[28] Unreal Tournament (Epic Mega Games/GT Interactive 1999).
[29] Spyro the Dragon (Insomniac Games 1998).
[30] EyeToy: Play (Sony 2003).

Multiple Motivations Framework

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Any theory of motivation must consider a large set of interactive processes if it is to provide an adequate explanation of human behavior. (Bandura, 1986, p. 243)

1. Introduction

It is 4 a.m. in the morning. A pair of bloodshot eyes stares at the TV monitor, which is connected to a Commodore 64 personal computer. The owner of the eyes is very exhausted; he has been trying to finish a computer game called "Henry's House" for the past 48 hours. While doing so his hands are almost integrated with the joystick. Although he is hungry and sleepy he refuses to leave the scene until he finishes the game. He has the task of organizing Henry's messy house room by room. He is currently in the cellar, the eighth and final room. Until finishing the game he will have no peace on earth; everything beyond Henry's House lies beyond his horizon of interest or concern.

The person in the previous paragraph could be one of millions of children caught up in today's video game dominant world, but this specific instance is based upon the author's personal experience. Computers and especially computer games have been a major part of my life, since the age of ten. Much water has passed under the bridge and computer game technologies have grown exponentially since then. I eventually finished Henry's House, the Commodore became obsolete, new technologies have been invented for playing computer games, and the video game revenues surpassed movie box office revenues in the U.S. (Greenspan, 2002). Video games have gone so mainstream that Wal-Mart, the top retailer in the world, has a "Video Games" section in its online store among its other big sections. Recently Personal Computers are being used for gaming in addition to solving many problems of life, but there have also been dedicated systems, called game consoles, for playing video games. Among those, Sony with its PlayStation 2, Nintendo with its GameCube, Microsoft with its Xbox (and recently with its Xbox 360), and Sega with its DreamCast are the reigning technologies in the gaming world of today. The transformation is still in progress; the diffusion of the Internet in the 1990's added the multiplayer element to video games.

Meanwhile, my gaming adventures have continued with these new technologies, and as time passed I eventually became a grown up. In the beginning of 2002, I joined the Quest Atlantis (QA) project, an educational computer game described in the following pages, both as a developer and researcher. Since then I have interacted with many kids who loved playing QA and who loved learning in the QA context. Observing the interest, devotion, and consequent motivation of these kids, I became curious about

their reasons for playing this game. What was so motivational in this computer game for almost five thousand kids even though this game was educational? What led them to continue participating in the game activities, including educational ones? In answering these questions, a review of the literature revealed that the major theories of motivation are confined within either the individual or the environment. In addition, the building blocks of these major theories differ significantly. For example, some theories like Keller's (1983) ARCS motivational design model include the issue of "relevancy" while others mention no word of it. Therefore even if these theories, and specifically the ones based on empirical data like the hierarchy of needs (Maslow, 1987), are good at explaining what makes learners motivated, probably all of them are missing the big picture since each one of them is providing a partial explanation. For that reason, an explanation of motivation that included a broader spectrum of variables, which were both within the individual and within the environment, seemed to be needed.

Past research on motivation in educational computer games was dominated by Malone and Lepper's (1987) "taxonomy of intrinsic motivations for learning." Their taxonomy asserted that challenge, curiosity, control, and fantasy were the motivational elements for the players of the educational computer games. However, this assertion was limited to isolated individuals. In contrast, recent learning theories emphasize the importance of the social and contextual factors in the learning process. In alignment with this emphasis, after reviewing sixty years of research on motivational research in education, Weiner (1990) concluded that:

- Older grand formal theories, such as drive, psychoanalytic, and associationistic conceptions, have faded away because they lacked cognitive approaches.
- Motivational research on individual difference variables was diminishing.
- Achievement was at the center of the study of motivation.
- Cognitive variables were starting to be incorporated into motivation theories more and more.
- There was a growing interest in the incorporation of emotions into motivation theories.

Besides, Weiner (1990) indicated that limiting the motivation studies in learning just with the individual was a narrow focus. He put emphasis on considering frameworks larger than the individual and thinking about extra motivational constructs. He also added that there were "many uncharted areas to incorporate" (p. 622) into motivational theories. Author of this chapter aspired to explore these uncharted areas in motivation and to put these constructs together into a framework of motivation. As a result, "Multiple Motivations Framework" was introduced to explain complex human activities while learning in computer games and learning in general. In this manuscript, I focus on details of introducing this framework and basic presumptions behind it.

2. Quest Atlantis

Quest Atlantis (QA, http://www.QuestAtlantis.org) is an educational computer game that immerses children in a 3-D virtual environment for completing educational activities. The purpose of the game is to save mythical Atlantis from an impending disaster (Barab, Thomas, Dodge, Carteaux, & Tuzun, 2005). According to the back story of the game, as the learners complete the educational activities called "Quests," they help with saving Atlantis from this disaster (Fig. 1).

Structure of Quest Atlantis

Atlantians have set up a portal, known as the OTAK, to gather knowledge from other civilizations to help stop the destruction of their planet. The OTAK is the virtual environment through which users can share their knowledge with Atlantians.

ON EARTH
Children give knowledge to the Atlantians by completing Quests about how their environment and civilizations function.

OTAK
The OTAK is the communication line between Earth and Atlantis

ON ATLANTIS
Council Members communicate with civilizations through the OTAK to gain wisdom to resolve Atlantian problems

NOTE: Teachers and mentors pose as anonymous Council Members to respond to students
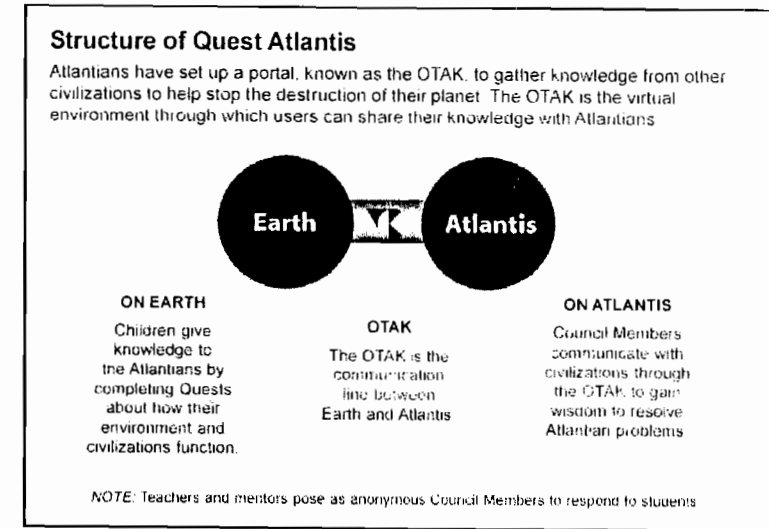
Figure 1. Structure of Quest Atlantis.

Quest Atlantis combines play, role playing, adventure, and learning, allowing learners to immerse themselves into virtual 3-D worlds where they select or are assigned developmentally-appropriate Quests, interact with other learners and mentors live from around the world, and build virtual personae (Turkle, 1995; Bers, 2001). The flexibly adaptive (Schwartz, Lin, Brophy, & Bransford, 1999) nature of QA seeks a balance between complete control by designers and easy configuration by teachers and other users. With this approach the game can be adapted to the needs of local contexts. As a result, Quest Atlantis has been implemented in many different contexts, including elementary schools as part of the curriculum, and after school programs as a volunteer activity (i.e., Boys and Girls Clubs of America). In order to participate in QA, children must be related to a particular center (participating elementary schools, Boys and Girls Clubs, or local libraries) and must register on the web site. After registering, they can participate at a centre or from anywhere through a computer with Internet access.

On the surface, QA might be perceived as a Multi-User Virtual Environment (MUVE) with rich multimedia elements. In their QA participation, students plunge into this multi-user virtual environment that is divided into different virtual worlds. Each world is further divided into three villages, each of which hosts about 25 Quests. These Quests range from simulation to application problems of differing levels of complexity. All worlds and villages have a theme. For example, when children visit the villages in Culture World, they can explore many different expressions of culture, especially art, music, and writing. Villages in culture world include artists' village, sound of music village, and words of meaning village. Each village hosts a range of Quests in alignment with the theme of that village. Some of the Quests are combined into thematic unit plans to provide further structuring for teachers.
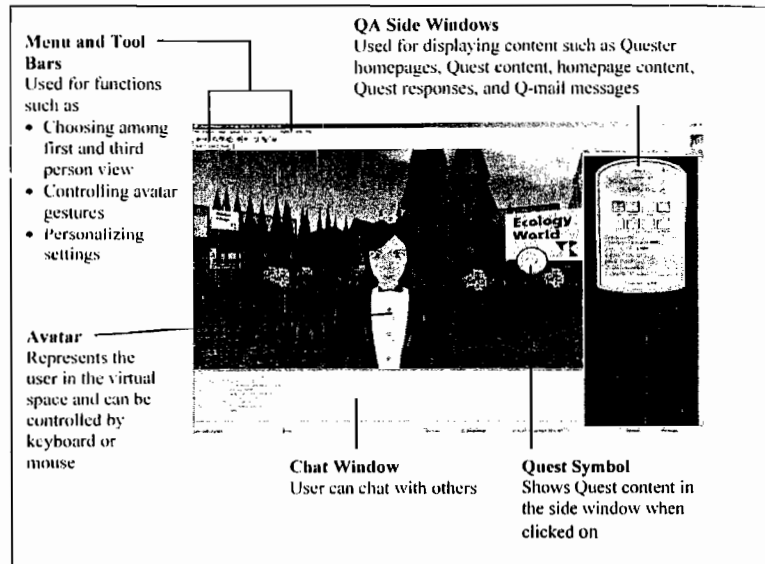
Figure 2. OTAK Interface. A screenshot from Quest Atlantis, showing a scene from a virtual world on the left and the homepage for a student on the right.

At its core, Quest Atlantis would better be described as a virtual environment designed to support an online community as well as multiple face-to-face communities, instead of conceptualizing it as simply a computer software, or a computer "game" utilizing a MUVE and multimedia elements. The Quest Atlantis storyline, its virtual worlds and villages, policies, participant structures, activity sets, and social commitments make up the brand of QA (Barab, Arici, & Jackson, 2005). This brand contains the following key components:

- A mythological legend that provides a back story for Quest Atlantis activities.
- A number of 3-D worlds and villages through which learners, mentors, and the fictional Quest Atlantis council members can interact with each other (Fig. 2).
- A Personal Digital Assistant (PDA) for each learner, serving as a portfolio of their participation and learning.
- An advancement system centered on pedagogically valid activities that encourage academic learning, entertainment, and social commitments.
- Extrinsic rewards structure.
- A globally-distributed community of participants.

Quest Atlantis lies at the intersection of education, entertainment, and social commitments (Fig. 3). Our QA team have worked to understand how to develop a "computer game that transcends the computer," that includes inquiry-based and experiential activities that are in alignment with academic standards and that can be assessed for learning gains, that provides entertainment without violence, a girl-friendly environ-
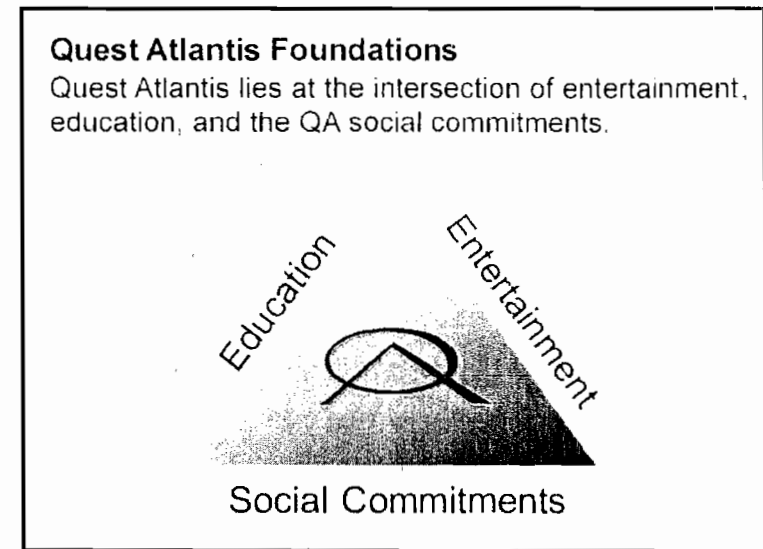
Figure 3. Quest Atlantis Foundations.

ment that still is attractive to boys, and that is committed to making the world a better place (Barab, Thomas, Dodge, Carteaux, & Tuzun, 2005).

Quest Atlantis has many components that can be categorized under different major groups: for example, communication, collaboration, and ownership. Within the game the channels of communication are chatting in the 3D space, the internal Q-mail system, telegramming, and other discourse within the physical space through various means (i.e., talking within the computer lab, or learners talking over the phone). The methods of collaboration are co-questing (i.e., doing Quests together as a team), being part of a guild, requesting help from others, and helping others related to different QA tasks. The modes of ownership are having a personal PDA with various elements on it (emoticons, awards, etc.), Q-points that learners collect after successfully completing Quests and other activities, having a unique representation, called an avatar, through customization, renting virtual land and building on it, artifacts created as the result of the Quests, and QA merchandise (QA trading cards, QA rulers, QA pencils, etc.) that can be purchased from the Quest Atlantis trading post in exchange for the Q-points.

3. Research Methodology for Generating Multiple Motivations Framework

The study from which data were obtained to introduce multiple motivations framework can be characterized with multiple labels. First of all, since the study aimed to characterize a group (Fetterman, 1998) it can be described as an ethnographic research. For this characterization I spent two months at the data collection site. In addition, a year of irregular site visits preceded this time frame. The study integrated common elements of

ethnographic studies, like participant observation, interviews and field work. At the same time the study can also be characterized as a naturalistic research study (Lincoln & Guba, 1985) because the data were collected in a natural setting, in which there were no variables to confirm or disconfirm a priori hypothesis. Quest Atlantis implementation requires developing a vision collaboratively with the stakeholders at local centers. During this process the designers of the Quest Atlantis game are more than participant observers. We call this process as "critical design ethnography," referring to "an ethnographic process involving participatory design work aimed at transforming a local context while producing an instructional design that can be used in multiple contexts" (Barab, Thomas, Dodge, Newell, and Squire, 2005, p. 254). This process is based upon a collection of methods including ethnographic research, naturalistic research, and action research. The goal of critical design ethnography is to change or empower the culture under study. The purpose of the researcher is to support a transformational process. Towards this end, the researcher acts as a change agent (Rogers, 1995) and she/he participates both within the culture as an "active member" and outside the culture as a "peripheral member" (Adler & Adler, 1987, p. 50). This position, which requires us to be more than a researcher, complicates our role as researchers and presents challenges in addition to those traditionally associated with ethnographic or naturalistic research (Clifford & Marcus, 1986; Fielding & Fielding, 1986; Silverman, 1993).

Design ethnographers need to consider three ongoing focal points, which are trust, intervention, and sustainability. Trust evolves based on many factors, including adopting a participatory position, developing multi-tiered relationships, and having an evolving agenda. During the second focal point, a socially responsive design with the purpose of supporting change is carried out. The third focal point requires making the commitment to support sustainable change. The study at this site was conducted during this third focal point of our critical design ethnography.

3.1. Research Questions

Since the basic elements of a theory are concepts (Mark, 1996), it was essential to reveal these concepts first. For this purpose, the following analytical research question was asked: "What are the motivational elements of Quest Atlantis, whether intrinsic or extrinsic, in terms of student-defined motivation?" Since motivation is a hypothetical construct (Martin & Briggs, 1986; Good & Brophy, 1997) and its definition differs among academicians, I needed to define motivation as individuals' showing their willingness to initiate and sustain participation in Quest Atlantis activities. In this sense, I was more interested in continued motivation (Brugman & Beem, 1986; Malouf, 1988), as opposed to momentary motivation. Initiating engagement and sustaining it over time are different phenomenon, and we know little about the latter (Garris, Ahlers, & Driskell, 2002). To discover the relationships between the concepts discovered, a second analytical question was asked: "How do high, medium, and low participating groups differ in their responses with respect to the motivational elements found after answering the first research question?"

3.2. Context Selection

I critique many motivational research studies, including the ones by Malone (1980) and Lepper and Malone (1987) that paved the way for their "taxonomy of intrinsic motiva-

tions for learning" (Malone & Lepper, 1987), in that these research studies offered the innovation, the computer games, to the learners and then measured the momentary motivation of the learners quickly after these games were used. This problem in media studies is known as the novelty effect (Clark, 1983). In studies including the novelty effect, the validity of the findings of the factors that explain the motivation of users playing these games becomes questionable, especially from the perspectives of sustainability and persistency. Bandura (1986) advises that motivation toward activities can be measured at different points in time, which decreases the risk of misinterpreting short-term changes in motivation. I wanted to eliminate the novelty effect in this study by a purposeful selection of the research context. Since the novelty effect tends to disappear over time (Krendl & Broihier, 1991), the major criterion for context selection was selecting a Quest Atlantis center that was enrolled in the Quest Atlantis program for at least six months. There was just one such Quest Atlantis center, a U.S. Midwestern after-school program, in geographical proximity to the researcher. This center was selected for this study given their willingness to participate. Choosing an after-school context also made it an interesting research context for examining motivation in that learners were not forced by teachers to participate. The after-school context was a member of the national Boys and Girls Clubs of America. The club had 645 members (36% girls, 65% boys). The age group of the children attending the club ranged between six and eighteen years old. There were 346 members between the age of 9 and 12 (54%), which is the target age group for QA. Once members are at the club, it is up to them what to do at the club during the rest of the day. They can participate in activities in game room, canteen area, teen room, library, art room, gym, outside, or computer lab. Quest Atlantis educational game was one of the options in the computer lab among other software titles or activities such as Magic School Bus educational software series, Reader Rabbit's Math, Amazon Trail, Civilizations II, SimCity 3000, and using the Internet.

3.3. Participant Selection

When conducting this study, there were 133 QA members at the club. Altogether, these members had logged on to the game 6344 times and completed 319 Quests, 197 of which were accepted. Among these QA members, those, who had played the game at least five different sessions, and who had spent at least three hours within the game, were chosen for conducting the interviews. With these selection criteria, I wanted to make sure that the learners had accumulated the prerequisite skills necessary to play the game at a basic level. To answer the second research question appropriately, which required having game participants with high, medium, and low participation frequencies, the sampling of the interview participants was done conveniently so that equal number of participants would be obtained in each of the high, medium, and low participation categories. A total of twenty members were interviewed, five of whom were female and fifteen of whom were male.

3.4. Data Collection

Ethnographic methods such as interviews, observations, and document analysis were used for collecting data. Semi-structured interviews were the main data collection method of the study. To provide validity for a research study the ethnographer needs to ask the right questions (Fetterman, 1998). To provide this kind of validity, I visited the

after-school context for a year at different times before this study took place so that I could form the interview questions based on what people did in this context in their daily lives. A total of 20 interviews were completed during a 36-day period, which lasted between 15 and 45 minutes. After their transcription, these interviews resulted in 161 single-spaced pages of data. The attention spans of the members at this age group (nine to twelve) were very low. For that reason, a demographics questionnaire form was developed for collecting factual data. This questionnaire included open and close-ended questions related to their club life, Quest Atlantis use, and information technology use. This demographics questionnaire was completed by the interviewees at a time after the interview. Using the questionnaire prevented asking redundant questions that would make the interview length longer.

Observations were conducted while the members of the after-school context were interacting with Quest Atlantis in the computer lab. The after-school context was open daily from 3pm to 8pm. My observations took place daily, Monday through Friday, for two months. During the observations, I usually spent the time between 3pm and 7pm in the computer lab, taking notes, summarizing events and interactions that took place physically in the computer lab and virtually in the online QA space. I spent the remaining hour between 7pm and 8pm for entering these notes into an electronic QA database available through the Internet. These observations resulted in 76 single-spaced pages of data.

Document analysis included examining materials from the club and digital data from the Quest Atlantis servers. Documents from the club included member information, such as members' social and economic status, and annual meeting reports. Digital data from the QA servers included all electronic data related to Questers' participation within the game. These electronic data can be categorized within two groups: the frequency of participation (such as, time spent in the 3D space, the number of logon times to the game, the number of e-mails received and sent, and the number of Quests done) and the content of participation (such as, responses to the Quests, the contents of the e-mails, and the contents of their chatting in the online game space).

3.5. Data Analysis

I used the constant comparison method of grounded theory (Glaser & Strauss, 1967) for data analysis. This method of data analysis seemed to be the most appropriate for several reasons. First of all, this approach is exclusively tailored for producing theory about a substantive area in social sciences. Specifically, grounded theory is "... a general methodology of analysis linked with data collection that uses a systematically applied set of methods to generate an inductive theory about a substantive area" (Glaser, 1992, p. 16). Since my intention was to provide an organizing framework from which to explain things of significance for motivating learners, this kind of data analysis fitted well with this purpose. In this kind of data analysis, categories inductively emerge out of the data rather than being decided prior to the data analysis (Patton, 1987). Possible data sources for producing theory can include interviews, field observation records, and documents (Strauss & Corbin, 1994). All of these data collection techniques were employed, as it was indicated in "Data Collection" section. To analyze the data through the constant comparison method, three stages are followed (Glaser, 1992; Strauss & Corbin, 1998): open coding, axial coding, and selective coding. These three stages were applied to the interview and observation transcription records as explained below.

- During the open coding stage, data are broken down into their parts. To do so, incidents in the data are inspected closely, by comparing for their differences and similarities. During this stage data are conceptualized, so that mountains of data are reduced into manageable pieces. The data may be broken down into parts by three different methods. They can be analyzed line by line, as a whole sentence, or as a whole document. The first five interview documents were openly coded by three researchers (author of this chapter, another doctoral candidate, and a faculty member), while the remaining fifteen interview documents were openly coded by two researchers (author of this dissertation, and another doctoral candidate). The same two researchers coded one of the observation records. All of the remaining observation documents were coded by myself. Before the coding, the researchers read all interview documents to explore and to grasp the content in them. When coding for an interview document the researchers first read the question and the answer for it. Then the answer part of this chunk was coded as a whole paragraph. Data stated by the researcher, like questions or clarifications, were not coded. The researchers negotiated the codes within the chunk until they arrived at a 100% agreement. This process of open coding was independent of the research questions. Open coding of the observation documents was done in a fashion similar to that described above. Naturally, the majority of the codes emerged during the open coding of the interview documents. For that reason, existing codes from the interview documents were used for open coding of the observation documents. Since there were no questions in these documents the coding was done at the paragraph level. After the open coding of the interview documents there were 202 codes. Open coding of the observation records added 32 new codes. At the end a total of 234 codes were obtained.

- During the axial coding stage, categories are systematically developed and related to each other along their properties and dimensions. It needs to be emphasized that open coding and axial coding are not sequential stages. One needs to move between open coding and axial coding, during which the researcher continues coding for properties and dimensions while developing relationships between categories. Saturation is reached when a category does not seem to produce any more properties or dimensions. Just after completing the coding of the interview documents and just before starting the coding of the observation documents two researchers preliminarily organized 202 codes in 16 categories. These 16 categories were: store items, edutainment, building, 3D, identity, social, different from others, QA extras, people, homepage, Boys and Girls Club context, design, implementation, control, motivation, and feelings. Further, these categories were collapsed then again under 5 of these original categories so as to create more parsimony and usefulness to the codes: The different from others category included identity, social, building, and edutainment; design category included homepage, 3D, and QA extras; motivation category included store items and control; implementation category included Boys and Girls Club context and people; and feelings category stood alone.

- During the selective coding stage, the theory is integrated and refined. For this purpose, the emerging story is explained around a core category, while all the other categories are linked to this core category. The three researchers got together to discuss 16 categories found during the axial coding stage and the

codes within them. Since the open coding and the collapsing of categories were done independent of the research questions, these 16 categories and the larger 5 categories were characterizing the data well in general but not well with respect to the research questions of the study. For that reason, the researchers re-debated the codes and the categories in light of the data, by using their own characterization of motivation based on salient themes and the research questions, and by re-visiting the current literature on motivation theories. This re-debate was a dialectic intersection of the categories grounded in the data, our intuitive responses to the research questions, and the current theories of motivation. After the re-debate a number of changes were made. Nine of the categories were kept but renamed: building as creativity, social as social relations, identity as identity presentation, store items as rewards, motivation as achievement, 3D as immersive context, Boys and Girls Club context as context of support, different from others as uniqueness, and control as control and ownership. Six categories were dropped and they were collapsed under other categories: QA extras, people, homepage, design, implementation, and feelings. The remaining edutainment category was huge in size; therefore it was split into playing and learning categories. Two new categories emerged which were previously nested under one of the 16 categories: curiosity and fantasy. In the end, we obtained thirteen categories all of which related to and were placed under one of the research questions: identity presentation, social relations, playing, learning, achievement, rewards, immersive context, fantasy, uniqueness, creativity, curiosity, control and ownership, and context of support. These thirteen categories, their dimensions in QA, and the total number of responses coming from the interviewees related to each of the categories and their dimensions in QA are presented in Table 1.

3.6. Measuring Participation and Assigning Participants to Groups

The second analytical research question required assigning the interviewees into high, medium, and low participating groups. The difficulties with measuring participation in research studies have been documented in education as well as other domains (see, for example, Mussino, 1999). The biggest difficulty is the selection of indexes of participation, i.e. what activity or activities show participation in a specific field. To overcome this complexity in education Fin (1989) developed a four-part taxonomy to identify the forms of student participation in schools. Participation in the first level is basic and it involves students' tendency to attend the class. At the second level students take initiative in the class. For example, they might ask questions to teachers or they might do extra school work. The third level of participation occurs outside the class. For example, students might participate in social or extracurricular school activities. The fourth level involves the empowerment of students by involving them in the school's disciplinary system or school government. Finn, Folger, and Cox (1991) developed an instrument for elementary school students to measure their participation based on the four-part taxonomy. They also examined the empirical relationships among the parts of the taxonomy. They found the correlations among the parts of the taxonomy sufficiently high, concluding that any one of them could be used as a single participation index.

In alignment with Finn's taxonomy of participation, I chose two indexes to calculate Questers' participation in QA. These indexes were the total amount of "time spent in QA" and the number of "Quests" undertaken. Since all QA activities take time

Table 1. Thirteen Categories and Sub-Categories as Motivational Elements.

Category	Sub-category	Total number of responses (phrases)	
1. Identity Presentation	Avatars	22	
	Usernames	10	83
	Homepages	51	
2. Social Relations	Interaction with others	166	
	Sharing	40	
	Competition	3	
	Showing off	28	260
	Groups	13	
	Privacy	5	
	Security	5	
3. Playing	Multimedia	5	
	Points	138	147
	Pushball	4	
4. Learning	Unique learning	4	
	Meaningful learning	17	
	Active learning	231	288
	Feedback	23	
	Multimedia	5	
	Attitudes	8	
5. Achievement	Challenge	9	36
	Recognition	27	
6. Rewards	Awards	9	
	Points	185	269
	Trading cards	7	
	Open market	68	
7. Immersive Context	Support structures	6	170
	3D	164	
8. Fantasy	QA myth	19	31
	Council members	12	
9. Uniqueness	Unique opportunity	19	
	Different from others	16	133
	QA vs. others	98	
10. Creativity	Building	129	129
11. Curiosity	End of the game	3	
	Quest status	5	28
	Secret places	20	
12. Control and Ownership	Control	38	52
	Jobs	14	
13. Context of Support	School vs. club differences	9	
	Username	2	14
	Trading post items	3	

to complete, Questers need to spend time within the game as a basic requirement. For that reason, the total amount of time spent in QA is equivalent to the first level of Fin's (1989) participation taxonomy. Doing Quests is the salient activity in this educational game and initiative is required to do them. For that reason, the number of Quests undertaken is equivalent to the second level of Fin's (1989) participation taxonomy.

Since kids attend the club with varying frequencies, kids attending the club more frequently would have more chance to spend time in QA. For example, a youth visiting the club everyday would have more chance to spend time in QA than a youth visiting the club just once a week. This would create a measurement error while calculating the participation in QA. To eliminate this error for "time spent in QA," I divided "time spent in QA" by "club attendance per week" for each interviewee (Table 2; since there were three kids playing QA once a week at their schools, I added a day to their "club attendance per week," as bolded in Table 2) — this gave me equalized "time spent in QA." Then I calculated standard scores for equalized "time spent in QA" and "Quests." For this purpose, I calculated Z scores for equalized "time spent in QA" and "Quests" by using SPSS v11.5. Since the cognitive and intellectual development of kids are dependent on doing educational activities more than other activities in the game, Questers' doing the Quests in QA are given the most importance by the designers of QA. In alignment with this philosophy, I gave more weight to the index of "Quests" while calculating the overall participation score. To obtain the participation score I doubled the Z score of "Quests" and added it to the Z score of equalized "time spent in QA." Table 2 shows interviewees sorted by their participation scores from high to low. The participation scores were used as a mean to sort the interviewees based on their participation. For that reason, the numbers themselves are not meaningful beyond that purpose.

After sorting the interviewees by their participation scores it was apparent that Questers towards the top of list would belong to the high participating group, Questers towards the bottom of the list would belong to the low participating group, and Questers between these groups would belong to the medium participating group. The difficulty was in choosing the cutoff points. To determine the cutoff points I compared the Questers in the list next to each other starting at the top of the list. While comparing them I depended on my intuition, which was based on my longitudinal observations of the kids. I asked the following analytical question during the comparisons: "Did I observe a difference in the participation of Questers in row X and row X+1?" After following this methodology, it became evident that the first seven Questers belonged to the high participating group, while the next seven Questers belonged to the medium participating group, and the last six Questers belonged to the low participating group. Each Quester's belonging to a specific group highly correlated with my intuition. In order to check the validity of these results, I asked the most experienced member of computer lab staff to put these twenty Questers into high, medium, and low participation groups based on their participation in QA. I asked him not to look into QA usage statistics and just to depend on his observations. He placed 17 of the 20 Questers into three categories in alignment with the assortment in Table 2. This high agreement validated the methodology for dividing the Questers into three participation categories.

3.7. Trustworthiness

Lincoln and Guba (1985) summarized four areas for considering the importance of any scientific study: truth value, applicability, consistency, and neutrality. Since qualitative

Table 2. Questers Sorted by Their Participation in QA.

Quester	Time spent in QA	Club attendance per week	Equalized time spent in QA	Quests	Z of equalized time spent in QA	Z of Quests	Participation Score	Frequency of participation
Andrew	71	5	14.2	22	1.03	2.93	6.88	High
Emily	142	5	28.4	5	3.27	0.14	3	High
David	27	5	5.4	15	0.36	1.67	2.97	High
Jason	27	4	6.75	13	0.15	1.31	2.46	High
John	47	5	9.4	10	0.27	0.77	1.8	High
Ryan	80	5	16	6	1.31	0.05	1.4	High
Kevin	18	2	9	6	0.21	0.05	0.3	High
Anthony	21	2	10.5	5	0.45	-0.14	0.18	Medium
Jennifer	12	3	4	6	0.58	0.05	-0.49	Medium
Thomas	41	5	8.2	4	0.08	0.32	0.55	Medium
Rebecca	8	5	1.6	6	-0.96	0.05	0.87	Medium
Eric	6	1	6	4	-0.27	0.32	-0.9	Medium
Brian	16	5	3.2	5	-0.71	-0.14	-0.98	Medium
Amy	10	2	5	3	-0.42	0.5	-1.41	Medium
Mark	9	1	9	1	0.21	-0.86	1.5	Low
Scott	18	3	6	2	-0.27	0.68	-1.62	Low
Tyler	6	1	6	2	-0.27	-0.68	1.62	Low
James	17	5	3.4	0	-0.68	1.04	2.75	Low
Luke	4	5	0.8	0	-1.09	1.04	-3.16	Low
Sarah	3	4	0.75	0	-1.09	1.04	3.17	Low

research and quantitative research differ in their world views, they require different kinds of paradigms to evaluate their worth. Creswell (1998) documented that multiple perspectives existed for the verification of results in the qualitative research paradigm. Lincoln and Guba (1985) recommended using the word "trustworthiness" to refer to the verification in qualitative studies. They defined the trustworthiness as persuading the audience of a research study that the findings of the study are worth paying attention to. Aligned with their taxonomy for considering the importance of a scientific study, Lincoln and Guba (1985) offered the term credibility to deal with the truth value, the term transferability to deal with the applicability, the term dependability to deal

with the consistency, and the term confirmability to deal with the neutrality, for considering the importance of qualitative research studies.

Since multiple realities are involved in a qualitative research study Lincoln and Guba (1985) offered "credibility" as an operational term. The implementation of credibility requires two tasks: doing the research in such a way that the possibility of finding credible outcomes is enhanced, and showing this credibility by having the results agreed to by the constructors of multiple realities (i.e., participants and other researchers). With respect to the former task, I followed prolonged engagement with the research site (frequently for a year), persistent observation in the research site (daily for two months), and triangulation of methods, sources, and researchers. Fetterman (1998, p. 36) agreed that "working with people, day in and day out, for long periods of time is what gives ethnographic research its validity and vitality." With respect to the latter task, I followed up with peer debriefing. During the peer debriefings I was challenged by the QA design and research team. This helped me with increasing my awareness to "substantive, methodological, legal, ethical, or any other relevant matters" (Lincoln & Guba, 1985, p. 308) about the research study, with defending my assertions, and with developing the methodology.

The implementation of transferability requires providing a thick description of the culture (Lincoln & Guba 1985; Gilbert 1993; Creswell, 1998; Merriam 1998). If the researcher knows the rules and norms of the culture under study and if he can convey this information to the readers such that they can integrate themselves into the culture by following the description of the researcher, transferability is established (Gilbert 1993). Further, since the researcher can not apply the findings to many other substantive fields, providing a thick description of the research site allows others "to compare the 'fit' with their situations" (Merriam, 1998, p. 211).

Dependability criterion reflects the consistency of a qualitative study. The existence of multiple realities and the changing nature of the research site create "instabilities" (Lincoln & Guba, 1985, p. 299), which prevent applying the traditional reliability techniques into qualitative research. Lincoln and Guba (1985) use the term "confirmability" to refer to the neutrality of a qualitative study. They claim the emphasis of objectivity should be on the data instead of the researcher. Therefore, confirmability becomes an issue of checking the characteristics of the data. Lincoln and Guba (1985) recommend using external audit trails to establish both dependability and confirmability at the same time. In this sense, an outsider can examine data, findings, and interpretations just like a fiscal auditor checks the process and the product of a business account (Creswell, 1998). Approving the process provides dependability while approving the product provides confirmability. During the selective coding stage, the third researcher provided such an audit trail. He examined the products of the two researchers, which were the data and the sixteen categories, and also the process to produce those products.

4. Participation Patterns of High, Medium, and Low Group Members over Time

To answer the second research question, each of the high, medium, and low participating groups was characterized based on the thirteen motivational categories. These three groups were then compared for similarities and differences to see to what degree their participation differed. Figure 4 provides the mean number of responses for the motiva-
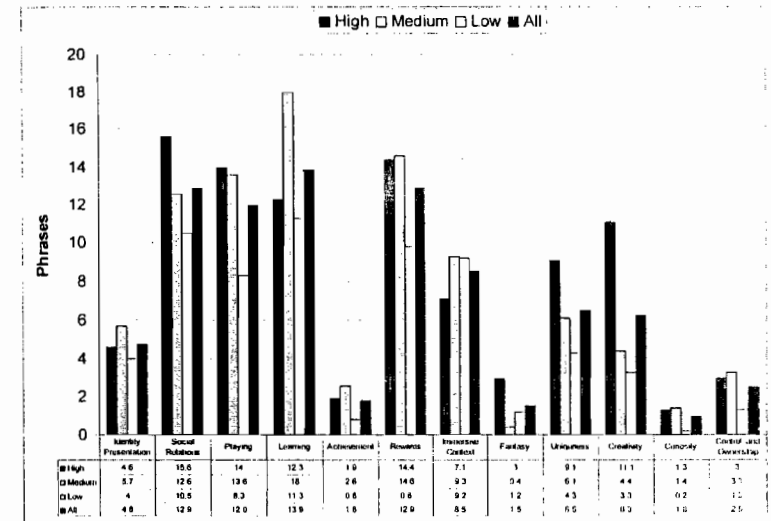
	Identity Presentation	Social Relations	Playing	Learning	Achievement	Rewards	Immersive Context	Fantasy	Uniqueness	Creativity	Curiosity	Control and Ownership
High	4.6	15.6	14	12.3	1.9	14.4	7.1	3	9.1	11.1	1.3	3
Medium	5.7	12.6	13.6	18	2.6	14.6	9.3	0.4	6.1	4.4	1.4	3.7
Low	4	10.5	8.3	11.3	0.6	0.6	9.2	1.2	4.3	3.1	0.2	1.2
All	4.8	12.9	12.0	13.9	1.6	12.9	8.5	1.5	6.5	6.3	1.6	2.5

Figure 4. A Visual Comparison of the Mean Number of Responses from High, Medium, and Low Participating Group Members with Respect to the Motivational Categories.

tional categories for each of the high, medium, and low participating group members in a visual form.

Members of the high participating group wanted to lead other kids, in this way they can be described as innovators or early adopters in Roger's (1995) terms. Members in the medium and low groups seemed not to fit into this category. The high group members spent significantly more time (59 hours) in the game than the medium group (16 hours) or the low group (10 hours) members. Although there was a huge difference between the high and medium groups in terms of time spent in the game, the understanding of the kids from both groups about the participant structures in the game was pretty close. The low group members seemed to need more time to know more about the game.

The mean age for the high and low groups was both 10.5, but this was 12 for the medium group. The family income for the high and medium groups was very close, $36,000 and $34,000 respectively, however it declined noticeably to $21,500 in the low group. However, it should be noted that the family income of the most participating Quester was $20,000 and the family income for the least participating Quester was $40,000. Therefore, the family income did not necessarily correlate positively with the participation.

QA as a whole seemed a fun game for all three group members. When asked about the three most favorite activities in QA, the themes that included these activities matched for all three groups: learning, social relations, and immersive context. There was an additional category of creativity for the high group. Although their most favorite activities matched, the order of these differed among the groups. The order for the three most favorite activities in QA was:

- Social relations, creativity, learning, and immersive context for the high group.
- Social relations, learning, and immersive context for the medium group.
- Immersive context, learning, and social relations for the low group.

This preference was reflected in the interviews. For example, low group members talked most about the 3D worlds and villages, navigation in 3D, and avatars which constituted the immersive context category. On the contrary, members of the high and medium groups complained about the paths in 3D that became routine and suggested placing shortcuts to eliminate this problem. The least favorite activities for the medium group were related to the learning category and the least favorite activities for the low group were related to reading. The high group did not complain about the learning.

Considering the identity and social relations, the mean number of responses for the social relations category was much higher than the identity category for all three groups. The interview and observation data supported this outcome; all kids loved interacting with others through various communication modes, shared information, competed with others, showed off their own game artifacts (points, awards, self-information, etc.) to others, and experienced conflict at times as the result of all these interactions. Their usage statistics with respect to using e-mail, chat, and number of entries on the friends page correlated positively with the time spent in the game, and these numbers decreased while going from the high to low participating groups. There was a slight difference between the high and –medium and low– groups in that the members of the former included others in the same context in their gameplay more than the members of the latter.

Avatars had a higher impact on the identity of the Questers in the medium and low groups. High group members reflected their identity more in their homepages; each of them detailed their identity on their homepages. This using of homepages for identity decreased towards other groups; for example, half of the medium group and one third of the low group entered their self information into their homepages. Related to using the functions on the homepage, all three group members seemed to have limited information processing capability. One of them specifically indicated that she forgot about some functions during her usual play, or that some functions were just out of focus at a specific time.

For the members of the medium participating group and low participating group the mean number of responses for the learning category was higher than the playing category. On the other hand this was the opposite for the high participating group; the number of responses related to the playing category was higher than the learning category. The mean number of responses for the playing category for the high group (14) and medium group (13.6) was very close.

The mean number of responses for the rewards category was much higher than the achievement category for all three groups. This is a clear indicator that members of all groups valued extrinsic rewards. These rewards included QA points, awards, and trading post items. Members of the high group actively exchanged their points with items in the trading post; however, the majority of the members in the medium and low groups did not know about the trading post and participated in limited transactions. Although they did not know about the trading post and items in it, these kids heard about the availability of some items from others. The mean number of responses for the rewards category for the high group (14.4) and medium group (14.6) was very close.

The mean number of responses for the immersive context category was close for the medium and low groups, being 9.3 and 9.2 respectively. This was 7.1 for the high group. All group members knew about the worlds and villages that made up the 3D space, but members of the high group were able to discriminate between the worlds and villages better than the other group members.

The fantasy category was another category that seemed to be different for the high group. In this category dimension, the medium and low groups were close to each other in that they did not absorb the legend well, and they did not remember about fictitious game characters. Many high group members on the other hand linked their efforts to helping the Atlantis people.

Related to the uniqueness category, the number of responses decreased gradually through the high group to low group, from 9.1 to 6.1, and to 4.3. Of particular note, the members in the high and medium groups pointed to the unique learning and social interaction opportunities afforded by the game. For the low group, QA did not seem any different from other games, excluding the immersive context mostly provided by the 3D feeling of the game.

The mean number of responses for the creativity category was 11.1, 4.4, and 3.3 for the high, medium, and low groups respectively. Almost all members of the high group actively built on virtual land, while almost all other Questers planned to rent land and build on it. The enjoyment of the building was not limited just to the builders; many others indicated that visiting these structures was an activity in which they regularly engaged.

The mean number of responses for the curiosity category was very close for the high group (1.3) and the medium group (1.4). This closeness was reflected into the group characterization equally; both groups indicated secret places was the most exciting activity to do, and three to four kids from each group talked about the excitement of finding secret places. The low participating group members did not frequently engage in finding secret places, the mean number of responses being just 0.2.

Related to the control and ownership category, the numbers for the high and medium groups were close. This was 3 for the high group, 3.3 for the medium group, and 1.3 for the low group. All group members from the high participating group felt the tension of the controlling elements in the game and complained about them. Meanwhile, tension was a noted factor for only half of the medium group members. Lastly, none of the low group members felt any control tension. Related to jobs, two members from the high group signed up for a job and an equal number of people from both the high and medium groups indicated their intentions to sign-up for a job soon. Low group members were not aware of the availability of the jobs.

5. Multiple Motivations Framework

When I looked into the results of my data analysis, it was surprising that such a broad range of categories that motivated children in QA emerged. Traditionally, research regarding motivation in computer games has characterized motivation in a smaller number of categories, usually challenge, curiosity, control, context, and fantasy. Since I have been a close follower of the computer games since childhood, I was expecting new emergent categories such as interaction based on my observation of the popularity of online multi-player games. Initially I had no ideas or expectations much beyond that.

Because of this diversity of motivational reasons to play an educational game, I want to refer to my findings as the "multiple motivations framework" for playing educational computer games. Since the data helping me understand the construct of motivation were collected from a single context, I would prefer to call it a framework rather than a theory. I continue to conduct studies involving learners with different age groups, different subject matters, and different contexts to evolve my framework into a theory. Any scholar in education or social sciences can guess that I was influenced by the theory of multiple intelligences developed by Gardner (1993) while naming my framework. This guess would be correct. I believe such a name selection reflects learners' multiple reasons for learning.

A theory tries to explain something that is not easily visible (Gilbert, 1993; Mark 1996). When theories are used to explain something, they provide reasons for a specific phenomenon. For example, information-processing theory describes, among other things, that information goes through the short-term memory before entering the long-term memory. It does not inform how to facilitate learning (Reigeluth, 1999). Theories that are descriptive can be used for prediction, i.e. given an initial event what event will likely to occur (Reigeluth, 1999). Prescriptive theories on the other hand offer guidelines for using the best methods to achieve a specific goal. For example, a prescriptive theory might recommend relating new information to learners' previous knowledge for helping the retention of that information in the long-term memory (Reigeluth, 1999). There could be other methods for the retention of information in the long-term memory. Therefore, while the major concern for the prescriptive theories is their preferability (i.e., does this method achieve the goal better than any other known method?), validity is the most important concern for descriptive theories (Reigeluth, 1999). The theory of multiple motivations is prescriptive in nature since it includes categories and methods that motivate learners in educational computer games. To a certain degree it is also descriptive at the same time, because it describes the relationships between these categories.

When a theory is explicated, it is necessary to clarify its content and form (Steiner, 1998). The basic elements of a theory are concepts (Mark, 1996). Concepts are related to each other to produce universal generalizations. Concepts and these universal generalizations are the content of a theory. Relationships between the concepts and relationships between universal generalizations give a theory its form (Steiner, 1998).

The purpose of my multiple motivations framework is to provide an organizing framework from which to explain things of significance for motivating learners (Fig. 5). In this sense, its content includes categories which are formed by relating concepts through the constant comparison analysis of the data. Although my framework is inducted from multiple interviews and observations, it is only in relation to one study so I offer it as a descriptive framework for making sense of and interpreting this dataset and not yet as a theoretical framework with generalizable power.

The categorical content of multiple motivations framework contains the categories of identity presentation, social relations, playing, learning, achievement, rewards, immersive context, fantasy, uniqueness, creativity, curiosity, control and ownership, and context of support. After a comprehensive examination of these thirteen categories in the light of my data, further relationships between some categories, universal generalizations so to speak, emerged. These generalizations are characterized as an organizing framework and presented as a series of dualities. Along these relationships are those between identity presentation and social relations, playing and learning, and achievement and rewards. In addition immersive context, fantasy, and uniqueness came closer
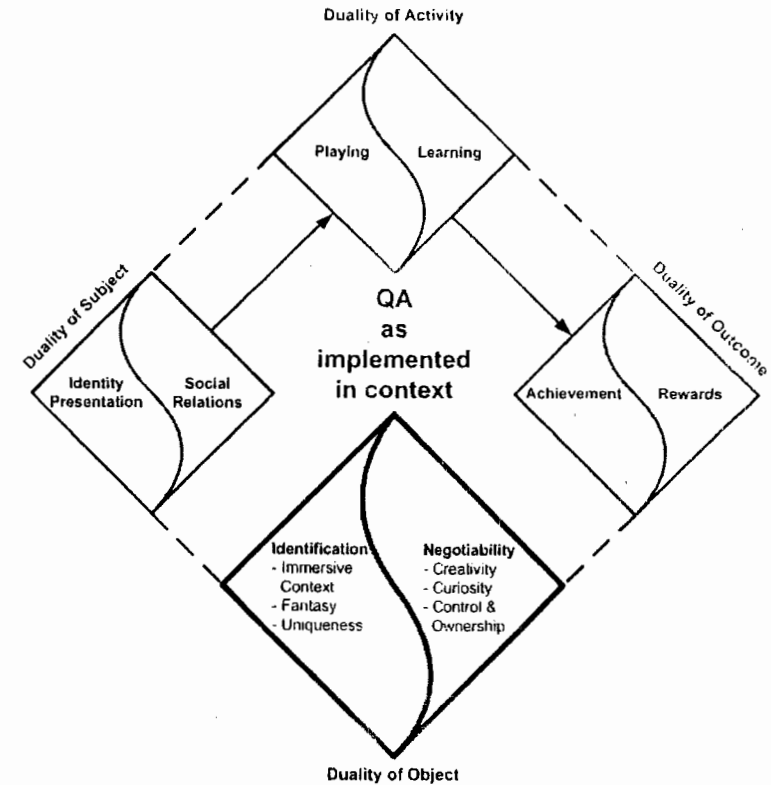
Figure 5. Multiple Motivations Framework.

while creativity, curiosity, and control and ownership made another group. The fourth relationship is between these groups, with three categories in each. I will refer to the relationships between the categories as dualities.

Wenger (1998) defines a duality as "a single conceptual unit that is formed by two inseparable and mutually constitutive elements whose inherent tension and complementarity give the concept richness and dynamism" (p. 66). In this sense, dualities are not polarizations in a Hegelian or Marxist sense. They exist together. Dualities do not make up a spectrum. For example, going from one side to the other does not imply leaving the other. The effective functioning of one side of a duality necessitates, and is dependent on, the existence of the other (Barab, Makinster, & Scheckler, 2003). Sides of a duality describe an interplay. Understanding this interplay between the sides of a duality is of primary interest. For example, Wenger (1998) and Barab et al. (2003) utilized this understanding as a framework to understand the community life. Here I utilize the interplay between the sides of dualities in Multiple Motivations Framework to understand motivation in learning.

I will define the universal generalization between the categories of identity presentation and social relations as the "subject" duality, the one between the categories of playing and learning as the "activity" duality, and the one between the categories of achievement and rewards as the "outcome" duality. Additionally, I discuss the universal generalization between identification and negotiability as the "object" duality.

Here I need to note Leontiev's concept of activity. Vygotsky and later his student Leontiev struggled to explain the differences between human beings and animals. For this explanation, Leontiev came up with the concept of activity. In his explanation he conceptualized activity as a collective process between the individual and community (Hedegaard, Chaiklin, & Jensen, 1999). In this sense, I need to clarify that my concept of activity is different from that of Leontiev's in that activity is not necessarily a collective process. However, I find Leontiev's framework, discussions, and even categorical labels as discussed in terms of activity theory to be informative of my work, especially in that I use the labels subject, object, activity, and outcome.

6. Core Dualities in Multiple Motivations Framework

When the motivational categories in Multiple Motivations Framework are closely examined, it is evident that some of these categories make up an activity system, while some other categories directly pertain to the designed product. The activity system centers on the designed product and follows a historical route. Participation patterns of the high, medium, and low group members over time helped with revealing the historical activity system. Both the designed product and the activity system exist in a particular context. Dotted lines enclose the designed product and the activity system in Multiple Motivations Framework to reflect dissimilar contexts with differing cultures and norms. Dotted lines simulate the variability of the context; i.e., some other motivational categories might be introduced or some of the motivational categories might disappear in different contexts. However, I will argue that the basic activity system, including subject, activity, and outcome, will remain unchanged for most of the contexts. Below, components of the Multiple Motivations Framework, including subject, activity, outcome, and object are detailed.

6.1. Duality of Subject

Identity presentation and social relations categories make up the "object" duality. In this sense an individual likes to be part of a culture or social structure, however the individual still would like to keep his identity through various means, a duality expressed by Jung (as cited in Stone, 1997) as individuation (our need to be unique) and integration (our need to be part of a community). Therefore, an individual can participate in activities alone or he can participate with others.

Within QA context, identity found it's meaning with avatars, usernames, and homepages. The existence of the individuality in the game starts with transforming into an avatar. Most starters of the game first customized and changed their avatars. A second indication of identity is usernames. Having a unique username is one of the ways the learners can represent their identity. Learners exposed more of their identities through their homepages. By revealing miscellaneous data about their selves (like what they liked, and things that they were good at) they made public what and who they were. Avatar, username, and homepage of a person were synthesized into a unified

identity. Having such an identity was a reason for them to play and continue to participate in this game.

This identity appeared to be complemented through social relations as they interacted with others. Social relations happening in the game was one of the biggest motivators for the players. These social relationships included interacting with others, sharing, competing, forming groups, and showing off. These relations happened both within the online space and within the physical space where they connected to the game. In their relations, they interacted with various people through multiple communication modes. At times there was competition among the Questers but data showed that sharing dominated over competition. Although there were Questers who wanted to play the game individually, playing it as a group was more frequent. And security features within the game bettered the social relations.

6.2. Duality of Activity

Playing and learning categories make up the "activity" duality. In Multiple Motivations Framework, activities are performed by the duality of subject and activities result in the duality of outcome. The combination of lower level actions produces higher level activities. For example, when playing a game called pushball, players travel to the healthy world, navigate to the pushball arena, follow the ball object, and attend to other players and the scoreboard. When completing a Quest, they travel to different game worlds, navigate in them, find Quests, read and listen to Quest descriptions, interact with other learners to get help, submit answers, and get feedback. Each of these steps is an action, and actions contribute to the higher level activities of playing and learning.

Actions can be described as activities themselves, but one difference between activities and actions is that activities are relatively more meaningful than actions and therefore they have the potential to produce greater enjoyment. Perhaps the action of navigating in a 3D world is an amazing feeling for a learner who just starts the game (like for those in the low participating group). But over time this novelty wears off and users' enjoyment decreases. On the other hand, activities give learners consistent, sustained enjoyment.

This sustained enjoyment comes from the tight integration of actions that lead to an activity. Since there is a broad range of combinations of actions one can take while engaging with an activity, each instance of an activity becomes unique. As an example, a learner might logon to the game, meet with new players and talk to them, travel to "words of meaning" village in culture world, browse Quests in this village, choose a Quest, read the Quest description, browse online resources, discuss Quests with other players, and submit his answer in text format. Another player, on the other hand, might logon to the game, check to see if her previous response was approved, travel to "sound of music" village in culture world, find her assigned Quest, listen to a narrated Quest description, browse online resources, browse her textbook, create the artifact the Quest asks for, and submit this artifact as a response to Quest. Therefore, although these two learners can be said at the macro level to have simply completed a Quest, their engagement at the micro level differs greatly and reflects diversity.

Interestingly, for some activities there were varying opinions on the type of that activity. For example, some kids characterized completing Quests more as learning while some other kids characterized the same activity more as playing. This difference comes from the diversity of combinations one can take while engaging with an activity. Kids who characterized doing the Quests more as learning were weak at integrating the

play elements (like those in the low and medium participating groups). On the other hand, kids who characterized doing Quests as fun tended to be good at integrating play elements into their learning (like those in the high participating group).

Nonetheless, one should keep in mind that when the perception of an activity weighed more on playing or learning, the other part was still remembered and given importance. This supports the duality or inseparability of playing and learning. The playing and learning were so intertwined for the kids that they had difficulty distinguishing the two. For example, when I pointed to the education aspect of the game they reminded me about the playing aspect of it. Similarly, when I turned to the playing side they argued that one would also learn at the same time. Therefore, there was no point or need for them to separate the playing and learning.

Overall, learners considered QA as a game and there was no question about this issue. Multimedia elements, points, and the pushball game contributed, to a great extent, to the game aspect of QA. Some other categories, like immersive context, creativity, or fantasy, were also considered as play elements. While these components, multimedia elements, points, and pushball, make QA game-like and make the learning fun, the fun part also comes from the learning itself. What makes learning fun are the features of it: meaningful learning and active learning. These two features of learning are highly interrelated in QA context.

6.3. Duality of Outcome

Achievement and rewards categories make up the "outcome" duality. The duality of outcome is the result of the activity duality. Achievement refers to the enjoyment and recognition learners get after overcoming learning activities. Rewards refer to the extrinsic incentives they obtain. Based on my data, I can assert that most of the children interviewed in this study perceive their learning and education "as a job." I speculate that the current status of the society, which has become increasingly materialistic, might have an impact towards this end. Considering their learning as a job, it is so natural for them to expect a return for their effort. Who in the world works in a job without payment? Therefore, although they like the achievement of overcoming the challenges and the recognition associated with it, obtaining some kind of extrinsic incentives is indispensable. Both the achievement and the rewards are the conditions for the present that will affect the future. In QA, the rewards are both materialistic and non-materialistic. Among the non-materialistic rewards are points, awards, and social approval. Among the materialistic rewards are items in the virtual trading post like trading cards, Internet time, pencils, rulers, and t-shirts. The availability of both kinds of rewards gives learners choice options for the outcome of their activities.

6.4. Duality of Object

Six categories, immersive context, fantasy, uniqueness, creativity, curiosity, and control and ownership, make up the duality of object. Specifically immersive context, fantasy, and uniqueness categories contribute to the "identification," while creativity, curiosity, and control and ownership categories constitute the "negotiability."

I adapted the terms identification and negotiability from Wenger (1998). He utilizes identification and negotiability duality to characterize identity in communities of practice. Identification refers to "the process through which modes of belonging become constitutive of our identities by creating bonds or distinctions in which we be-

come invested" (p. 191). Negotiability is "the ability, facility, and legitimacy to contribute to, take responsibility for, and shape the meanings that matter within a social configuration" (p. 197). In the framework of multiple motivations I use these two terms slightly differently. In my framework, identification refers to the overall reification of game material providing the experience. In a sense, identification is the learners' identifying the game as something. Research participants identified QA as an immersive context with fantasy elements, and as completely different from other things, which made it unique. Negotiability on the other hand is the investment of learners in this reification. In a sense, it is learners' impact or "mark" on the game. Research participants negotiated QA identity by building in it, by investing their curiosity in it, and by exercising control over it, which increased their ownership of the game.

6.5. Context of Support

QA is implemented in multiple contexts, including schools and after-school environments. It is significant to put forward the contextual implementation differences in different contexts. Three of the interview participants also utilized the game in their schools and all three participants indicated differences in their schools implementations, which made the QA experience different from the after-school context. First of all, because of limited time at schools, it appears that teachers try to maintain the management of learners by enforcing control over them. For example, in one of the learner's classroom the teacher synchronized Questers' participation so that everybody was doing the same activity at the same time. Learners revealed a frustration over this control. They indicated that with increased control on the teachers' part, and decreased control on their part their motivation to participate in the activities tended to decrease. A second contextual difference was in the assignment of usernames. At the club Questers were able to pick up any username they liked. At the schools teachers tend to assign usernames to Questers, usually in the combination of Questers' names, last names, and some numbers, probably for easier management of their classes. However, this strategy may eliminate the identity of players and at the same time removes the empowerment from them. The third contextual difference was in the variety of rewards in the virtual trading post. The QA implementation at the club included many more materialistic items in the virtual trading post than the school implementations. As it was discussed under the duality of outcomes, having a diversity of materialistic rewards is a necessity for both the effort of Questers and also for the creation of a QA economy. Possibly, addition and distribution of these rewards by teachers has been neglected by time constraints or they were simply in conflict with their teaching beliefs.

Apart from these differences, the "Internet time" emerged as a contextual item in the trading post of the club. The culture of the club was such that the use of Internet was tied to using educational software. When members used educational software for a specified amount of time, they then had the right to use the Internet for a specified amount of time. Having the Internet time as an item in the virtual trading post was extremely meaningful and valuable in this context. This reward item may not make sense and may not have a value in most other contexts, like schools.

As these examples verify, the culture, values, and norms of the context of the game implementation can make a difference in providing the motivational categories. More research needs to be done in broader contexts in order to see the extent to which the implementation of motivational categories differs in other contexts.

7. Assertions of Multiple Motivations Framework

In the following section, I present my assertions in the light of Multiple Motivations Framework. In this section my intention is to generalize my framework to the broader topic of motivation.

Assertion 1: Motivation is distributed among many elements of the context

Traditionally, theories of motivation have focused on just one, or a few, traits. My framework of multiple motivations includes multiple elements that contribute to one's motivation and that collectively constitute the activity of motivation. Ignoring most of these elements, and the interactions between them, while focusing on just one or a few of them, could produce incomplete research results and possibly invalid conclusions. Motivation is dependent upon not just reinforcers as Skinner (1953) suggested, not just intrinsic reasons as Deci (1975) and Malone and Lepper (1987) suggested, not just modeling others as Bandura (1986) suggested, not just self-actualization as Maslow (1987) suggested, not just need for achievement as Atkinson (Atkinson & Feather, 1966) suggested, and not just the origin of people's own actions as De Charms (1968) suggested. As a researcher in social sciences, I understand these researchers' passion for explaining motivation with reduced variables just like physicists and astronomers have been struggling to come up with a theory of everything with a compact formula like $e = mc^2$. However, I don't see this as simply a case in motivation research, and instead posit that the most condensed form would have to include multiple motivations.

Assertion 2: These elements are both intrinsic and extrinsic to the learners

While browsing the literature on motivation and learning, it has been so typical to come up with a piece like the following for commenting on the decrease in motivation in learning:

> ... Before school age, learning seems clearly and universally intrinsically motivating for children. Few of us have ever seen, or even heard of, a three- or four-year-old with a "motivational deficit." Instead, young children seem eager and excited about learning of all sorts, and the more typical parental complaints concern their children's apparently insatiable curiosity and boundless energy. Yet, by the time these same children have entered school, a sizeable fraction are quickly labeled as having motivational difficulties of one sort or another in learning
>
> (Lepper, Sethi, Dialdin, & Drake, 1997, p. 23).

The same ideas were expressed in the past by Cordova and Lepper (1996) and Brugman and Beem (1986). These kinds of ideas can be summarized in the following steps: 1) children are motivated to learn from their birth, 2) when children enter school their motivation to learn falls dramatically, and 3) what is the reason for this decreased motivation as the children grow up? Lepper et al. (1997) indicated that there was no single answer to this question, and worse there were no convincing data to help with choosing alternative explanations. One of their possible explanations was the heavy use of extrinsic rewards over time undermining children's intrinsic motivation in the school.

Actually there has been extensive literature that attempts to explain the decrease in motivation of learners as being the undermined intrinsic motivation. Three independent studies conducted almost at the same time by Deci (1971, 1972), Kruglanski, Friedman, and Zeevi (1971), and Lepper, Greene, and Nisbett (1973) showed the negative

effects of the extrinsic rewards on learners' subsequent intrinsic interest in the activities, for which the extrinsic rewards were no longer available (as cited in Lepper & Henderlong, 2000). Since then, another 100 additional research studies have been conducted challenging the same issue; however, these follow-up studies came up with a similar conclusion (Lepper & Henderlong, 2000).

Some other researchers on the other hand objected to the idea of the negative effects of rewards on intrinsic motivation. These various meta-analytical reviews of previous research on this issue revealed that negative effects of rewards occur under certain conditions, and rewards can be used to increase motivation when properly arranged (Cameron & Pierce, 1994; Eisenberger & Cameron, 1996; Cameron, Banko, & Pierce, 2001). Based on these conclusions, Cameron and Pierce (2002) stated that intrinsic motivation was a misguided construct. The opponents of these findings claimed that these meta-analyses were flawed and that their conclusions were incorrect and came up with their meta-analyses (Deci, Koestner, & Ryan, 1999; Deci, Koestner, & Ryan, 2001). They claimed again that extrinsic rewards undermined intrinsic motivation.

While there are different viewpoints, my finding is that multiple motivations can exist simultaneously, including those that are intrinsic and extrinsic. Many reasons, both intrinsic and extrinsic, exist for learning. Moreover, both intrinsic and extrinsic reasons might be involved for a learning activity at the same time. As an example, some of the learners playing the Quest Atlantis educational computer game indicated that they completed Quests in the game both to get points and to help the fictitious Atlantian people. Likewise, they collected points to buy extrinsic items but at the same time mere availability of the points was a motivator as showing their development. Assuming the coexistence of intrinsic and extrinsic motivations is a very important theoretical standpoint; because it can change the scales used to measure motivation, and the conclusions based on data coming from these scales. As an example, Harter's (1981) self-reporting scale, which is one of the most widely used scales for measuring motivation, assumes that intrinsic and extrinsic motivations are mutually exclusive. Therefore, while completing this scale a student has to be either intrinsically or extrinsically motivated for a learning activity. By using a modified version of this scale that allowed being intrinsically and extrinsically motivated at the same time Lepper, Sethi, Dialdin, and Drake (1997) found that both type of motivations could coexist. Eventually, even Lepper, whose taxonomy of motivation (Malone & Lepper, 1987) included just intrinsic factors, concluded that "... [S]uccess in school, as in many areas of life outside of school, may require us to attend simultaneously to both intrinsic and extrinsic sources of motivation" (Lepper & Henderlong, 2000, p. 295).

This conclusion of Lepper and Henderlong (2000) came after a review of intrinsic and extrinsic motivation research within the past 25 years; however, this idea is not new. When the philosopher Plato conveyed the dialogues of Socrates and Glaucon about 25 hundred years ago, he mentioned the highest class where individuals would do tasks both for their own sake and for their results:

Glaucon: ... How would you arrange goods – are there not some which we welcome for their own sakes, and independently of their consequences, as, for example, harmless pleasures and enjoyments, which delight us at the time, although nothing follows from them?

Socrates: I agree in thinking that there is such a class, I replied.

Glaucon: Is there not also a second class of goods, such as knowledge, sight, health, which are desirable not only in themselves, but also for their results?

Socrates: Certainly, I said.

Glaucon: And would you not recognize a third class, such as gymnastic, and the care of the sick, and the physician's art; also the various ways of money-making—these do us good but we regard them as disagreeable; and no one would choose them for their own sakes, but only for the sake of some reward or result which flows from them?

Socrates: There is, I said, this third class also. But why do you ask?

Glaucon: Because I want to know in which of the three classes you would place justice?

Socrates: In the highest class, I replied,—among those goods which he who would be happy desires both for their own sake and for the sake of their results.

(Plato, The Republic, 357b-358c&d)

Our task then, as educators and researchers, is to utilize both intrinsic and extrinsic motivators to promote and support student learning. The framework of multiple motivations provides a useful framework for the coexistence of both kinds of motivations.

Assertion 3: The use of playing and learning together is a strong motivator

As Csikszentmihalyi (1990) points out, "One cannot enjoy doing the same thing at the same level for long. We grow either bored or frustrated ..." (p. 75). It was discussed under the heading of "Duality of Activity" that when playing and learning elements are integrated, they produce unique activities. These unique activities eliminate or reduce the redundancy and the boredom in the learning process by providing sustained engagement. In the QA context, elements like back-story of the game, fictitious characters, use of points, multimedia elements, pushball game, immersive game context, and building in this context make it playful. It was found that learners in the high participating group, who engaged with most of these playful activities, undertook more Quests than the learners in the medium or low participating groups.

After recognizing this assertion, one problem becomes that of figuring out what is play. Although there are many definitions of play, Fromberg's (1992) characterization of play provides a useful explanation that includes all the play elements listed above. According to Fromberg (1992), play is symbolic, meaningful, active, pleasurable, voluntary, rule-governed, and episodic. One can notice that these characteristics of play also apply to the characteristics of learning in QA (unique, active, and meaningful), which suggests that even this kind of learner-centered learning can be playful without the play elements.

When we examine traditional learning environments, we see a sharp distinction between playing and learning. As an example, school environments reflect a culture in which learning is treated as hard and serious. In such environments, play elements are excluded from learning, and most of the time playing is used as a separate and isolated reward after learning activities are completed (Silvern, 1998). Moreover, there is a concern among some educational researchers that when fun and entertainment are integrated into learning, learners will develop a new kind of attitude towards learning (see for example, Okan, 2003). These researchers fear that with this new kind of attitude, learners will despise the school and demand more enjoyable learning environments.

Some other researchers on the other hand perceive this demand as a good thing. As an example, Prensky (2002) states that it is not the use of the Internet, distance learning, computers, wireless devices, computer-based learning, and e-learning that will revolutionize the learning in the 21st century. It is making learning fun and relevant, and therefore discarding the pain and suffering that accompanied it for so long, that will revolutionize it. Prensky (2002) predicts that after spending so much time playing with fun and engaging computer games, learners will demand these types of learning

environments, to the point that parents and teachers can no longer resist. Moreover, he envisions a future in which learners can get their degrees by choosing distributed accredited courses. Since the course content will be relatively the same among the courses with the same title, it will be the motivational elements of the course that will guide the learners towards choosing one of these courses.

Although playing and learning together motivates learners and increases learner participation, providing a balance between playing and learning is crucial (Bergen & Fromberg, 1998). Besides, although this study frames how to increase learner motivation and participation, this might not be the ideal in every learning context. As an example, one of the teachers at a school where QA is implemented was concerned about the amount of time that is being spent by certain users on the bulletin boards (A mode of communication that enables asynchronous threaded discussions among Questers, it is similar to Usenet discussion groups) as opposed to educational activities. The whole purpose of Multiple Motivations Framework is to present ways for increasing such participation. Evidently, this is not preferred in all contexts and motivation should be considered with other factors of the learning context including learners, teachers, administrators, and parents.

Assertion 4: Creativity is the new emerging "C" over traditional "4Cs"

Traditionally, motivation in educational computer games and intrinsic motivation in general have been explained by 4Cs: challenge, curiosity, control, and context (Lepper & Henderlong, 2000). The results of this study showed that creativity is the new emerging "C" as a candidate for inclusion with the intrinsic motivators. Out of curiosity, when a Discriminant Function Analysis (DFA) was conducted to predict group membership from thirteen motivational categories, it was found that creativity was the only discriminant category that separated the high participating members of QA from the medium and low participating members. For that reason, creativity seems to be a very important construct in providing intrinsic motivation.

There seem to be many definitions of creativity. For example, Sanders and Sanders (1984) cited various definitions of creativity given by leading educators and researchers. However, creativity defined in multiple motivations framework is closer to the spatial intelligence defined in Gardner's theory of multiple intelligences (Armstrong, 1993; Gardner, 1993). This kind of intelligence includes perceiving the spatial and visual nature of the world, and the ability to perform transformations in it. A spatially intelligent person can shape and mold images in the world, either through physical means such as building, drawing, molding, sculpting, and inventing, or through mental means such as rotations and transformations (Armstrong, 1993). Children have used materials such as Lego bricks, wooden blocks, constructo straws, clay, pipe cleaners, and lasy blocks in the past to exercise their spatial intelligence (Forman, 1998). The 3D virtual worlds are the new frontiers for the utilization of digital objects for the same purpose.

To understand the relationship between spatial intelligence and building activities, it is helpful to present some information from neurophysiology. The left side of the brain is responsible for analytical, logical, and verbal abilities. This side controls cognition and language in people. The right side is responsible for imagery, intuitive thinking, and spatial relationships. In the development of the right side of the brain and in fostering creativity, it is essential to practice imagery information (O'Neil, Abedi, & Spielberger, 1994). Building activities present such an opportunity toward practicing imagery and spatial information. While building, children participate in constructive

play in which they create symbolic patterns, real world objects, working systems, and sequences of actions (Forman, 1998).

This kind of spatial intelligence requires a context that is conducive to creativity. In such a context, people first observe the aesthetics of the materials such as shape, line, space, volume, balance, light and shade, color, pattern, and harmony. Then they examine artifacts created by others. Eventually, they become artists themselves producing these artifacts (Armstrong, 1993).

Two further examples illuminate the importance of creativity for sustained motivation in computer games. There was a time when a virtual world, called "Sandbox," was created in QA per request of our remote collaborators in Denmark. These collaborators used the Sandbox world for building activities in alignment with their curriculum. Because of technical issues, the world was allowed to be entered and built in it by all Questers. It was assumed by QA designers that just Questers in Denmark would use this world. After the need of the Denmark collaborators was over, the Sandbox world was closed. However, it was apparent from many angry inquiries that this world was actually discovered by other Questers and used for building activities. The QA team members received many questions asking why the Sandbox world was not open for building anymore.

Another example comes from the data collection site of this study. After my longitudinal daily observations were completed, I kept on visiting the club on different occasions. In one of these visits, I observed that the computer game "Roller Coaster Tycoon" was just installed on all lab computers. The purpose of this simulation game is to design and manage an amusement park, keep its guests happy, and increase the park profit. Most of the building phenomenon in this game is similar to building in QA. For example, while building rides and attractions players use pieces from the game's library. Although the ideas that can be created are limited to just rides and attractions, the final completed product is a working system. For example, after building a roller coaster track, players can put a roller coaster on it, let the virtual guests ride it, and observe different data of the ride, like the speed of the ride and the thoughts and feelings of its riders. On the day of my visit, both boys and girls were playing this game with great engagement. To see if this interest was due to its novelty, I kept on visiting the club that week and on subsequent weeks. Not surprisingly, this interest has been high long after the game was introduced in the lab. Much of the interest towards this game came from the building activities in the game.

Assertion 5: Choice is in the foundations of all motivators

The curious reader might wonder about the core category found during the selective coding stage. The availability of choices in an educational computer game is the core category emerged in the study. Prior research supports that even a small amount of choice has the potential to motivate children (see for example, Cordova & Lepper, 1996). Interestingly, the "choice" code was not available after obtaining the codes at the end of the open coding process. The emergence of a core category from other categories and overall data is proof of the fact that I stood closer to the emergent nature (Glaser, 1992) of data analysis during the constant comparison method of grounded theory.

When Papert (1980) talks about his LOGO programming language, designed for children, he conveys a personal story. Papert fell in love with car parts when he was two years old. His obsession was so high that he knew most of the concepts like the gearbox, the transmission system, and the differential. Later when he grew up, he prac-

ticed with these parts, and specifically with gears. He discovered the cause and effect relationships in the gear systems. He believes this experience with gears later helped him when he learned mathematics. For example, while solving equation problems with two variables (e.g., $5x + 3y = 12$), he made a mental gear model of the relation between x and y. Overall, he had a love relationship in addition to a deep understanding of the gears. Therefore, his interest in gears cannot be reduced to just cognitive terms.

This experience of Papert was a personal experience, and therefore it cannot be expected that many other children will like gears. Papert (1980) however, argues that computers have so much capability to simulate and are so flexible that they "can take on a thousand forms and can serve a thousand functions, [they] can appeal to a thousand tastes" (p. viii). Therefore, computers can be used as flexible instruments in which every child can find her/his gear, as long as the context does not stifle the child.

The availability of choices in a computer game is what gives its flexibility. An individual has the best knowledge about the self; therefore, by using the choices in the game the individual has the ability to stretch the learning process based on her/his personal interest and taste. In the context of QA the choices are many, and the availability of choices in dualities and categories of framework of multiple motivations is a proof for this. For example, the introvert learners can participate in activities alone while the social learners can join the crowd. While participating in the learning activities, they can enrich the process with playful elements. If the learner finds these elements somewhat childish, she/he can trim, or minimize, these elements and focus entirely on learning. When doing a Quest they can read the Quest description and purposes, or they can listen to its narration. After completing the activities they can enjoy the achievement of overcoming these challenges, or they can get a reward for their effort. In choosing a reward, further options are available; materialistic souls can satisfy the cravings of a materialistic nature with trading cards, t-shirts, pencils, stickers, or other contextual items. In their social relations they can share information and activities with others; or they can compete over these activities. When interacting with others, they can choose different communication modes from among chat, e-mail, telegrams, and discussion boards. They can also use the immersive game context for exploring, for interacting with objects, for building, or for transactions. They can perceive the game points as an indicator of their development, or they can use them as an exchange currency in an open market environment. The back-story of the game can be learned through an animation, but further formats are available for different styles; in the form of a comic book for visual enthusiasts or in the form of a novel for those who like reading. These choice examples can go on for many other elements of the game.

Furthermore, most of these choices do not have to be mutually exclusive. For example, while a learner may prefer handling the activities alone, the same learner can take on social relationships to overcome activities which are not possible, or are very difficult, to handle alone. This issue points to the fluidity of human nature. Human beings might be prone to changes in their preferences, interests, and tastes as the result of their physical, cognitive, and social development, conditions and constraints of the context, and by other factors. For this reason, multiple motivations framework contradicts the findings of Cordova and Lepper (1996) in which they found the personalization of the learning process motivational. Since human nature is changeable, so much personalization might create a state where old and new interests clash, which in turn might prevent learners' coming back to the learning environment. The explicit availability of choices in the learning environment is the key for providing continued learner motivation.

8. Conclusion

This study proposed an emergent explanation of motivation, "Multiple Motivations Framework." The content and form of this framework were explicated by using the Quest Atlantis educational computer game. The framework needs to be amended and extended with further studies so that it can become more comprehensive. One way for doing this would be to replicate this study in different contexts.

The data for this study was collected within an after-school context. In this sense, while playing with the educational computer game learners were not exposed to the limitations of a traditional school context, like a strict curriculum and deadlines. It would be fitting to replicate this study in a school context with such constraints to investigate the extent to which the results match or differ. This is one of the ways to improve and add to the framework.

Other than by amendment and extension, future studies might verify the validity and preferability of the framework. For this purpose, horizontal studies involving other educational computer games need to be conducted. In addition, further vertical studies need to be conducted for different contexts, audiences, and conditions.

Bandura (1986) acknowledged that "any theory of motivation must consider a large set of interactive processes if it is to provide an adequate explanation of human behavior" (p. 243). This statement has long been ignored in research regarding motivation, probably for the reason Bruner (1973) stated: "How one manages to time the steps in pedagogy to match unfolding capacities, how one manages to instruct without making the learner dependent, and how one manages to do both of these while keeping alive zest for further learning – these are very complicated questions that do not yield easy answers" (p. 122). As a result, motivation studies have focused on piecemeal factors to explain human motivation. On the other side, this study revealed the large set of interactive processes as a whole and proposed the Multiple Motivations Framework to provide an adequate explanation of human motivation.

Traditional motivation studies have typically relied upon quantitative methods, including one time data collection through surveys. In addition, tasks whose meaning were not strategically aligned with the context were offered to measure motivation in most of these studies. The qualitative methods used in this study provided a very different perspective than what is available in understating motivation. I strongly recommend to future researchers of motivation the use of ethnographic methods, making prolonged observations in the research context, and observing learners in their naturalistic learning contexts.

Sternberg, Kaufman, and Pretz (2002) have presented a descriptive taxonomy called "propulsion model of creative contributions." They suggest that creative contributions propel a field in some way. They identified eight kinds of creative contributions which might propel a field:

1. In replication a field stays where it is.
2. In redefinition the current status of the field is seen from a new perspective.
3. In forward incrementation the field is moved in the direction in which it is already moving.
4. In advance forward incrementation the field is moved in the direction in which it is already moving, but beyond where others are ready for the field to move.
5. In redirection the field is moved to a new direction.

6. In reconstruction/redirection the field is moved back to where it was so that it can be moved to a new direction.
7. In reinitiation the field is moved to a different starting point and then the field is moved in a different direction from that point.
8. In integration many past contributions of the field, that were viewed as distinct, are put together.

This study replicated the conclusions of previous research on motivation in finding that the constructs of curiosity, control, choice, fantasy, achievement, and rewards motivated these learners. It advanced the field in finding that the availability of choice options to learners was more important than previously thought. It reinitiated the field in that creativity, identity of learners, social relations, and active learning were proposed as important constructs in providing motivation. And most importantly it integrated many past contributions in the field that were perceived as distinct, such as intrinsic and extrinsic motivators, playing and learning, and achievement and rewards into a coherent framework of motivation. I hope that these creative contributions move the conceptual understanding and practice of motivation positively. I also hope that the framework will be improved with progressive, analytical critiques by interested practitioners and scholars in the field.

Note

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An Instructional Design/Development Model for the Creation of Game-Like Learning Environments: The FIDGE Model

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Abstract. Computer games are considered as powerful tools to learning and they have a potential for educational use. However, the lack of available comprehensive design paradigms and well-designed research studies about the question of "how to" incorporate games into learning environments is still a question, despite more than thirty years' existence of computer games and simulations in the instructional design movement. Setting off from these issues, a formative research study is designed to propose an instructional design/development model, which may be used for creation of game-like learning environments. Depending on the results and with the inspiration from fuzzy logic, an instructional design/development model for creating game-like environments, which is called as "FIDGE model" is proposed.

Keywords. Games, simulations, game-like learning environments, instructional design/development (IDD), instructional design/development model (IDDM), formative research, fuzzy logic

1. Introduction

One of the possible novelties regarding the methods of education, which should be discussed, is the use of games. As a matter of fact, games are not so much a novelty in this field, as young human beings, by nature, begin to learn through games and playing from their early childhood [1]. At the older ages, games are replaced by formal education. Nevertheless, the transition from informal games to formal education environment does not always, and especially nowadays, seem to be a sharp one as it is known that games are being used also in some educational environments, yet their success is questionable. When one looks deeper into the subject, it is understood that the use of games in education is not so much a novelty too, because its history may be traced back a few thousand years [2]. It is now known that even in times before history, games and dramatic performances as representations of real life were more effective as teaching tools than the presentations of life itself. In our modern day, with the new technological advancement of societies, traditional games of old times have been replaced by electronic games and in similar manner, dramatic representations of old have been transformed

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