonstrated significantly higher understanding of the target vocabulary than the other subject group.

The researchers further attempted to identify the communication patterns that occurred during in-game dialog between the native and non-native speaker group. Analysis of the 600 chat messages collected showed that the most frequent categories of speech act were openings and closings, requests for game or personal information, assertive statements, attempts to influence players' future actions, and player character's commitment to future actions. The researchers found that the native speakers adopted leadership roles during the interaction. This finding appears to be the result of the students, who were novice users, experiencing initial difficulties in comprehending the English-only game interface and vocabulary associated with the tasks. This finding also suggests that the limited duration of the pre-study training period affected learner performance. However, these difficulties did not result in communication breakdowns. In a positive finding, interaction in the game elicited extensive TL output. In their interaction with the native speakers, the subjects produced messages including greetings and clarification requests that were appropriate to the context. The native speakers provided suggestions and instructions on how to proceed, and this supportive guidance enhanced collaboration and led the students to become more comfortable as the game progressed. The researchers confirmed that as the project continued the subjects increased their output of chat messages, and that these messages contained a wider variety of game-related content over time. The findings on vocabulary learning are positive and suggest that MMORPGs may provide a valuable tool for vocabulary learning. The findings relating to communication patterns are equally encouraging, as they showed evidence of extensive TL output involving collaborative dialog.

Conclusions and directions for future research

The analysis conducted in this discussion draws attention to positive findings. The findings reported by Rankin et al. (2006b) and Thorne (2008) show the beneficial effects of participation in network-based gaming in terms of enhanced production of TL output and extensive practice in the four skills. These studies emphasize that the communication context provided supports social interaction based on the operation of collaborative interpersonal relationships. The positive learner feedback indicates that for a majority of subjects, inhibition was reduced, while enjoyment and motivation appeared to be enhanced by the game-based interaction. These studies contain evidence suggesting that interaction in a MMORPG facilitates situated learning involving collaborative dialog, negotiation, and self-repair. The research conducted by Rankin et al. (2006b, 2009) highlights

the apparent beneficial effects on vocabulary learning of interaction in MMORPGs, involving both learner and native speaker interlocutors. Findings reported in the above studies draw attention to the need for learner training. This research indicates that the environment provided by MMORPGs may be somewhat challenging for beginners and appears more suitable for learners of intermediate and higher levels of proficiency. The study conducted by Rankin et al. (2006b) further identifies the need for the addition of built-in language support in order to enhance learner performance during gaming.

As has been observed previously, the studies analyzed here are exploratory in nature and are therefore subject to a number of significant limitations that call for caution in interpretation of their findings. The small sample sizes and limited duration of these studies make the findings difficult to generalize. The reliance on learner feedback data raises potential issues associated with learner self-reporting. Another issue with this body of research lies in the absence of any evaluation of the grammatical accuracy of the learner TL output produced. Moreover, not all of the claims made regarding the value of utilizing MMORPs are borne by the findings reported in this body of work. Although these factors require recognition, the findings analyzed here, taken as whole, are broadly positive and suggest a number of areas with potential in future research.

The small-scale exploratory nature of the research examined in this discussion draws attention to the need for more large-scale longitudinal studies. The analysis conducted here highlights a number of areas that require investigation. The effects of sustained participation in network-based gaming involving diverse learner groups and proficiency levels may yield value evidence that the benefits identified can be sustained. Research exploring the interaction of such groups in international projects may shed new light on the development of learner cross-cultural knowledge. Additional research offers the further advantage of providing new perspectives on the role played by beneficial forms of interaction in the development of communicative competency in the online domain. The investigation of training effects and the influence of effective variables and reduced social context cues remain areas that offer the prospect of providing important new insights that can shape the future research agenda in this area. The use of data recording offers the prospect of obtaining new perspectives on learner behavior and its use by educators in learner-based projects may provide a useful means to raise awareness and facilitate the focus on form that plays an important role in second language acquisition. As has been noted in the literature (Rankin et al., 2006b), another area that would benefit from investigation is the use of supplementary and in-game learner-support materials. The rise of user-created content in gaming the so-called modding is of relevance here, as it provides educators with a powerful means to meet learner needs and create the conditions in which language learning may occur.

Increasing technological innovation and the dramatic expansion in online gaming presents CALL researchers with a dynamic field rich in opportunities. The studies analyzed here though exploratory in nature, and subject to limitations, nonetheless represent an important first step. This discussion has shown the urgent need for carefully designed learner-based studies that explore in greater depth, the opportunities for language development made possible by the use of MMORPGs. Future research offers the prospect of providing valuable new insights into the ways in which second language acquisition may be supported in network-based gaming environments.

Notes on contributor

Mark Peterson is an associate professor at Kyoto University. His current research focuses on exploring the use of games and simulations in computer assisted language learning, http://www.users.iimc.kyoto-u.ac.jp/~z59316/.

References

Aldrich, C. (2009). *Learning online with games, simulations, and virtual worlds: Strategies for online instruction*. San Francisco, CA: John Wiley.

Anderson, T.A.F., Reynolds, B.L., Yeh, X.-P., & Huang, G.-Z. (2008). Video games in the English as a foreign language classroom. In M. Eisenberg, Kinshuk, M. Chang, & R. McGreal (Eds.), *Proceedings of Second IEEE International Conference on digital games and intelligent toys based education* (pp. 188–192). Banff, Canada: IEEE.

Ang, C., & Zaphiris, P. (2006). Computer games and language learning. In T. Kidd & H. Song (Eds.), *Handbook of research on instructional systems and technology* (pp. 1–31). Hershey, PA: Information Science Reference.

Bartle, R. (2003). *Designing virtual worlds*. California: New Riders.

Bryant, T. (2006). Using world of warcraft and other MMORPGs to foster a targeted, social, and cooperative approach toward language learning. Retrieved from http://www.academiccommons.org/commons/essay/bryant-MMORPGs-for-SLA

Bryant, T. (2007). Games as an ideal learning environment. Retrieved from http://dspace.nitle.org/handle/10090/6565

Bryant, T. (2008). From age of Empires to Zork: Using games in the classroom. Retrieved from http://www.academiccommons.org/commons/essay/gamesinclassroom

Coleman, D.W. (1990). Computerized simulations and games for language learning: Part 1. *Simulation & Gaming: An Interdisciplinary Journal*, *21*, 443–444.

Coleman, D.W. (2002). On foot in SIM CITY: Using SIM COPTER as the basis for an ESL writing assignment. *Simulation & Gaming: An Interdisciplinary Journal*, *33*, 217–230.

Donato, R. (1994). Collective scaffolding in second language learning. In J.P. Lantolf & G. Appel (Eds.), *Vygotskian approaches to second language research* (pp. 33–56). Norwood, NJ: Ablex.

Ellis, R. (2005). Principles of instructed language learning. *System*, *33*(2), 209–224.

Garcia-Carbonell, A., Rising, B., Montero, B., & Watts, F. (2001). Simulation/gaming and the acquisition of communicative competence in another language. *Simulation & Gaming: An Interdisciplinary Journal*, *32*(4), 481–491.

Gass, S. (2000). Changing views of language learning. In H. Trappes Lomax (Ed.), *Change and continuity in applied linguistics: Selected papers from the annual meeting of the British Association of Applied Linguistics Edinburgh* (pp. 51–67). Edinburgh: BAAL.

Gee, J.P. (2003). What video games have to teach us about learning and literacy. *ACM Computers in Entertainment*, *1*(1), 20–24.

Gee, J.P. (2005). Why are video games good for learning? Retrieved from http://academiccolab.org/resources/documents/MacArthur.pdf

Gee, J.P. (2008). *What video games have to teach us about learning and literacy*. Basingstoke: Palgrave Macmillan.

Hayes, C. & Holmevik, J.R., (Eds.). (2001). *High wired: On the design, use and theory of educational MOOs*. Michigan: The University of Michigan Press.

Lankshear, C., Gee, J.P., Knobel, M., & Searle, C. (1997). *Changing literacies (changing education)*. Buckingham: Open University Press.

Lantolf, J.P. (2000). *Sociocultural theory and second language learning*. Oxford: Oxford University Press.

Lantolf, J.P., & Thorne, S.L. (2006). *Sociocultural theory and the genesis of second language development*. Oxford: Oxford University Press.

Li, R.C., & Topolewski, D. (2002). ZIP & TERRY: A new attempt at designing language learning simulation. *Simulation & Gaming: An Interdisciplinary Journal*, *33*, 181–186.

Long, M.H. (1991). Focus on form: A design feature in language teaching methodology. In K. De Bot, R.B. Ginsberg, & C. Kramsch (Eds.), *Foreign language teaching in cross-cultural perspective* (pp. 39–52). Amsterdam: John Benjamins.

Long, M.H. (1996). The role of linguistic environment in second language acquisition. In W.C. Richie & T.K. Bhatia (Eds.), *Handbook of research on language acquisition: Vol. 2. Second language acquisition* (pp. 413–468). New York: Academic Press.

Meyer, B., & Sørensen, B.H. (2007). Serious games in language learning and teaching: A theoretical perspective. In *Proceedings of the 2007 digital interactive games research association conference* (pp. 559–566). Tokyo: Digital Interactive Games Research Association.

Meyer, B., & Sørensen, B.H. (2008). Designing serious games for computer assisted language learning a framework for development and analysis. In M. Kankaanranta & P. Neittaanmäki (Eds.), *Design and use of serious games* (pp. 69–82). Berlin: Springer Verlag.

Mich, O., Betta, E., & Giuliani, D. (2004). PARLING: E-literature for supporting children learning English as a second language. In N.J. Nunes & C. Rich (Eds.), *Proceedings of the 4th International Conference on Intelligent user interfaces* (pp. 283–285). New York: ACM Press.

Nardi, B., & Harris, J. (2006). Strangers and friends: Collaborative play in World of Warcraft. In J. Turner & R. Kraut (Eds.), *Proceedings of computer supported collaborative work '06* (pp. 149–158). New York: ACM Press.

Peterson, M. (2006). Learner interaction management in an avatar and chat-based virtual world. *Computer Assisted Language Learning*, *19*(1), 79–103.

Peterson, M. (2010). The use of computerized games and simulations in computer-assisted language learning: A meta-analysis of research. *Simulation & Gaming: An Interdisciplinary Journal*, *40*, 863–885.

Prensky, M. (2001). *Digital game-based learning*. New York: McGraw Hill.

Prensky, M. (2006). *Don't bother me mom, I'm learning*. St. Paul, MN: Paragon House.

Rankin, Y., Gold, R., & Gooch, B. (2006a, July). Evaluating interactive gaming as a language learning tool. Paper presented at *SIGGRAPH 2006*, Boston, MA.

Rankin, Y., Gold, R., & Gooch, B. (2006b). 3D role-playing games as language learning tools. In E. Gröller & L. Szirmay-Kalos (Eds.), *Proceedings of EuroGraphics 2006* (Vol. 25, Number 3). New York: ACM.

Rankin, Y., Morrison, D., McKenzie, M.C., Gooch, B., & Shute, M. (2009). Time will tell: In-game social interactions that facilitate second language acquisition. In R. Michael Young (Ed.), *Proceedings of the 4th international conference on foundations of digital games* (pp. 161–168). New York: ACM.

Steinkuehler, C. (2007). Massively multiplayer online gaming as a constellation of literacy practices. *E-Learning*, *4*(3), 297–318.

Taylor, M. (1990). Simulations and adventure games in CALL. *Simulation & Gaming: An Interdisciplinary Journal*, *21*, 461–466.

Thorne, S.L. (2008). Transcultural communication in open Internet environments and massively multiplayer online games. In S. Magnan (Ed.), *Mediating discourse online* (pp. 305–327). Amsterdam: John Benjamins.