Original article

doi: 10.1111/j.1365-2729.2010.00353.x

Effectiveness of MMORPG-based instruction in elementary English education in Korea

S. Suh,* S.W. Kim† & N.J. Kim‡

*Chuncheon National University of Education, Chuncheon 200-703, Korea
†Ajou University, Suwon 443-749, Korea
‡Yonsei University, Seoul 120-749, Korea

Abstract This study investigated the effectiveness of massive multiplayer online role-playing game (MMORPG)-based (massive multiplayer online role-playing game) instruction in elementary English education. The effectiveness of the MMORPG program was compared with face-to-face instruction and the independent variables (gender, prior knowledge, motivation for learning, self-directed learning skills, computer skills, game skills, computer capacity, network speed, and computer accessibility) were examined to see how accurately achievement was predicted in MMORPG instruction. The results indicated that students studying English utilizing online role-playing games showed higher scores in areas of listening, reading, and writing than those who attended face-to-face instruction classes. It was also found that prior knowledge, motivation for learning, and network speed were factors affecting achievement in English learning. These findings suggest that MMORPGs can play an important role in improving English communicative skills.

Keywords elementary students, English education, instructional effectiveness, language learning, massive multiplayer online role-playing game, online game.

Introduction

In recent years, online games have increasingly become a major mechanism of socialization among a wide sector of the population. According to the Korea Game Development Institute, certain online games have become spaces where users of all ages can experiment with a variety of social interactions (Korea Game Development Institute 2004). In particular, massive multiplayer online role-playing games (MMORPGs), highly graphical 2D or 3D video games played online, allow individuals to interact not only with the gaming software but also with the avatars of other players through their self-created digital avatars (Steinkuehler 2003, p. 2). A major aspect of MMORPGs is these interactions, which enable collaborative exchanges of thoughts, emotions, and ideas among the game players (Brown 1994). Most of the interactions, which develop as players participate in MMORPGs, take place in the form of language and language skills, and this may be why MMORPGs evolving out of multi-user dungeons have been applied to educational environments (Lee *et al*. 2005; Lee & Hoadley 2006). The applicable principle of teaching and learning behind MMORPGs might be the very fact that at any time thousands of participants can be online interacting with one another at the same time, engaging in a 3D online representation of actual locations (Childress & Braswell 2006).

Accepted: 08 February 2010
Correspondence: Soonshik Suh, Chuncheon National University of Education, Chuncheon 200-703, Korea. Email: ssuh@cnue.ac.kr

Multiplayer online role-playing games and education

Play is an important mediator for learning and socialization throughout life (Rieber 1996), and research argues that online games can empower the role of learners in several ways. First, MMORPGs elicit learners' engagement (Jensen 2002), as learners are the centre of the game and every story is run by them. This enhances learners' motivation to participate in embedded learning tasks, which is ultimately likely to improve their achievement in the tasks (MUVEES Project 2003). Another factor that increases motivation is that the needs of learners to develop their own identities can also be addressed through online gaming activities (Bers 2001), as a learner constructs a virtual, customized, digital representation of himself or herself (i.e. a self-created avatar) and constructs a second life that permits him or her to be anyone he or she pleases (Lee & Hoadley 2006). Second, MMORPGs improve learners' critical thinking, problem-solving, and leadership skills (Yee 2003; Bonk & Dennen 2005; Childress & Braswell 2006). MMORPGs make learners recognize their own problems and encourage them to constructively search for solutions to the problems. Successful engagement and completion of a game requires extensive critical thinking and problem-solving skills. Lastly, MMORPGs highlight the importance of persistent groups and worlds (Bonk & Dennen 2005). Communities of learners in online games can foster active interactions and communications about the game, resource sharing, negotiation, social construction of meaning and experiences of support and encouragement for one another (Palloff & Pratt 1999). Such interactions can provide educators with opportunities to develop learning environments where real-world learning experiences are replicated, which were previously only available through face-to-face interactions (Childress & Braswell 2006).

There is also an argument that MMORPGs play an important role in improving English communicative skills and, in general, reinforce language acquisition (Rankin *et al*. 2006). This is of particular interest in the case of language learning environments such as Korea, because Korean students learning English as a foreign language experience limitations to their success in studying English, as the language is very separate from their real lives. Because of the lack of opportunities to communicate with others in English, repeating the contents of textbooks in isolated ways is the typical case for most of Korean students. However, the provision of virtual reality in MMORPGs permits the experiential learning of language to be realistic. The virtual reality of MMORPGs may foster the proficiency of students' English as they interact with others in English while playing the game (Waters 2007). Prior research in language education shows evidence that language skills (i.e. speaking, listening, writing, and reading) are improved through online games and MMORPGs can be an effective tool for language learning (Kelm 1992; Falsetti 1995; Backer 1999; Rankin *et al*. 2006; Yip & Kwan 2006; Schneider & Zheng 2007; Waters 2007). Besides, the MMORPG environments allow students to practise English in a holistic way in that the knowledge and skills of speaking, listening, writing, and reading are integrated into communications with game players. Although MMOPRGs might not be best suited for absolute beginners and might be less effective in conveying the grammatical aspects of language, it is recommended that MMORPGs be implemented in the contexts where students need to learn the knowledge and skills of English and practise them in authentic ways; to make game playing effective in language learning and to extend its impact, more sophisticated experiential games may be necessary, as they provide active interactions and collaborations among learners as well as address cognitive issues and foster active learning (Yip & Kwan 2006).

Despite the potential benefits of online gaming, including MMORPGs, for teaching and learning in language education, there has not been much research in this regard because of the following two reasons. First, as most MMORPGs are developed and supported by commercial companies, research conducted on these games tends to be internal and unpublished. In addition, such research tends to focus only on topics of interest to the company, which might be too narrow to consider other possible audiences outside the scope of the company. Second, research on MMORPG applications in education tend to be conceptual or anecdotal in nature rather than reports of empirical studies based on a systematic design and data collection (Bonk & Dennen 2005). Furthermore, a review of research trends suggests that more attention should be being paid to multiple predictor variables that may operate at different levels, yet most studies limit themselves to

psychological or external affective environmental perspectives and disregard other empirical variables. This narrow focus on few variables is not sufficient to depict and understand the relationships of the variables that impact English education using MMORPGs. As interest increases in the identification of the significant factors that contribute to the success of English education, the authors of this study believe that if more factors that support language acquisition can be isolated and quantified, more will be accomplished and implications for practical applications will be greater. Given these gaps, this study aimed to examine the effectiveness of MMORPGs in English language learning versus traditionally offered classroom courses through an experimental research project. Nine independent variables were also investigated, in order to determine how accurately they might predict students' English learning through MMORPGs: gender (Jakobsdottir & Hooper 1995), prior knowledge (Park & Hannafin 1993), motivation for learning (Pintrich & Schunk 2002), self-directed learning skill (Buchman & Funk 1996; Mumtaz 2001), computer skill (Kayang & Rowley 1994), game skill (Kujanpää & Mannien 2003), computer capacity (Jones *et al*. 1992), network speed (Hiltz 1994; Muilenburg & Berge 2001), and computer accessibility (Volery 2001).

In short, this study addressed 1) if there were significant differences in achievement between MMORPG-based instruction and face-to-face instruction groups in an English learning environment; and 2) which of the aforementioned variables were influential in students' English learning in MMORPG-based instruction.

Method

The participants of this study were 302 elementary students (5th and 6th graders) from five schools located in Seoul, Incheon, and the Kyunggi province in South Korea. Data from 220 students who completed the study were used for this report, as the responses of 76 of the students were incomplete, and six students with extensive study-abroad experience were exempted. There were 118 students in the treatment group who were taught with an English MMORPG, and 102 students in the control group who were taught in a face-to-face classroom. To fairly evaluate the course, two elementary school English teachers, two curriculum specialists, and one educational technology specialist were chosen to thoroughly go over the MMORPG curricula, the multimedia materials for the control group classes, and the curriculum currently used in public schools. They focused on determining the similarity between the programs and concluded that the similarity was enough to exclude the difference as a factor.

The experiment of this study was conducted over 2 months. A 40-minute class was given twice a week to both groups in place of their regular weekly English classes for the duration of the study. The treatment group was taken to computer labs and asked to log on to Nori School (nori means 'play' in Korean) and follow the instructions given in the game. English was used for the content of the gaming program and Korean for instructions because of the students' lack of English proficiency.

As students in the experimental group log on to the server, they are asked to complete a set of basic test items that measure their learning abilities in four areas-(speaking, listening, writing, and reading), and, according to the results, get separated into smaller groups with learners who have similar learning levels. Learners of a certain subgroup, or a 'team', enter the gaming area of suitable levels. The game presents 'monsters', which the players are supposed to slay, and upon succession players are rewarded with 'items' which make players' task easier. The 'items', however, do not go into an individual player's possession but get stored in the inventory of the team as a whole. When the item collection is completed to a certain point, there appears a 'wizard', who gives a question which the players are required to solve in order to go to the next level. While solving the question, players of a subgroup communicate and discuss together through 'chatting', and offer a final answer the players agree upon. If the answer is correct, the players obtain a 'treasure'. If the answer is incorrect, the players lose the collected items and go back to the gaming area in search of items and another wizard who would present them with an easier question. Repeating this process, the players finally get the chance to go 'learn' when they obtain two or more 'treasures'. The 'learning' is based on group activities as well, and learners get to interact through 'chatting' as they solve each question. The 'learning' includes activities such as reading English story books and quizzes on reading, listening, and writing. After finishing all these learning process, players move on to the next level. About three or four times of repeating these, learners finish going

through the amount that equals one chapter of their textbook.

While the students in the treatment group were involved in gaming activity, there was no direct instruction from the teachers. Students created an avatar for their character and the aim of the game was to save the village by successfully completing tasks. First, students engaged in games such as role-playing game (RPG), monster hunting and item acquisition, as a warm-up to the learning games, in order to strengthen their interest and attention. Then, the learning portion began with a level test and selection of stages suitable for each learner's ability. In each unit, students practised communication, listening, reading, writing, and speaking skills through activities such as reading stories, watching animations, and completing quizzes, by competing either one to one, one to group or group to group. After each game, learners received instant feedback including answer confirmation, a tally of correct answers, and commentary on incorrect answers, which allowed the learner to recognize his or her level of achievement. After each level and feedback, the learner either returned to the previous stage or proceeded on to the next one.

Interactions between players logged in to the game employed strategies such as chatting, exchanging items, and building guild systems to help each other grow within the game and build friendships. Further details of the community interactions can be seen in the learning management system of Nori School(See Fig. 1). Nori School, the MMORPG game includes about 500 English storybooks based on textbooks used in American elementary schools and a systematic curriculum of 188 modules. It has six phases and the first phase, Phonics, is composed of 23 levels. This phase closely corresponds to the English level of Grade 5–6 elementary school students in Korea. See Table 1 for a description of the Phonics phase of Nori School. In addition, the creators of the MMORPG issued special passwords for the experiment, to ensure that the test group was only exposed to the modules that corresponded with face-to-face lesson content.

The various activities in Nori School are made up of many instructional strategies, especially for motivation.

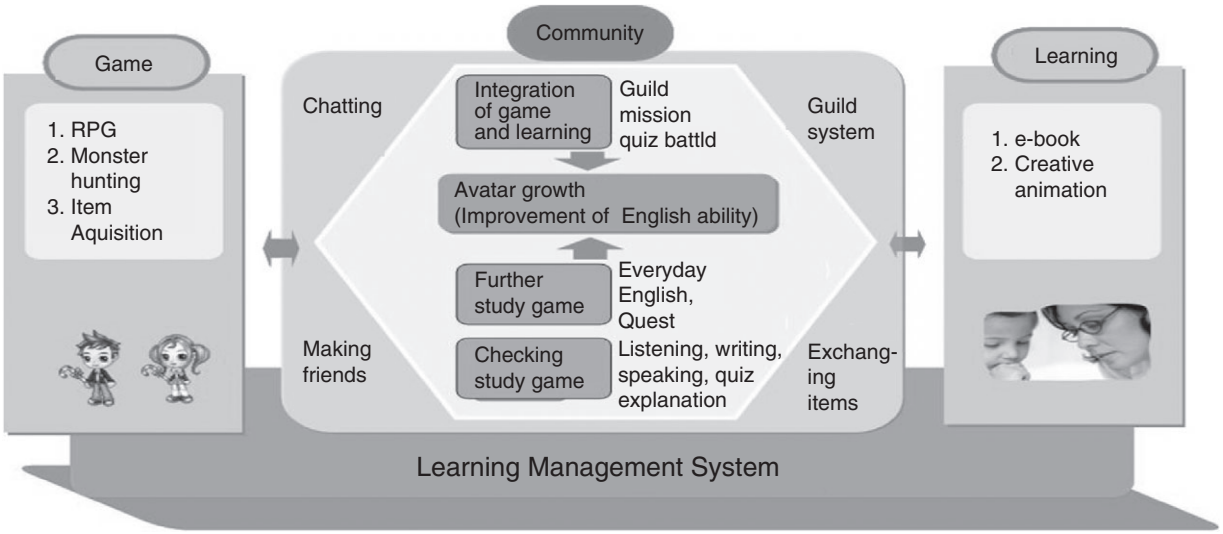

Fig 1 LMS of Nori School.

Table 1. Description of the phonics phase.

Stage	Learning objective	Themes	Words	Fairy tales	Quizzes	Structure
Phonics	alphabet consonants, double consonants short vowels, long vowels, double vowels	44	285	88	700	simple and basic sentences present tense (declarative sentences, questions, negative sentences)

For example, to promote user's attention on English learning and to encourage their easy and joyful understanding of English, fairy tales in Flash animation are provided. The researchers make full use of e-books to provide children with more access to learning many sentences related to realistic life. It helps students recognize the relevance of learning and their life. In addition, student's repeated practice in English quiz makes them improve their self-confidence. Giving the appropriate reward in various games and providing immediate feedback after the test such as 'main word quiz' are designed to improve their confidence. Besides these strategies for motivation, Nori School utilizes a variety of instructional strategies including encouragement of interaction by the group for problem solving.

Meanwhile, the students in the control group were given lessons involving multimedia courseware and a simple textbook developed by the researchers of this paper to be similar to the existing Grade 5 and 6 curricula. The students in the control group were not exposed to or involved in the computer games. They were taught the same contents using visual learning aids. To remove any concerns of teacher variable, the classes were conducted by a researcher, with the English teacher of each school present during the class. The class and materials were presented in English, except for instructions, which were given in Korean. Students participated in various interactive and cooperative group activities such as games, role playing, and singing in order to engage their interest and build their communication skills. Lessons were learner-centred, and the role of the teacher was mostly to help students when needed. The multimedia content, mostly Flash animations, were presented to students as visual and audio aids via TV sets in class. In most classrooms in Korea, there is a big TV which is connected to the teacher's computer and used as a monitor screen. So, the students look at the big TV to get visual instruction. The textbooks were mostly used as a guideline, or for later review. See Table 2 for details of the lesson schedule.

Table 2. Face-to-face lesson schedule.

	Activities	Methods	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th	13th	14th	15th	16th
1	Greeting and small talk		O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
2	Pre-test		O															O
3	Read and interpret main text	Textbook, ICT (animation and Flash)		O							O							
4	Role-play	Pair and group work			O							O						
5	Sing	ICT				O							O					
6	Game	ICT					O							O				
7	Quiz	ICT						O							O			
8	Review	Textbook, ICT							O	O						O	O	

ICT, information and communication technology.

Testing and results

A survey and five tests (i.e. English learning achievement test, motivation test, self-directed skill test, computer use ability test, and game skill test) were conducted to compare students' achievement between the two groups and to test the preliminary model of

Table 3. Measuring tools.

Tool	n of Items	Type of scale	Cronbach α	Reference
English learning achievement test	30	4	0.85	KICE (2004, 2005)
Motivation test	17	5	0.89	Park (1998)
Self-directed learning skill test	30	5	0.93	Jung and Kim (1992)
Computer use ability test	11	3	0.87	Loyd and Gressard (1986)
Game skill test	7	5	0.90	Jung (2005)

Table 4. Equivalence between groups.

	Source	Case	Mean	SD	*t*	*df*	*P*
Pre-test	Treatment	118	43.72	13.37	0.38*	219	0.69
	Control	102	42.50	12.34			

*$P < 0.05$.

factors predicting English learning achievement in the MMORPG. To test the equivalence of the groups, a *t*-test for a pre-test of English learning achievement was performed. An English achievement test developed by the Korea Institute of Curriculum & Evaluation (KICE) was implemented for the pre-test. Table 3 shows the measuring tools that were used in this study. Note that the Cronbach α figures, all greater than 0.8, show a high degree of reliability. The results shown in Table 4 indicate that there was no statistically significant difference between the treatment and the control groups in English learning achievement.

Means and standard deviations on English learning achievement scores are given in Table 5, which contrasts the differences between the treatment and control groups based on four dependent variables: listening, speaking, reading, and writing scores. In order to account for the differences between the treatment and control groups, a multivariate analysis of variance (MANOVA) for the post-test was conducted. As the Box's test revealed that equal variances could be assumed, Wilk's Lambda was used as the test statistic. Wilk's Lambda criterion indicates significant group differences in the learning achievement category (See Table 6). Univariate ANOVA results in Table 7 show that for the post-test the differences in the mean scores between groups were significant in all the subcategories of listening, reading and writing, but not speaking. The statistical evidence indicates that the MMORPG group (treatment group) outperformed the traditional classroom group (control group) in the post-test.

Table 5. Means and standard deviations on English learning achievement.

Dependent variable	Source	Mean	SD	N
Listening	Treatment	20.09	5.27	118
	Control	17.71	6.44	102
Speaking	Treatment	12.36	3.37	118
	Control	11.61	3.38	102
Reading	Treatment	7.06	2.83	118
	Control	6.00	3.20	102
Writing	Treatment	8.02	2.62	118
	Control	6.82	3.12	102
Total	Treatment	47.54	2.65	118
	Control	42.15	3.19	102

A multiple regression was conducted to determine the accuracy of the independent variables (gender, prior knowledge, motivation for learning, self-directed learning skill, computer use skill, game skill, computer capacity, network speed and computer accessibility) predicting the dependent variable (English learning achievement). Regression results in Table 8 indicate that the overall model of the nine independent variables significantly predicts English learning achievement. A summary of regression coefficients is presented in Table 9 and indicates that only three variables, prior knowledge, motivation for learning, and network speed, significantly contributed to the model. This model accounts for 47% of the variance in English learning achievement. According to the standardized regression coefficient (Beta) interpreting the relative importance of the three variables, prior knowledge made the strongest contribution to English learning achievement, compared with motivation for learning and network speed.

Table 6. MANOVA on English learning achievement.

Effect		Value	Hypothesis *df*	Error *df*	*F*	*P*	Eta squared
Group type	Wilk's Lambda	0.916	4	215	4.496*	<0.01	0.529

*$P < 0.05$.

Table 7. Results of univariate ANOVA.

Source	Dependent variable	SS	*df*	MS	*F*	*P*	Eta squared
Group type	Listening	513.94	1	513.94	15.04*	<0.01	0.554
	Speaking	41.23	1	41.23	2.86	0.07	0.012
	Reading	50.96	1	50.96	5.26*	0.01	0.265
	Writing	64.19	1	64.19	7.92*	<0.01	0.426

*$P < 0.05$.

Table 8. ANOVA table.

	SS	*df*	MS	*F*	*P*
Regression	398.423	9	44.269	11.259*	<0.01
Residual	424.656	108	3.932		
Total	823.078	117			

*$P < 0.05$.

Conclusion

This study investigated the effect of MMORPG-based instruction on elementary students' English learning and examined the accuracy of the nine independent variables predicting English learning achievement. The findings suggest that MMORPGs may be useful for improving the English abilities of students who study English as a second language. Elementary school students who studied English with online RPGs (i.e. Nori School) showed higher scores in listening, writing, and reading than those who studied English with face-to-face classroom instruction. In this study, it was also found that the most influential variables in English learning achievement were prior knowledge, motivation, and network speed in MMORPG-based instruction. Interestingly, this study showed that network speed

Table 9. Results of multiple regression for post test.

Variable	Unstandardized coefficients		Standardized coefficients	*t*	*P*
	B	Std. Error	Beta		
(constant)	134.576	3.558		37.821	<0.01
Gender	–0.371	0.414	–0.070	–0.897	0.37
Prior knowledge	0.168	0.020	0.620	8.560*	<0.01
Motivation for learning	2.611	1.256	0.197	2.078*	0.04
SDL skill	0.266	0.334	0.071	0.798	0.43
Computer use skill	–0.234	0.553	–0.037	–0.424	0.67
Game skill	0.190	0.388	0.039	0.489	0.63
Computer capacity	0.077	0.105	0.053	0.735	0.46
Network speed	0.344	0.118	0.218	2.923*	<0.01
Computer Accessibility	0.187	0.372	0.035	0.503	0.62

$R^2_{adj} = 0.47$.
*$P < 0.05$.
SDL, Self-directed learning.

was relatively interpreted as more important than motivation for learning in contributing to English achievement, although motivation for learning was a significant factor impacting students' learning. It is speculated that when interactions among learners were impeded because of problems with the network speed, learners might have lost motivation considering that MMORPGs were grounded in synchronous interactions through the web. This implies that optimizing environments is critical for the design and implementation of MMORPGs for learning and instruction. Meanwhile, the factors of computer use skill, computer capacity, and computer accessibility related to learning environment were not found to be influential for students' learning in MMORPGs. It appears that as high-quality computers have come into wide use, there are no noticeable differences in terms of physical environments and basic computer skills among the students. Therefore, when instructions utilizing MMORPGs are planned, factors such as prior knowledge, motivation, and network speed might need to be considered above all other things. In future studies, it would be useful to take into consideration the model of factors predicting English learning achievement in MMORPG so that specific ways to enhance the factors can be incorporated.

References

Backer J.A. (1999) *Multi-User Domain Object Oriented (MOO) as a high school procedure for foreign language acquisition*. Unpublished Doctoral Dissertation, Nova Southeastern University.

Bers M.V. (2001) Identity construction environments: developing personal and moral values through the design of a virtual city. *Journal of the Learning Sciences* **10**, 365–415.

Bonk C. & Dennen V. (2005) *Massive multiplayer online gaming: a research framework for military training and education (Technical Report No. 2005-1)*. Washington, DC: US Department of Defense(DUSD/R): Advance Distributed Learning(ADL) Initiative. Available at: http://mypage.iu.edu/~cjbonk/GameReport_Bonk_final.pdf (last accessed 1 October 2005).

Brown H.D. (1994) *Teaching by Principles: An Interactive Approach to Language Pedagogy*. Prentice-Hall, Englewood Cliffs, NJ.

Buchman D.D. & Funk J.B. (1996) Video and computer games in the '90s: children's time commitment & game preference. *Children Today* **24**, 12–15.

Childress M.D. & Braswell R. (2006) Using massively multiplayer online role-playing games for online learning. *Distance Education* **27**, 187–196.

Falsetti J. (1995) *What the heck is a MOO? And what's the story with all those cows*. ERIC Document Reproduction Service No. ED 389 222.

Hiltz S.R. (1994) *The Virtual Classroom: Learning without Limits via Computer Networks*. Albex, Norwood, NJ.

Jakobsdottir S. & Hooper S. (1995) Computer-assisted foreign language learning. *Educational Technology Research and Development* **43**, 43–59.

Jensen J. (2002) *Serious play: challenges of educational game design*. Paper presented at the American Educational Research Association, New Orleans, LA, April. Available at: http://www.yorku.ca/jjenson/papers/aera2002.htm (last accessed 20 February 2003).

Jones A., Kirkup G. & Kirkwood A. (1992) *Personal Computers for Distance Education*. Paul Chapman Publishing, London.

Jung J.W. & Kim J.J. (1992) Self-directed learning theory in adult education and its implication to education. *The Journal of Educational Research* **30**, 243–257.

Jung Y.S. (2005) *Effects of learner's game and learning ability on the logical thinking in game based learning*. Unpublished Doctoral Dissertation, Korea National University of Education.

Kayang J. & Rowley M. (1994) *Media and technology*. Paper presented at the Annual Meeting of the Association for Education in Journalism and Mass Communication. Kansas City, MO.

Kelm O. (1992) The use of synchronous computer networks in second language instruction: a preliminary report. *Foreign Language Annals* **25**, 441–454.

KICE (2004, 2005) *National Assessment of Educational Achievement: English*. Available at: http://www.kice.re.kr/kice/article/m007/view?searchtype=stored&hitadd=1&articleid=44695 (last accessed 17 August 2006).

Korea Game Development Institute (2004) *2004 Korea Game White Paper*. Seoul: KGDI.

Kujanpää T. & Mannien T. (2003) Supporting visual elements of nonverbal communication in computer game avatars. In *Proceeding of Level Up– Digital Research Conference* (eds M. Copier & J. Raessens), Universiteit Utrecht, 220–233.

Lee M., Eustace K., Fellows G., Bytheway A. & Irving L. (2005) Rochester Castle MMORPG: instructional gaming and collaborative learning at a Western Australian school. *Australasian Journal of Educational Technology* **21**, 446–469.

Lee J. & Hoadley C. (2006) Online identity as a leverage point for learning in massively multiplayer online role playing

game (MMORPGs). In *Proceedings of the Sixth International Conference on Advance Learning Technologies (ICALT). Kerkrade, The Netherlands*.

Loyd B.H. & Gressard C. (1986) The reliability and validity of an instrument for the assessment of computer attitudes. *Educational and Psychological Measurement* **45**, 903–908.

Muilenburg L.Y. & Berge Z.L. (2001) Barriers to distance education: a factor analytic study. *The American Journal of Distance Education: An International Journal* **21**, 81–100.

Mumtaz S. (2001) Children's enjoyment and perception of computer use in the home and the school. *Computers & Education* **36**, 347–362.

MUVEES Project (2003) *Multi-user virtual environment experimental simulator*. Available at: http://muve.gse.harvard.edu/muvees2003/index.html (last accessed 9 May 2004).

Palloff R.M. & Pratt K. (1999) *Building Learning Communities in Cyberspace: Effective Strategies for the Online Classroom*. Jossey-Bass, San Francisco, CA.

Park I. & Hannafin M.J. (1993) Empirically-based guidelines for the design of interactive multimedia. *Educational Technology Research and Development* **41**, 63–85.

Park J.S. (1998) The effects of anxiety and motivation on the oral performance in English conversation classroom. *English Teaching* **53**, 73–102.

Pintrich P.R. & Schunk D.H. (2002) *Motivation in Education: Theory, Research, and Applications*, 2nd edn. Merrill/Prentice Hall, Upper Saddle Rivers, NJ.

Rankin Y.A., Gold R. & Gooch B. (2006) *Playing for keeps: gaming as a language learning tool*. International Conference on Computer Graphics and Interactive Techniques: ACM SIGGRAPH 2006 Educators Program.

Rieber L.P. (1996) Seriously considering play: designing interactive learning environments based on the blending of microworlds, simulations, and games. *Educational Technology Research and Development* **44**, 43–58.

Schneider E. & Zheng K. (2007) *English speaking players as In-Game content: new ideas for marketing to youth in Asia*. Paper presented Game Developers Conference (GDC). San Francisco, CA.

Steinkuehler C. (2003) *Massively multiplayer online videogames as a constellation of literacy practices*. Paper presented at the International Conference on Literacy, Ghent, Belgium. Available at: http://www.sit.wisc.com/~steinkuehler/papers/SteinkuehlerAILA2003.pdf (last accessed 13 May 2007).

Volery T. (2001) Online education: an exploratory study into success factors. *Journal of Educational Computing Research* **24**, 77–92.

Waters J.K. (2007) On a quest for English. *T.H.E. Journal* **34**, 27–32.

Yee N. (2003) *Learning leadership skills*. The Daedalus Project. Available at: http://www.nickyee.com/daedalus/archieves/000338.php (last accessed 17 June 2007).

Yip F.W. & Kwan A.C. (2006) Online vocabulary games as a tool for teaching and learning English vocabulary. *Educational Media International* **43**, 233–249.