

Motivational Factors in Educational MMORPGs: Some Implications for Education

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Abstract. Studies have shown that motivation is an important factor positively related to learning outcomes. Thus, educators have tried to combine digital games with teaching materials to motivate students participating in learning activities for the past two decades. However, most studies so far view games as universally motivating rather than acknowledging that several factors may be at work within games to influence motivation. We feel it is important to understand the various factors in educational games that motivate students. Twenty 5th grade students in KaoHsiung, Taiwan participated in a study. Each participant completed a motivation and overall attitude questionnaire after playing educational MMORPGs. Results suggest that four factors motivated students to play the game provided, and allow extension to other educational MMORPGs: achievement (desire for competition with a standard of excellence), social (collaboration with others and building social networks), immersion, and the completeness of instructional mechanisms. Implications for both educators and educational game designers are provided.

Keywords: MMORPG, educational MMORPG, motivation.

1 Introduction

“The fundamental deficiency of the school system is its failure to motivate the youth of the country to want to learn.” [1]

During the past two decades, digital games have been acknowledged as motivational and have become a source of study for educational researchers and instructional designers who wish to maximize motivation in educational materials [2]. Studies indicate that educational games are effective for increasing motivation because they generate enthusiasm, excitement, and enjoyment [3] [4]. However, early research on video games and motivation has viewed digital games as a universally motivating factor for education. Very few research studies further analyzed specific factors within games in attempts to discover how games with educational features motivate.

Among different types of digital games, massively multiplayer online role playing games (MMORPGs) continue to grow in popularity. These games allow thousands of gamers to play simultaneously in the game’s persistent virtual world via the Internet. Recently, researchers have started to explore the possibilities of using MMORPGs in

education [5]. For example, Beedle and Wright (2007) indicate that playing MMORPGs can inspire creativity, motivation, problem solving skills, and communication skills [6]. Dickey (2007) also argues that playing MMORPGs can foster learning while requiring players to think, plan, and act critically and strategically [7]. He further indicated that different types of quests in MMORPGs could facilitate different knowledge domains (e.g. declarative knowledge, procedural knowledge, strategic knowledge, and metacognitive knowledge). Many research institutes also are building their own virtual worlds or MMORPGs for education, such as Quest Atlantis (at Indiana State University, by Sasha Barab and colleagues), River City (at Harvard University, led by Chris Dede), Learning Village (at The Chinese University of Hong Kong, led by Junjie Shang), MMOG for Photography (at the National Taiwan Normal University, by Kuang-Chao Yu and colleagues), Whyville (by Numedeon, Inc.), and Zon (at Michigan State University, led by Yong Zhao). While MMORPGs have been proven to be a tool that can strengthen students' learning, to enhance their efforts educational game designers need to know more about how educational MMORPGs motivate students. Studying specific motivational factors in educational MMORPGs will help ensure that they do not simply become, as Brody (1993) has said, "not-very-entertaining learning activities" or a "not-very-educational game" [8].

To address the above need, we set out the following two objectives for the study briefly reported herein: To examine the motivational factors of playing educational MMORPGs; To discuss how educators and educational game designers could use motivational factors in designing learning activities and educational experiences within MMORPGs.

The remaining sections of this paper will continue to discuss the conceptual framework, research methodology, major findings and implications related to the above goals.

2 Conceptual Framework

Martin and Briggs (1986) indicated that "motivation is a hypothetical construct" and differs among academicians noting that it is important to define motivation in research studies related to motivation [9]. In this study, we follow Tuzun's (2004) definition of motivation and define motivation as "individuals' showing their willingness to initiate and sustain participation in educational MMORPGs" (p. 7) [10].

Our conceptual framework is based on Yee's (2007) theory that indicates players are motivated to play MMORPGs by achievement, social, and immersion factors [11]. His theory extended Bartle's Player Types of Multi-User Dungeon (MUD) (Bartle, 1996) and also used qualitative information from surveys of over 3000 commercial MMORPG players [12]. Here we briefly discuss Yee's factors of achievement, social, and immersion.

2.1 Achievement

McClelland and associates (1953) defined achievement motivation as involving "competition with a standard of excellence" [13]. This definition allows a myriad of activities to be considered to be achievement motivated, the crucial point being a concern with doing those activities well, better than others, or best of all. Achievement

goals can affect the way a person performs a task and represent a desire to show competence [14].

An MMORPG is a virtual place for people to seek achievement [11]. Different players may try to achieve different “standards of excellence” such as advancing in level, gaining power, surpassing others, or getting prestige and abilities while they are playing in the MMORPG world. They may also want to acquire special items for their characters in a variety of ways, such as defeating monsters, doing quests, buying things, or by gathering raw materials and then fashioning them into desired items. The acquisition of these items allows players to level up faster, which in turn adds to their in-game prestige [15]. In addition, many MMORPGs provide player rankings and also allow competition between players, and rankings also plays a fundamental role on motivation [16]. In this sense, MMORPGs can motivate those who are competitive or simply want a quantitative descriptor of their achievement in the game world.

2.2 Social

Maslow (1943) stated that when people have gratified their physiological and the safety needs they will hunger for relations with other people [17]. They want to become a part of family, friends, or society. Research has shown that the motives regulating social life in groups also derive from evolved structures forming the genetic framework upon which later developments were based [18]. These social motives include various forms of social bonding, such as: (1) filial love, (2) parental love, (3) conjugal love, (4) friendship, and (5) seeking and maintaining positive relationships with unfamiliar others of both sexes and a similar age. There is no doubt that these motives form the basis for humans who are “social beings.” An important reason that people play MMORPGs appears to be that their friends are playing [11]. That is, players often want to bring real-life friendships to MMORPGs. Moreover, players may want to make new friends in MMORPGs. Ways that some MMORPGs have facilitated friendship and gratify player’s social needs are through Guilds and Groups. Guilds are groups of players who come together for social reasons or to facilitate advancement in the game. As a result, guilds provide an opportunity for players to collaborate and progress to higher levels. Groups are formed when a player finds a task to be greater than what his/her current skill is able to conquer. Guilds are more continuously long-term, while groups often form to meet specific goal and advance. A group even within a guild will proceed within a given quest to overcome an obstacle.

2.3 Immersion

Immersion is the sense that a player has of being in a virtual world [12]. Yee (2007) stated that one important reason for players to get immersed in the MMORPGs is to escape from real life problems and to allow a transportive, fantasy experience. Immersion is related to the concept of presence [11]. In virtual world terms, although presence is an aid to immersion, it is not sufficient to cause immersion. For virtual worlds, immersion takes longer to develop than most players suppose. Bartle (1996) indicated three situations, forming possible cycles, that influence players’ tendency to feel immersed in a virtual world [12]:

- (1) If they are playing and feel as if they are in the virtual world, they are immersed;
- (2) If, while immersed, they are interrupted, they are no longer immersed.
- (3) If, having been interrupted, they return and pick up where they left off, they are again immersed.

3 Ed-Wonderland

In this study, we used a self-developed educational MMORPG called Ed-Wonderland to explore the two objectives noted earlier. In this section we will introduce the instructional goals, game zones, game values, and educational theories of Ed-Wonderland, and discuss the educational theories we utilized to design Ed-Wonderland.

The instructional goal of Ed-Wonderland is to increase English-language learners' vocabulary proficiency while playing, learning, sharing, collaborating, competing, chatting, and completing quests in its virtual environment. Its aim is to provide a content-rich English learning environment reflective of the target language (in this case, English), and to form an online English learning community through game-play and learning.

Ed-Wonderland has five game areas: Welcome Island—where first time users acquire information needed to play Ed-Wonderland. Community Island—where all residents of Wonderland live. Educational Island—where most educational content/activities are presented. Forest Island—where players compete with creatures around vocabulary knowledge to “level up” (see Fig. 1). Carnival Island—where individual or multiplayer educational games are provided. Fig. 2 shows a screen of a game called “Happy Runner” in Carnival Island.

Players can gain four types of “value” in the game (Intelligence, Experience, Money, and Energy), earned by defeating monsters, playing sub-games, completing quests, or helping others, respectively. The Intelligence value indicates the learners' academic achievements. The Experience value represents level of engagement, measured by the number of activities completed (games, vocabulary, quests). The Money value allows players to virtually buy items including clothes, furniture, houses, and so on while the Energy value relates to a player's speed and health status. These game values help players monitor their game status and learning.



Fig. 1. Players are defeating monsters in the Forest Island

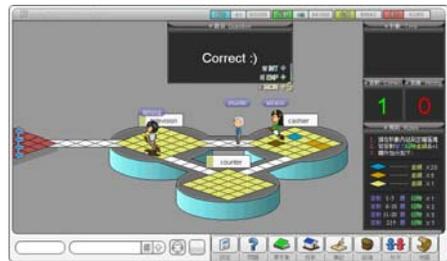


Fig. 2. A game called “Happy Runner” provided in Carnival Island

Ed-Wonderland was designed to incorporate socio-cultural, metacognitive, and multiple context theories of education, which have been shown to have positive influences in teaching and learning. Briefly, a socio-cultural theory of learning avers that human intelligence originates in a society or culture, and individual learning results from interaction with one's social environment [19]. Learning results from the accretion and reorganization of individual knowledge structures and the conversations and collaborations that groups of learners conduct. Thus, like most MMORPGs, Ed-Wonderland provides graphical chat functions, competition, collaborative activities and embedded games to address social factors, and official websites for asynchronous communication.

Metacognitive theory indicates that the ability to monitor one's learning is linked to better performance [20]. Educational MMORPGs can facilitate metacognitive strategies, as they are permanent platforms where players' achievements are not erased and can be thought about strategically over time. Ed-Wonderland records students' learning histories automatically so that students can always have chances to track their own learning. In addition, students can understand their overall learning status by checking their own game values on demand.

While metacognitive theory addresses the benefits of monitoring one's learning, multiple context theory indicates that knowledge taught in a single context is less likely to support transfer than knowledge taught in multiple contexts [21]. Educational MMORPGs can embed multiple contexts within an environment; thus designers can provide different contexts to support a given concept's learning. In Ed-Wonderland, vocabulary knowledge is taught or used via scenes, games tasks, or sub-games in mini-environments and across different "Islands" so that students are learning vocabulary knowledge in various contexts.

4 Research Methodology

4.1 Participants and Setting

The research was conducted in a computer lab of a primary school in KaoHsiung, Taiwan in January, 2009. The primary school is one of the largest primary schools in the Kushan district of KaoHsiung city, with approximately 1600 students and 100 teachers. We asked one of the two computer teachers in the school to select one 5th grade class that was representative of the school's 5th grade students' academic performance. Twenty 5th grade students (female=10, male=10) agreed to participate. Eleven of the twenty participants went to after school English classes (female=4, male=7); ten were interested in learning English vocabulary words (female=3, male=7); and ten had MMORPG playing experience (female=2, male=8).

We first conducted a twenty-minute session to introduce Ed-Wonderland and its game world, rules, and functions. This was followed by a 1-hour play session. During the play session, an Applied Linguistics master's student, fluent in both Mandarin and English, served as an online assistant to help the participants with English-related questions. After the play session, each participant completed a motivation questionnaire and overall attitude questionnaire. The two questionnaires are described in the next section.

4.2 Instruments

Motivation Questionnaire. To see if Yee's (2007) factors were salient, and whether or not additional factors might be present in educational MMORPGs, we began with a pilot study in November, 2008 [22]. Participants were interviewed about what motivated them in Ed-Wonderland. Pilot study results indicated that besides the achievement, social, and immersion factors, the completeness of the *instruction mechanism*, including the teaching materials and tools that support learning, was an additional factor for students in choosing whether or not to play educational MMORPGs. Based on the pilot study results, we then designed a 32-item questionnaire to explore four factors related to students' motivation of playing educational MMORPGs such as Ed-Wonderland. The four factors are: achievement, social, immersion, and the instruction mechanism.

Overall Attitude Questionnaire. We also designed an overall attitude questionnaire. The first part of this questionnaire investigates participants' attitudes toward Ed-Wonderland. An interesting finding in our pilot study was that even though participants agreed that playing educational MMORPGs could make learning more motivating, they tended to choose commercial MMORPGs with entertainment goals rather than educational MMORPGs during their leisure time. Thus, the second part of this questionnaire investigates this area.

5 Results

5.1 Participants Are Motivated by Achievement, Social, Immersion, and Instructional Mechanism Factors

The mean score of the achievement factor (1=low / 5=high) is high ($M=4.53$, $SD=.79$). This indicates that the participants agreed the achievement factor motivates them to play educational MMORPGs such as Ed-Wonderland. Dividing the achievement factor into its components questions indicates that participants indicate that getting high scores, and adding to their intelligence value ($M=4.45$, $SD=.83$), experience value ($M=4.60$, $SD=.68$), energy ($M=4.45$, $SD=.76$), and virtual money ($M=4.55$, $SD=.89$) is motivational. They also want to challenge others ($M=4.35$, $SD=.93$) and are more likely to be motivated if educational MMORPGs provide "high score" boards ($M=4.45$, $SD=.83$). A t-test to examine whether the mean overall achievement-factor score of males and females indicates no significant difference by gender on the achievement factor; the difference between mean achievement score of males (4.58) and females (4.47) is not large enough to be statistically significant ($p=.709$) (see Table 2). Therefore, the achievement factor is equally high and important for both males and females in terms of motivation.

The mean score of the social factor (1=low / 5=high) is high ($M=4.37$, $SD=.88$). This indicates that the participants agreed the social factor motivates them to play educational MMORPGs such as Ed-Wonderland. Participants want to know/meet other players ($M=4.45$, $SD=.83$), and chat with their real life friends ($M=4.55$, $SD=.76$) or new friends they make in the game ($M=4.55$, $SD=.76$). The difference between mean social score of males (4.43) and that of females (4.31) are not large

enough to be statistically significant ($p=.703$). Therefore, the social factor appears equally high in importance to both males' and females' motivation to play educational MMORPGs such as Ed-Wonderland.

The Immersion factor was also listed as an important motivational factor important ($M=4.44$, $SD=1.00$) for participants deciding to play educational MMORPGs. With regard to component questions within this factor, our results indicate that participants want to explore new game scenes ($M=4.50$, $SD=1.05$) and use different personalities when playing ($M=4.45$, $SD=.76$). They also want to buy new things such as clothes ($M=4.60$, $SD=.75$), furniture ($M=4.60$, $SD=.75$), and houses ($M=4.70$, $SD=.66$). The difference between mean immersion score of males (4.43) and that females (4.46) are not large enough to be statistically significant ($p=.902$). Thus, the immersion factor appears to be equally high and important across males and females.

The mean score of the instructional mechanism factor (1=low / 5=high) is high ($M=4.47$, $SD=.78$), indicating that instructional mechanisms motivates players to play educational MMORPGs such as Ed-Wonderland. There was no statistically significant difference between the mean instructional mechanism scores of males (4.49) and females (4.46) ($p=.924$). As for the other factors noted above, the instructional mechanism factor is equally high in motivational value across males and females.

In summary, the participants indicate that achievement, social, immersion, and instructional mechanism factors are important with regard to motivating them to play educational MMORPGs such as Ed-Wonderland. This finding is in line with Yee's factors of achievement, social and immersion, but extends those to add "instructional mechanism." Independent t-tests to examine differences between males and females found no statistically significant differences in any of the four factors, indicating that males and females are influenced equally by these factors as they relate to motivation to play MMORPGs such as Ed-Wonderland.

5.2 Attitudes toward Ed-Wonderland is positive

The mean score of overall attitude toward Ed-Wonderland is high ($M=4.47$, $SD=.78$). This indicates that participants have positive attitudes toward Ed-Wonderland. When asked whether they would rather play a commercial MMORPG or an educational MMORPG such as Ed-Wonderland, however, responses were essentially neutral ($M=3.55$, $SD=1.32$). The high standard deviation indicates that fairly strong feelings about this, in either direction, existed in our group of participants. This area is one that would be fruitful for further investigation, as biases toward commercial, or "non-educational" MMORPGs could ultimately be an important, perhaps even an overriding consideration in determining motivation to play. Students are biased against games that are educational because they don't view such items as true games, thus educational game designers have a significant hurdle to overcome. Our sample is, of course, small, and our results should be taken as indicators of areas that require further, more stringent research, but we feel that taken together, the trends in the data are consistent and point toward important possibilities that should be explored.

Table 1. Means scores and standard deviations of motivational factors (1=low, 5=high)

	M	SD
Achievement	4.53	0.79
1. Getting a higher intelligence value	4.45	0.83
2. Getting a higher experience value	4.60	0.68
3. Getting a higher energy value (walk faster)	4.45	0.76
4. Getting more virtual money.....	4.55	0.89
5. Making my avatar more powerful	4.55	0.95
6. Getting more special items	4.65	0.67
7. Learning more English vocabulary words	4.45	0.83
8. Challenging Others (e.g., playing vocabulary tic-tac-toe game with others)	4.35	0.93
9. Understanding the game more (e.g. knowing more hidden areas and hidden characters).....	4.75	0.55
10. Achieving a high score board	4.45	0.83
Social	4.37	0.88
11. Knowing more players	4.55	0.69
12. Helping other players	4.15	1.18
13. Chatting with real life friends.....	4.55	0.76
14. Chatting with friends in the game.....	4.55	0.76
15. Participating in a guild.....	4.10	0.91
16. Collaborating with others to complete tasks (e.g. defeating monsters together)	4.25	0.97
17. Learning with others (e.g., learning English vocabulary words)	4.45	0.83
Immersion	4.44	1.00
18. Exploring new game scenes	4.50	1.05
19. Using different personalities to play the game	4.45	0.76
20. Immersion in the virtual world	3.80	1.58
21. Buying clothes.....	4.60	0.75
22. Buying furniture	4.60	0.75
23. Buying houses	4.70	0.66
24. Relaxing	4.75	0.55
25. Forgetting real life problems	4.15	1.31
Instructional Mechanism	4.47	0.78
26. Updating educational scenes (e.g. coffee shop or bus).....	4.50	1.00
27. Providing everyday readings	4.45	0.69
28. Recording my actions in the game.....	4.50	0.69
29. Recording answer result	4.15	1.04
30. Having complete educational content.....	4.60	0.68
31. Having systemic educational content (from easy to hard)	4.50	0.61
32. Having experts online to answer questions.....	4.60	0.68

Table 2. T-Test of achievement, social, immersion, and instructional mechanism score based on gender

	Female (n=10)		Male (n=10)		Comparing means	
	M	SD	M	SD	T	p
Achievement	4.47	.60	4.58	.69	.379	.709
Social	4.31	.58	4.43	.73	.388	.703
Immersion	4.46	.45	4.43	.83	-.125	.902
Instructional Mechanism	4.46	.45	4.49	.81	.097	.924

6 Implication for Education

Given the caveats mentioned above in terms of our sample size, our findings, point to the following implications for both educators and educational game designers:

6.1 For Educators

Educational MMORPGs such as Ed-Wonderland could be used to motivate students to learn. Not all students succeed in the school system. We believe that this is less a function of a given students' capability, and more a function of mismatches between teaching methods, materials, and procedures and students' motivation and variable strengths. We also believe that educational games may provide a way to address issues of motivation and could benefit educators' efforts to engage students in learning activities. If students are motivated, they will spend more time on the task that motivates them, and if educational games are motivational they can increase time within educational activities. Research has shown that time is an important factor that is positively related to learning outcomes. For example, learners need time to rehearse information in order for it to go into long-term memory. Ericsson et al. (1993) reviewed a many fields where time spent practicing is critical to success [23], and Singley and Anderson (1989) also stated that the development of expertise is only possible with major investments of time [24]. In this study, we found participants showed positive attitudes toward Ed-Wonderland and were willing to use Ed-Wonderland to learn English vocabulary words. In addition, at least four motivational factors motivated our participants to use Ed-Wonderland, indicating that using educational MMORPGs such as Ed-Wonderland may be an engaging way for users to learn.

Educational MMORPGs such as Ed-Wonderland could be a social learning platform for after class usage. According to our findings, the social factor is important for motivating participants to play educational MMORPGs such as Ed-Wonderland. Thus, educational MMORPGs may be valuable platforms for building out-of-classroom social networks. In addition, Goldstein (1994) pointed out that playing video games is a social activity that often involves cooperation between and among players [4]. Therefore, educational MMORPGs may serve as an environment where more able partners can assist with scaffolding and coaching,

and also assist teachers in supporting learning via appropriate communication technologies.

Educators could utilize the four motivational factors in their learning activities.

That games are motivating is widely accepted. In our study, we found four motivational factors that educators could use to design “game-like” learning activities, either together or separately. For example, educators could use score systems, high score boards (both individual and group), or competitions as part of their learning activities to motivate students to achieve “standards of excellence”. The test scores in schools system could be accumulated like the game scores in MMORPGs. These may let students know not only their performances on a particular test, but also all their previous performances on previous tests. Furthermore, study groups structured like guilds in MMORPGs could be encouraged. Group members should be heterogeneous, with high performers encouraged to help low performers, as occurs in most MMORPGs. Teachers could also facilitate collaboration within a study group by setting group goals or through appropriate competition with other study groups. While many of these aspects are things teachers do intuitively, looking at these factors and how they positively affect game play in MMORPGs can be informative in traditional classrooms situations as well.

6.2 For Educational Game Designers

The instructional materials and tools should be thorough. Unlike most traditional single player educational games that usually teach only a few concepts in a game, MMORPGs are ideal platforms to carry systematic and thorough teaching materials. It is important to develop systematic and thorough teaching material so that students will feel they are systematically developing their knowledge, not just learning something “randomly.” Besides, educational game designers should provide tools to support metacognitive strategies such as recording students’ learning histories to help them track their own learning, and incorporate ways to encourage reflection on their learning, gameplay and learning/playing histories.

Educational games could be accompanied with other materials. Of course, educational games are is not the only option for students during their leisure time or in classrooms. Even though students may have positive attitudes toward educational MMORPGs, they may choose commercial MMORPGs to play in leisure time, rather than educational MMORPGs. Our results, however, suggest that this may be true for some people and not others, and that there may be a bias against things termed “educational” rather than “entertaining” games. We believe however, that taking into account the motivational factors shown to be important by the participants in our study may mitigate negative bias toward educational games and place them on an equal footing with entertainment. In effect, motivational factors may serve to blend education and entertainment, resulting in a satisfying game experience and learning outcomes as well.

References

1. Gordan, A.K.: *Game for Growth*. Science Research Association, Inc., Palo Alto (1970)
2. Chang, M., Wu, S., Heh, J.-S.: Making the Real World as a Game World to Learners by Applying Game-Based Learning Scenes into Ubiquitous Learning Environment. In: Pan, Z., Cheok, D.A.D., Müller, W., El Rhalibi, A. (eds.) *Transactions on Edutainment I*. LNCS, vol. 5080, pp. 261–277. Springer, Heidelberg (2008)
3. Gee, J.: *What Video Games Have to Teach Us About Learning and Literacy*. Longman, New York (2003)
4. Goldstein, J.: *Handbook of Computer Game Studies*. The MIT Press, Cambridge (2005)
5. Dickey, M.D.: Three-dimensional Virtual Worlds and Distance Learning: Two Case Studies of Active Worlds as a Medium for Distance Education. *British Journal of Educational Technology* 36, 439–461 (2005)
6. Beedle, J.B., Wright, V.H.: *Games and Simulation in Online Learning: Perspectives from Multiplayer Video Games*, ch. 7. Idea Group Inc., NY (2007)
7. Dickey, M.D.: Game Design and Learning: A Conjectural Analysis of How Massively Multiple Online Role-Playing Games (MMORPGs) Foster Intrinsic Motivation. *Educational Technology Research and Development*, 253–273 (2007)
8. Brody, H.: Video Games that Teach? *Technology Review*, 51–57 (1993)
9. Martin, B.L., Briggs, L.J.: *The Affective and Cognitive Domains: Integration for Instruction and Research*. Educational Technology Publications, Englewood Cliffs (1986)
10. Tuzun, H.: *Motivating Learners in Educational Computer Games*. Unpublished doctoral dissertation, Indiana University, Bloomington (2004)
11. Yee, N.: Motivations of Play in Online Games. *Journal of CyberPsychology & Behavior* 9, 772–775 (2007)
12. Bartle, R.: Hearts, Clubs, Diamonds, Spades: Players Who Suit MUDs. *The Journal of Virtual Environments* 1 (1996)
13. McClelland, D.C., Atkinson, J.W., Clark, R.A., Lowell, E.L.: *The Achievement Motive*. Appleton-Century-Crofts, New York (1953)
14. Harackiewicz, J., Barron, K., Carter, S., Lehto, A., Elliot, A.: Predictors and Consequences of Achievement Goals in the College Classroom: Maintaining Interest and Making the Grade. *Journal of Personality and Social Psychology* 73, 1284–1295 (1997)
15. Riegler, R.P., Matejka, W.A.: The Learning Guild: MMORPGs as Educational Environments. In: 22nd Annual Conference on Distance Teaching and Learning, the Board of Regents of the University of Wisconsin System (2006)
16. Garcia-Mateos, G., Fernandez-Aleman, J.L.: Make Learning Fun with Programming Contests. In: Pan, Z., Cheok, D.A.D., Müller, W., El, R. (eds.) *Transactions on Edutainment II*. LNCS, vol. 5660, pp. 246–257. Springer, Heidelberg (2009)
17. Maslow, A.H.: A Theory of Human Motivation. *Psychological Review* 50, 370–396 (1943)
18. Bischof-Kohler, D.: Zur Phylogenese menschlicher Motivation. In: Eckensberger, L.H., Lantermann, E.-D. (eds.) *Emotion und Reflexivität*, pp. 3–47. Urban und Schwarzenberg, Wien (1985)
19. Vygotsky, L.S.: *Mind in Society: The Development of Higher Psychological Processes*. Harvard University Press, Cambridge (1978)
20. Mayer, R.E., Wittrock, M.C.: Problem-solving Transfer. In: Berliner, D.C., Calfee, R.C. (eds.) *Handbook of Educational Psychology*, pp. 47–62. Simon & Schuster Macmillan, New York (1996)

21. Bransford, J., Brown, A., Cocking, R.: *How People Learn: Brain, Mind, Experience, and School*. National Academy Press, Washington (2000)
22. Hung, K.H.: *A Study of Motivation for Playing MMORPGs and an Educational MMORPG: Ed-Wonderland*. Unpublished pilot study (2008)
23. Ericsson, K.A., Krampe, R.T., Tesch-Romer, C.: The Role of Deliberate Practice in the Acquisition of Expert Performance. *Psychological Review* 100, 363–406 (1993)
24. Singley, M.K., Anderson, J.R.: *The transfer of cognitive skill*. Harvard University Press, Cambridge (1989)