A PROPOSAL OF INSTRUCTIONAL DESIGN/DEVELOPMENT MODEL FOR GAME-LIKE LEARNING ENVIRONMENTS: THE FID^{2}GE MODEL

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Prof. Dr. Canan ÖZGEN
Director

I certify that this thesis satisfies all the requirements as a thesis for the degree of Master of Science.

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Prof. Dr. M. Yasar ÖZDEN
Head of Department

This is to certify that we have read this thesis and that in our opinion it is fully adequate, in scope and quality, as a thesis for the degree of Master of Science.

_____

Asst. Prof. Dr. Kürsat ÇAGILTAY
Supervisor

Examining Committee Members

Assoc. Prof. Dr. Barbara BICHELMEYER _____

Asst. Prof. Dr. Zahide YILDIRIM _____

Asst. Prof. Dr. Kürsat ÇAGILTAY _____

Asst. Prof. Dr. Erdinç ÇAKIROGLU _____

Dr. Sadi SEFEROGLU _____

ABSTRACT

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Kaplan Akilli, Göknur

M.S., Department of Computer Education and Instructional Technology

Supervisor: Asst. Prof. Dr. Kürsat ÇAGILTAY

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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 30 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. Eighteen undergraduate students from Computer Education and Instructional Technology Department in METU participated to the study. Data collection lasted for three months and data were collected through interviews, observations and the artifacts that the participants produced. After the data analysis, it was found that the phases of the instructional design/development process should not be separate, strictly bounded, and processing a linear manner. Depending on these results and with the inspiration from fuzzy logic, an instructional design/development model for creating game-like environments, which is called as "FID^{2}GE model" is proposed.

Keywords: Games, simulations, game-like learning environments, instructional design/development, instructional design/development model, formative research, fuzzy logic.

ÖZ

OYUN BENZERI ÖGRENME ORTAMLARI IÇIN BIR ÖGRETIM TASARIMI/GELISTIRME MODEL ÖNERISI: FID^{2}GE MODELI

Kaplan Akilli, Göknur

Yüksek Lisans, Bilgisayar ve Ögretim Teknolojileri Egitimi Bölümü

Tez Yöneticisi: Y. Doç. Dr. Kürsat ÇAGILTAY

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Bilgisayar oyunlarinin güçlü ögrenme araçlari olduklari ve bu nedenle de egitim amaçli kullanilabilme potansiyeline sahip olduklari düsünülmektedir. Bununla birlikte, bilgisayar oyunlari ve simülasyonlarin ögretim tasarimi faaliyetleri içerisinde 30 yildan fazla süredir yer almis olmasina ragmen, bu oyunlarin ögrenme ortamlarina “nasil” entegre edilebilecegi ile ilgili kapsamli tasarim paradigmalarinin ve uygun biçimde tasarlanmis arastirma faaliyetlerinin mevcut olmayisi hala bir sorun teskil etmektedir.

Bu sorunlardan yola çikarak, bu çalismada oyun benzeri ögrenme ortamlarinin yaratilmasinda kullanilabilecek bir ögretim tasarimi/gelistirme modeli ortaya koymak üzere biçimlendirici (formative) bir arastirma yapilmistir. Arastirmaya Orta Dogu Teknik Üniversitesi Bilgisayar ve Ögretim Teknolojileri Egitimi Bölümü'nden 18 lisans ögrencisi katilmistir. Üç ay süren veri toplama sürecinde veriler; görüsmeler, gözlemler ve katilimcilarin sagladigi belgeler araciligiyla toplanmistir. Verilerin analizi göstermistir ki; ögretim tasarimi/gelistirme süreci birbirinden tamamen ayri, kati sinirlari olan ve dogrusal bir sira takip eden safhalardan olusmamalidir. Bu sonuçlar isiginda, bulanik (fuzzy) mantik kavramindan da esinlenerek, oyun benzeri ortamlarin yaratilmasinda kullanilabilecek bir ögretim tasarimi/gelistirme modeli olan "FID^{2}GE modeli" ortaya konmustur.

Anahtar kelimeler : Oyunlar, simülasyonlar, oyun benzeri ögrenme ortamlari, ögretim tasarimi/gelistirme, ögretim tasarimi/gelistirme modeli, biçimlendirici (formative) arastirma, bulanik mantik.

To mom and dad,
whom I owe everything

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INTRODUCTION

This introductory chapter addresses the issues that underlie the background of the study; the statement of the problem in the light of these background issues; purpose and significance of the study; and, lastly, definition of the terms that were used throughout the study.

1.1. Background of the Study

It is unanimously acknowledged that presently we are living in that part of history, which is called the Information Age. This also provides that contemporary human society is likewise referred to as the Information Society (Bates, 2000; Reigeluth, 1996). What made these two emerging concepts possible, however, was another one, technology, or rather, the rate of progress that has been achieved in technology over the past fifty or so years (Molenda & Sullivan, 2003). Throughout this period, technology has been both the generator and the transmitter of information with an increasingly faster speed and an increasingly wider audience each and every

day. Soon it has dominated all our lives, penetrating into the conduction of normal daily life.

The field of education has not been, and actually could never be, an exception in the spreading out of technology. On the contrary, education has always been considered as one of the most productive breeding-grounds for technology, where it would find its finest resonances and thus would have revolutionary effects. Yet, high expectations regarding the revolutionary impacts of technology on education have hardly been realized so far. More specifically, what we call instructional technology, or the use of technology in educational environments, does not presently seem to have contributed significantly to the realization of these expectations (Molenda & Sullivan, 2003; Russell, 2003). It may be argued that the reason for the existence of the relative ineffectiveness is the application of the same old methods in new educational media. To make an analogy, "New wine was poured, but only into old bottles" (Cohen & Ball, 1990, p. 334). Another reason related to this issue can be the famous Clark and Kozma debate, started by Clark's 1983 statement that media do not influence students' learning (Clark, 1983). On the contrary, Kozma (1991) argued that learning and media are complementary and interrelationships of media, method and external environment have influence on learning. Both of them rationalize their arguments by Russell's (2003) study on, so called, 'no-significant-difference' researches. Clark (1983, 1994a, 1994b) uses this phenomenon as evidence for his argument, whereas Kozma (1994) uses this phenomenon an indicative of insufficient evidence for his debate.

Moreover, there is the insufficiency of current models and methods to meet the consequences of a paradigm shift from Industrial Age to Information Age (Bates, 2000; Reigeluth, 1996, 1999).

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 (Rieber, 1996). 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 (Dempsey, Lucassen, Haynes & Casey, 1996). 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 into role-playing in simulation environments. Hence, electronic games and simulations have been parts of contemporary formal education. However, such transformation cannot be expected to take place quite smoothly and without its problems.

The first question that arises, when the use of games and simulations in formal education environments is concerned, is that of “how?”: “How games and

simulations should be used in education?", "Is there a design/development model tailored for the creation of game-like learning environments?" The answer that the researcher of the present study gave to the second question was "No." To be more specific, the researcher has not yet found, and apparently is not likely to find in near future; information about the presence of such a model as can be used for the above-given purpose, except for the model she proposes in this study. She has only come across basic design guidelines and principles offered by researchers (Amory, Naicker, Vincent & Adams, 1999; Prensky, 2001; MIT, 2003). In other words, there is the apparent and urgent need for the introduction of an instructional design/development model that will help and guide instructional designers for the efficient use of games and simulations in educational environments, more precisely for creating game-like learning environments.

Accordingly, what this thesis aims to do is to propose a model that can possibly contribute to, if not solve to some extent, the problem concerning the lack of an instructional design/development model, which can be employed for creating game-like learning environments. Otherwise, instructional designers have to take the challenge of forcing the situation to fit a model rather than selecting an appropriate model to fit the situation, due to the non-existence of even one appropriate instructional design/development model (Gustafson & Branch, 1997).

1.2. Statement of the Problem

Traditional instructional development models have been criticized on the grounds that they hardly represent a variety of structure, although they are abundant in number. In other words, as time passes models are enhanced in quantity, but not in

quality (Gustafson & Branch, 1997, 1998). The procedural stratifications and time-consuming practices have constituted the main rationale of these criticisms. Both Prensky (2001) and Rowland, Parra and Basnet (1994) put forth that much of instructional design is done by the book or by using a rational view, which in turn produces "boring cookie-cutter outcomes" (Prensky, 2001, p. 83) and they emphasize creativity or creative approaches against the growing dissatisfaction about the current methods. Many researchers also suggest new approaches to be adapted from various fields, such as employment of hermeneutics, chaos theory or fuzzy logic (Jonassen, et al., 1997).

On the other hand, although computer games and simulations have a history of more than three decades in the instructional design movement, literature still lacks available comprehensive design paradigms and well-designed research studies (Gredler, 1996). While there is vast number of similar studies about the perception of students and their reactions, the question of how to incorporate games into learning environments stays unresolved (Dempsey, Lucassen, et al., 1996). The researcher came across some studies about general design principles and elements, yet not a model (Amory, et al., 1999; Prensky, 2001; MIT, 2003). For these reasons and while it has been impossible to find a study that resembles the researcher's intentions, we believe that the findings of this study reveal important information and illuminate the path that goes to the answer of the above-mentioned question.

1.3. Purpose of the Study

This study has a general aim to contribute to knowledge base in instructional design theory and to make a humble contribution to the organizational and somewhat

social phenomenon of creating game-like learning environments. More precisely, the purpose of the current study is to propose an instructional design/development model, which may be used in the creation of game-like learning environments. Specifically, the study is concerned with the exploration and identification of distinctive components of the model and its sufficient subelements, which are peculiar to game-like learning environments. Additionally, it is aimed to preserve the essential and working components of an instructional design/development model and to offer suggestions for the improvement of impeded elements, while removing the excessive components and/or subelements to guarantee the simplicity and to avoid parsimony of the model. Accordingly, what this thesis aims to do is to propose a model that can possibly contribute to, if not solve to some extent, the problem concerning the lack of an instructional design/development model which can be employed for creating game-like learning environments.

The following research questions were taken as the blueprint for the current study to achieve this purpose of proposing an instructional design/development model especially for creating game-like learning environments in 3D realm of simulations:

1. What are the distinctive characteristics of an instructional design/development process for the creation of game-like learning environments?
2. What are the necessary and sufficient components of an appropriate instructional design/development model for the creation of game-like learning environments?
3. How do these components come together to form a model?

1.4. Significance of the Study

Computer games and simulations have appeared on the scene of instructional design/development activities more than three decades ago; yet, the literature still lacks available comprehensive design paradigms and well-designed research studies (Gredler, 1996). Although, there is an accumulating mass of research about the perceptions of the students and their reactions, effects of games on learning and various skills, and even about the illustrations of such environments, the question of how to incorporate games into learning environments stays unresolved.

Moreover, Reigeluth and Frick (1999) mention that since the existing design theories have not reached perfection; there is need for more theories and models that will guide us through human development and related additional kinds of learning, where for different kinds of situations those utilize new information technologies as tools. They further state that the design theories are prescriptive guidelines that tells us "how to do" education, in contrast with its descriptive counterpart that tells us "what is" education. Yet, they further contend that graduate programs in many universities encourage their students and faculty to conduct qualitative and quantitative researches, for creating descriptive knowledge of education more and more every day (Reigeluth & Frick, 1999).

Although, there is vast number of instructional design/development models, which reveal answers of "how to" questions for various learning environments and situations, the researcher has not yet found, and apparently is not likely to find in near future; information about the presence of such a model with the exception of the model that she proposes, as can be used for creating game-like learning

environments. The three studies within researcher's reach were proposing basic design guidelines and principles rather than a model (Amory, et al., 1999; Prensky, 2001; MIT, 2003). As for the situations in Turkey, studies related with games are very rare, and none of them applies to the scope of the current study.

In conclusion, there is the apparent and urgent need for the introduction of an instructional design/development model that will help and guide instructional designers for the efficient use of games and simulations in educational environments, more precisely to create game-like learning environments. Additionally, while there exists hardly any study that bears a resemblance to the researcher's intentions, she believes that the findings of this study can possibly contribute, if not illuminate to some extent, the path along with the creation of game-like learning environments. Moreover, the model proposed at the end of the current study may also add much to the literature, due to its prescriptive and complementary nature about the creation of game-like learning environments. The study might also be unique in this sense, since it is separated from other descriptive studies that provide knowledge of 'what is.'

1.5. Definitions of Terms

In this part of the chapter, the operational definitions of the terms that are used throughout the study will be presented:

Model is "simple representation of more complex forms, processes, and functions of physical phenomena or ideas" (Gustafson & Branch, 1997, p. 17). It provides a visual representation of an abstract concept (Schindelka, 2003), helps people to conceptualize representations of reality (Gustafson & Branch, 1997), and explains ways of doing" (Gustafson & Branch, 1998, p.3).

Instructional Design is "optimizing the process of *instructing*" (Reigeluth, 1983, p.9), which is "concerned with understanding, improving and applying methods of instruction" (Reigeluth, 1983, p.7).

Instructional Development is "optimizing the process of developing the instruction." (Reigeluth, 1983, p.9). It encompasses design, implementation, and formative evaluation activities. It is "concerned with understanding, improving and applying methods of *creating* [italics added] instruction" (Reigeluth, 1983, p.8).

It is "an organized procedure that includes steps of analyzing, designing, developing, implementing, and evaluating instruction." (Seels & Richey, 1994, p.31).

It is "a complex, yet purposeful process that promotes creativity, interactivity and cyberneticity" and encompasses analysis, design, development, and evaluation (Gustafson & Branch, 1997, p.18).

A unified term of "instructional design/ development (IDD)" will be used throughout the study, due to interchangeable usage of these two terms and instructional systems design (ISD).

Instructional Design/ Development Model (IDDM) is a simple representation of the complex processes of instructional design/development (Gustafson & Branch, 1997).

Game is an activity, in which participants follow prescribed rules that differ from those of real life as striving to attain a challenging goal (Heinich, Molenda, Russell, & Smaldino, 2002); simply it is an organized play (Prensky, 2001, p. 119).

Simulation is an interactive abstraction or simplification of some real life (Heinich, et al., 2002; Baudrillard, 1983). It is "a simulated real life scenario

displayed on the computer, which the student has to act upon" (Tessmer, Jonassen, & Caverly, 1989, p. 89).

Game-like learning environments are authentic or simulated places, where learning is fostered and supported especially by seamless integration of motivating game elements, such as challenge, curiosity, fantasy, etc.

3D Virtual worlds are combination of 3D settings of desktop Virtual Reality, interactive multimedia and a chat application, which were tied up in a bundle.

Fuzzy Logic is a departure from classical two-valued sets and logic, that uses "soft" linguistic (e.g. large, hot, tall) system variables and a continuous range of truth values in the closed interval [0, 1], rather than strict binary (True or False) decisions and assignments.

CHAPTER 2

LITERATURE REVIEW

This chapter addresses the related literature regarding the scope of the study bounded by the research problem and research questions articulated in the previous chapter. More specifically, it is an attempt to reveal, summarize and synthesize the issues about the field of instructional design/development; theoretical facet of the study; and games and simulations. After the definitions, historical background and new trends in the instructional design/development are given, the theoretical foundations of the study, namely fuzzy logic is explained. Lastly, the definitions of games and simulations, their educational history, effect on learning, and related design models will be handled. Finally, all literature is synthesized that, in turn, revealed the gap in the literature, for which the current study may add much to fill this gap, if not fill it up completely.

2.1. Instructional (Systems) Design/Development (IDD)

As the name of this part implies there does not exist a consensus about the name and the definition of, what the researcher chooses to call, "instructional design/development (IDD)." During the review of the relevant literature the researcher was faced with the interchangeable use of instructional design, instructional systems design (ISD) and instructional development and even instructional technology, which was also asserted by many researchers (Schrock, 1995; Seels & Richie, 1994; Gustafson & Branch, 1997; Reigeluth, 1983). Even though several attempts have been made to derive standardized definitions and terms (Gustafson & Branch, 1997; Seels & Richie, 1994; Schiffman, 1995), the results have not been adopted and used in the literature.

Reigeluth (1983) characterizes his views on instructional design as "[it] is concerned with understanding, improving and applying methods of instruction" (p.7), as he puts forth instructional development as being "concerned with understanding, improving and applying methods of *creating* [italics added] instruction" (p.8). Furthermore, he states that instructional design produces knowledge of optimal blueprints about methods of instruction, whereas instructional development optimizes the process of developing the instruction and encompasses design, implementation, and formative evaluation activities (Reigeluth, 1983). He also emphasizes that design theories are different from descriptive theories due to their prescriptive nature, in the sense that they offer guidelines, but not that they spell out every detail and allow no variation (Reigeluth, 1983, 1997, 1999). Gustafson and Branch (1997) accept the Seels and Richie (1994) definition, which is "an organized procedure that includes steps of analyzing, designing, developing, implementing, and

evaluating instruction" (p.31). However, they declare that Seels and Richie (1994) have coined this definition for ISD, instead of instructional development. Shrock, (1995) have also made a definition similar to that of Seels and Richie's (1994) definition, yet for instructional development. Gustafson and Branch (1997) further characterize instructional development as "a complex, yet purposeful process that promotes creativity, interactivity and cyberneticity." (p. 18).

The need for the development of a linking science and the need for a 'middleman' between learning theory and educational practice was first asserted by John Dewey in 1900 (Reigeluth, 1983), yet, when the origins of instructional design procedures are traced, it is seen that the first research efforts date back only to the time of World War II (Dick, 1987). Moreover, the need for a 'middleman' was also put forth by Glaser (1971), who stated that an instructional designer must perform the interplay between theory, research and application.

2.2. Instructional Design/Development Models (IDDM)

Gustafson and Branch aver that "models help us to conceptualize representations of reality" (1997, p. 17); and they also state that "models explain ways of doing" (1998, p.3). In line with Reigeluth 's (1983) above-mentioned opinions about instructional development, Gustafson and Branch (1997) have gone one step further and have stated that instructional development models have at least four components, which are "analysis of the setting and learner needs; design of a set of specifications for an effective, efficient and relevant learner environment; development of all learner and management materials; and evaluation of the results of the development both formatively and summatively." (p. 12). They have also

added that a fifth activity could be the distribution and monitoring of the learning environment across various settings, over an extended period of time. Furthermore, they state that instructional development models serve as "conceptual and communications tool" for these four activities (p.13) and give a triad taxonomy for the classification of IDD models. Moreover, as for instructional design models, like Glaser's (1971) above-mentioned statement for instructional design, Gros, Elen, Kerres, Merriënboer and Spector (1997, p.48) state that "instructional design models have the ambition to provide a link between learning theories and the practice of building instructional systems."

When the origins of instructional design procedures are traced, it is seen that the first research efforts date back to the time of World War II (Dick, 1987). Gustafson and Branch (1997) state that instructional development models first appeared in 1960s and since then an increasing number of models have been published in the literature. Seels and Richie (1994) highlight the simplicity of instructional design at those times on the grounds that one had only to master a few techniques and a fundamentally linear theory, since the instructional technology was an infant and many of the tools and theories of today were not conceivable. Since then, there have been a variety of developments and trends that have had significant impact on instructional design practices (Reiser, 2001). However, one of the factors, the introduction of microcomputers in 1980s, did have a major effect on instructional design practices. From that time onwards, discussions began for the need to develop new models of instructional design to accommodate the capability and interactivity of this technology (Merrill, Li & Jones, 1990) and wide variations have emerged in models in terms of their purposes, amount of detail provided, degree of linearity in

which they are applied and quantity, quality, and relevance of the accompanying operational tools (Gustafson & Branch, 1997). This change and above-mentioned instability of the terminology proves that the field of IDD is not static; it has evolved in time and still evolving. This is good, since a field that becomes static and uncreative is likely to become less prominent (Seels & Richie, 1994).

As for 1990s, Reiser (2001) states that there have been six factors that have had significant impact on instructional design practices. These were performance technology movement, constructivism, Electronic Performance Support Systems (EPSSs), rapid prototyping, increasing use of Internet for DE/DL and knowledge management endeavors. Among these issues rapid prototyping will be scrutinized in one of the following subheadings, since it is the only one that is included within the scope of the current study.

2.3. Criticisms and New Trends in IDD and IDDM

It is argued that the traditional instructional design models are resistant against substantial changes (Rowland, 1992) and are criticized due to their fittingness to narrow, well-defined and static scenarios, for being process-oriented rather than people-oriented, and for having a bureaucratic and linear nature within a clumsy process (Zemke & Rossett, 2002; Gordon & Zemke, 2000; Jonassen, 1990; Tripp & Bichelmeyer, 1990; You, 1993; Mc Combs, 1986). In contrast with to these criticisms, many researchers have stated that with instructional development experience through time, the problems become apparent in the traditional ISD model and important and permanent modifications and additions are performed (Clark, 2002; Shrock, 1995; Schiffman, 1995).

Furthermore, Gustafson and Branch (1997) assert that there has been a cumulative increase in the number of published instructional development models since 1960s. However, there seems to be little uniqueness in the structure of these models and generally they display a circular trend. Alternatively, illustrating instructional development as a set of concurrent, overlapping procedures might help both to speed up the process and to overcome many limitations of the traditional instructional design models. One the most well-known examples is 'prototyping' or 'rapid prototyping', which is a design approach borrowed from the discipline of software engineering (Tripp & Bichelmeyer, 1990).

Moreover, both Prensky (2001) and Rowland, et al. (1994) put forth that much of instructional design is done by the book or by using a rational view and they emphasize creativity or creative approaches against the growing dissatisfaction about current methods. Rowland, et al. (1994) also declare that ID has tended to follow the rational route, but a move to a more creative methodology is necessary, which would lead to flexible, creative solutions to situations which are seen as unique.

In addition to the above mentioned factors Reiser (2001) puts forth, today new trends are also articulated by different researchers, which should be added to his list of factors. For instance, apart from technological changes, Reigeluth (1999) discusses a paradigm shift in education and training, which is another important factor that has significant impact on instructional IDD practices. He outlines a major shift from Industrial Age to Information Age thinking, which has lead to shifts in various attributes that have important implications for instruction (see Table 2.1.). However, examination of all of these issues is beyond the scope of the current study, and only the related ones will be handled. For instance, consistent with Richey's

(1995, 1997) and Tessmer and Richey' (1995) discussion that the importance of "timing" and especially "context" in comparison to "specific nature of the problems, their solutions and the people involved," Reigeluth (1996; 1999) outlines a major shift in the social and intellectual context that is influencing ID theory.

Table 2.1.
Key Alterations with the Shift from Industrial Age to Information Age

Industrial Age	Information Age
Industrial Society (Bates,2000)	Information Society
Bureaucratic Organization	Team-Based Organization
Centralized control	Autonomy with accountability
Adversarial Relationships	Cooperative Relationships
Autocratic Decision Making	Shared Decision Making
Compliance	Initiative
Conformity	Diversity
One-way communications	Networking
Compartmentalization	Holism
Parts-oriented	Process-oriented
Planned Obsolescence	Total quality
CEO or boss "King"	Customer (Learner) as "King"

Furthermore, Reigeluth (1996) also stresses the shift from standardization to customization, which is an attempt to make possible a unique learning experience for each learner, rather than trying to produce a single, clearly-defined outcome for all learners. This specification is also consistent with Winn's (1997) and Jonassen et al.' (1997) criticisms about the positivist basis of ID models. Both disapproved the linear design process assumes the predictability of human behavior, the closure and isolatedness of learning situations, responsibility of instructor than the learner for learning and ignores the dynamic, complex and non-linear nature of the design

processes, contextualness of learning environments, differences among learners, metacognitive abilities of learners, unstable, elusive and complex nature of human consciousness.

As alternative approaches that can be employed for the improvement of IDD process, various researchers offer various suggestions. Jonassen et al. (1997) suggest adapting new sciences, such as hermeneutics, fuzzy logic and chaos theory. Reigeluth (1996, 1999) suggests customized, learner-centered and social-contextual design conducted by user-designers, which is also articulated by Winn's (1997) matched timing of design and use of instructional material and Winn's (1996) statement of necessity to get help from Human Computer Interaction discipline. Lastly, Hoffman (1997) offers plasticity and modularity as a result of linking Reigeluth (1983)'s Elaboration Theory (ET) and hypermedia. There are further suggestions, such as Gros et al. 's (1997) multimedia-facilitated IDD models that depend on multi-perspectival presentation of knowledge or Wilson, Teslow and Osman-Jouchoux' (1995), and Wilson's (1997b) adaptation of postmodernism to IDD field. However, the latter two are beyond the scope of the current study.

Hermeneutics emphasizes the importance of socio-historical context in mediating the meanings of individuals creating and decoding texts, which implies that IDD must strive to introduce gaps of understanding, which allow the learner to create his/her own meanings (Jonassen et al., 1997).

Chaos theory finds order in the chaos of natural structures through looking for self-similarity and self-organization, patterns that are repeated at different levels of complexity through a structure, e.g. a fractal. It can offer two alternatives to IDD; first complex, dynamic IDDMs, and secondly due to its sensitiveness to initial

conditions, consideration of learners' emotions and related self-awareness, besides cognitive skills and self awareness (Jonassen et al., 1997; Çagiltay, 2002).

The last alternative that Jonassen et al. (1997) suggest, which is already used to structure the proposed model in the current study, is fuzzy logic.

Fuzzy logic is based on the idea that reality can rarely be represented accurately in a bivalent manner. Rather, it is multivalent, having many in-between values, which do not have to belong to mutually exclusive sets. It implies for IDD that behavior could only be understood probabilistically, using continua, rather than binary measures and integration of problematic areas such as student perceptions of the efficacy of the educational program into the design. More specifically set-theoretic facet of fuzzy logic also implies the non-linear, dynamic IDDM phases, which has "fuzzy" rather than strict boundaries.

Depending on above-mentioned shift to Information Age, Reigeluth (1999) also suggests an alternative to the linear stages of the ID process. The entire process cannot be known in advance, so designers are required to do "just-in-time analysis" (p.15), synthesis, evaluation and change at every stage in the ID process. However, this is not a newcomer to the field, since learner-centeredness and parallel process have been articulated by Heinich (1973) a long time ago (cited in Winn, 1996).

Reigeluth (1999) further states that to be capable to meet the demands of the Information age, the instructional designer should become more aware of the broader social context, within which the instruction takes place, and a point which is also made by various researchers as well (Dede, 1996; Jonassen et al., 1997; Kember & Murphy, 1995; Richey, 1995; Tessmer & Richey, 1997). Moreover, the instructional designer will also need to consult more broadly with stakeholder groups to reach a

common vision of the final instruction and the means to develop it. This is also consistent with Kember and Murphy's (1995) suggestion regarding the importance of linking the learners to designers and thereby providing iterative improvement.

To sum up the whole discussion, IDD and IDDM should find alternative ways to catch up with the changing world of education due to changes in the world itself. For instance, when reviewing the literature, the researcher did not come across an IDDM model to be used in creating game-like learning environments, more generally for the use and integration of games and simulations in education. The above-mentioned alternatives are thought to be useful and helpful to renew and strengthen the IDD field against the criticisms. It also reveals the fact that like the other disciplines, IDD also begins to evolve into a multidisciplinary discipline.

Specifically, it will be better to add some unnoticed features of fuzzy logic. Since the sequence of events within a project depends on human decisions, which is based on approximate reasoning of human beings, fuzzy logic can be well-applied to IDD process. Instead of having strictly bounded and sequenced phases, having intertwined phases, which have flexible and fuzzy boundaries would be more advantageous in that it would allow designers to move freely in between phases throughout the entire IDD process. Jonassen et al. (1997) states that the more one moves away from deterministic approaches to thinking and designing toward more probabilistic ways of thinking, the more useful it becomes in providing methods for assessing in "real-life" issues, where things are not black-and-white, but rather any number of different shades of color across the spectrum. Jonassen et al. (1997) further state that it is impossible to predict, let alone describe, what will happen in learning situations due to elusive and complex nature of human consciousness, which

is also consistent with Winn's (1996) opinion that although instructional designers would like them to do otherwise, people think 'irrationally,' and reason 'implausibly.' Both of these statements support the main definition of fuzzy logic. However, both researchers' studies lack more specific facets of fuzzy logic, which is handled by the researcher in the following parts of this chapter.

In conclusion, Jonassen et al.'s (1997) following statement summarizes the researcher's opinion:

> Like the chiropractor who realigns your spine, we might become healthier from a realignment of our theories. If we admit to and attempt to accommodate some of the uncertainty, indeterminism, and unpredictability that pervade our complex world, we will develop stronger theories and practices that will have more powerful (if not predictable) effects on human learning. (p.33)

2.4. An Alternative IDDM: Rapid Prototyping

Rapid prototyping IDDM stems from its namesake counterpart, rapid prototyping methodology used for design in software engineering (see Figure 2.1) and is adapted to IDD field by Tripp and Bichelmeyer (Gustafson & Branch, 1997; Tripp & Bichelmeyer, 1990).

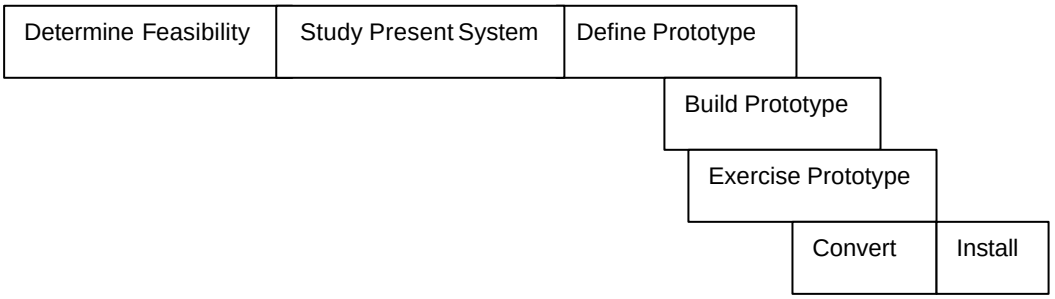

Figure 2.1. Prototyping approach to software design (by Tripp & Bichelmeyer, 1990).

After articulating the resemblances and distinctions between the fields of software engineering and IDD, they adapted the rapid prototyping design methodology, which allows rapid construction and modification of software in software engineering, to IDD. They said that as with software engineering, rapid prototyping in IDD is "the building of a model of the system to design and develop the system itself." (p. 36). As can be seen from Figure 2.2, rapid prototyping continues with the parallel processes of design and research, or construction and utilization.

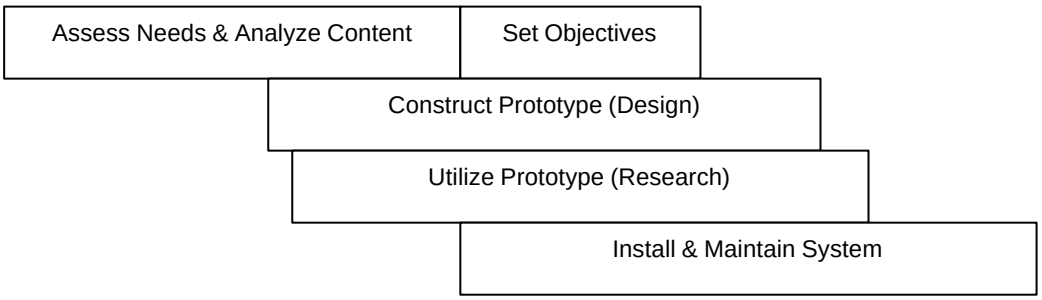

Figure 2.2. Rapid prototyping IDDM (by Tripp & Bichelmeyer, 1990).

In this methodology, after the needs and objectives were briefly stated, research and development are conducted as parallel processes that create prototypes, which go under testing and which may or may not evolve into a final product. The crucial parts and, in a sense, the advantages of the rapid prototyping are the utilization of the design with active participation of potential learners, which leads to participatory design; a design environment which makes it practical to synthesize and modify instructional artifacts quickly, which also leads to increase in creativity; an accelerated development, which built on sound footing by the earlier detection of the

errors by the quick iterations (Tripp & Bichelmeyer, 1990; Wilson, Jonassen, & Cole, 1993).

On the contrary, the main disadvantages of rapid prototyping are its tendency to encourage informal design methods which may introduce more problems than they eliminate, such as substituting prototypes for paper analysis; committing to a premature design, if it is not remembered that a design is only a hypothesis; designs that could get out of control easily in the hands of careless and hasty designers (Tripp & Bichelmeyer, 1990).

Lastly, according to Tripp and Bichelmeyer (1990), the biggest difference between rapid prototyping and traditional instructional systems design is that although many traditional models emphasize early constraining of design decisions, rapid prototyping follows the pragmatic design principle of minimum commitment, which depends on synthesizing and limiting the design necessarily only regarding the solution of the problem at hand at that stage.

2.5. A Better Guide: Fuzzy Logic

As stated and justified in the previous parts of this chapter, the traditional models are also being critiqued on the grounds that they reflect the Newtonian worldview, and are consequently established on classical (predicate) logic (Jonassen, 1990; Tripp & Bichelmeyer, 1990; Gustafson & Branch, 1997; Rowland, et al., 1994; Prensky, 2001). However, let alone the activities that the humans perform, most of the human reasoning is approximate in nature. Setting off from this point, the researcher was inspired by "fuzzy logic," which had been coined first by Lotfi A. Zadeh in 1960s, but remained concealed until it was discovered in the late 1980s (Dubois, Foulloy, Galichet & Prade, 1999). Fuzzy logic is "a body of concepts, constructs, and techniques that relate to modes of reasoning that are approximate rather than exact" (MIT Encyclopedia of Cognitive Science, ¶2, 2003). It can be seen as an enhanced and generalized version of classical logic. Although fuzzy logic rests on the same mathematical foundations as that of classical logic, due to its fittingness in reflecting the pervasive imprecision of human reasoning, it is much better suited than classical logic to serve as the logic of human cognition and the decisions that underlie human actions.

Nevertheless, the above-given definition of fuzzy logic is a very simplified one. Indeed, fuzzy logic has many distinct facets, which overlap with each other and have unsharp boundaries. Figure 2.3 illustrates these facets of fuzzy logic, where *F* and *G* stand for *fuzziness (*or *fuzzification)* and *granularity (*or *granulation)* respectively (Zadeh, 1996; MIT Encyclopedia of Cognitive Science, ¶9, 2003).

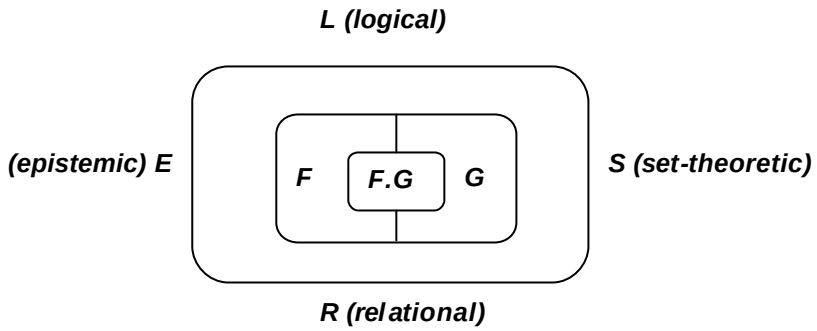

Figure 2.3. Conceptual structure of fuzzy logic (by MIT Encyclopedia of Cognitive Science, 2003).

For the current study, the researcher was especially interested in the set-theoretic facet of fuzzy logic, which is concerned with fuzzy sets, whose boundaries are not sharply defined (Zadeh, 1999; MIT Encyclopedia of Cognitive Science, ¶5, 2003). The set-theoretic facet of fuzzy logic is also the initial focus of the development of fuzzy logic, which gave birth to applications such as fuzzy arithmetic (also known as "computing with words" (Zadeh, 1999, p.1)), fuzzy topology, etc.

Moreover, by fuzzification, which is the process of replacing the concept of a set with that of a fuzzy set, it becomes possible to provide a way of constructing models or theories that are more general and more reflective of the imprecision of the real world than the models or theories in which the sets are assumed to be sharply bounded and definitely limited. Briefly any concept, method or theory can be generalized to a reflection of the real world via fuzzification. This was exactly what the researcher wanted, i.e. the proposal of an alternatively structured instructional design/development model against the traditional instructional development models

that have been criticized for their linear structures, procedural stratifications and time-consuming practices.

2.6. Games and Simulations

Games and simulations are often referred to as experiential exercises (Gredler, 1996), in which there is 'learning how to learn' (Turkle, 1984). Turkle (1984) further contended that it provides more than thinking; beyond thinking. Specifically, Prensky (2001) defines games as "organized play." (p. 119). Dempsey, Rasmussen and Lucassen (1996) define gaming in a basic sense as "any overt instructional or learning format that involves competition and is rule-guided" (p. 4).

As put forth by many researchers, several game genres can be distinguised, such as action, puzzle, educational, fighting/combat, sports, racing, role play/adventure, flight, shoot'em, platform games, business, board, word, general entertainment, fantasy violence, human violence, non-violent sports, sports violence, simulation games (Yelland & Lloyd, 2001; Alessi & Trollip, 2001; Funk, Hagan & Schimming, 1999; Prensky, 2001; Media Analysis Laboratory, 1999). Many researchers also assert that games have some characteristics such as "one or more players (decision makers), rules of play, one or more goals that the players are trying to reach, conditions introduced by chance, a spirit of competition, a strategy or pattern of action-choices to be taken by the players, a feedback system for revealing the state of the game, and a winning player or team" (Price, 1990, p. 52), "turn-taking, fantasy, equipment, and some combination of skill versus luck" (Alessi & Trollip, 2001, p.271). Furthermore, Price (1990) categorizes 'educational' games as academic games, which aim to teach and provide practice, while motivating the

learners; and life simulation games, which are context simulation games including strict rules in real-life contexts, or open-ended life simulation games including flexible rules and goals in social science contexts.

As for simulations, it is defined as any attempt to imitate a real or imaginary environment or system (Alessi & Trollip, 1991; Reigeluth & Schwartz, 1989; Thurman, 1993).

Although both games and simulations are terms that refer to different concepts, they have common characteristics, too. On surface, both contain a model of some kind of system and in both of them learners can observe the consequences of their actions, such as changes occurred in variable, values or specific actions (Gredler, 1996; Jacobs & Dempsey, 1993). Moreover, Jacobs and Dempsey (1993) state that the distinction between simulation and games is often blurred, and that many recent articles in this area refer to a single "simulation game" entity. One of them is Prensky (2001), who argues that "depending on what it is doing, a simulation can be a story, it can be a game, [and] it can be a toy" (p. 128). On contrary, Gredler (1996) identifies three important differences between the deep structure of games and simulations. Instead of attempting to win the objective of games, participants in a simulation are executing serious responsibilities with privileges that result in associated consequences. Secondly, the event sequence of a game is typically linear, whereas, according to Gredler (1996), a simulation sequence is non-linear. The player or a team in a game responds to a content-related question and either advances or does not advance depending on the answer, which is repeated for each player or team at each turn. However, in a simulation, participants are confronted with different problems, issues or events caused mainly by their prior decisions made at

each decision point. The third difference is the mechanisms that determine the consequences to be conveyed for different actions taken by the players. Games consist of rules that describe allowable moves; constraints; privileges and penalties for illegal (non permissible) actions. Further, these rules may be totally imaginative, unrelated to real world or events. In contrast, a simulation is based on dynamic set(s) of relationships among several variables that change over time and reflect authentic causal processes (i.e. should possess verifiable relationships).

In like manner, according to Prensky (2001) simulations and games differ in that, "simulations are not, in and of themselves games. They need all the additional structural elements - fun, play, rules, a goal, winning, competition, etc." (p. 212).

As for theories that inspired the game design, "Flow Theory of Optimal Experience" developed by Mihaly Csikszentmihalyi (1990) and "Activity Theory" developed by Alexey Leontiev, a student of Lev Vygotsky (Kaptelinin & Nardi, 1997) could be recognized. Moreover, there are some principles to be taken into consideration proposed by Cerny and John (2002). Yet, there seems to be hardly any design models.

2.7. Effects of Games and Simulations on Learning

Although the literature about games and simulations is accumulating day by day, the issue of whether games influence students' learning in a positive way is still vague. For instance, Molenda and Sullivan (2003) state that among problem solving and integrated learning systems, games and simulations was the least used technology applications in education. However, there exist studies that put forth effects of games and simulations on discovery learning strategies, problem solving

skills and computer using skills; their effects on students' intellectual, visual, motor skills and about the engagement and interactivity which are important for learning environments.

Cole (1996) has proved that long-term game playing has a positive effect on students learning (cited in Subrahmanyam, Greenfield, Kraut & Gross, 2001, p.16). Gredler states that intellectual skills and 'cognitive strategies' are acquired during academic games (1996, p. 525). However, she also states that, games generally require simple skills such as recall of verbal or visual elements rather than higher-order skills an as a result provide environments for winning by guessing (Gredler, 1994). Similarly, Prensky (2001) admits that especially with the non-stop speedy games, the opportunity to stop and think critically about the experience is lessened (Prensky, 2001; Provenzo, 1992); despite his belief in games that they have positive impact on students' learning. Csikszentmihalyi (1990) also supports this belief that during an enjoyable activity, insufficient amount of time is devoted for thinking and reflection.

As for visual skills, games are claimed to have cognitive development effects including "spatial representation," "iconic skills," and "visual attention" (Subrahmanyam, et al., 2001 p. 13; Greenfield, 1984 cited in Prensky, 2001 p.45). Greenfield, deWinstanley, Kilpatrick and Kaye (1994) claim that as players became more skilled in games, their visual attention became better proportionally.

Critical thinking and problem-solving skills (Rieber, 1996), drawing meaningful conclusions (Price, 1990), some inductive discovery skills like observation, trial and error and hypothesis testing (Gorriz & Medina, 2000; Greenfield, 1984 cited in Prensky, 2001; Price, 1990) and several other strategies of

exploration (Provenzo, 1992; Prensky, 2001) were also other positive issues related to games' effects on learning.

Moreover, Subrahmanyam, et al. (2001) articulate that playing computer games can provide training opportunities for gaining computer literacy, which was consistent with Prensky's (2001) statement that games were used in order to help people gain some familiarity with the computer hardware.

As for motivation, games are convenient ways that lead learners to have the responsibility of their own learning, which leads to intrinsic motivation contained by the method itself (Rieber, 1996).

Malone (1980) and Malone and Lepper (1987) define four characteristics of games that contribute motivation and thus eager learning. These are challenge, fantasy, curiosity and control. Challenge avoids students' boredom and keeps them up with the activity by means of adjusted levels of difficulty. Fantasy stands for the enthusiasm increased with the appealing imaginary context, whereas curiosity offers interesting surprising and novel contexts that stimulate students' needs to learn the unknown. Lastly, control characteristic gives learner the feeling of self-determination.

According to Rieber (1996), gaming elements have a relationship with enjoyable activities that enable the flow stage, coined by Csikszentmihalyi (1990). Thus, gaming activities have the potential to engross the learner to the flow stage and consequently cause a better learning (Prensky, 2001), while increasing their motivation and attainment (Rosas, Nussbaum & Cumsille, 2003).

Other characteristics that ensure the effectiveness of game based learning are their engagement and interactivity, and active participation (Price, 1990; Prensky,

2001; Gredler, 1996; Provenzo, 1992). Within interactivity of games a great importance is given on feedback, considering its effect on learning (Prensky, 2001; Malone, 1980; Rieber, 1996; Gredler, 1994). "Practice and feedback, learning by doing, learning from mistakes, goal oriented learning, discovery learning, task-based learning, question-based learning, situated learning, role playing, coaching, constructivist learning, multi-sensory learning" are applicable interactive learning techniques, when learning through games is of concern (Prensky, 2001, p. 157).

2.8. Educational Use of Games and Simulations

There is evidence that the use of games as instructional tools dates back to 3000 B.C. in China (Dempsey, Lucassen, et al. 1996). Nevertheless, games and simulations have hardly become a part of instructional design movement until early 1970s, despite their entrance to educational scene in the late 1950s (Gredler, 1996). Seels and Richie (1994) reports that in those times audio-visual specialist saw the potential of games and simulations but not of video (or likewise electronic) games.

Although computer games are considered as powerful tools to increase learning (Dempsey, Lucassen, et al., 1996; Dempsey, Rasmussen, et al., 1996), there are two major problems that are encountered. One is that there are no available comprehensive design paradigms and the other is the lack of well-designed research studies (Gredler, 1996). While the literature is growing as time passes, by the carbon copy researches that report perceived student reactions preceded by vague description of games and simulations or comparative studies of simulations versus regular classroom instruction (Gredler, 1996), the question of how to incorporate games into learning environments rather than, simply, to master the material, is much

more frequently asked to the educational researchers (Dempsey, Lucassen, et al., 1996; Dede, 1996).

Rieber (1996) argues that growing technological innovations provide opportunities of interactive learning environments that can be integrated with the theories of learning. However, Prensky (2001) further claims that, instruction through neither CAI, nor web based technologies contributes to learning, rather they subtract. People do not want to be included in such learning "opportunities" offered via innovative technologies, but they have to, since these learning "opportunities" possess still the same boring content and same old fashioned strategy as traditional education (p. 92-93). Prensky (2001) puts forth that learning can best take place when there is high engagement and he proposes "digital-game-based learning," which has potential for achievement of the necessary "high learning" through "high engagement" (p.149). He states that high engagement, interactive learning process and the way the two are put together will guarantee the sound working of digital game-based learning works (Prensky, 2001).

Rieber (1996) states that "Research from education, psychology, and anthropology suggests that play is a powerful mediator for learning throughout a person's life." (p.43). In line with this statement, Prensky (2001) further claims that "Play has a deep biological, evolutionarily important, function, which has to do specifically with learning." (p.112). However, despite some important psychological and cultural relationships to games, the education profession has long been hesitant about the value of games as an instructional tool or strategy (Rieber, 1996). For instance, as the prevailing philosophy in education changed, the attitude toward play changed accordingly too. As Rieber (1996) emphasizes, "In one era, play can be

viewed as a productive and natural means of engaging children in problem-solving and knowledge construction, but in another era it can be viewed as wasteful diversion from a child's studies" (p.44).

Up to now, the compromising elements and factors of games and simulations, with their do's and don'ts in the design process have been handled. In conclusion, all of the above discussions imply that seamless integration of these beneficial elements of games and simulations into learning, in an endeavor to create game-like learning environments seems compromising and worth trying.

2.9. Design Models for Educational Use of Games and Simulations

Throughout the literature review the researcher has also searched for design models that will help and guide educators especially to design game-like learning environments, "which requires the ability to step outside of a traditional, linear approach to content creation—a process that is counter-intuitive to many teachers." (Morrison & Aldrich, 2003, ¶ 15).

However, the researcher could not find one and in turn she came up with various design principles and lessons learned from commercial game designs. For instance, Amory, et al (1999) identified game elements that students found interesting or useful within different game types, which were the most suitable for their teaching environment and presented a model that links pedagogical issues with these identified game elements.

On the other hand Prensky (2001) presents various principles for good computer game design and other important digital game design elements. As for the most recent study on the subject, the design and research team that currently works

on the "Games-to-Teach" project carried by Massachusetts Institute of Technology (MIT), also proposed design principles for successful games design (MIT, 2003).

All of these studies deserve appreciation, since educational games are mostly classified as 'boring' by students. Moreover, they also show that endeavors are being suffered for and steps are being taken toward what Kirriemuir (2002) emphasized: "Computer games provide a medium that engages people for long periods of time, and gamers usually return to the same game many times over. There are obvious lessons here for the developers of digitally-based educational, learning and training materials." (¶2).

2.10. Synthesis of the Related Literature

Prensky (2001) states that the new generation is different from many of us in various aspects and outlines some differentiating characteristics that (already present) "game generation" possesses resulting from different experiences and "new media socialization" (Prensky, 2001, p.65; Calvert & Jordan, 2001). They are provided with skills, such as dealing with large amount of information quickly even at the early ages, using alternative ways to get information and finding solutions to their own problems through new communication paths. The new "game generation" prefers doing more than one thing simultaneously by using various paths toward the same thing, rather than doing one thing at a time by following linear steps. They are not stuck with frustration within a new situation; on the contrary they push themselves into a new situation without knowing anything about it and prefer being active, learning by trial and error and by themselves rather than reading or listening the exact way. Lastly they want to be treated as "creators and doers" rather than

"receptacles to be filled with the content" (p.76). So they are also referred to as "intellectual-problem-solving-oriented generation". Regarding these characteristics of the "game generation," the above-handled importance of games for education, and criticisms about IDDMs' failure to meet these changing needs, instructional designers should take the best bet. They should strive to integrate game-like elements to their designs seamlessly and to create game-like learning environments, so that they can armor and build power into their designs. However, there seem to be no such IDD model in the literature, to guide instructional designers through this painstaking process. Therefore, this study may add much to the literature to fill this gap and can possibly contribute, if not illuminate to some extent, the path along with the creation of game-like learning environments.

CHAPTER 3

METHODOLOGY

Throughout this chapter the detailed design of the study will be covered. The methodological foundation of the study, namely the overall design of the study, justification for the selection of the methodology, implementation process, data collection procedures, data analysis approaches and validity and reliability issues will be explained in a comprehensive manner.

3.1. Research Problem and Research Questions

The aim of this study is to contribute to knowledge base in instructional design theory, thereby making a humble contribution to the organizational and somewhat social phenomenon about creating game-like learning environments. More specifically, this study strives to reveal and understand the underlying elements of these environments, about which little, almost nothing, to researcher's knowledge, is yet known. In accordance with this research problem, the following research

questions appeared to be the blueprint for the current study to achieve the purpose of the study.

1. What are the distinctive characteristics of an instructional design/development process for the creation of game-like learning environments?
2. What are the necessary and sufficient components of an appropriate instructional design/development model for the creation of game-like learning environments?
3. How do these components come together to form a model?

For the purpose of finding answers to these questions, an undergraduate must course given in the Department of Computer Education and Instructional Technology (CEIT) at Middle East Technical University (METU) was selected as an instance to collect data (see 3.4.1. for details).

3.2. Overall Design of the Study

After finding out the need for a model that will provide direction for the creation of game-like learning environments, the researcher decided to handle this issue with the guidance of her advisor. Subsequent to the discussions with her advisor, she employed a special methodology, which is the offspring of formative evaluation and case study method of qualitative research (Yin, 1994). Reigeluth and Frick (1999, p.633) refer to this methodology as “formative research” and they define it as “a kind of developmental research or action research that is intended to improve design theory for designing instructional practices or processes.” The researcher will also employ this term throughout the study, although there are

different terminologies used to illustrate similar research processes such as “design experiments” (Greeno, Collins & Resnick, 1996, p.15) or more generally “design-based research” (Design-Based Research Collective, 2003, p.5).

Reigeluth and Frick (1999), specifically, assert that the design of formative research is the same with that of a holistic single case outlined by Yin (1994). Since the methodology followed throughout the study is once named, we can move forward to scrutinize the methodology anatomically. The researcher conducted her research as a semi-*in vivo*-and semi-*post facto*- naturalistic case, i.e. as a mixture of *in vivo* (during the case)-, and *post facto* (after the case)- naturalistic case. Reigeluth and Frick (1999) state three characteristics for a formative research to be a naturalistic case. These characteristics, which are followed by their fulfillment for the current study, are as follows:

a) “The researcher picks an instance (or case) that was not specifically designed according to the theory but serves the same goals and the context as the theory” (p.637). The case that forms the focus of the current study was not specifically designed according to any theory, since, to researcher’s knowledge, there is no such theory about creating game-like learning environments both in Turkish and in international sources. However, during the course of the selected case rapid prototyping model was used. This was a relatively new model, which is adapted from software engineering discipline (Tripp & Bichelmeyer, 1990). The instructor of the course had the idea of using rapid prototyping, which would be better than being unable to use any model due to the lack of any theory or methodology, while designing the course. Moreover, depending on his experience he also claimed that since rapid prototyping had been rooted in software engineering, it had the most

appropriate structure for the course design. As for the goals and context, they were perfect servants for the researcher's purpose of proposing an instructional design/development model, since the participants of the study, namely the students, were to create a game like learning environment by using a 3D virtual tool.

b) "The researcher analyzes the instance to see in what ways it is consistent with the theory, what guidelines it fails to implement, and what valuable elements it has those are not present in the theory." (p.637). Since there is no theory, new and distinctive elements that are born throughout the duration of the course are identified and the elements, which were consistent with each other within this duration are searched. The problems that deteriorate or slow down the whole process or the problems that are born in the implementation process are identified and declared.

c) "The researcher evaluates that instance formatively to identify how each consistent element might be improved, whether each absent element might represent an improvement in the instance and whether removing the elements unique to the instance might be detrimental." (p.637). During the study, the elements and the problems that are declared are formatively evaluated. As for the newly discovered elements, these evaluations lead us to understand whether each of them would represent an improvement or to identify in what ways they can be improved, while helping us to discriminate the irremovable and vital elements of the proposed model.

As stated above, the current study is a naturalistic case, but what is more, it is a mixture of in vivo- and post facto- naturalistic case, while some part of the formative evaluation of the selected case is done during its practical application, and the remaining part is done after the selected case has completed its duration. Actually, two out of the four data collection techniques, namely observations and

interviews were performed throughout the duration of the course, whereas the course-related documents and artifacts of the students were collected and analyzed after the semester was over.

Specifically, the structural framework of the research process both for post-facto, and in-vivo naturalistic case studies is as follows (Reigeluth & Frick, 1999):

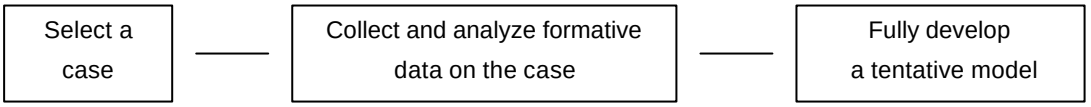

Figure 3.1. Diagram that shows the post-facto and in-vivo naturalistic case research frameworks.

Before giving the justifications for the selection of the study, it would be better to clarify the definition of the term "formative evaluation" for an instructional design process and for an instructional product, since formative research is based on the formative evaluation of an application of an instructional design theory (or model). According to Flagg (1990) formative evaluation is an iterative process consisting of a test-modify-retest-modify cycle, which includes any kind of feedback from target group of the research study, in an attempt for improvement of an instructional product during its design, development and initial implementation steps. In like manner, Kim (1994) gives the definition and major components of formative evaluation for an instructional product, which is under development and for which a need for improvement arises, as a systemic process, in which series of individual testing, field testing, extended testing and self evaluations of the developers are conducted to meet changing needs of learners.

On the other hand, Dick and Carey (1985) defined formative evaluation for an instructional design process as "the collection of data and information during the development of instruction, which can be used to improve the effectiveness of the instruction" (cited in Shon, 1996, p. 43). In brief, formative evaluation for an instructional design process means systematic and, in a sense, systemic collection of information to be capable of giving sound decisions about design and development process of instruction for the purpose of improvement.

To sum up, the logic underlying the formative research methodology is that an accurate application of an instructional design theory (or model) inherits all the characteristics of that instructional design theory (or model). So any weaknesses that the application possesses may reflect weaknesses in the theory (or model) and in the same manner, any improvements identified for the application may reflect ways to improve the theory (or model).

3.3. Justification for the Selection of the Methodology

The foremost and maybe the most important justification that could be set forward is the researcher's need for a research strategy, which must be inductive in nature (Merriam, 1998), due to the lack of a leading model (or a theory) for creating game-like learning environments. The lack of a theory (or a model) is also the reason of researcher's incapability to develop hypotheses that will structure the research study and select a formative research strategy with the intent of theorizing about the investigated phenomenon.

The subsequent selection criteria that were used when determining the methodology of the study were the characteristics of the research questions, the

answers of which the study sought for, the researcher's scarce control over the investigated phenomenon and the phenomenon's ignored or undervalued as well as contemporary and popular structure as outlined by Yin (1994). Moreover, the researcher was interested in the design and development process rather than the product or outcomes, in contextual structure rather than specific variables and in discovery of the underlying elements rather than conformation (Merriam, 1998). As the rationales for the selection of the methodology are once named, it is time to scrutinize them from a wider perspective.

The research questions addressed in the first chapter and also stated in the previous part, which are structured as "what" and "how" questions (Yin, 1994) and the researcher's intention to develop a tentative model that will, perhaps, lead to a theory by further inquiry (Goetz & Le Compte, 1984; Strauss & Corbin, 1990; Reigeluth & Frick, 1999) become justifiable rationales for the formative research methodology. What is more, Reigeluth and Frick (1999) also claimed that several theorists have intuitively used this methodology without naming it, when developing their theories.

Moreover, the researcher deals with a contemporary and in a sense ever-developing phenomenon, which pulls researcher's control over the phenomenon below zero, while at the same time giving the opportunity to full access to actual behavioral events. However, this does not mean a utility to manipulate the relevant behaviors, instead to document them via a variety of evidence that also lead to triangulation of the data, which are "direct observations," systematic and semi-structured "interviews," and analyzing "documents" and "artifacts" (Yin, 1994;

Stake, 1995; Merriam, 1998; Reigeluth & Frick, 1999; Fraenkel & Wallen, 2000; Cohen, Manion & Morrison, 2000; Yildirim & Simsek, 2000).

In addition, case study is the best way for in-depth understanding of a process, while it provides a thick and a holistic description of the studied phenomenon, which are fastened in real life situations, beyond enhancing the critical and intellectual dimensions of human thought (Merriam, 1998; Shimahara, 1990; Edson, 1990). It is the best strategy to discover or to gain novel and fresh points of view on meanings people have constructed in relation to context of the studied phenomenon (Strauss & Corbin, 1990; Sherman & Webb, 1990; Shimahara, 1990). Apart from giving intricate details of the phenomenon (Strauss & Corbin, 1990), there is this possibility, as Stake (1995) declared, for the emergence of previously unknown relationships and variables. Hence, this research methodology is a good servant to contribute to the advancement of the field's knowledge base and in turn to affect, and even, to improve the practice, i.e. to fulfill the main goal of the current study.

Briefly, when this study's concern about the complex process of design, development of an instructional model for creating game-like environments kept in mind, a case study approach, specifically a formative research methodology, proves to be the best plan upon which to build the study.

3.4. Implementation Process

Under this subheading the case that made up the focus of the study, the development of appropriate instruments and the participants that form the sample of the study will be explained.

3.4.1 The Case

The undergraduate must course named "Design, Development and Evaluation of Educational Software" was selected as the instance to investigate the focus of the current study. This course was given in two sections by two instructors and two assistants in the spring semester of the 2002-2003 academic year in the Department of Computer Education and Instructional Technology (CEIT) at Middle East Technical University (METU). There was no prerequisite to take the course except from being a senior CEIT student, who has come to the end of his/her undergraduate education in the department and have already designed and developed instructional systems before. The description of the course as given in General Catalog 2001-2003 of METU is as follows:

> Overview of computer aided instruction (CAI): types, strengths and weaknesses, effective CAI. Implications of learning theories for courseware design and authoring. Features, advantages and limitations of different CAI modes. Planning and managing CAI projects. Designing and producing CAI. Evaluation and revision.

To evaluate whether these general aims of the course are fulfilled or not, instructors of the course gave students the assignment of creating a game-like learning environment about a topic of their own choice for the purpose of preparing an instruction about the related topic. Furthermore, the course instructors decided that the assignments would also function as final substantial work before graduation,

almost like a graduation project. The students worked in groups of three or four and used an interactive, three-dimensional (3D) simulation environment, which is called "Active Worlds 3.3©," while creating their game-like learning environments. Access to this 3D simulation environment was provided over the Indiana University servers, since it is a commercial and licensed product of a commercial company, and registration and subscription by paying a certain amount of money is compulsory.

As for the interface of "Active Worlds 3.3©," it is composed of six main parts. These are "3D," "web" and "chat" components, "tabs" part, toolbar and menu bar (see Figure 3.2). Using the 3D part you can roam through the virtual world, while browsing the related information in the Web component and chatting with the others already logged in the same virtual world using chat component, simultaneously. By using related tabs in the tabs part, you can select the world you want to wander in; you can view the topics in the user guide, you can teleport yourself from one world to another, which means to transfer yourself from one world to another in an eye-blink, you can view your contacts, or you can send telegrams to one of your contacts. Finally by using the menu bar and toolbar, you can change your preferences, avatar, etc. or you can start building a virtual world of your own. A selection of various screenshots from the completed student projects are given in Appendix C.

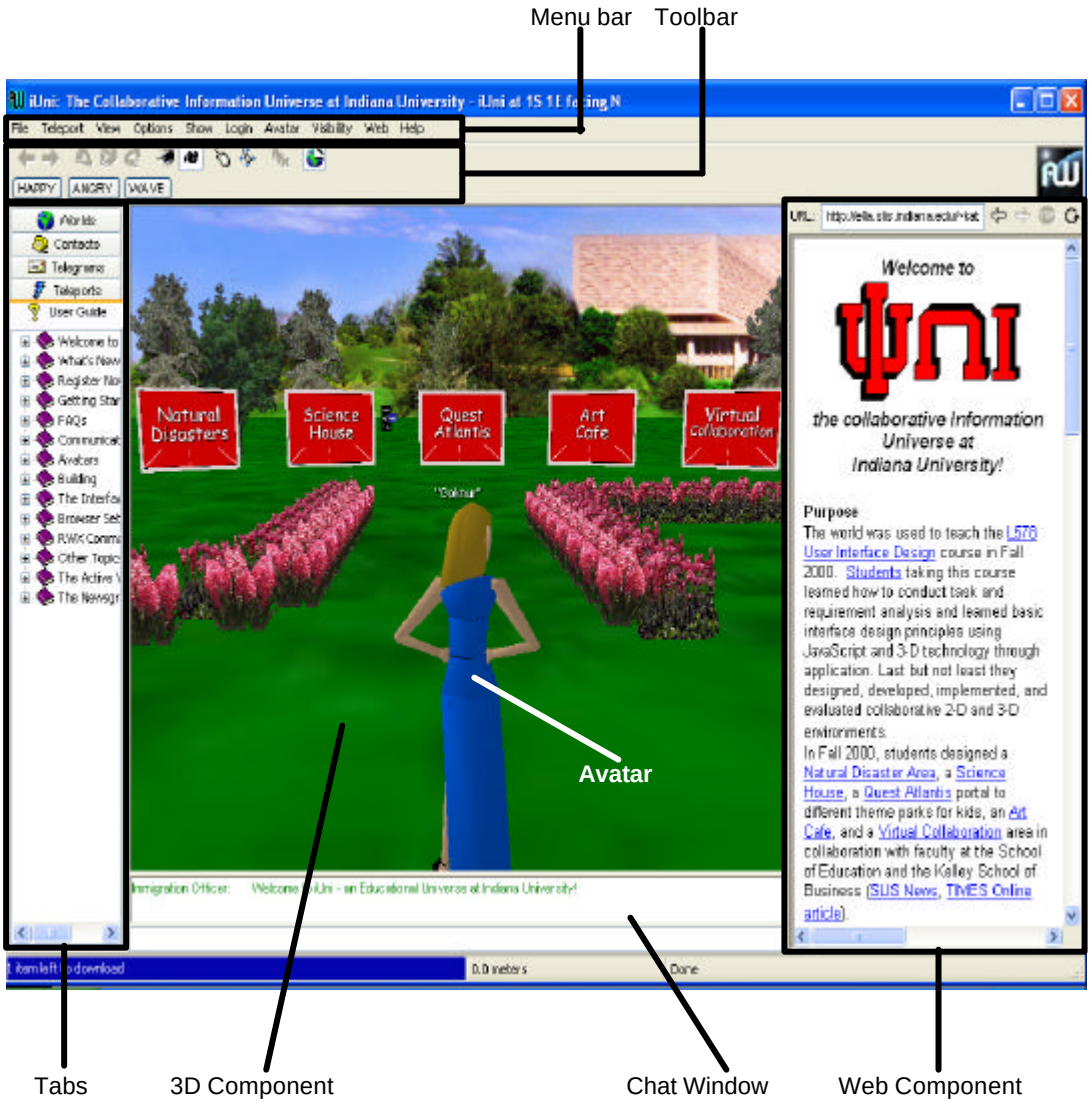

Figure 3.2. The components of Active Worlds 3.3©.

As for the instructional design/development model, the students used “rapid prototyping” throughout their projects. Rapid prototyping stems from its namesake counterpart; rapid prototyping methodology used for design in software engineering and is adapted to field of instructional design/development by Tripp and Bichelmeyer (Gustafson & Branch, 1997; Tripp & Bichelmeyer, 1990). Rapid prototyping continues with the parallel processes of design and research, or construction and utilization. In this methodology, after the needs and objectives were briefly stated, research and development are conducted as parallel processes that create prototypes, which go under testing and which may or may not evolve into a final product. During the progress of their projects, students also wrote group reports for each phase of rapid prototyping model after they completed it and took weekly feedbacks and advices from their instructors about their progress and reports.

Additionally, the researcher was already acquainted with all of the instructors and the assistants of the course. Both of the instructors had an instructional technology and design background. The background knowledge of one of the instructors depended on master’s education, personal endeavor and experience from the courses given by that instructor in the department for three years; whereas the other instructor’s knowledge depended on doctorate education and came from the previous experience obtained from personal and professional projects that were conducted for seven years, through which the instructor took part in the whole instructional design process or was employed in different parts of it. As for the assistants, both of them had no formal education about instructional design, other than their personal endeavor such as reading books or papers about the topic. More

specifically, one of them had information only about Posner's instructional design model.

The last issue that will be handled about the case that forms the focus of the study is the boundaries and delimitations of the case. From Yin's (1994, p.13) perspective the case should be a contemporary phenomenon that would be investigated within the real-life context, especially when the boundaries between phenomenon and context are not clearly evident. On the contrary, Merriam (1998) and Stake (1995) share the opinion that a case is a single entity delimited by the object of the study and bounded intrinsically. In conclusion, the case selected as the focus of the study has already possessed boundaries, and delimitations, when the aim of the study and when finite data collection opportunities limited to the number of the participants, such as finite amount of time for conducting observations and interviews, are taken into consideration. If we are to remind the aim of the study, it is to propose an instructional design/development model especially for creating game-like learning environments in a 3D realm of simulations. The reasons for this case to be selected were the easy access of the researcher to the members of the design development team and to different sources of data. The case that lies in the heart of the study along with its boundaries and delimitations is illustrated in Figure 3.3.

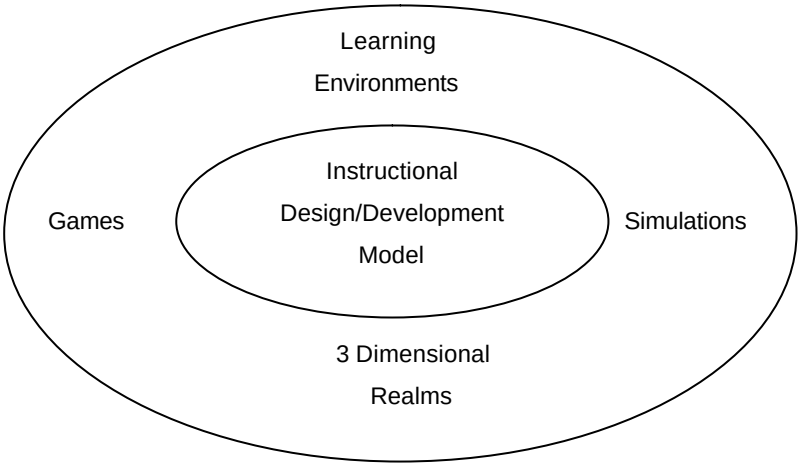

Figure 3.3. The boundaries and delimitations of the case that forms the focus of the current study.

3.4.2. Participants and Sampling

The participants of the study were 18 senior students enrolled in an undergraduate course named "Design, Development and Evaluation of Educational Software", which was given during the spring semester of the 2002-2003 academic year in the Department of Computer Education and Instructional Technology (CEIT) at the Middle East Technical University (METU). The participants were selected from the first section of the course. Seven out of 18 (39%) participants were female, and the remaining 11 (61%) participants were male. Ages of the participants were in a range of 21 to 26 with a mean age of 23.22 (*SD* = 1.11). The cumulative GPA of the participants ranged from 2.00 to 3.75 with a mean of 3.00 (*SD* = .46). Participants' individual profiles, obtained from the first interview that is conducted to

explore their background knowledge and experiences will be given in the results section in detail.

While determining the participants of the study, a two-stage sampling strategy was used by combining two different sampling approaches. This is consistent with Merriam's (1998, p.66) statement that "in case studies, …, sample selection occurs first at the case level, followed by sample selection within the case." Initially, students attending to the above mentioned undergraduate course were selected due to their availability and convenience for the current study by using convenience sampling approach (Fraenkel & Wallen, 2000). Selected case and consequently the students that are involved in the case comply with the current study's aim to propose an instructional design/development model for creating game-like learning environments. Secondly, by using purposeful (or purposive) sampling approach, 17 students were selected from the previously selected convenient sample of 56 students, and one other exceptional student was taken into consideration by the end of the study due to suggestion of one of the course instructors. Actually, these selected students worked in groups throughout the course and five out of 16 groups were selected purposively, regarding the researcher's personal judgment and with the help of the course instructors. Out of these five groups, one group has been selected for the pilot study, which will be conducted to examine the validity and reliability of the interview guide, whereas the remaining four groups have been selected to participate to the fundamental part of the study. However, since the pilot study showed no necessity for alteration, the group selected for the pilot study is also included to the sample of the current study.

Since generalization founded on a statistical base was not a goal of the current study, purposeful (or purposive) sampling approach was used in the second stage of the sample selection (Merriam, 1998). Another reason for the selection of this sampling approach was to explore information-rich cases for the purpose of gaining in-depth information about the central issues under investigation (Patton, 1990). This was consistent with the "intensity" type of sampling, which is one of the 16 strategies for purposeful (or purposive) sampling specified by Miles and Huberman (1984). When their typology of purposeful (or purposive) sampling strategies were examined, the strategy that the researcher used fitted best to "combination or mixed" type of purposeful (or purposive) sampling, which was the combination of "intensity," "criterion," "theory based," and "maximum variation" types of purposeful (or purposive) sampling. The first type, namely, "intensity" type of purposeful (or purposive) sampling was already declared above. As for the "criterion" type of purposeful (or purposive) sampling, as mentioned in the previous paragraph, the main selection criterion was the researcher's own judgment. However, this was not a bare judgment. Indeed, the researcher specified some criteria with the help of one of the course instructors, which were the instructional design and computer game-player experiences. Yet, the former criterion was already fulfilled approximately to the same degree by all of the students enrolled in the course. So, the researcher chose the students that would most probably provide valuable information for the study. In other words, the researcher chose the participants based on their ability to contribute to an evolving phenomenon, which is classified as the "theory based" type of purposeful (or purposive) sampling (Miles & Huberman, 1984) or "theoretical sampling" in grounded theory (Creswell, 1998). As for the game-player

experience, in view of the fact that the students of the selected case were working in groups, the groups that included a team member with the game-player experience were selected. Furthermore, these groups had already inherited the "maximum variation" type of purposeful (or purposive) sampling in addition to "criterion" type, since each member in the group was assigned according to their gender, GPA and experience in various fields, such as technical skills and abilities; programming; instructional design; etc.

3.4.3. Data Collection

In this part of the study the whole data collection process, namely the design of the instruments used and the context, in which the instruments were administered, will be explained in detail.

3.4.3.1. Instruments

According to Merriam (1998, p.42), in a qualitative study, the researcher himself is "the primary instrument of data collection and analysis." As a result there are some characteristics that a qualitative researcher should possess. These are declared as tolerance for ambiguity, sensitivity (or intuitiveness), good communication, listening and writing skills (Merriam, 1998). The researcher has already had some of the qualifications above. The one and only lacking trait was the tolerance for ambiguity, which was substituted with the researcher's impatient nature. The lack of already set procedures or protocols both eased and made difficult the researcher's course of action. It was hard to conduct this kind of study, since the researcher was used to following rigid steps of quantative research. Yet, the

flexibility, which stems from this ambiguity allowed the researcher to adapt to unforeseen events and to make the necessary changes.

Apart from the researcher, there are three main data collection techniques that one researcher can use, when conducting qualitative research. These are interviews, observations and, artifact and document analysis (Yin, 1994; Merriam, 1998). Due to the qualitative nature of the study, the usefulness of these three techniques for collecting formative data and the ability to provide triangulation of the data, researcher used all of the three data collection techniques. According to Reigeluth and Frick (1999), observations provide the researcher with the opportunity to judge the presence of design theory elements and to see the surface reactions of participants to these elements, whereas documents both on elements of the design theory and outcomes help researcher to judge the value of these elements. As for the interviews (both individual and group), Reigeluth and Frick (1999) state that they are the most valuable data gathering instruments, which allows the researcher to explore the participants' perspective, reactions and thinking in-depth with probes and to discover the possible improvements for the case. Specifically, the researcher chose to conduct group interviews, while it is possible to increase the participant number by this way and it also provides participants with the opportunity to make additional comments beyond their own opinions after they listened to others' responses. This opportunity had also a disadvantage like distortion and informal manipulation of the participant's original opinion, but to the researcher's observations during the interviews, this was not the case.

As mentioned above the current study was designed as a mixture of in-vivo and post-facto naturalistic case. Observations and interviews were placed in the in-

vivo part of the case. As the groups began to the design development process in April 2003, the researcher began to conduct the observations in the firsthand through the ongoing process. The researcher took notes on the physical settings of the environment, participants and their roles, and the activities, interactions and conversations that took place. As for the researcher's role in these observations, she participated in the observations as the observer, who was not hidden from the group.

Interviews were designed as semi-structured interviews, placing more open-ended and less structured questions with probes. Although the researcher conducted six different interviews with the participants, there were actually four different interview guides for the purpose of data gathering in four different perspectives. These were the interview guides prepared to collect data about demographics, personal experiences and backgrounds of the participants; about the reactions, perspectives and thinking of the participants on the instructional design/development process; social issues that emerged throughout the process; and lastly a hybrid one that includes questions from the first and the second interview guides prepared for the interviews with the instructors and assistants of the course (see Appendix A). The second interview guide was used, by making slight changes, for each phase that the participants completed throughout the design/development process. In the interview sessions, the researcher tried to learn and collect as much information as possible about the participants' perspectives, reactions and thinking about the instructional design-development process.

The development procedure of the interview guides was occurred in the following order: First, the researcher tried to find a study similar to the current study that she wanted to conduct, but as was brought up in the previous chapters and at the

first part of this chapter, she could not find one. However, she found two doctoral theses to inspire for the preparation of the interview questions. She took and adapted the questions about the design/development process from Çagiltay (2002) and the questions about the personal experiences and backgrounds of the participants were inspired from Lee (2002).

As for the interview guide about social issues that emerged throughout the process, it was prepared by the researcher herself and the one prepared for the interviews with the instructors and assistants of the course was a hybrid one which was created by crossing over the first two interview guides, mentioned above.

Secondly, before piloting the prepared interview guides, the researcher asked two colleagues and two experts to check the questions and related probes in terms of clarity and to determine whether there were multiple, leading or yes-no type of questions. The questions that were found to be unclear or vague were revised and it was seen that there were no unnecessary; or multiple, leading or yes-no type of questions.

Lastly, the pilot study was conducted with the interviewees of one of the selected five groups to examine the validity and reliability of the interview guide and accordingly to find out the questions that should be omitted or modified to make the final retouching. However, since the pilot study showed no necessity for alteration or modification, the group selected for the pilot study was also included to the sample of the study.

Observations were conducted complementary to interviewing, although they were conducted before and during the interviews. Generally, the team meetings with the previously assigned facilitators of the groups (i.e. instructors and assistants of the

course) were the focus of the observations. Most of the groups did not conduct team meetings on their own; instead they used an e-mail discussion list. Consequently, these e-mail messages were included to the documents to be analyzed by the researcher.

The observations were unstructured, participant observations (Yildirim & Simsek, 2000; Creswell, 1998), which depended on descriptive depictions and illustrations that were an endeavor to expose as much detail as possible. Although observations were unstructured, the researcher's notes were in the form of the observation protocol given in Appendix A. Above and beyond the opportunity to judge the presence of the design elements and examine surface reactions to these elements, observations provide valuable information about technical, social, organizational and IDD process-related problems and solutions to those problems articulated by the participants. Moreover, the researcher found a chance to monitor the social environment; the roles of the group members; the activities performed by the participants (asking questions, listening, participation, etc.), decision-making strategies, and the body language that is used in the environment in a context-related manner.

For the document analysis, the researcher has collected as many relevant resources as possible. The reports about each completed step of the design/development process, prototypes, e mail logs, and peer evaluations of the participants were collected after the course completed its duration. These documents were not prepared specifically for the current study, though; they provided rich information about the design/development processes, tasks and social issues related to these processes.

3.4.3.2. Data Collection Procedures

The data collection process has begun in April 2003 with the observations and last to the end of June 2003 with the gathering of the documents. As mentioned above four groups were invited to participate in the study and one group was invited to participate in the pilot study to provide the validity and reliability and to evaluate the understandability and clarity of the interview guides. However, they were also involved to the sample of the study, since the pilot study showed no necessity for alteration or modification.

Observations and interviews took place in the in-vivo part of the case. As the groups began to the design development process in April 2003, the researcher began to conduct the observations through the ongoing process. The observation times and frequencies was once in a week during seven weeks for each group, but this schedule created problems, too. The problem was the collision of the team meetings with the instructor. Many of the meetings were held simultaneously, so it became impossible to join all of the meetings in the flesh. Another problem arose, when the researcher began to conduct interviews with the groups. The above stated collisions became triple, since the groups wanted to talk with the researcher on the same day that the team meetings were held. However, short briefing sessions of these meetings with the participants were arranged to meet this deficit.

Table 3.1.

Detailed Schedule of Observation and Briefing Sessions

Groups	Observations and Briefing Sessions	
	Analysis	Design and Development
1. Group	29 April 2003*****	29 April 2003*****
2. Group	08 April 2003	22 April 2003
3. Group	15 April 2003	29 April 2003
4. Group	21 April 2003*****	22 April 2003
5. Group	08 April 2003	22 April 2003

***** indicates the briefing sessions conducted after the team meetings were held

Observations were held in two different locations. First was the office of one of the instructors, which was moderately roomy, warm and well-illuminated. There existed also a quiet atmosphere, without any disturbance throughout the observation sessions. The second was the meeting room in the department, which was moderately roomy, cool and well-illuminated, but there was the problem of echoing of the voices, which caused some difficulty in understanding conversations.

For the first observations with each group, the researcher was introduced by the facilitator of the group to the group members. However, since the researcher was familiar to the participants, they did not find the existence of the researcher strange or odd. As a result, this familiarity evaded the existence of both the potential marginality of the researcher in the setting and the potential deception of the people being observed (Creswell, 1998), even though the researcher was not hidden from

the participants throughout the observations. The researcher recorded the observations by taking notes with as much detail as she could (see Appendix A).

As mentioned above interviews also took place in the in-vivo part of the naturalistic case. Interviews were conducted by the researcher herself, after the groups completed each relevant step of the design/development process. The detailed interview schedule is given in Table 3.2.

Table 3.2.

Detailed Schedule of Interviews

Groups	Interviews				
	Personal Experience	Analysis	Design and Development	Evaluation	Social Issues and Group Interactions
1. Group	29 April 2003 13:30	29 April 2003 13:30	6 May 2003 13:30 and 27 May 2003 13:30*	17 May 2003 13:30	17 May 2003 14:10* and 27 May 2003 13:50*
2. Group	28 April 2003 13:30	28 April 2003 13:30	5 May 2003 12:30	7 June 2003 16:00	9 June 2003 16:00
3. Group	28 April 2003 11:45	28 April 2003 11:45	27 May 2003 12:30	6 June 2003 13:00	9 June 2003 12:30
4. Group	21 April 2003 13:30	21 April 2003 13:30	2 June 2003 13:30	7 June 2003 19:00	9 June 2003 14:30
5. Group	21 April 2003 12:30	21 April 2003 12:30	5 May 2003 11:30	9 June 2003 12:30	9 June 2003 13:30
1 Participant**	-	-	-	-	9 June 2003 11:30

***** indicates the interviews, which are conducted individually due to the absence of the participant.

****** indicates the only participant included to the study due to the suggestion of one of the course instructors.

As can be seen from the Table 3.2., although the interviews were mostly conducted as group interviews, there happened to be absent participants during that group's interviews. To eliminate any kind of flaw that would disturb the reliability of the study, individual interviews were conducted afterwards with these absent participants at their first suitable time they informed the researcher. However, the last three interviews made with the fourth group were conducted with only two of the four members and it had not been possible to conduct even individual interviews with the absent members of that group, since they did not come to the arranged interviews. Since the participation was voluntary, none of them had been warned or forced to come to the interviews.

Although the interviews lasted 545.64 minutes in total, length of each interview varied from one group to another in proportion to its scope. The details about each interview's length could be found in Table 3.3.

Table 3.3.

Students' Interview Durations and Grand Totals of Interviews

	Interviews' Durations (minutes)					
Groups	Personal Experience	Analysis	Design and Development	Evaluation	Social Issues and Group Interactions	**Groups' Totals**
1. Group	29.19	21.01	27.44 and 13.11*****	10.19	5.15	**106.09**
2. Group	36.28	13.47	16	25.29	30.06*****	**121.1**
3. Group	16.13	15.45	27.34	28.38	7.28	**94.58**
4. Group	27.51	17.35	29.27	16.12	10.5	**100.75**
5. Group	21.59	17.56	28.44	25.05	9.33	**101.97**
1 Participant******	-	-	-	-	21.15	**21.15**
Interviews' Totals	**130.7**	**84.84**	**141.6**	**105.03**	**83.47**	**GRAND TOTAL of 545.64 minutes**

***** indicates the interviews, which are conducted individually due to the absence of the participant.

****** indicates the only participant included to the study due to the suggestion of one of the course instructors.

The group interviews were also held in three different locations. First was the researcher's office, which was hardly roomy, warm and well-illuminated. However, it had been mostly impossible to provide a quiet atmosphere, since the interview sessions were broken by many people. The second was the meeting room in the department, which was moderately roomy, cool and well-illuminated, but there was the problem of echoing of the voices, which caused some difficulty in understanding conversations. The third was outdoors, the garden of the department. This place was especially used for the interviews conducted in weekends; or when the researcher was convinced that there would not be any disturbing elements nearby, like the noise of the vehicles that were passing by, etc.

As for the interviews that were conducted with the course instructors and assistants, the interviews lasted 82.06 minutes in total. More precisely, each interview lasted 41.7, 14.29, 15.5, and 10.57 minutes for the two instructors and assistants, respectively. These interviews were conducted, between 23 June 2003 and 2 July 2003, in the instructors' and assistants' offices, which were moderately roomy, warm and well-illuminated and had a quiet atmosphere, without any disturbance throughout the sessions.

Before each interview, the interviewees were greeted in a warm manner with the researcher's thanks for their participation. Afterwards, the researcher informed the interviewees briefly about the focus of the study and her intentions in conducting this kind of study. Lastly, the researcher guaranteed the participants' confidentiality through warranting them that she would use pseudonyms and reminded them that they were free to choose to participate in the study or not. Since confidentiality was guaranteed, the interviewees became voluntary and they gave their informed consent

by returning their thoughts, perspectives and reactions, but still the researcher took their informed consents verbally. By making these explanations participants were prepared to the interviews, as Reigeluth and Frick (1999) suggested for sound data collection.

During the interviews, the researcher acted in a positive manner, tried to follow the interview guide without losing eye-contact with the interviewees, listened the answers of the talking respondent by giving all her attention to him/her. By doing these, the researcher tried to make him/her believe that his/her ideas are really valuable for the study. There were some times that interviewees lost their focus on the interview due to variety of reasons such as their problems about department, courses, assignments or their worries about the future. When this was the case, the researcher tried to pull the focus of the interview from irrelevant issues back to the relevant issues of the study without hurting them. If this was impossible, she listened to them patiently and omitted these kinds of irrelevant data after the recorded interviews had been transcribed. Briefly, the researcher tried to protect the positive interaction, by preserving her respectful, nonjudgmental and non-threatening nature.

The researcher used a digital recorder to record the interviews. The recorded interviews were transcribed afterwards and transcriptions were e-mailed to each of the group members for member check. The returned additions and modifications were also carried out before the data analysis procedure.

As for the documents, they took place in the *post-facto* part of the naturalistic case. Except e-mail messages of some groups, the rest of the documents were collected from the course instructors and assistants after the course completed its duration.

3.5. Data Analysis

In this study, except for the document analysis, data collection and analysis activities were running simultaneously, as it always is in qualitative research (Merriam, 1998). Specifically the data analysis of the interviews was continuous and iterative in nature, as suggested by Reigeluth and Frick (1999). Unfortunately, due to lack of time, only one iteration had been possible for the interviews to explore the consistent and distinct evidence that would be built-into the conclusions. However, iterations for the analysis and design-development phases were also made, since the participants of the study gave some more details and additional opinions in the interviews that are conducted for design-development and evaluation phases, respectively.

Since there was no leading theory or model for creating game-like learning environments, it was impossible to find possible categories by scanning the literature. For this reason, the researcher tried to find out themes and categories from the transcribed interviews, observations and documents, which will lead to concepts that will turn out to be the bricks of the tentative hypotheses of the proposed model by building abstractions depending upon the collected data.

The researcher went through the following steps throughout the data analysis of interviews: First, the researcher transcribed the interview records word by word using Microsoft Word processor. As mentioned before, researcher also transcribed the instants that interviewees lost their focus on the interview, to avoid any kind of data loss. These parts were excluded after the print-outs of the transcriptions were taken. For the print-outs, the margins were adjusted to allow the researcher take notes on them. Next, the print-outs were arranged into groups according to their focus, i.e.

the print-outs of each group, related with the analysis phase were put together. Then, the researcher read them twice to view the whole picture of the participants' ideas. As the next step, the researcher tried to construct categories and subcategories by comparing the answers of each groups' members. Each category and subcategory were labeled related to the focus of the study and these labels were written on the print-outs, for instance a subcategory such as "efficiency study" under the "content analysis" category in the interview related to the analysis phase is coded as A-4-1, where 'A' stands for 'Analysis,' '4' indicating that the category is the fourth category that emerged, and '1' indicating that the subcategory is the first one under this category (see Figure 3.4).

A1. Konuyu belirlemek
A2. Target grup belirlemek
A3. Goal'leri belirlemek (//A5 ve A 4.2.2)
A4. Content (task) analizi (//A7 ve A8.2 bunu etkiliyor)
    A4.1. Efficiency study (= min. zaman max. content)
    A4.2. Ihtiyaç analizi
        A4.2.1. Dersin yetersizlikleri
        A4.2.2. Ögrencilerin yetersiz gördükleri noktalar
    A4.3. Güncellik
A5. Ihtiyaç analizi (needs analysis)
    A5.1. Structured analysis
    A5.2. Bilgisayara karsi bakis acilari
    A5.3. Oyunlar/simulasyonlardan neler bekliyorlar
    …

Figure 3.4. An excerpt from the coded data collected from the "analysis" interviews.

At this point, it should be emphasized that the numbers do not mean any order of importance. These procedures were followed for each bunch of interviews.

After each category and subcategories were established, a separate Excel sheet was prepared for each bunch of interview transcriptions. For the interviews conducted to collect data about personal information about the participants, namely, about the demographics, personal experiences and backgrounds of the participants, an Excel sheet was prepared that has three main parts. In the first part, all of the themes, categories and subcategories were written as rows of one column, including their above-mentioned codes that were assigned by the researcher. In the second part, codes of each participant (such as G21, representing the first participant of the second group or I1, representing the first instructor) were written in separate columns. The researcher also recorded the page number(s) in the cell, which was the intersection of the column that was labeled as the participant's code, with the row of the related theme, category or subcategory. Lastly, in the third part, the researcher used Excel to calculate the frequencies of each theme, category and subcategory in one final column.

	B	C	D	E	F	G	H	I	J	AK
1		G11		G12		G13		G21		TOTAL
2	1.4. Depends upon your group mates, people you work with.							p3	1	2
3	4. Individual/Group work									
4	4.1. Worked in groups			p1	1			p3	1	6
5	4.1.1. I did not get used to groupwork					p2	1			1
6	4.2. In general everybody worked with the same group mates.			p1	1			p3	1	4
7	4.3. Gorev dagilimi									
8	4.3.1. tasarimin nasil olacagina hep birlikte karar veriliyor.			p1	1					3
9	4.3.2. tasarimin teknik isini bir kisi yapiyor (renk button etc)			p1	1					1
10	4.3.3. herkes kendi alanina gore yapiyordu.			p2	1			p9	1	5

Figure 3.5. Excel sheet prepared for the transcriptions of "personal information" interviews.

However, since the researcher noticed that this was a both tiresome and inefficient way for data analysis, she used a different strategy for the rest of the data. She again used an Excel sheet, yet this time a different one, which consisted of only three columns, and in which the codes of the participants; the themes, categories and subcategories; and finally the expressions of the participants about each of these themes, categories and subcategories were written. As for the frequency calculation of each theme, category and subcategory, the researcher used the "filter" property of Excel.

	A	B	C
1	KISILER	ANALIZ	GORUSLERI
2	G22	1. Konuyu belirlemek	Öncelikle konuyu belirledik
3	G31	1. Konuyu belirlemek	Şimdi başta bir kısa summary verdik, daha sonra projemizin ne olduğ bilgi verdik. Description'ını yaptık.
4	G21	2. Target grup belirlemek	Yok, öyle değil de... Yani, adult education olarak tanımladık, daha sonı paragrafta, işte ortaokul sonundan başlayıp, lise, üniversite eğitimi fal yazmıştık. Kürşat hoca, şimdi tabii bu bir adult education değildir dedi şey diye düşünmüştük: Bu dersi alanlar değil de sadece bu konuya ilç herkes ve bu ilgisinin, zevkinin farkında olan herkes 'adult' diye tanıml girip bakınabilir diye düşündük. Yani, herhangi bir internet sitesi gibi, i herkesin girip bakabileceği bir yer gibi düşünmüştük ama öyle olmazs olacağını duyunca, üniversite öğrencilerine geri döndük.
5	G22	2. Target grup belirlemek	Target grubu belirledik,
6	G22	3. Goal'leri belirlemek (//A5 ve A 4.2.2)	Onlara göre biraz goal'leri belirledik.
7	G31	3. Goal'leri belirlemek (//A5 ve A 4.2.2)	Ondan sonra objective'lerimizi verdik.
8	G41	3. Goal'leri belirlemek (//A5 ve A 4.2.2)	Amaçlarımızı belirledik, içeriği belirledikten sonra, yani neler öğretme bunun sonucunda neler öğrenmelerini istiyoruz.

Figure 3.6. Excel sheet prepared for the transcriptions of "analysis" interviews.

This strategy became a relief for the researcher, since she would have been able to find the related quotations much more easily, while reporting the results of the study. To make this work even much more painless, the researcher originated the following codes given in Table 3.4. Combinations of these codes were also used

when referring to the original quotations of the participants' expressions appended at the end of the study (see Appendix B).

Table 3.4.

Codes Used in Data Analysis

Code	Corresponding Meaning
G52	The second member of the fifth group
PI	An abbreviation for the transcribed "Personal Information" interview
A	An abbreviation for the transcribed "Analysis" interview
D	An abbreviation for the transcribed "Design and Development" interview
E	An abbreviation for the transcribed "Evaluation" interview
5.2.1	The first subcategory of the second category under the fifth theme
IR	An irregular statement regarding the content of that interview transcription
*	A surprising and important statement
p4&p5	Shows that the designated statement stands in the fourth and fifth pages

The researcher also searched for the similarities among data that stems from interviews, observations and documents. Finally all the data were summarized in a matrix format to obtain a grand and whole picture of the puzzle, to identify certain aspects about social and somewhat organizational issues and to discover underlying elements as well as the unique ones.

After all of these procedures were completed, the data were quantified by calculating the repetition frequencies of each category and sub category via Microsoft Excel as described by Yildirim & Simsek (2000).

3.6. Validity and Reliability

There are two views about the validity and reliability of qualitative studies. Merriam (1998) stated that ensuring validity and reliability in qualitative research is closely related with the ethics of the study. For instance, there is this danger of selecting appropriate data among the available mass to fit and support already determined results that are settled by the researcher before the study is conducted (Merriam, 1998).

On the contrary, Bassey (1999) coined the term *trustworthiness* as a substitute for validity and reliability. In the same manner, Reigeluth & Frick (1999) mentioned a methodological concern, apart from validity and reliability, which should be taken into consideration due to the nature of the formative research. They claimed that validity is the major concern of the research studies on descriptive theory. On the other hand, for a design theory or model the major methodological concern is *preferability*, which is defined as "the extent to which a method is better than other known methods for attaining the desired outcome" (Reigeluth & Frick, 1999, p.634). The personal values that the researcher, or in a broader sense, all stakeholders of design theory applications possess, constitute the term preferability. These values could be handled under three subheadings. These are *effectiveness*, *efficiency* and *appeal* (or *satisfaction*) (Reigeluth & Frick, 1999). Effectiveness is defined as the extent to which the application attained the goal in broad range of given contexts and situations. Efficiency is the measure of the resources, such as human time, effort, and energy or cost of the materials, used to perform the application, whereas appeal (or satisfaction) stands for the measures of affective reactions, namely the degree of enjoyability of the application's design for all the

associated people (Nielsen, 1993; Reigeluth & Frick, 1999). However, these three criteria are not applicable for the current study. For example, as mentioned in the beginning of the chapter, there is no model or theory of this kind to make a comparison with the proposed model to verify its effectiveness, efficiency, and appeal. Yet, as for the efficiency and appeal, the following chapter involves and reveals some related issues. What is more is the researcher's intention to conduct iterative follow-up studies to document these issues later on.

Kim (1994), also, emphasizes some critical features in a formative research study, which should be taken into consideration carefully, as are stated at the second part of this chapter. He discriminates formative research on an instructional theory (or model) from formative evaluation of an instructional product by depending on the means of data collection. He asserts that when the latter is of concern, data can be gathered directly from the learners, whereas for the former, data is collected through the "instance" of the theory (or model). Hence, issues concerning the validity of a formative research on an instructional theory (or model) should be handled carefully and answers to questions such as whether the instruction is a true instance of the theory (or model) or not, should be stated openly.

What is more, Reigeluth and Frick (1999) especially emphasized the importance of construct validity, thoroughness, accuracy (or, internal validity or credibility), and external validity (the extent, to which results could be generalized).

Construct validity is defined as "establishing correct operational measures for the concepts being studied" (Yin, 1994, p.33). Specifically, Reigeluth and Frick (1999) set forth that "the concepts of interest in formative research are the methods offered by the design theory, any situations that influence the use of those methods

and the indicators of strengths and weaknesses [which should include the above mentioned measures of effectiveness, efficiency and appeal] (criteria for outcomes)" (p. 647). Yin (1994) recommends three tactics, which are use of multiple sources of evidence, establishment of chain of evidence, and the review of a key informant on the draft of the case study report. Reigeluth and Frick (1999) widened the last tactic by suggesting that the operationalization of the methods and analysis of situations should be conducted by at least one expert in the theory. For the current study, interviews, observations, documents and artifacts were used as multiple sources of evidence to provide convergence and which lead to triangulation of data sources (*data triangulation*). To be able to establish chain of evidence, all of the steps that are taken by the researcher were explained in detail to provide the reader with rich descriptions and evidence mined from the initial research problem and questions to ultimate conclusions. Lastly, two relevant expert reviewers were identified and data, findings and the draft reports were presented to them to take their opinions. Both of the experts had a background about instructional design/development processes, whereas one has an enormous experience in qualitative research in addition and the other has a wide range of experiences related to his practical and technical background.

Internal validity deals with the question of how research findings matched with the reality (Merriam, 1998). Yin (1994) suggests pattern-matching, explanation building and time-series analysis to improve the internal validity. The researcher made pattern matching, namely comparing the patterns obtained from the empirical data with the ones that she intuitively identified. She also strived to demonstrate the related categories as implied at the end of the study. Additionally Merriam (1998)

recommends triangulation, member checks, peer examination, clarification of researcher's biases to ensure internal validity. Triangulation and member checks were already handled in the previous sections. For peer examination, the researcher asked for a PhD student with instructional technology background on the emerging findings. As for the researcher's assumptions and theoretical orientation, there is not much to say. Being a novice practitioner in the field has both advantages and disadvantages for the course of the study. Due to her lack of knowledge about the field, she has the advantage of being creative and independent from the dominance of the underlying theory or models designed in similar manners, being linear, strict and grinning due to their "done-by-the book" nature. Alternatively, this is a disadvantage, since it could cause unnecessary loss of time or direction, when striving to discover something that is already identified and included to the theory. The academic background of the researcher in the field of mathematics teaching also brought up its advantages and disadvantages. The strong and tamed intuition of the researcher and her enhanced sense of logic helped her very much throughout the study, while, on the other hand, forced her to search for rigid and clear guidelines for the research and findings. As a result, these issues should be kept in mind, when reading the findings and conclusions.

Thoroughness or completeness of the data was provided by advance "preparation of the participants, [following] emergent data collection methods gradually decreasing the obtrusivity and identification of the strengths and weaknesses" (p.647), as Reigeluth and Frick (1999) put forward. However, iteration until saturation was not possible in the course of the study, as mentioned above, due

to lack of time. Additionally, although it is not intended, in participant observation or interviews informal manipulation could have occurred.

As previously stated a statistical generalization was not the aim of the study, since the current study is designed as a formative research, due to researcher's wish to understand the selected instance comprehensively, not to find out what is generalizable to or true for majority. In multicase or cross-case studies it is much easier to generalize the findings (Merriam, 1998). It could not even be possible to discuss the situationality of the findings, as Reigeluth and Frick (1999) suggested to enhance the generalizability. However, the readers were provided with rich and thick descriptions to be able to determine to which degree their case is close to the current study (Merriam, 1998). Actually, in general terms qualitative research involves "interpretations by the researcher or participants from particular standpoints and against the background of accumulated meanings" (Greene, 1990, p.175). These interpretations that lead to subjectivity have also been afraid to lead to problem of bias in relation to lack of rigor in the data collection and analysis procedures (Hamel as cited in Merriam, 1998). Furthermore, since the information obtained through formative evaluation is highly specific to a particular situation, as in this study, it would be inappropriate to make generalizations to many settings, by which there will occur the danger of overgeneralization. Therefore, this methodology is designed to produce information that is valid and useful within the decision-making context of that particular situation or alike, but not for universal contexts.

Replication was also the second unlikely subject for the current study, since there was no opportunity for one. Nevertheless, it took its place in the recommendations for further studies.

Lastly, the reliability of the study was ensured through the use of multiple sources of evidence, which leads also to triangulation of data, the detailed, rich and thick descriptions of the researcher's own assumptions and position in the study, data collection, category derivation, decision making procedures and ultimate conclusions. These techniques also led to the accuracy and credibility of the data that Reigeluth and Frick (1999) underlined in their study. Nevertheless, there is always a risk that documents may lack correspondence with the conceptual model, since they were not produced for research purposes. Authenticity and accuracy of the documents are also a problem, but since the researcher was involved in the research process, she also witnessed the production period of the documents. Thus, she has no doubt about these issues to the extent of her observations. There is also the familiarity of the researcher to the participants. This acquaintance has both advantages and disadvantages. Since the researcher is the advisor of the participants she has the opportunity to be acquainted with them and to have at least a rough idea about their personal traits, and to have a preexistent empathy before the study due to proximity of the researcher's age to their ages, which eased her workload and warranted the trustworthiness of the data by avoiding potential marginality of the researcher in a strange setting and potential deception of the people being observed or interviewed. In contrast, this was a disadvantageous situation for her, since most of the time, during the interviews the conversations were drawn to different directions by the students, such as their problems about the department, courses, assignments or their worries about the future.

3.7. Limitations and Delimitations

As mentioned in the data collection instruments parts above, the researcher was "the primary instrument of data collection and analysis" (Merriam, 1998, p.42). However, there was not any opportunity for the researcher to take up a course or training about how to make sound observations and interviewing. Yet, the researcher tried to compensate this limitation by reading as many books about these issues as possible. Although there were many useful and detailed instructions about the data collection and analysis of the collected data, another limitation was the lack of guidelines about writing a final report on conducted research.

Moreover, the validity and reliability of the study will be limited to the honesty of the participants' responses. Apart from the participants' honesty during the interviews, documents may lack correspondence with the conceptual model as they were not produced for research purposes, which would yield to authenticity and accuracy problems. Additionally, although it is not intended, in participant observation or interviews informal manipulation could have occurred. Specifically, the researcher chose to conduct group interviews, while it is possible to increase the participant number by this way and it also provides participants with the opportunity to make additional comments beyond their own opinions after they listened to others' responses. However, this opportunity may also yield to distortion and informal manipulation of the participant's original opinion.

There is also the familiarity of the researcher to the participants, which on one hand warranted the trustworthiness of the data. On the other hand, it caused conversations to be drawn to different directions by the students, such as their problems about the department, courses, assignments or their worries about the

future, during the interviews, due to proximity of the researcher's age to their ages. This acquaintance provided the researcher with the opportunity to have at least a rough idea about their personal traits, and to have a preexistent empathy before the study, which helped her during the sample selection.

As for the sampling methods used in the study, convenience sampling method brings some problems about the replicability. For this reason, apart from reporting demographics of the participants, the researcher conducted a separate interview session to be able to include as much information on other characteristics of the sample as possible (Fraenkel & Wallen, 2000). However, it is impossible for the researcher to have control over the facts, which are changing in relevance to individuals and the environments they are involved. Consequently, replicability of the study will not be possible or a replication may not give the same results as this study, even though the similar conditions described throughout the study would be provided (Yildirim & Simsek, 2000).

Another delimitation of the study is about the second sampling method, namely, purposive sampling. Purposive sampling is different from convenience sampling in that researcher does not simply examine, whoever is available, but uses her judgment to select a sample that she believes, based on prior information, will provide the data she needs. However there is this danger that the researcher's judgment may be in error – she may not be correct in estimating the representativeness of the sample or their expertise regarding the information needed.

Lastly, the context of the selected case could be a possible delimitation to the current study. More precisely, the IDD model followed during the course; the software/tool used in the development of the projects by the students; and lastly, the

assignment of the students to project groups by the instructors could be counted among the related factors that constituted the context of the case. The problem with the IDD model followed during the course was that it was not designed specifically for the selected case. As for the development software/tool, the students had a vast number of restrictions, which caused problems and affected both them and their projects in various dimensions. Lastly, allocation of the members of project groups by the instructors, which might cause having one member of the group to do all the work, resulted in fairly shared workload and responsibilities of the project.

CHAPTER 4

RESULTS

This chapter presents the findings of the current study regarding the research problem and the questions stated in the first and third chapters. The findings will be reported under four subheadings. These are background information of the participants, soft issues, process-related issues, and hard issues related to creation of game-like learning environments, respectively. In the first part demographics and background information of the students and instructors, who participated in the study, will be presented to provide as much detail as possible, when illustrating the whole picture in its clearest form. Under the soft issues subheading, peopleware part of an instructional design/development (IDD) process will be exposed. In other words, the human relations and social or organizational issues will be reported. As its title suggests, in the process-related issues part, the findings related to analysis, design, development and evaluation steps of an IDD process will be explained. As for the hard issues part, the technical aspects of this IDD process will be handled.

Throughout all of these subheadings the findings will be supported via English translations of quotations taken from the transcripted interviews made with participants. However, the originals of these quotations were also added in Appendix B.

One important point to be emphasized before moving forward is that the above-stated subheadings are completely invented and were determined by the researcher herself, depending upon the data, to scrutinize the phenomena much more easily and comprehensively. In reality, the collected data showed an interrelational and fuzzily-bounded nature, making a comprehensive coverage essential, both of which will be revealed in the relevant parts of the study.

4.1. Background Information of Participants

This part of the study will be handled under two subheadings, since the participants of the study consisted of the students enrolled in an undergraduate course named "Design, Development and Evaluation of Educational Software", which is given during the spring semester of the 2002-2003 academic year in the department of Computer Education and Instructional Technology (CEIT) at Middle East Technical University (METU), and the instructors and assistants carrying out the designated course. Under the first subheading background information of 18 students will be reported in detail, whereas in the second subheading related background information of the two instructors and two assistants will be revealed. Although the data that form the skeleton of the study were collected from the students, the researcher thought that reporting the background information of the

instructors and assistants was also important to picturize the phenomena in its most vivid form.

The last issue that should be reminded is that at the beginning of the study 17 students had been selected from the previously selected convenient sample of 56 students by using purposeful (or purposive) sampling approach as was written in the third chapter. Afterwards, one other exceptional student was taken into consideration by the end of the study due to suggestion of one of the course instructors. The data collected from her were obtained via the interview about the social issues, so they are included to the soft issues part of this chapter.

4.1.1. Background Information of Students

The group of participants that made the main contribution to the study consisted of 18 students enrolled in an undergraduate course named "Design, Development and Evaluation of Educational Software", which was given during the spring semester of the 2002-2003 academic year in the department of Computer Education and Instructional Technology (CEIT) at Middle East Technical University (METU). They were selected from the first section of the course. As for the demographics of the participants, seven out of 18 (39%) participants were female, and the remaining 11 (61%) participants were male. Ages of the participants were in a range of 21 to 26 with a mean age of 23.22 (SD = 1.11). The cumulative GPA of the participants ranged from 2.00 to 3.75 with a mean of 3.00 (SD = .46).

As mentioned above, at the beginning of the study 17 students had been selected from the previously selected convenient sample of 56 students by using purposeful (or purposive) sampling approach. Afterwards, one other exceptional

student was taken into consideration by the end of the study due to suggestion of one of the course instructors. The only data collected from her were obtained via the interview about the social issues, so they are included to the soft issues part of this chapter. However, her demographics were also reported above.

As for the other details of 17 students' backgrounds apart from their demographics; their IDD experiences, duration of performance in IDD, attributes of their projects, their working habits, their own definitions of area of profession and their self perceptions about the IDD field were revealed.

All of the participants declared that their educational backgrounds of IDD have been built through the courses they took in the department. Additionally, one of them took elective courses from another department about the design processes and one of them attended to an IDD-related conference as a listener and told that he had been informed about various aspects of IDD. In line with their educational backgrounds, all of the participants declared that their IDD experiences stemmed from the departmental projects that they performed throughout the courses they have taken up to that time (Table 4.1). Only two of them voiced their doubts concerning whether their current experiences could be accounted as "real IDD experiences" by stating:

"I do not believe that we can be considered as experienced, for the projects were not taken so much seriously; we would finish them only in the last two or three weeks, unlike we do in the present term." [G21-PI-p1]

> If you are asking about experience, we do not have much…until the fourth year [grade] … we were taught about pedagogy, theory, strategies, and approaches … [yet] nothing was given about the instructional technology dimension, or the design aspect of education … [I suppose] we do not have any experience since we did not have a

> chance to get a part-time job … and take part in better projects … we only have elementary knowledge. [G43-PI-p1]

What is more, eight of the participants took part in professional projects lead by private companies or organizations, in which three of them have found a chance to be informed about design and development phases of an IDD, whereas three of them had the chance to practice his/her theoretical information about these issues. Moreover four out of these eight participants also worked in projects, to which they referred as “less instructional, more technical” (see Table 4.1).

There was also disagreement among the participants about the duration of performing IDD and the number of IDD projects they conducted. Ten of them stated that they were conducting IDD projects, since their second year in the department, whereas the rest stated that they began to conduct IDD projects, when they began to take departmental courses as freshmen. Yet, the numbers they gave for their IDD projects varied between five and 12, fifteen participants said that they prepared 10 to 12 IDD projects, whereas the rest said that they conducted five to seven projects (see Table 4.1). This disagreement among the participants about the number of the IDD projects may have originated from the participants’ lack of understanding about their area of profession. Sixteen of the seventeen participants asserted divergent and confusing opinions when they were defining what an instructional designer do, such as “designs learning environments, considers the system from an educational aspect, integrates the content into technology, determines the media and feedback types that will be used in the instructional system to present the content in the most effective way for the user, works as the project manager, communicates with the team

members and provides coordination, settles the needs with the administrators of the projects".

One last participant's words were almost a summary of all the above-written views of the rest:

> I do not know. I do not know what I do, because I dealt with codes, not with design. I do not know if I can prepare a page design. In what we do now we need a graphics designer and a code writer. They also need us but we did this on our own. [Therefore] we do not know what our real job is. [G41-PI-p6]

Another reason for the disagreement among the participants about the number of the IDD projects may be their own criteria for determining whether the projects that they conducted are IDD projects or not. Different participants explained various kinds of projects that they classify as IDD projects, which was not either an IDD or did not include the whole process of IDD, but specific steps that it possesses, such as design, development, or evaluation. For the former statement above, one of the participants mentioned about the difficulty of the project on designing network connections of a building, which he classified as an IDD, but in fact it was a technical project totally. As for the latter statement, one of the participants mentioned about two projects, in which she performed the development phase of an IDD by writing codes in different programming languages:

> I did a Pascal project in my second year. It was a challenge … it was teaching the sum of n I suppose. After all, it was a program [but] it is in the instructional design area … for instance there is also the program we made by Visual Basic. [G51-PI-p5]

In like manner, the other two participants stated:

"I made applets by using Flash, which teachers can use in their lectures. It was a JavaScript already and I made the animation by Flash, which teachers can obtain from the library when necessary." [G31-PI-p3]

"What we do may be classified as instructional system design, but when we compare what we learn now with what we did then, we see that we almost developed a webpage for a course." [G43-PI-p2]

Another one mentioned about the project that he evaluated and redesigned an elective course:

> ... I redesigned an elective course titled Cultural Evolution. [In the present situation] field research was being done and its reports were being written down. But, to make a comment on an evolution of that kind, or on culture, one needs to have a strong background. This makes [the course] beyond the reach of a student who is taking it as an elective course. The gap is expected to be filled by the instructor. For the instructor to meet this demand, I made a design that would include one-to-one interaction. [G52-PI-p4&p5]

All of the students stated that they worked in groups or as teams throughout their IDD projects both within the departmental and non-departmental projects (technical projects or projects they performed for private companies). This supports their claim that IDD requires teamwork. Only one participant expressed that he did not get used to groupwork due to his individual study habits, by saying:

"...in fact I am not the kind of person who can work with a group. I do it all alone since high school and also in the courses I take here. I never got used to group work." [G13-PI-p2]

Table 4.1.

IDD Background Information of the Participants

1. IDD experience	Number of the Participants (# out of 17)
1.1. Departmental Projects	17
1.2. Working in private companies	8
1.2.1. I have been informed (especially about design and evaluation phases)	3
1.2.2. I have done it personally.	3
1.2.3. I worked in technical projects	4
2. Duration of performing IDD	
2.1. Since 2nd year (2.5 years)	10
2.2. Since 1st year (3.5 years)	7
3. Number of IDD projects	
3.1. 5-6 or 7 projects	15
3.2. 10-12 projects	2
4. IDD related educational activities	
4.1. Courses taken from CEIT Department	17
4.2. Courses taken from Industrial Design Department	1
4.3. Attended to conferences	1

All of the participants also mentioned that in general everybody preferred to work with the same group mates during the departmental projects, which might lead to automatically, but in some cases, unreasonably distributed workload among the team members, since each member became a specialist in various kinds of areas, such as graphics design, programming, etc..., as the time passed. Fifteen out of 17 participants voiced their opinions related to this issue.

All of the participants said that they were aware of the analysis, design, development, implementation and evaluation steps of the traditional (or so called ADDIE) model theoretically, but they did not apply each of them exactly. They said that they would have been able to conduct only the design and development steps practically:

> "We made development with a design." [G41-PI-p6]

> Scientifically it is analysis, design, development, implementation and finally evaluation, but this is not so much the case in practice. We went over all of them but I really can't say if we ever did something substantial for analysis or evaluation. [G31-PI-p2]

"We never had the time for testing and evaluation, since we were busy programming." [G42-PI-p6]

Seven of the participants emphasized especially that they even did not follow the design and development steps completely when compared to those which the model possesses. They said that they used naïve versions of their own, by trial and error, or designing, building, tearing down, redesigning and re-building:

"In fact we never used [analysis, design, development, implementation evaluation] so far. We did them in the way we wanted and in fact we were not aware of them. We did not worry about them." [G41-PI-p3]

"[Traditional model] was being used but generally we were constantly deconstructing and reconstructing." [G31-PI-p2]

One of the participants also proposed a very interesting statement that would also be a justification for the naïve methods that they used in their previous projects. He said that

"To me one may well not follow what somebody else thought and designed according to his/her own necessities, because everyone might, in time, come up with new systems tailored for their own necessities." [G41-PI-p3]

For their background knowledge of IDD models, all of the participants said that they already knew traditional models, such as ADDIE and ASSURE models, and were aware of the existence of non-linear models since their third year in the department, but have never heard of or used the rapid prototyping model before.

As for the participants' working habits, it might be better to have a look at the points that they made, when they were mentioning about the IDD processes of their previous projects. There was a consensus among the participants about the restricted amount of time and lack of a linear and systematic workflow or appropriate planning that will provide the continuum of this kind of systematic work. Another thing was the need for a guide that would check and give feedback about the progress of the project. One of the participants summarized the above-mentioned issues by saying:

> All through the term we had the project in mind, things accumulated in time and in the last two-three weeks they came out all together. Because we were not given a linear working order specifying what will be done until what time. In fact, we were not given any corrections either. [G11-PI-p2]

Furthermore, all of the participants told that they used different tools, when preparing their projects with various contents and related the state of being obliged to complete the project in such a small amount of time to spending most of the time and effort to discover and learn that tool. One of the participants gave an account of the general flow of the project time as follows:

> ... The first few months would be spent with the question concerning how to use the program, and in the last month even the subject of the projects, in other words, what were to do would not yet be clear. The project was given in the last month. What sort of a project can be presented in the last one

> month? In fact what we did was to put into practice what we had learnt. [G22-PI-p2]

Lastly, the participants stated their qualifications that distinguish them from other professionals in the field. These were their widespread knowledge about the theoretical, educational, graphical, content-related, learner-related aspects of their field, which was voiced by ten participants; extended vision related to their awareness of the developments in the field (such as new technologies, new models, etc.), which was voiced by three participants; and, creativity; perfection in manipulation of the new technology; and, consequently, self confidence in technology use, which were voiced by two participants. Yet, two of the participants asserted that the only lacking thing was the professional experience, namely practice in the business world.

As for the perceptions of the participants about the game use in education, more precisely, about creating game-like learning environments, the researcher obtained the findings given below, after analyzing the reflection papers they wrote as one of the course assignments. They wrote down that they all had a positive attitude about this issue, except for one of the participants. He wrote that due to the current structure and conditions of the education system, it would not be possible to use such learning environments.

The participants stated that games could be used in order to increase the motivation and to develop and enhance critical and creative thinking skills, as well as to avoid boredom of the students and the monotony in the lessons. However, they also mentioned about the problems of social isolation caused by single-player-games; integration of games into the curriculum and the lesson, not to mention the time

constraints; and the fact that the majority of games were designed exclusively for boys. Inspite of all these drawbacks, all of them wrote that they would consider using games or game-like learning environments in their lessons, when they become teachers.

4.1.2. Background Information of Instructors

The course, which constituted the case of the study, was carried on by two instructors and two assistants, as stated previously. Both of the instructors were experienced and took a formal education about IDD. One of the instructors had taken IDD related courses during her master's education, whereas the other had taken courses during his doctoral education. Both of the instructors had a professional experience in IDD projects for an average of nine years. One of them said that she had taken part in not only instructional software development part of the IDD, but also in the training part of IDD, too. She added that she mostly joined to projects that were not commercial IDD projects directed towards the market. There were also some IDD projects that she developed or produced on her own. The latter was also valid for the other instructor, too. He stated that he took part in both commercial and non-commercial projects, in which he carried out mostly teamwork. Both of the instructors had a wide knowledge of IDD models, but they used mostly the generic traditional model (so called ADDIE model), when designing instructional systems. Both of them, also, had some academic works related to IDD.

As for the assistants, they did not have any formal education or professional experience. They said that they had a limited knowledge, which were constituted by the readings that they made. Furthermore, they said that they have never been

included in an IDD project, so they did not have any professional experience. Apart from the rapid prototyping model that they used during the course, one of the assistants said that he was also aware of the ADDIE model.

In all the interviews that are conducted with the instructors and assistants, there were also some questions, which were related to soft issues, IDD process and hard issues. Their answers about these issues will be handled under the designated subheadings.

4.2. Soft Issues

In this part of the chapter, peopleware part of an instructional design/development (IDD) process, i.e. the human relations and social or organizational issues will be reported.

All of the participants stated that they worked in groups or as teams throughout their previous IDD projects both within the departmental and non-departmental projects (technical projects or projects they performed for private companies). This supports their claim that IDD requires teamwork. In addition, one of the instructors stated that he also carried out individual work due to the scope of the project or absence of an appropriate team at the moment and added that being both "chief and Indian" was the most challenging situation for him in an IDD project. In spite of this, one participant stated that he could not get used to groupwork and did not like it, because of his prior working habits.

For the team members' characteristics and qualifications, they listed many issues, such as field knowledgeableness, proficiency in technology, strategic, holistic and especially creative thinking abilities, project management skills, leader

qualifications, communication skills, responsibility, honesty, empathy and professionality. They also stated that the quality and qualifications of the team members affect the quality of an instructional system. There was one more important aspect that the participants asserted, which was familiarity. They said that prior familiarity of team members with each other has both advantages and disadvantages. The main advantage was the potential to work in harmony throughout the project, since all the attitudes, qualifications and working habits of the team members would have been already well-known by the other team members. On contrary, there would also be a risk of repetitiveness and sameness of the produced projects, which was likely to exterminate creativeness and originality. However, they also said that working with different people, gives an opportunity to get acquainted with new people and to get to know them much closer.

All of the participants agreed that to be able to fulfill their design properly, high-level programming knowledge and advanced coding skills were required. For this reason, they said that there should be a 'techie guy,' a team member who should have technology proficiency.

Another important attribute that a team member should possess is project management skills and leader qualifications. All of the participants stated that there was a need for a leader, who would guide and show the way throughout the IDD process and a project manager, who would provide the communication among the team members and conduct time management and planning aspects of the project. However, they said that if the team consisted of their friends or persons with whom they were familiar, then it became very difficult to play the role of a leader. They also asserted that in that case it would be a problem for that person, who would

undertake the role of the leader to be accepted by the other team members. Actually this statement explicates the situation that emerged among the team members of one group that participated to the current study during their correspondence via e-mail and observations that the researcher conducted through their team meetings. One of the participants stated that in one of the previous projects they assigned one of the team members as the leader. He said that they conducted face-to-face meetings very rarely and used a forum instead, to provide the communication among themselves. He added that in that project they did not have any conflicts and aforementioned problems, so he suggested that this kind of strategy could be used to avoid that kind of problems.

As for the communication skills, participants stated this was especially important to provide the continuity of the IDD process safe and sound and to avoid probable conflicts, let alone honesty and empathy. The biggest problem that the participants confronted was that of synchronization. They said that it is so important that the lack of a synchronized communication could damage the usual flow of an IDD project, and could cause delays in the final product. Another statement was about the instructors or the advisors of the team. They asserted that if their communication with their advisor was good, then the communication among the team members would be better, and vice versa.

All of the participants stated that responsibility is also an important attribute, which should be possess by each team member; to complete his/her duties and his/her part of the project on time. They also said that each team member should be responsible and should own his/her duty, otherwise other members would have to do that work or duties instead of that team member. At this point, they also mentioned

diverse personal standards that each member had. They said that it would be better to come to an agreement about the outlines of the instructional system, to avoid possible conflicts that are likely to emerge due to these diverse personal standards.

Apart from the aforementioned consensus about the outlines of the instructional system and good communication skills, the participants also stated that honesty and empathy were especially important to avoid the emergence of possible conflicts within the team. They said that it is always better to speak openly rather than to keep a problem or worry to oneself and to accumulate those until it becomes the last stroke that broke the camel's back. They also stated that being gentle to a team member, who speaks harshly, has a great influence on avoiding a small disagreement which might have otherwise turned out to be a grand discussion. Furthermore, they emphasized that behaving in professional way rather than acting with their emotions and feelings is another important factor in such situations.

Besides the participants' statement that there should be a project manager, a leader, a subject-matter or content expert, a designer, an animator, and a graphics designer in the team, one group also emphasized that there should certainly be a person in the team, who has a wide game experience as a player, when creating a game like learning environment is of concern. Presence of such a team member has uncountable advantages for such an IDD process, such as ease in writing a scenario, specifying motivational issues, etc…

They also stated that signing a group contract before the project was a good idea, again to avoid the possible conflicts and to make them feel that they were conducting a serious work. However, one of the participants said that it would not work for the departmental IDD projects conducted for the fulfillment of a course

assignment. She stated that there should be more serious sanctions to make them consider their works more seriously, but she could not articulate one. Only one group said that knowing that the final product attained at the end of the IDD process would be utilized by authentic learners, motivated them to complete the product as good as possible.

4.3. Process-related Issues

In this part of the chapter, the distinctive characteristics of an instructional design/development (IDD) process and necessary and sufficient components of an appropriate instructional design/development model (IDDM) for the creation of game-like learning environments will be revealed. These issues are of great importance since they will form the basis of the IDDM, which will be proposed in the next chapter.

Although the limits of the analysis, design, development, and evaluation phases are fuzzy in line with the participants' views and opinions, they will be given separately to give as much detail as possible.

4.3.1. Analysis Related Issues

All of the participants said that they began their IDD, on which a game-like learning environment would be created, by determining and specifying a tentative subject, depending upon the need that emerged within their previous experiences. At this point one of the participants stated that a subject related to social sciences, fine arts or something verbal would be much more appropriate, when creating such environments:

"We supposed that something verbal would be more suitable [for creation in such an environment] than a numerical subject. We decided to create an environment in which the user could wander among houses and artists and their works." [G11-A-IR1]

Actually, above statement of this participant was valid for all the groups that have participated to the study. Except for one group, which had selected a technical subject, all the rest had selected these kinds of subjects.

When determining the subject, the participants said that they also specified their target group and tentative goal of the project. They affirmed that they already know that they would have to conduct needs analysis, learner analysis, and content (or task) analysis. They stated that they conducted needs analysis to find out the teachers' and students' attitudes toward computers, and their opinions about computer use, their expectations from simulations and games, why they should use them, and lastly the insufficiencies and gaps of the course stated by the target group. The latter part also emerged, when conducting the content analysis. Then, they said that they decided the general goals of their project, which were constituted according to the conducted needs analysis. One of the participants said that:

> We looked at the purposes of the course. The course already had predefined goals, so we did not develop that course. What can we contribute to this course? … We specified what the students needed the most in the course, in other words, we specified the gaps. We tried to see how we could fill these gaps, and this eventually became our purpose. Needs and necessities were eventually transformed into goals. [G 43-A3]

Another participant also asserted that the findings of the needs analysis should be supported by the literature. Illustration and description of what the product would look like was an obstacle they faced when conducting needs analysis. In addition to this, another participant stated that needs analysis should be well-structured to avoid any deviations that would cause a shift in the focus:

> I think we need to know about the system and the format, one needs to be able to ask clear questions, but most of the time I tried understand what we would do for these people … It was a serious problem indeed. [G11-A5.1]

Afterwards, the participants articulated that they conducted a learner analysis. One of the participants averred that utilization of an educational book shed light on the learner analysis that they conducted. They emphasized the importance of conducting real observations, surveys and structured or semi-structured interviews about the actual target group's background, i.e. characteristics, attributes, skills, prior knowledge, and specific entry competencies, instead of depending upon their own estimates.

One of the participants said that after ascertaining the learners' characteristics and needs; there should be a comparison among these issues and the final decisions that they made for the game-like learning environment, to evaluate the appropriateness of their IDD projects.

Another participant pronounced a very interesting statement, which should be taken into consideration. This was the cultural factors that the target group possesses:

> Learner analysis section is really of critical importance. It should not be direct quotations from books, it must be seen realistically. It must be paid great attention, because, generally speaking, the books which will be quoted would be from another country and thus would not reflect our experience. This matter and those conditions must also be considered. [G31-A7]

They also emphasized that needs and learner analyses were carried on as processes that are parallel to each other. The only problem that the participants faced, was to reach the learners of the actual target group due to lack of permission from the school administration or predetermined school-wide examinations. This problem was also declared by the instructors and assistants of the course and monitored by the researcher during her observations.

Another analysis that is said to have been carried out parallel to the needs analysis was the context analysis. During the context analysis, the participants said that they tried to capture learners' perspectives about the attributes of a game-like learning environment, in which they would learn the designated content. As mentioned in the learner analysis before, the participants emphasized the importance of talking with the actual target group about this issue, instead of depending upon their own estimates which stemmed from their own previous experiences. One of the participants stated:

> We did it by relying on our own knowledge of what [kind of an environment students would like to be learning in]. If we made a research with the actual users, the results may be extreme. … It was necessary to conduct a research and to prove that it was in parallel to what we had in mind. [G43-A9.8]

Furthermore, the participants stated that they also began to lay the design foundations of the learning environment to enable learners to use it effectively and efficiently. One of the participants asserted that:

> We looked for the answers of questions as to how we should present this subject to the students, how it is presented that they are not learning it, and how can we present it so that the students will learn it better. [G31-A9.5]

The participants stated that they examined the computer infrastructure to find out whether it fulfills the necessary and sufficient conditions and specified minimum system requirements to work out the prepared program or not. They said that they did not only specify the hardware-related issues, but also decided the role of the teacher or instructor; and specify the amount of the learner control. One of the participants stated that:

> Since there were things that might have created diversion, we tried to learn how we could use the program, whether we would use the program under the control of an instructor or the students will use it on their own. Eventually we decided that the program should be used under the supervision of an instructor but we added that if he/she has an Internet connection at home the student may also use the program from home after installing it and connecting to the net. [G22-A9.7]

Afterwards they mentioned that they conducted a content (task) analysis. According to participants' expressions, this analysis included an efficiency assessment, which stood for the maximum amount of content in a limited amount of time. Moreover, they said that they also used the data that they collected in the needs analysis about the insufficiencies, gaps and troubles of the course stated by the target group. The participants stated that they checked the currency of the content and verified the topics included in the content through various resources, took students' and experts' opinions, carried out step-by-step reduction, and lastly, settled on the structure of the content, when performing content (task) analysis. For the importance of the content currency and verification of the content through various resources, one of the participants stated that:

> First we needed to figure out how much importance is being given to the subject at schools if given any. [G31-A4.3] … We found [the content] from a single source, we could not make verification for it. We did not have enough material. There was only the text, no pictures no animations and it was not good as it was from a single source. … [If I was to do it again] I would make use of more sources, and I would talk with instructors to take hints from them concerning the content. [G31-A4.7]

As mentioned in the latter part of this participant's opinion, taking students' and experts' opinions, when conducting content (task) analysis is also another component of content (task) analysis. Here, the participants mentioned two kinds of experts. The first kind of expert is a person, who was knowledgeable and had an experience about content (task) analysis, whereas the other was the subject-matter expert and had a teaching experience. Two of the participants said that:

> Since we prepared the content on our own, or more precisely, since we knew the subject, we would understand from a few sentences that we wrote and think it enough. But our instructor, who had a more objective point of view, told us that [it] was not clear enough and that someone who did not know about the subject would understand nothing. We also saw that problem when looked from this point of view. We made rearrangements concerning such matters. [G53-A4]

> I believe in the necessity of having the opinions of the user, an expert on the subject, an instructor who uses the traditional method and a teacher. I mean the more the sources of information to be synthesized the more efficient it would be. [G52-A4.7]

As a result, the participants also emphasized that the collected opinions both of the students and the experts; the elements included in the content; and lastly their own opinions should be synthesized, when finalizing the content analysis. Also, this kind of synthesis should be taken into consideration as another component of the content analysis to provide an intact objectivity. In relation to this synthesis, they said that they carried out step-by-step reduction in content, and lastly, settled on the structure of the content, when performing content analysis. They also said that they

began to think on the main elements of the scenario. According to participants, there was also one other factor that affected step-by-step reduction in content and establishment of the structure of the content that will be handled in the tool analysis part below, which was recommended by the participants as a must-be-done analysis. Briefly, the participants said that the content (task) analysis was also in line with the learner analysis and was affected by the tool analysis.

In the light of the conducted analyses, participants said that they specified their instructional approach and its implications for their projects. Two of the groups said that they used a hybrid approach, which was obtained by the integration of the constructivist and cognitivist approaches. Two of the remaining groups said that they used discovery learning. Another group stated that they used scenario-based learning, whereas the last one used problem-based learning. Moreover, the participants also stated that they paid attention to the structure of the content and the tool's structure (nature), when deciding on the instructional approach. Indeed, they asserted that needs, learner and content analyses were the factors that played role in the selection of the instructional approach. One of the groups even said that after talking with the learners, they have changed their instructional approach.

All of the above-mentioned analyses were conducted and reported by the participants in the flesh. As for the participants' recommendations and overall thoughts about the analysis phase of an IDD, they recommended tool analysis, which they characterized as a must-be-done analysis and asserted the necessity and importance of this phase.

All of the participants mentioned the problems derived from the 3D virtual world tool that they used during the whole IDD process. Thus, they recommended a

tool (media) analysis to be able to foresee and prevent the occurrence of these problems. For instance three of the participants stated that:

"What we should have done in analysis was to study the program as well." [G12-A8]

> We should also analyze the program that we will use, it is important for us to know what we can and what we cannot do by using the program. You can do it when you meet other things but can I do it with this program? It is a big problem. This is an important point to be considered. [G22-A8]

> The only thing that we do not analyze is the software on which we build. We by no means have analyzed Active Worlds. Whether the student can use it or not, we did almost nothing concerning these matters. While doing the analysis we took for granted that it was a good program. We were not involved in such discussions and analysis as to the positive and negative aspects of it; whether we should use Active Worlds or an alternative program; or whether we should directly create a webpage. [G53-A8]

In the light of the opinions mentioned above, under tool analysis, the participants stated that there should be analyses to put forth the tool's structure or nature; what are its uses; how it is used; what are its limitations and utilities, the students' viewpoints and reactions to the tool and to investigate alternatives to the selected tool or technology. They also lay emphasis on a need for a user guide and an expert, who would provide guidance and support; and give a helping hand, when needed. Furthermore, the participants articulated that tool's nature, the chosen instructional approach and the structure of the content should be apt and parallel to each other. They also stated that the limitations of the tool were other criteria in the step-by-step reduction of the content. Finally, one of the participants added that the product attained at the end of the IDD process should inherit the structure of the content, by saying:

> …let us make the program according to [the structure of the content], the structure of the program, and its flow [as included in the content] should be

> in the chronological order. … We thought that we should maintain the course of history in our program, so that the user would come to realize thing as he/she wanders in the program. [G11-A4.5]

As for the overall importance of the analysis phase, there was a consensus among the participants that the analysis phase was very critique and diagnostic especially from the learners' aspect, since everything else would be built upon it. One participant said that:

> As a matter of fact this is the most important point, for whatever you do here shapes the rest of the developments. You do needs analysis, and specify the needs …. You do learner analysis and design the components of the development section, such as avis and animations and other things, depending on the pedagogical state of the target group. When this section is done, there is not much left for the remaining sections. There you also have product output and other important things, but [this part] is the one where thinking is done, the dark veil before your eyes is lifted and you begin to see further. [G43-A10.4]

Another participant said that:

> It must certainly be done, the analysis. Not that it must be followed strictly but that it should be used as a guideline where you can come back and consult if you get stuck in a further stage. So it is important in that it may be used as a guideline, and not a strict rule to be obeyed. [G31-A10.4]

Moreover, all the participants stated that lack of this phase would cause a failure. They said that without an analysis, design phase might become the starting point, which would bring going back to the beginning each time to redesign and change the structure by trial-and-error that would result in an enormous loss of time. They also stated that without an analysis, the effectiveness, efficiency and the robustness of the end product and to whom it applies would be of question. They also affirmed that all of these statements would also be valid, when this part was not conducted properly.

In addition to all of the above analyses the participants said that there also should be a cost analysis, analysis to adjust the duration and the frequency of the system for effective use, and an analysis of themselves, i.e. the team members. The selected opinions of some participants about above-mentioned issues are as follows:

"If there is a budget, there is got to be cost analysis. We do not have cost analysis since we do not have any such budget, but it should normally be there." [G43-A12]

> I can take the best results if those who use this system begin to interact in frequencies specified by the system and at a specified time. How much should this [frequency and amount of use] be? This should also be specified. [G31-A13]

"Maybe we should analyze ourselves too; I mean those who are in the group." [G21-A18]

There should also be a time planning for the whole project to arrange the time of group meetings and time of meetings with the designated experts. This is said to be an issue that should not be ignored, since the participants said that the limited amount of time and the lack of regular communication within the group and with the experts were the primary problems throughout the whole IDD process. Time limitation was also articulated by all of the instructors and assistants, too. Again consistent with the instructors' and assistants' opinions, one of the participants stated that when conducting the analysis and design phases, an instructional desiner should start with a literature review, since it is no use to find out something, which is already discovered. Moreover, one group stated that they began to think on the main elements of the scenario, and to shape it accordingly. They also said that there should

be suggestions about updating and maintenance of the system to provide the continuum of the system and elements.

Lastly, one participant asserted that analysis phase should be a dynamic process and added:

> It is necessary to return to analysis in the later phases, it is not right to make it and leave there. It is useful to go back sometimes and ask ourselves what we have achieved and what we should change at development and design sections. [G22-A*]

4.3.2. Design and Development Related Issues

The participants said that they began the design-development phase by preparing a scenario of the game-like learning environment regarding the content analysis and the selected instructional approach. They said that the preparation of the scenario took most of their time, since they also spent time on the design of the scenario's by-products, such as setting, plot structure, and a flowchart. For the setting they prepared prototypes, to be used to take feedback from the learners and IDD experts continuously, whereas for the plot structure they wrote a typical use case, which also provided guidance for the usage of the prepared program. As for the flowchart, they said that it emerged with the scenario, which inherited the content's structure and was bound by the tool's limitations. Moreover, one of the participants stated the importance of a team member that possesses wide game experiences as a game player, when writing the scenario:

> We might have had difficulties in preparing the scenario but we did not, because …, [one of the group members], has a wide game experience, he has played so many games; there are so many scenarios in his mind. Eventually we produced a game that was similar to those he played previously. For that reason the scenario came out easily. [G44-D1.6]

One of the participants said that if the scenario of the game-like learning environment was established on role-playing, the roles should be designed as detailed and realistic as possible, so that the user would identify himself/herself with the role and added that this would also bring along the motivation. Another participant said that it would be better to prepare more than one scenario and to select the most appropriate one regarding the structure of the content, instructional approach, and boundaries of the tool and added that it would have been an advantageous situation in case the selected scenario failed to be implemented.

Lastly, all of the participants characterized the scenario as the foundation of the design-development phase and emphasized that the scenario should be spelled out clearly, otherwise they would face difficulties in the design-development phase.

About the content, they stated that it became much more clear by the reductions and modifications via iterations, especially, due to the tool's boundaries and limitations. Briefly the step-by-step reduction, which began in the analysis phase, continued during this phase too, but this time, due to the restrictions that the tool brought along. However, tool was not the only factor for the modifications and reductions. The participants stated that the feedbacks taken from the team members; subject matter- and IDD experts; and learners via formative evaluations were also the reasons of these modifications and reductions. They said that these modifications and reductions also affected the goals that were specified in the analysis phase, besides the content analysis and the flowchart prepared with the scenario in the design phase. They also expressed that these modifications resulted in making things more clear; and more brief; and better related and connected to each other and a content, which contained less text.

The participants said that for the feedback components and learning assessment they created game-like activities and utilized mostly the web component of the tool. They asserted that the reason for the latter was due to the limited interaction between the web and 3D components of the tool. As for the motivation components of their IDD, they said that they used again mostly the web component of the tool. Three of the participants also stated that chat component and 3D components of the tool were motivational factors on their own, since they provided a utility to bring various users, which logged in to the program from different locations. All of the participants said that they employed some additional elements, such as curiosity, challenge, fantasy and control given to the learner to give his/her own decisions. For instance, one of the groups gave missions to the learners, which would result in loosing or winning money and would earn them 'novice,' 'hardworking,' and 'expert' titles respectively. One other group utilized a hidden Hittite treasure for these purposes, whereas some other one utilized role-playing. Apart from these, one participant talked about connecting the simulation and real-life for motivation. He said that after reaching a certain score, students could be taken to the actual place, if possible, which was simulated in the program or experts of the simulated content could be invited to the classroom. Another participant said that they also gave place to some contemporary popular culture elements, such as adding questions to the assessment part about a very popular science fiction movie to keep the motivation and attention alive, although it had nothing to do with either content or the program itself.

Lastly, for these design elements, one participant offered to combine the feedback and the assessment parts, whereas the other stated that feedback brought about the motivation, which in turn brought about the attention.

Three of the participants also mentioned interaction and engagement issues that should be taken into consideration related to the feedback, motivation and content components. For instance, one of them asserted that they provided an active engagement for the learner; whereas another one said that instructional designers should pay attention to enrichment of the social aspect of the interaction provided via the program that they developed, such as ways to help establish a virtual community, or the feeling of being together:

> In fact it may vary significantly depending on the subject. For instance there may be something to provide interaction. How can the people that will use it be brought together, how can they be unified, how can they be put into action are of concern. When the matter is simulation [the social aspect] is quite important. [G11-D27]

Another design component was the issues concerning the guidance for and support to the user, such as 'help,' or 'technical support.' Actually one of the participants claimed that it should be taken into consideration in the analysis part, parallel to needs and learner analyses; whereas another participant stated that it would be impossible to write a guide in the first days, since even the design of the program would not exist in those days.

For the overall design process, the participants stated that they thought the design phase would be difficult and that they were anxious about the design process of the user interface. Participants' anxiety was not baseless; since they were faced with various technological problems about the tool they used both in design and development phases. As stated in the analysis phase above, they again emphasized

the importance of a tool analysis part that should be completed before beginning the design phase. They said that they had to make changes in the design, especially due to the restricted area they had in the 3D space provided by the tool they used. Thus, the biggest change in the design was the difference between the final user interface and the initial one envisioned at the beginning of design phase. They stated that after the development was completed, they had a very different version of the program, compared to the previously visualized design at the beginning. For this reason, they suggested that if the IDD that would be done was already definite in its every detail; instructional designers could be let free to determine the software they would use and to change the tool accordingly.

As for the other factor that sculptured the design, it was the scenario, as stated above. Besides, the participants stated that they structured the design of the program in line with the content's structure. For instance, one of the participants said:

> We are telling about a historical period, after all some of the movements emerged as a reaction to another or went in line with another. We thought much on this problem for instance. Eventually we decided to follow a U-shaped linear structure in [the 3D environment]. If it is paid attention the result is satisfactory, you can see what is following what as you wander around. [G12-D40]

Another important point was to take not only the opinions of their team members but also of various experts before starting and throughout the design process. However, all of the participants emphasized that everything should be evaluated by the user in the first place and should be user-centered, since they would be the ones, who would use the product. Consequently, one group also said that usability issues should be taken into consideration, when conducting the design phase. One of the participants said:

> As a matter of fact, in school projects there is no time left to think about [the user]. ... But I believe the requests and needs of the user should be considered primarily as the user is the backbone and the most sensitive component of such projects. Put differently, everything should be focusing on the user. [G11-D29]

In addition, all of the participants agreed that evaluations and feedback taken from the users should be continuous. One group stated that they had a tendency to think of and create a utopia in the design phase. However, with continual evaluations, they could be aware of the realities of their current situation and get rid of their utopian expectations, until it was too late to change their design.

Furthermore, they stated that design should be done as detailed as possible and should be completed in majority, so that they would not have to deal with problems in the development stage. This statement was also valid for the relationship between the analysis and design phases. All of the participants said that if they did not leave vague parts in the analysis part, then they would be able to avoid possible problems in the design phase. They also stated that anyone that was not aware of the analysis phase would fail in the design phase. Yet, they also articulated that they began thinking and sketching the design through the analysis phase, but the structure that they thought did changed mainly with respect to the above-mentioned issues, when they began conducting the design phase. The only thing that changed was not the structure of the design; the participants said that they also made modifications and additions to the analysis, when performing the design phase. Indeed, they asserted that any modification made in the design phase affected both analysis and development phases. On one hand, it affected the development phase, since design constituted the blueprint of the development, whereas on the other hand, it affected

the analysis phase, since design was founded on the analysis, the modifications should have been reflected to the analysis phase accordingly.

Lastly, three groups complained that their designs had been static and declared that the user-interface of an IDD product should have flexibility and modularity to allow further updates and modifications.

In line with the IDD model, namely rapid prototyping, which the participants used throughout the course, the design and the development phases were encompassed in each other and progressed via prototypes all the way through the process. The participants stated that progressing via prototypes was very useful, because it resulted in a more advanced and systemically developed product. However, they emphasized that one should save great amount of his/her time to the construction of both paper-based and computer-based prototypes, created in line with the scenario.

As for the development phase the participants articulated again the limitations and boundaries of the tool. They agreed that to be able to fulfill their design exactly, high-level programming knowledge and advanced coding skills were required. Consequently, as stated before, they said after the development was completed, they were faced with a very different version of the program, compared to the previously visualized design at the beginning. Nevertheless, they were inspired by these limitations and boundaries of the tool to write suggestions for further improvements and expected maintenance mentioned in the analysis phase.

To sum up, all participants stated that according to their opinions, the design phase of an IDD is more important than both analysis and development. However, they said that each of these phases serves to a different aspect of an IDD; in analysis

phase you see what you can give, in the design phase you plan how to give and in the development phase, you shape your instruction by the tool you used.

As the last word, all of the participants stated that it is impossible to omit or ignore any one of the analysis, design, and development phases and they suggested that instead of isolating these phases from each other strictly and conducting them in a linear sequence, it would be better to conduct them parallel to each other and in an intertwined manner. Some selected quotations are as follows:

> … We do not have to separate analysis, design, etc.... maybe they should come out all together in a specific process. Of course it is not possible to assign the components, those tiny pieces, of both. Still, we can place them parallel rather than forcing them into a linear process in separate time periods, there is no problem with that. [G11-D25]

> I think they are all equally important and there is not even a ranking, because all of them are intertwined, because as you prepare the design you also develop it, and as you develop it you redesign and reanalyze ... All of them are intertwined, not separate. [G12-D25]

> Actually each one of these phases is important. All of them are complement each other. For design analysis is necessary. Analysis and the data we obtain from analysis function as guidelines for design. Design becomes a guide for us in [development]. For all these, in fact all of them complement each other. [G43-D25]

4.3.3. Evaluation Related Issues

For the evaluation phase, all of the participants agreed that it has a great importance in an IDD process. They asserted that without evaluation, they would not be able to say a word about the efficiency and effectiveness of their instructional system. One of the participants claimed that it would be more logical to remove the flaws of an instructional system via evaluations rather than creating a product that would have no use and that would not be utilized by the learners. Another participant asserted that the children seemed to develop and mature on the knowledge and skills

bases so rapidly that; the data collected from the learners in the analysis phase could be misleading for the instructional designers. He claimed that they would be able to catch up with these developments and changes in the learners by conducting continuous evaluations. This claim was also a justification for other three participants' statement that they should start conducting evaluations as soon as the analysis phase has begun and conduct the design-development phase accordingly.

Furthermore, they said that evaluation phase consisted of two types of evaluation; formative and summative evaluation. Before scrutinizing those, the general issues about this phase will be handled. The participants said that before conducting evaluations, the issues should be clarified, such as, by whom the product would be evaluated, how they would be reached, where the evaluations would be conducted, and how they would be conducted. For the latter, two groups said that they prepared a rating scale and a checklist during the design phase, which included items about the arrangement, presentation, appropriateness, consistency of the content; the general appearance, appropriateness and consistency of the user-interface, and to what extent the program appealed to the user. On contrary, one group said that it would be better to conduct evaluations via qualitative methods that are open to commentary rather than quantitative methods, since giving a checklist or a rating scale might direct the learners and cause bias.

> I think we should avoid preconditioning the user to whom we ask for the evaluation. When we give a checklist that contains specific points such as usability or user motivation, the result is not healthy. What should be asked to the user should be general questions concerning the extent to which the tool achieves or fails to fulfill its goals or its reasons of success or failure. In other words, it should be more open to commentary, should be qualitative not quantitative. [G31-E13.9]

All of the participants stated that evaluations should be conducted frequently and with shorter intervals throughout the IDD process. Moreover, they also said that evaluations should be conducted while determining the foundation stones of the instructional design, not after the instructional design had been completed.

The participants said that they began conducting formative evaluation in the design-development phase and continued till the end of their IDD process. They said that during these evaluations, they took feedback from their team members, their peers, learners in their target group and various experts of various professions. As stated in the previous part, participants asserted that, when conducting the evaluations, the learners should be in the first place. They also stated that the learners that took part in the evaluation should represent the variance of the target group. Moreover, one participant suggested that it would be better to conduct the evaluations with the same sample of the target group, to be able to notice the development and improvements made to the instructional system.

As for the feedbacks taken from their peers, the participants said that on one hand, they were useful, since they warned each other depending on the feedbacks that they had already taken from experts and their target groups. On the other hand, they were useless, since after some time they get used to the tool and become blind about the lacking sides of the product. Therefore they emphasized the importance of conducting evaluations with the people, who were not familiar with the tool.

For the feedbacks taken from the experts, the participants said that it would be better to take the opinions of an instructional designer, a subject-matter expert, a graphics designer, an instructor from the department, etc... One group said that the latter also caused the team members to take the evaluations seriously. They also

stated that they had difficulty, when explaining their project to them and describing what the formative evaluation was. Another group said that they met negative reactions from the teachers about the attractiveness of their subject, but they did not change their subject, because of the below-stated reason.

As stated before, the participants stated that everything done in the IDD process should be user-centered. Therefore, they drew attention to the usability test that should be conducted within the evaluation phase. This situation should be an example for the participants' suggestion that the final decisions should depend on a synthesis and interpretation of all the data collected from the evaluations and the participants' own comments. They stated that after each evaluation, collected data should be analyzed, common points should be noted and final decisions should be given depending on the synthesis of the participants' own interpretations that they agreed on and the sum of the analyzed data. They justified this statement by emphasizing the effect of the background on the feedbacks taken from the above mentioned people. They said that:

> One needs to consider the background and knowledge of the person who is doing the evaluation and determine the value of that evaluation; otherwise it is of no use. Whether the person is familiar with computers, what is his/her level of information, there are so many factors, and even the most unexpected things may influence the comment in that instant … they may also interpret things quite differently because they have different social aspects. [G31-E16.2]

"For instance, he/she does not like computers, does not like anything, or wants to go quickly. One may like graphics, looks only at these aspects." [G32-E16.2]

"…He/she does not like to play games…" [G22-E16.2]

In the evaluation phase, they again had technical problems related to the tool. All of the participants articulated that they could not conduct an evaluation for the 3D part of their program due to inadequate infrastructure, which did not fulfill the minimum requirements of the tool. This caused problems in reaching the learners, too.

All of the participants said that formative evaluations were very important to notice and identify a flaw in their design at the early stages of the process and to avoid building another flaw on the existing one. They also asserted that they made changes depending on these formative evaluations in the design from head to toe.

The participants stated that another important issue implied by the first formative evaluation was the need for an orientation. There were two types of orientation. First one was an orientation about the program that they created. The other one was a more general orientation to acquire the target with the basic computer literacy and game-related skills. According the participants, the former had also set forth the necessity of a 'user help,' whereas the latter would have served well for their by-goal of introducing technology to their target group to wipe out a probable technophobia and frustration and to help them gain basic eye-hand coordination. For these purposes, one participant even suggested providing an environment, in which the learners could play a simple game to acquire the game-logic and gain basic eye-hand coordination. Finally, four participants stated that to complete some lacking knowledge and to avoid misunderstandings, such an orientation should be considered and designed in the design-development phase.

As for the summative evaluation, all of the participants said that it is used to evaluate their instructional system as a whole. However, they asserted that in their

shoes, it was also a formative evaluation, since they did not have any opportunity to evaluate the ultimate version due to time restraints. Yet, they thought that summative evaluation was not critical as it was for the traditional model, since there was not much left, due to the continual formative evaluations conducted throughout the design-development phase.

As the last word, all of the participants again stated that it is impossible to omit or ignore any of the IDD phases and suggested that instead of isolating these phases from each other strictly and conducting them in a linear sequence, it would be better to conduct them parallel to and within each other.

4.4. Hard Issues

In this part of the chapter, the technical aspects and related problems that the participants met throughout their IDD process will be handled.

There was a consensus among the participants that the tool, which they used throughout their IDD process, namely Active Worlds, was not so useable. They stated that they encountered similar problems in the each IDD phase. The biggest technical problem was the limitations and restrictions that the tool possessed. All the participants articulated that these limitations and restrictions were mostly related to the 3D component of the tool. For instance two groups stated that 3D space was composed of hidden grids and the objects should be put, or built regarding these grids. Since they were unaware of this situation, they had to tear down all the buildings that they had already constructed and rebuild them properly. Another group said that the 3D space, which was assigned to them, was also used by all the students enrolled in the course for warm up activities in the first lab hour. They said that there

were many objects put by the whole class, and it was impossible for them to wipe them out, since these objects could be erased only by the person who put it there. They also stated that it was weird that even the administrator of the tool did not have the permission to erase them. Another participant also stated that for developing, building and editing their project, only one of the team members could log on to the program at a time.

Another problem was the restricted area assigned to them in the 3D space. They said that by using Active Worlds, they built 3D worlds as the name implies. However, for their project they had to share one 3D world with another group, which led to the problems of area restrictions. Due to this restriction they had to make modifications in the design-development and analysis phase as explained in the previous parts of the chapter. Moreover, they also stated that they had difficulties in putting or exporting appropriate objects or animations to 3D area, according to their scenario due to their absence or restrictions about their quantity. For instance:

"We have put an appropriate object there according to the scenario.. But you can not seek and find the objects." [G22-D8.1]

"For example, we need to add a white bed into the hospital but we are given a highly-decorated bed." [G51-D57]

> We have certain periods in the history of music. We wanted to put architectural structures, and properties of the time in question, in order to make people really experience that time, but what the tool gave us was not enough for all this. For example, we do not have the type of wall or furniture we want, there are computers but no musical instruments. [G44-D40]

"We can't import pictures or objects. It brings a restriction on it, it does not allow. So we had to use only what we had." [G43-D57]

"You can add a specific picture; you cannot add so many 3D items." [G32-D76.3]

"There are two-dimensional pictures in the three-dimensional program." [G52-D76.3]

As the last statement implies, the participants found a tragicomic solution to restricted numbers of restricted objects problem that was to put 2D pictures to the 3D environment.

The participants said that they had problems, when uploading their works to the server via FTP, where their 3D worlds were kept. Because of this problem they uploaded their 3D worlds to other commercial servers different from the one that was reserved for them in the department. However, this worsened the upload speed of their program, which was already slow due to the connection rate and insufficient infrastructure. This is said to be a problem when conducting the evaluations, since it exerted one's patience to the utmost.

Another technical problem was about linking something in the 3D to the web component. All of the participants mentioned that the interaction between these two components was also limited, more precisely, one-sided. One of the participants stated that:

"For instance, you can create a link from the 3D side to the internet page, the web section, and you can control it. But you cannot control the 3D section from the web. That is a problem." [G43-D76]

All of the participants mentioned about the difficulty of carrying the program to another location other than the computer labs in the department. They said that due to the Java script that ran in the background of Active Worlds and above-mentioned

problems of connection rate or inadequate infrastructure, it would not possible to carry the program to the learners or experts to take feedback from them. This also gave way to location and communication problems in reaching the target group and experts, which were also stated by the instructors and assistants. Other obstacles in reaching the target group were the lack of permission from the school administration or predetermined school-wide examinations in the curriculum on the day the evaluations were to be conducted.

The participants stated that when working with the tools or media that would be used in their previous projects, they were able to find out the corresponding features and similar sides among them. However, they said that this was not the case with the tool they used for this project, so it was hard for them to adapt such a tool. For this reason, they also articulated that they felt the need for a technical advisor, who will provide guidance and help, when needed:

> We will learn how to use the program; of course everyone needs to learn, that is another question. But, who will help us when we are stuck? There is no technical help system. What will we do when we are stuck? [G21-PI-p2].

In general, they also asserted that since their project would be the first specimen of its kind, it had been also difficult to describe the project to the other people, prior to the evaluations and analyses.

Lastly, all of the participants complained about the time limitation. They all stated that the time of twelve weeks, which corresponds to the duration a course, was not sufficient to develop such an instructional system. They also stated that the workloads and duties of each team member should be well defined and planned to be able to manage this limited time in the most efficient and effective way.

CHAPTER 5

CONCLUSION

In this concluding chapter, the researcher tried to propose an appropriate and comprehensive instructional design/development (IDD) model for the creation of game-like learning environments, depending on the findings and related literature, explicated in the fourth and second chapters, respectively. Throughout the chapter, first, a general overview and the principles underlying the model will be handled. Subsequently, the model, its main characteristics, essential elements and limitations will be introduced. Finally, the researcher's recommendations and suggestions about further studies will be offered.

5.1. General Overview

Before scrutinizing the details of the proposed model, it would be better to emphasize the two general patterns that were dominant within the findings. First one is the contexts, in which IDD takes place, and, in which the product attained at the

end of IDD process will be used. The second one is the attributes of this IDD process.

The first pattern is both a contributor and the by-product of the IDD process. It seriously affects the quality of the product and IDD process itself, and is in turn affected by the socio-organizational needs and cultural issues, which appeared during the IDD process, such as the need for a leader who will lead the rest of the team throughout the process, and the necessity to avoid acting with their emotions and feelings. As for the context, in which the product attained at the end of IDD process will be used, the findings revealed the importance of the appropriateness of the product regarding the socio-economic status and the abilities of the learner with consideration of the cultural issues.

For the second general pattern, the "must-be" non-linearity and dynamism throughout the IDD process; the fuzziness among each step of IDD process; and lastly, features originated and inherited from games and simulations were asserted by the participants. Throughout the entire process, all the participants had to make modifications and revisions in their plans and actions that they took to overcome the problems and obstacles, by means of continuous evaluation. Findings have indicated that it is impossible to omit or ignore any of the analysis, design, and development phases and instead of isolating these phases from each other strictly and conducting them in a linear sequence, it would be better to conduct them parallel to each other and in an intertwined manner.

Lastly, findings of study revealed that all of the participants used some features peculiar to games and simulations. For instance, findings of the study provided traces of unique features peculiar to simulations, such as non-linear event

sequence, intertwined consequences of action-reaction chains, and dynamic set(s) of relationships changing with respect to the actions that the user took.

As for the games, findings of the study indicated the use of game characteristics, especially in the design phase of IDD process, such as challenge, fantasy, curiosity and control given to the learners that contribute specifically to motivation and thus eager learning. Moreover the findings also pointed out other features of games and simulations, such as engagement, interactivity and active participation. The use of popular culture elements with the above mentioned elements was another issue revealed by the findings of the study.

In conclusion, all of these attributes differentiate the proposed IDD model from other traditional IDD models. What is more, the researcher also coined the below presented model's name regarding these attributes, especially the non-linearity and fuzziness emerged from the findings. It is called as "FID^{2}GE" model, which is the acronym that stands for "**F**uzzified **I**nstructional **D**esign **D**evelopment of **G**ame-like **E**nvironments."

5.2. Underlying Principles of the FID^{2}GE Model

The following principles were extended from the findings obtained during the design/development process of creating game-like learning environments. They are the core of the findings reported in the fourth chapter under the soft (peopleware); process-related; and hard (technical) issues. Each of these principles applies to one or more than one phase of the process, and consequently has a more or less significant impact on these phases. These principles will also be given in two groups, which are principles related to soft (peopleware) and hard (technical) related issues; and principles related to the design/development process.

5.2.1 Principles Related to Soft and Hard Issues:

As its name implies, under this subheading the principles extracted from the soft (peopleware) and hard (technical) related issues will be given. All of the related principles and subsequently their extensions are as follows:

1. *Form a multidisciplinary and multi-skilled team including an experienced game-player:*

The results of the study have shown that besides the need for a leader that would take the role of the project manager, which will be handled in the fourth principle, IDD process requires contributions from experts of various disciplines. A subject-matter or content expert, an instructional designer, an animator, and a graphics designer should certainly be included in the team to avoid 'being both chief and Indian' in the team. There was a consensus that to be able to fulfill the design objectives properly, high-level programming knowledge and advanced coding skills were required. For this reason, there should be a 'techie guy,' a team member who

should have technology proficiency, who will also be helpful about the possible technical problems, since technology is an integral part of an IDD process, when creating a game like learning environment is of concern. Data obtained from the study have also shown that there should certainly be a person in the team, who has a wide game experience as a player, when creating a game like learning environment is of concern. Presence of such a team member has uncountable advantages for such an instructional design/development process, such as ease in writing a scenario, specifying motivational issues, etc.

Another important finding of the study was the issue of familiarity. Prior familiarity of team members with each other has both advantages and disadvantages. The main advantage was the potential to work in harmony throughout the project, since all the attitudes, qualifications and working habits of the team members would have been already well-known by the other team members. On contrary, there would also be a risk of repetitiveness and sameness of the produced projects, which was likely to exterminate creativeness and originality. However, it is also found that working with different people, gives an opportunity to get acquainted with new people and to get to know them much closer, which was also an evidence for the socio-organizational nature of the context, in which IDD takes place. The question of constituting the design team with the people, whether they had a prior familiarity to each other or not, is up to the person that uses the model, since both disadvantages and advantages were revealed above. However, the researcher believes that the latter would result in better products.

As for the multi-skilled team members, this term is coined, since the participants listed many issues for the team members' characteristics and

qualifications, such as field knowledgeableness, proficiency in technology, strategic, holistic and especially creative thinking abilities, project management skills, leader qualifications, communication skills, responsibility, honesty, empathy and professionality. Some of these attributes are consistent with some the thinking skills, which learners need to use as designers, stated by Carver, Lehrer, Connell and Ericksen (1992).

Another conclusion to be made after the study is that the quality of an instructional system is directly or indirectly related to the quality and qualifications of the team members. The relations among the product's quality and the various factors affecting it are illustrated in Figure 5.1. Although the relations between things are generally shown simply by using arrows, the researcher used icons to represent related items, since the figure would be too complicated otherwise. The legend showing the meanings of these icons are given in Table 5.1.

As for the assurance of the product's quality in terms of usability, the findings implied that in addition to experts, learners should also be included in the project.

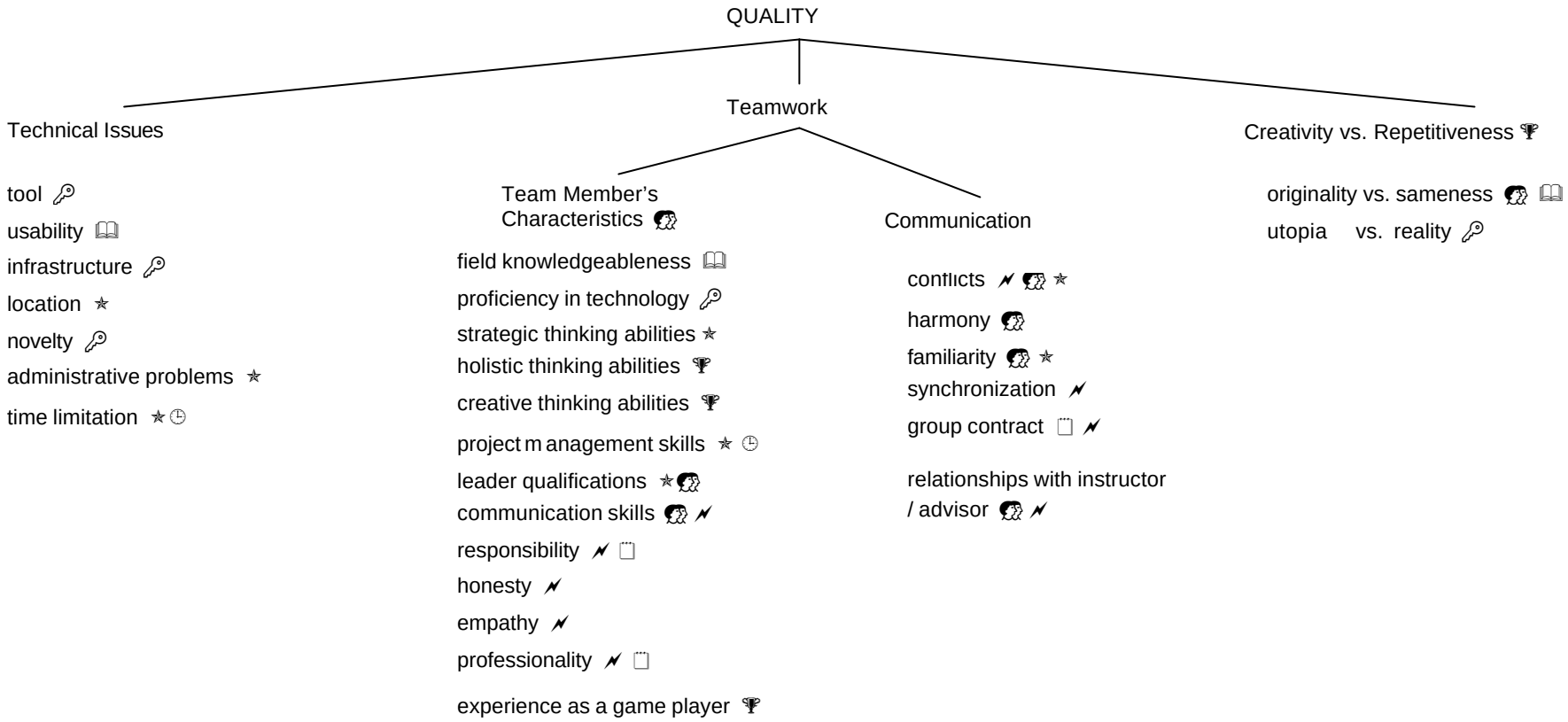

Figure 5.1. The relationships among the soft (peopleware) and hard (technical) issues of an IDD process, creativity, and the quality of the product.

Table 5.1.

Legend of icons used in Figure 5.1.

Icons	Corresponding Meanings
	Proficiency in Technology
	Proficiency in the IDD Field
	Leadership
	Time Management
	Communication
	Game Creation
	Conflict Resolution
	Group Contract

2. Provide common standards about the work done.

After listing aforementioned qualifications that a team member should possess, the participants also mentioned diverse personal standards that each individual had about the work done. Hence, the data have shown that it would be better come to an agreement to about these diverse standards and about the outlines of the instructional system, to avoid possible conflicts that are likely to emerge due to these issues. Specifying the outlines of the instructional system is also important, since it will provide a sense of direction and a specification for the borders, goals, outcomes and benefits of the project. If it is not the case, then the team members may lose the way, deviate from the goals, or redo the work already done, which will cause delays or failure of the project.

This specification should be as detailed as possible; nevertheless this does not mean it should be rigid. Since the instructional design/development process is said to

be dynamic, this specifications could also be flexible and open to revisions for the different situations that the team members would have to deal with.

3. Identify and develop awareness and need for an instructional system, and create mechanisms for motivation.

Especially at the beginning of the project, team members may not be aware of the necessity and the value of the project for the learners. It may be the case that even if they have been already aware of these issues; they could have doubts about the potential advantages and benefits of such an instructional system. This could be the case for the stakeholders, namely, for the school principals or teachers, who will put the produced instructional system into use. For the former situation the problem is that the designers did not take their work seriously and had no motivation for the project they would conduct. The results of the present study have revealed that there should be some mechanisms that will make the instructional designers informed and keep their motivation alive. For instance, one of the groups participating to the study asserted optimistically that knowing that the final product attained at the end of the IDD process would be utilized by authentic learners, teachers and schools, motivated them to complete the product as good as possible. On contrary, another pessimistic participant stated that there should be more serious sanctions to make them consider their works more seriously; however, she could not articulate one.

As for the teachers and school principals, by keeping Rogers' (1995) recommendations, particularly the opinion leaders and teachers, who are either accepting or even not resistant to innovations, should be invited to take part in the

team mentioned in the first principle. This is also good for preparing a base and gaining sympathy for the use of the new product.

4. Meet the need for a leader and a guide.

The analysis of the data obtained during the study has made it explicit that there was a need for a leader, who would guide and show the way throughout the IDD process, who might also take role of a project manager by providing the communication among the team members and conducting time management and planning aspects of the project. Findings of the current study implied that familiarity with other team members would cause problems in acceptance of a team member as a leader. A solution to this problem can be the utilization of various communication tools, as stated in the following principle.

Apart from the need for a leader in the team, the results of the study have indicated that there is also a need for an experienced instructional designer outside the team, who will enlighten the path they will walk throughout their instructional design/development process. A similar kind of this function, which is called "extreme programming," is being used in software development. Extreme programming brings mutual monitoring of two or more programmer into existence during the coding process.

5. Establish good communication strategies and create active involvement.

As for the communication skills, this was especially important, in addition to honesty and empathy, to provide the continuity of the IDD process safe and sound and to avoid probable conflicts. It was found that having good communication and

negotiation skills is especially important for the team leader, to avoid possible conflicts within the group and to be able to resolve a conflict. Another finding was about the instructors of the course or the coaches of the groups. The participants asserted that if their communication with their advisor was good, then the communication among the team members would be better, and vice versa.

It was also understood that synchronized communication through clear channels is very important that its absence could damage the usual flow of an IDD project, and could cause delays in the final product.

The results have shown that signing a group contract before the project was a good idea, again to avoid the possible conflicts and to make them feel that they were conducting a serious work.

Another conclusion to be made is that responsibility is also an important attribute, which should be possessed by each team member; to complete his/her duties and his/her part of the project on time. Lack of responsibility would also be a reason for a conflict within the team, since in case one of the team members would not be responsible and finish his/her own duty, other members would have to do that work or duties instead of that team member.

Apart from the aforementioned consensus about the outlines of the instructional system, responsibility and good communication skills, the participants also stated that honesty and empathy were especially important to avoid the emergence of possible conflicts within the team.

As a result, only with the presence of responsibility, good communication, and motivation, learners, teachers and school principals could also be made to participate actively to the instructional design/development process, besides active

involvement of team members. The former will also prevent possible problems in reaching the target group of learners and teachers, such as lack of permission from the school administration or predetermined school-wide examinations in the curriculum on the day the evaluations were to be conducted.

6. Manage, plan and schedule time.

Another important finding of the study was about the time limitation, which emerged as one of the biggest problems throughout the process. It is observed that the time period of twelve weeks, which corresponds to the duration a course, was not sufficient to develop such an instructional system. However, this was the half of the trouble about time limitations. The lack of time planning and scheduling or clumsily prepared last-minute time schedules were the other half of the trouble that resulted in spontaneous actions, which gave a considerable harm to flow of the IDD process. Thus, it is concluded after the interpretation of the results of the study that besides a seriously and meticulously prepared time schedule, the workloads and duties of each team member should be well-defined and planned to be able to manage this limited time in the most efficient and effective way.

5.2.2 Principles Related to the Design/Development Process:

In this part of the chapter, the general principles that underlie the FID^{2}GE model will be revealed. All of the principles and their explanations are as follows:

1. Dynamic, non-linear and fuzzy phases.

The findings have shown that the instructional design and development process is not composed of phases that have strict boundaries and with the

employment of these steps in a linear order. In other words, it is not composed of "boxes and arrows." In line with this, the participants emphasized the "must-be" non-linearity and dynamism throughout the instructional design/development process and fuzziness between each step of this process, persistently. Throughout the entire process, all the participants had to make modifications and revisions in their plans and actions that they took to overcome the problems and obstacles, by means of continuous evaluation. It was impossible for them to omit or ignore any of the analysis, design, and development phases and it was suggested that instead of isolating these phases from each other strictly and conducting them in a linear sequence, it would be better to conduct them parallel to each other and in an intertwined manner. These suggestions showed parallelism to the statement of various researchers about the replacement of linear models by more iterative, spiral, cyclic models, which possess no strict distinctions among the phases (Zemke & Rossett, 2002; Gordon & Zemke, 2000; Gustafson & Branch, 1997; You, 1993; Jonassen, 1990; Tripp & Bichelmeyer, 1990; McCombs, 1986).

Moreover the data obtained from the participants have also revealed that these phases were not static. For instance, due to any change in the design phase; the participants made modifications and additions to the analysis when performing the design phase. Indeed, any modification made in the design phase affected both analysis and development phases. On one hand, it affected the development phase, since design constituted the blueprint of the development, whereas on the other hand, it affected the analysis phase, since design was founded on the analysis, so the modifications should have been reflected to the analysis phase accordingly.

Accordingly, it was concluded that conducting any phase and leaving it there would not be right.

2. Early decisions about the utilities and restraints of the technology, which will be used throughout the project.

The results of the study revealed the importance of putting forth the tool's structure or nature; what its uses are, how it is used, what its limitations and utilities are, and what the students' viewpoints and reactions to the tool are. The results explicated the significance of investigating alternatives to the selected tool or technology at the very beginning of the project, since the problems derived from the 3D virtual world tool that the participants used during the whole IDD process were mentioned. Thus, it was recommended to employ a tool (medium) analysis to be able to foresee and prevent the occurrence of these problems. Consequently, the results also lay emphasis on a need for a user guide and an expert, who would provide guidance and support; and give a helping hand, when needed.

Such a tool analysis is also important, since it affects the whole instructional design/development process due to its being a key for many components, and for the process itself, such as chosen instructional approach or the structure and reduction of the content spelled out in the content analysis.

3. Analogous, participatory design and prototypes.

Parallel to the second principle, the results indicated that design should be structured analogous to the structure of the content and structure of the tool. In other

words, metaphors selected to be used within the program should be appropriate to the content and should be robust enough to avoid any misunderstandings.

As for the participatory design, it was found out that apart from the team members in the design team, teachers and especially learners should be included to the project to assure especially the usability of the product. Explicitly, the findings have shown that creating a sophisticated and high-technology product would be worthless, unless the actual users, namely, learners would not be able to use it. Consequently, usability issues such as effectiveness, efficiency of the user interface and the satisfaction of the users should be taken into consideration. Everything that is designed or developed should be evaluated by the user in the first place and should be user-centered, since they would be the ones, who would use the product. This is also important to be able to establish a seamless user-program interaction.

As for the prototypes, in line with the IDD model, namely rapid prototyping, which the participants used throughout the course, it was recommended that the design and the development phases be continued in an encompassing manner and progressed via prototypes all the way through the process. It was concluded that progressing via prototypes was very useful, because it resulted in a more advanced and systemically developed product, besides adding dynamism to the process. However, it was also emphasized that one should save great amount of his/her time that would be spent for the construction of both paper-based and computer-based prototypes, created in line with the scenario. Another important thing about the prototypes was its potential to avoid possible problems when explaining what the product would be like and deviations when conducting evaluations, which would be due to lack of understanding about the learning environment.

4. Support from the literature.

The study has reached the conclusion that every step that is taken should be supported by the literature, which would shed light on the instructional design/development process, through which they progress. Apart from the importance of conducting real observations, surveys and structured or semi-structured interviews with the actual users of the product, the work should be supported and compared by the literature to finalize the project-related-decisions, instead of merely depending upon estimates. Yet again, it is concluded that an instructional designer should start with a literature review, since it is no use to find out something, which is already discovered.

However, another very interesting finding was about the cultural factors that the target group possesses, which would not be involved in the literature, simply because the main body of the literature is mostly constituted by researchers from foreign countries.

5. Continuous and iterative evaluation and synthesis.

The results of the study have shown that evaluations and feedback taken from the users should be continuous and iterative. As stated by the participants, they had a tendency to think of and create a utopia in the design phase. However, with continual evaluations, instructional designers could be aware of the realities of their current situation and get rid of their utopian expectations, before it was too late to change their design. This also eliminates any probability of deficiency in the foundation

stones of the program, which would likely to create a snowball effect that penetrates through the whole program.

It was also found that instead of designing and developing the project by depending merely on evaluations and feedback taken from the users, the final decisions should be made after the evaluations and feedback taken from the users, related literature and each team member's opinions were compared to each other and synthesized.

6. Focus on the modularity and flexibility of the product:

The results of the study have emphasized that the attained product should have a modular and flexible structure, so that any flaw, which may not be noticed by the designers through the design/development process during the iterative and continuous evaluations and would be identified after the end-product appeared, could be removed easily. Modularity will bring along the probability to easily eliminate any deficiency in the program, even when this deficiency exists in one of the foundation stones. Moreover, modularity also eliminates any probability of a snowball effect which would be likely to penetrate through the whole program, while preventing the program from being static in the company of flexibility.

As for flexibility, it is related with plans of expected maintenance and further updates. It was found that flexibility is important to be able to catch up with the ever-changing and emerging developments that carry the technology to a more advanced level. In line with this statement, Molenda and Sullivan (2003) mention a "link rot" problem, which stands for a material that is available today may disappear tomorrow, because it is obsolete or not maintained by the provider or because provider goes out

of business. It was reaffirmed during the study that a program lacking flexibility would not survive long against the advancement hurricane of technology. Hence, having a plan B would warrant the durable use of the program, which put forth the instructional designers' envisions about further maintenances and updates that apply to the program, against the coming advancements in the technology.

7. Creativity.

The results of the study stressed the importance of creativity, when especially game like learning environments were of concern. For instance, the importance of a team member, who possesses wide game experiences as a game player, and the uncountable advantages of having such a team member for such an ISD process, such as ease in writing a scenario, specifying motivational issues, etc. were emphasized. This implies that creativity that will be utilized for the project could stem from game playing experiences. This statement is also valid, when specifying motivational issues. It was also recommended that besides well-known, and in a sense, traditional motivational elements, some additional motivational issues should be employed, such as curiosity, challenge, fantasy and control given to the learner to make his/her own decisions, which were typical for games (Malone, 1980; Malone & Lepper, 1987). For instance, one of the groups participating to the study gave missions to the learners, which would result in losing or winning money and would earn them 'novice,' 'hardworking' and 'expert' titles respectively. One other group utilized a hidden Hittite treasure for these purposes, whereas some other one utilized role-playing. However, one of the participants said that if the scenario of the game-like learning environment was

established on role-playing, the roles, which are products of their imagination, should be designed as detailed and realistically as possible. This participant went on to argue that detailed and realistic roles would make it easier for the user to identify with these roles and also added that this would bring along motivation as well. This statement also implies that the illusionary images of creativity should be made tangible by means of reality for it to be accepted and used by the learner.

As another component of creativity, which was utilized for the project, it was also asserted that the participants also gave place to some contemporary popular culture elements, such as adding questions to the assessment part about a very popular science fiction movie to keep the motivation and attention alive, although it had nothing to do with either the content or the program itself.

Creativity has threats besides the above-mentioned advantages, such as engendering a tendency to think of and create a utopia in the design phase, as one of the groups stated. However, with continuous evaluations and iterations, they could come within reach of the reality and be aware of the realities of their current situation so that they would be able to get rid of their utopian expectations, before it was too late to change their design. This situation could also result in disappointment in the team members when they were faced with a version of the program, after the development was completed, which turned out to be very different compared to the design visualized at the beginning.

5.3. Theoretical Foundations

In accordance with many of the traditional models, below-proposed instructional design/development model for creating game-like learning

environments, namely, the FID^{2}GE model also consists four phases, which are analysis, design, development and evaluation. However, the components of these parts and the way they are structured are different from these traditional models. Additionally, it possesses an additional phase; the "pre-analysis" phase. Moreover, all of these phases are dynamic in nature and have fuzzy boundaries, through which the instructional designers progressed in a non-linear manner, as opposed to boxes and arrows illustrations of many instructional design/development models that are composed of strictly bounded boxes, which also encompass procedural stratifications that follow the other through arrows in a linear manner. However, these models remain insufficient in helping the novices to understand their reflections and implications in practical applications, briefly what should be done in real-life situations (Dempsey, Lucassen, et al., 1996). Thus, the FID^{2}GE model is proposed depending directly on actual and concrete data collected from real-life practices.

Generally these models are also being critiqued on the grounds that they reflect the Newtonian worldview, and are consequently established on classical (predicate) logic (Jonassen, 1990; Tripp & Bichelmeyer, 1990; Gustafson & Branch, 1997; Rowland, et al., 1994; Prensky, 2001). However, let alone the activities that the humans perform, most of the human reasoning is approximate in nature. Setting off from this point, the researcher was inspired by "fuzzy logic," which had been coined first by Lotfi A. Zadeh in 1960s, but remained concealed until it was discovered in the late 1980s (Dubois, et al., 1999). Fuzzy logic is "a body of concepts, constructs, and techniques that relate to modes of reasoning that are approximate rather than exact" (MIT Encyclopedia of Cognitive Science, ¶2, 2003). It could be seen as an enhanced and generalized version of classical logic. Although

fuzzy logic rests on the same mathematical foundations that of classical logic, due to its fittingness in reflecting the pervasive imprecision of human reasoning, it is much better suited than classical logic to serve as the logic of human cognition and the decisions that underlies the human actions.

Nevertheless, the above-given definition of fuzzy logic is a very simplified one. Indeed, fuzzy logic has many distinct facets, which overlap with each other and have unsharp boundaries. Figure 5.2 illustrates these facets of fuzzy logic, where *F* and *G* stand for *fuzziness (*or *fuzzification)* and *granularity (*or *granulation)* respectively (Zadeh, 1996; MIT Encyclopedia of Cognitive Science, ¶9, 2003).

For the current study, the researcher was especially interested in the set-theoretic facet of fuzzy logic, which is concerned with fuzzy sets, whose boundaries are not sharply defined (Zadeh, 1999; MIT Encyclopedia of Cognitive Science, ¶2, 2003).

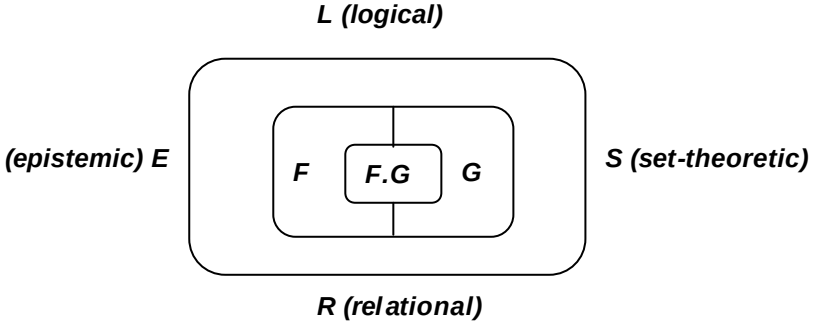

Figure 5.2. Conceptual structure of fuzzy logic (by MIT Encyclopedia of Cognitive Science, 2003).

By employing fuzzification, which is the process of replacing the concept of a set with that of a fuzzy set, it became possible to construct FID^{2}GE model that is more general and more reflective of the imprecision of the real world in comparison to the traditional IDD models or theories. In other words, this was exactly what the researcher wanted, i.e. the proposal of an alternatively structured IDD model against the traditional IDD models that have been criticized for their linear structures, procedural stratifications and time-consuming practices.

Another important characteristic of this model is its prescriptive nature, which provides guidelines for 'how to' create game-like learning environments. It is also unique in this sense, since it is separated from the other descriptive studies that provide knowledge of 'what is' (Reigeluth, 1983). However, the situationality of the model should be taken into consideration, when utilizing the model due to its above-mentioned context-dependent structure.

5.4. The FID^{2}GE Model

In this part of the chapter, the model itself, with its main characteristics and essential and distinctive elements, will be presented. Before scrutinizing the model, it would be better to have a bird's eye view on it. As asserted many times in the previous parts of the current chapter, the proposed model consists of dynamic phases, which have fuzzy boundaries and through which the instructional designers progressed in a non-linear manner.

What is more, the researcher also coined the below-presented model's name deriving from this dynamism, non-linearity and the fuzziness. It is called as the FID^{2}GE model, which is the acronym that stands for "**F**uzzified **I**nstructional **D**esign

Development of **G**ame-like **E**nvironments.” for learning. According to the Oxford English Dictionary (Oxford English Dictionary, 1989), “fidge” as a verb means “to be eager and restless; to express pleasurable eagerness by restless movements,” which is also consistent with the impatience that anybody shows when playing a game is of concern.

Since the model is founded on “fuzzy logic,” more specifically on “fuzzy sets” concept, it is difficult to visualize it completely. The visualization of the model will also be different than the “boxes and arrows” visualizations of traditional models (see Figure 5.3.). However, when a zoom made in the phases, it was impossible to preserve and illustrate this general structure. Although the figures related to each phase seems different from the figure below, they are not.

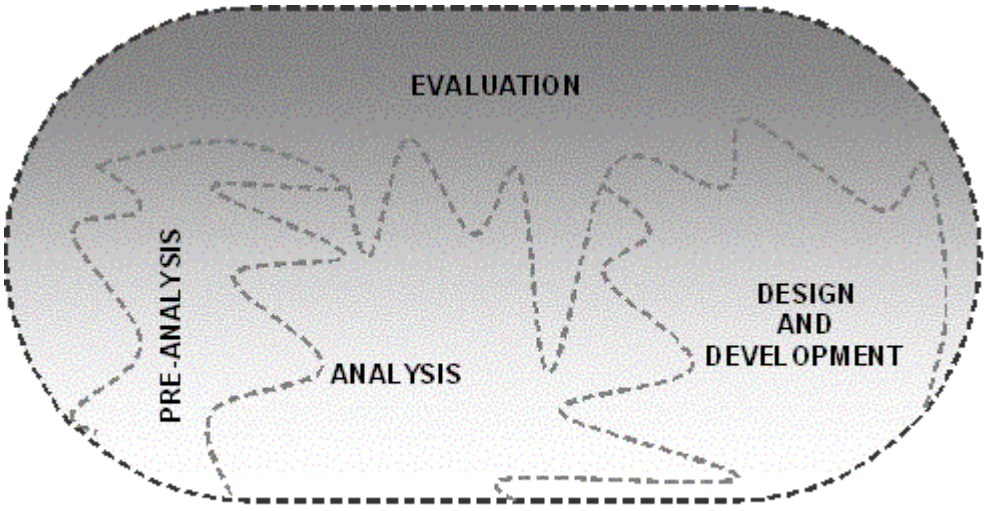

Figure 5.3. Overall appearance of the FID^{2}GE model.

Another difficulty is to separate the phases from each other, due to their intertwined structures. As a solution, the researcher explained the "pre-analysis, analysis and design-development evaluation phases" and gave the related components of other phases within each of the former. However, there were also intertwined components of analysis and design-development phases. These components were also given under a distinct subheading in the explanation of the related phase. In addition, a collection of these elements will also be presented under distinct subtitles. The findings of the study also revealed the importance of literature review in each phase. More specifically, the researcher also reported the literature review elements related to the components of each phase due to all of the participants' insistent expressions that an instructional designer should start an IDD process with a literature review, since it is no use to find out something, which is already discovered. This is consistent with Winn's (1996) statement that an instructional designer needs to know instructional theory, how to do content (task) and learner analysis, etc. to build his/her instruction onto a theoretically sound base. Like Winn (1996), Schiffman (1995) also stated that ISD should be a synthesis of theory and research. In like manner, yet with one addition Glaser (1971) agrees that instructional designer must perform the interplay between theory, research and application. It should also be noted that the literature review elements of the FID^{2}GE model is fused into each phase and will be illustrated within phase components.

5.4.1. Pre-analysis Phase of FID^{2}GE Model

This phase is added according to the participants' statements that they began their IDD process for creation of a game-like learning environment, by determining and specifying a tentative subject, depending upon the need that emerged within their previous experiences.

In this phase, a tentative subject, target group will be selected, and according to the selected subject, the tentative goals of the project will be specified (see Figure 5.4).

It should be emphasized that all of these issues are tentative and could be easily changed when the instructional designers begin to conduct analysis phase. The reason for the existence of this phase is to provide a starting point for the instructional designer. However, if there is no need for such a warm-up period, this phase could be skipped.

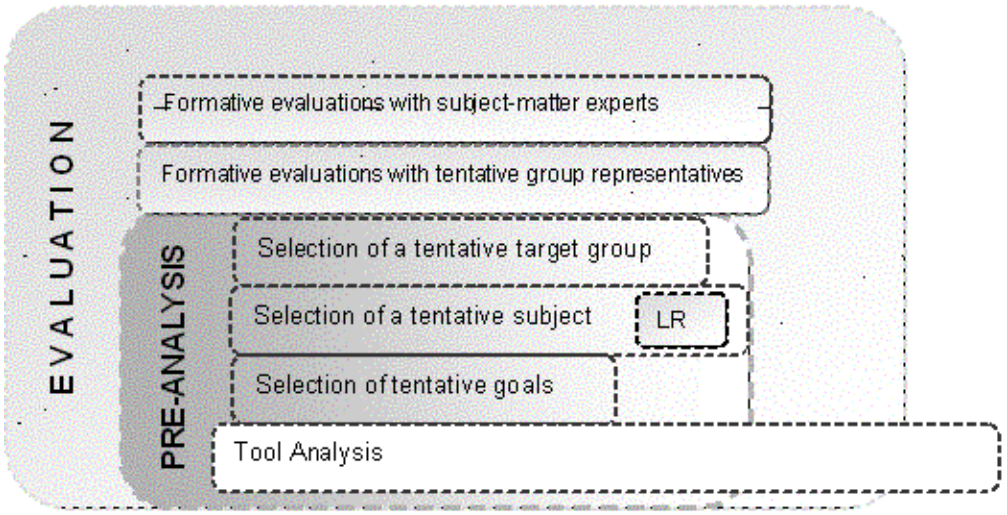

Figure 5.4. The visualization of Pre-Analysis phase of the FID^{2}GE model.

Analysis Phase Component: Another analysis that takes the start in this phase is the tool analysis that will continue through the analysis phase and end with it. The details of the tool analysis will be given in the following part of the chapter.

Literature Review (LR) Element: During this phase, a small literature review could be conducted to find evidence as to whether the selected tentative subject fits or is likely to be fit for creation of game-like learning environment, or not.

Evaluation Phase Component: The opinions and recommendations of the subject-matter experts, and a representative group of the tentative target group could be taken via interviews.

5.4.2. Analysis Phase of FID^{2}GE Model

In this phase, needs analysis, learner analysis, context analysis, content (or task) analysis, cost analysis, if needed, risk analysis, an analysis to adjust the duration and the frequency of the system for effective use, and a self-analysis should be conducted, while the tool analysis which began in the previous phase will continue (see Figure 5.5). Moreover instructional approach and its implications should be specified and a time planning activity should be done.

During the needs analysis, the teachers' and students' attitudes toward computers, and their opinions about computer use, their expectations from simulations and games, why they should use them, and lastly the insufficiencies and gaps of the course stated by the target group will be revealed. The latter part will also

continue when conducting the content analysis. Needs analysis should be well-structured to avoid any deviations that would cause a shift of the focus.

According to the conducted needs analysis, the general goals of the project will be constituted; more precisely, the needs will be transformed into the general goals of the project.

Learner analysis should also be well-structured and real observations, surveys and structured or semi-structured interviews with the actual target group should be conducted. Learner analysis, which will be conducted parallel to the needs analysis, should reveal the actual target group's background information, i.e. characteristics, attributes, skills, prior knowledge, and specific entry competencies. For these purposes, a time schedule should be made. During this analysis the instructional designer should be careful about the issues peculiar to the culture that the target group possesses.

Another analysis that will be carried out parallel to the needs analysis is the context analysis. During the context analysis, actual learners' perspectives about the attributes of a game-like learning environment, in which they would learn the designated content, should be captured. The role of the teacher or instructor and the amount of the learner control should be determined. Moreover, instructional designers should examine the computer infrastructure to find out whether it fulfills the necessary and sufficient conditions and approximately specify minimum system requirements to work out the prepared program to identify the hardware-related issues. Lastly the socio-economic status of the learners should be specified, which is related with their computer literacy, in order to determine at which grade will the program be used.

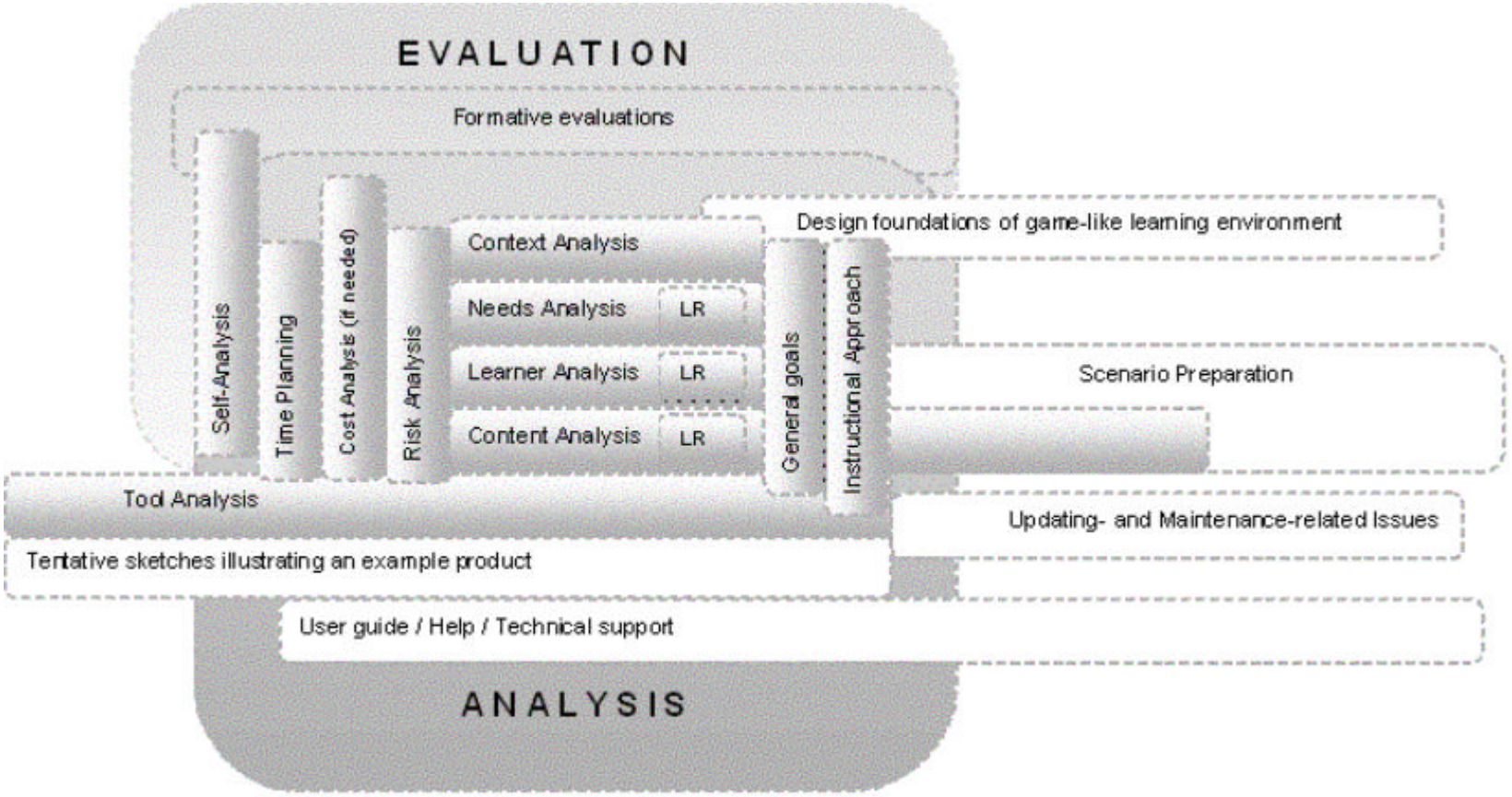

Figure 5.5. The visualization of Analysis phase of the FID^{2}GE model.

A content (task) analysis will be conducted, which includes an efficiency assessment that stood for the optimum amount of content in a limited amount of time. The data collected in the needs analysis about the insufficiencies, gaps and troubles of the course will be utilized in this analysis, too. The components that are contained in the content (task) analysis are checking the currency of the content and verifying the topics included in the content through various resources, taking students', subject matter experts' and experienced instructional designers' opinions, carried out by step-by-step reduction, and lastly, settling the structure of the content. As a result, the collected opinions both of the students and the experts; the elements included in the content; and lastly the instructional designers' own opinions should be synthesized, when finalizing the content analysis. Also, this kind of synthesis should be taken into consideration as another component of the content analysis to provide an intact objectivity. The limitations of the tool and the structure (or nature) of the tool are the factors that affect the step-by-step reduction in content and establishment of the structure of the content, respectively. Lastly, the content (task) analysis was also in line with the learner analysis and was affected by the tool analysis.

The tool analysis began in the pre-analysis phase will be continued in the analysis phase. Tool analysis should include analyses to put forth the tool's structure or nature; what its uses are; how it is used; what its limitations and utilities are, the students' or learners' viewpoints and reactions to the tool and to investigate alternatives to the selected tool or technology.

In the light of all of the conducted analyses, the instructional designers should select their instructional approach and specify the implications of their approach to

the project. Instructional approaches such as discovery learning, scenario-based learning, problem-based learning or a hybrid approach, which is offspring of constructivist and cognitivist theories, seems to be appropriate, when creating game-like learning environments, due to their aptitude and capacity that permit the application of attributes, which are similar to those that commercial games possess.

Moreover, instructional designers should pay attention to the aptness and the parallelism among the structure of the content, the tool's structure (or nature), and the instructional approach.

Besides the above-mentioned analyses, a cost analysis (if needed) and an analysis to adjust the duration and the frequency of the system for effective use should be conducted. A self-analysis should be conducted for each instructional designer in the design team, who take roles in the instructional design/development process, to find out the needs, characteristics and skills that are lacking but should be possessed to be able to gain them.

A risk analysis should be conducted to specify the potential risks those instructional designers likely to meet. This analysis is also important to outline a "panic room" plan against these foreseen risks, and take cautions both to avoid and to solve possible problems.

There should also be a time planning for the whole project to arrange the time of group meetings and time of meetings with the designated experts and learners from the target group. This is especially important to be able to use the limited amount of time effectively and efficiently.

As for the overall importance of the analysis phase, it is very critical and diagnostic especially from the learners' aspect, since everything else would be built

upon it. For this reason, omitting this phase would cause the total failure of the product. Skipping this phase would cause retreat to the beginning each time to redesign and change the structure by trial-and-error that would in turn result in an enormous loss of time. If this phase was to be ignored, the effectiveness, efficiency and the robustness of the end product and to whom it applies would be of question. Moreover, the instructional designer should warrant that this phase should be completed properly; otherwise, all of the above-made statements would also be valid.

Design Phase Components: Sketches illustrating a completed product should be provided or designed, to be shown to the target group or experts as an example throughout the needs analysis, in order to be able to transform an abstract concept into a tangible one for them.

With the context analysis instructional designers should begin to lay the design foundations of the learning environment to enable learners to use it effectively and efficiently.

With the content analysis, instructional designers should begin to think on the main elements of the scenario.

The product attained at the end of the instructional design/development process should inherit the structure of the content.

Towards the end of the design-development phase, regarding the issues obtained from the tool analysis, suggestions about updating and maintenance of the system should be stated to provide the continuum of the system and elements.

Another design component that should take a start from the analysis phase, especially parallel to tool analysis , was the issues concerning the guidance for and support to the user, such as 'help,' or 'technical support.'

Evaluation Phase Components: Apart from the verification of both the content and its currency, formative evaluations should be conducted with the learners, subject matter experts and experienced instructional designers, to take their opinions and feedbacks concerning these issues. With the specifications about the limitations that the tool possesses, these iterative cycles of formative evaluations lead to step-by-step reduction of the content.

As a result, the opinions collected both from the students and the experts; the elements included in the content; and lastly the instructional designers' own opinions should be synthesized, when finalizing the content analysis.

When selecting the instructional approach and to be able to adjust the duration and the frequency of the system for effective use, formative evaluations should be conducted to take the opinions of the learners and the experts.

Lastly, each instructional designer in the design team should also evaluate themselves to be aware of their progress for completing the lacking aspects and skills that they specified in the self- analysis.

Literature Review (LR) Elements: The findings of the needs analysis should be supported by the literature.

When structuring the learner analysis, instructional designers should get help from the related literature. However, they should be aware of the issues about the

cultural factors that the target group possesses, which would not be involved in the literature, simply because the main body of the literature is mostly constituted by researchers from foreign countries.

The findings extracted from the learner analysis should be supported by the literature.

The currency of the content should also be checked and verified through various and current resources in the literature.

5.4.3. Design-Development Phase of the FID^{2}GE Model

In this phase, scenario preparation; content clear-cuts; specification of motivation, attention, feedback, and learning assessment elements; preparation of user-help; creation of prototypes; preparation of rating scales, checklists and interview guides for formative evaluations; design of orientations; and insurance of usability issues, product's modularity and flexibility will be conducted (see Figure 5.6). It would be better to emphasize that the implementation phase of the traditional models are contained in the intertwined design and development phase of the FID^{2}GE model.

The instructional designers should begin the design-development phase by preparing a scenario for the game-like learning environment regarding the content analysis and the selected instructional approach, by utilizing the team member's wide experiences as a game player. Actually, it is recommended to prepare more than one scenario, namely, alternative scenarios and selecting the most appropriate one regarding the structure of the content, instructional approach, and boundaries of the tool, in case the scenario prepared at the beginning failed to be implemented.

The setting and plot structure of the scenario and a flowchart regarding the scenario should be prepared, during this component of the design and development phase. For the setting, prototypes should be prepared, to be used to take feedback from the learners and IDD experts continuously, whereas for the plot structure they wrote a typical use case, which also provided guidance for the usage of the prepared program. As for the flowchart, it should be prepared in line with the scenario and should inherit the content's structure, and should be framed by the tool's limitations.

As an extension of the content analysis in the analysis phase, instructional designers should be alerted that the content be clarified in its brief, intertwined and clear-cut form by the continuing step-by-step reductions and modifications via iterations and feedbacks taken from the team members; subject matter- and IDD experts; and learners by means of formative evaluations. These modifications and reductions affect the goals that were specified in the analysis phase, as well as the content analysis and the flowchart prepared with the scenario in the design phase.

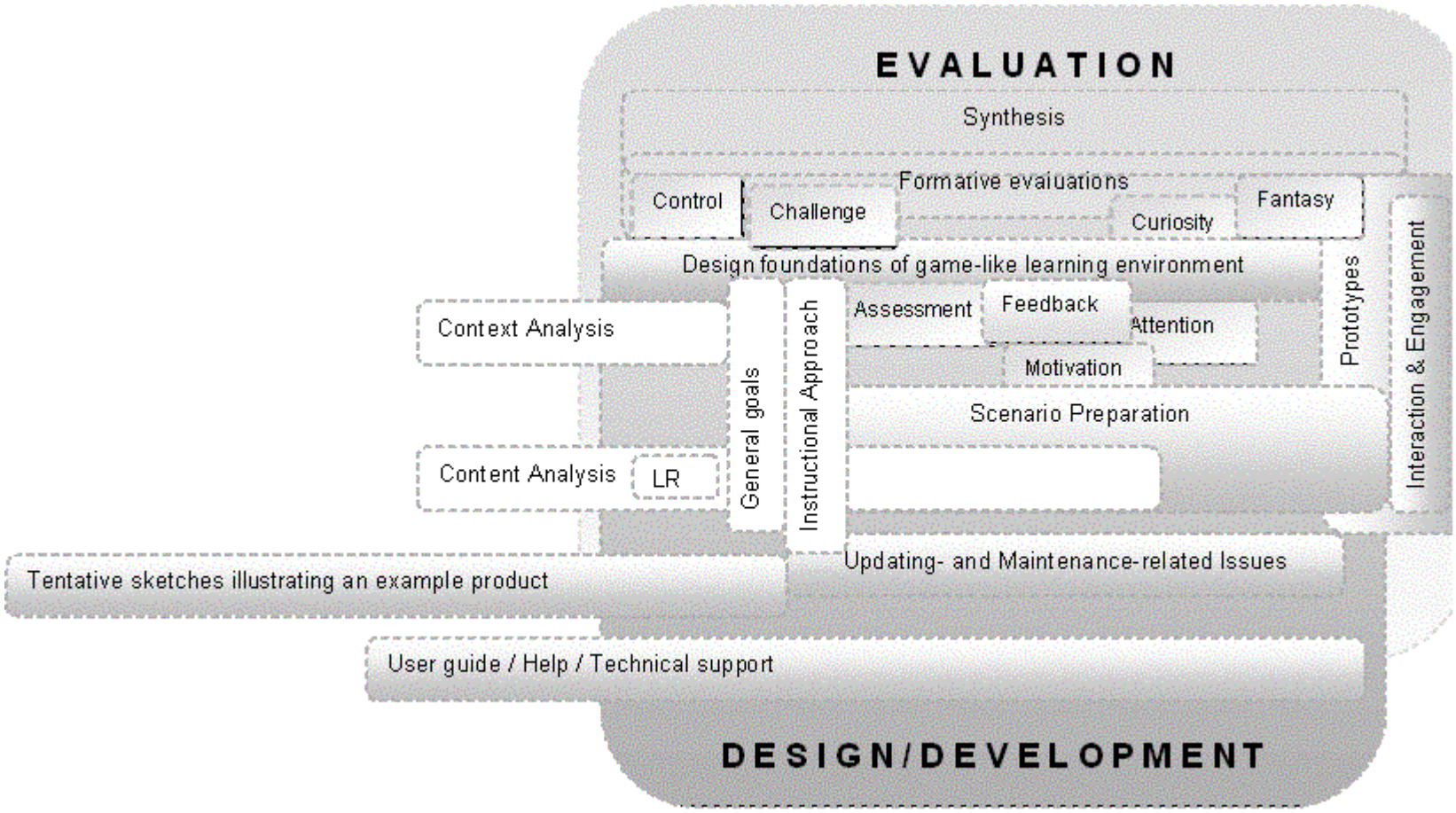

Figure 5.6. The visualization of Design phase of the FID^{2}GE model.

Other design-development elements are the motivation, attention, feedback and learning assessment components of the game-like learning environment. In this part, instructional designers should create game-like activities, while utilizing additional elements, such as curiosity, challenge, fantasy and control given to the learner to give his/her own decisions, which are the essential elements of many commercial games possess (Prensky, 2001). Moreover, instructional designers could also utilize elements from popular culture. Additionally, instructional designers should pay attention to the relatedness of motivation elements with the feedback and attention components, and they can also combine feedback and the learning assessment elements. Furthermore, interaction and engagement elements, which are also peculiar to games (Prensky, 2001), should be taken into consideration related to the feedback, motivation and content components of this phase. For instance, instructional designers should take actions to provide learners' active engagement and to enrich the social aspect of the interaction provided via the program that they developed, such as ways to help establish a virtual community, or the feeling of togetherness.

Another design component that should start in the analysis phase, especially parallel to tool analysis, is the issues concerning the guidance for and support to the user, such as 'help,' or 'technical support.'

In line with the above-mentioned analyses and the scenario, instructional designers should prepare both paper-based and computer-based prototypes to progress in an iterative and intertwined cycle of design and development, which would result in a more advanced and systemically developed product. These prototypes should be used to take feedback from the learners, experts and team

members, about both the user-interface design and the overall design itself. These prototypes are likely to reveal the above-given issues about the motivation, attention, feedback and the learning assessment elements of the design. The details of the 'user-help,' or 'technical support are also likely to emerge.

Furthermore instructional designers should prepare rating scales, checklist and interview guides to be used in the formative evaluations, which will include items about the arrangement, presentation, appropriateness, consistency of the content; the general appearance, appropriateness and consistency of the user-interface, and the extent to which the program appeals to the user. They should also design two different types of orientations to complete some lacking knowledge and to avoid misunderstandings: An orientation about the program that they created and a more general orientation to acquire the target with the basic computer literacy and game-related skills. For the latter, instructional designers could even provide an environment, in which the learners could play a simple game to acquire the game-logic and gain basic eye-hand coordination.

The instructional designers should be aware that the final user interface could not even bear a resemblance to the initial one envisioned at the beginning and they could be confronted with a very different version of the program, compared to the previously visualized design at the beginning.

Another important issue that the instructional designers must take into consideration throughout the whole phase is that everything should be user-centered, since they would be the ones who would use the product. Consequently they should be aware of usability issues and should employ them in the first place throughout the phase.

Lastly, the instructional designers should provide as much flexibility and modularity as possible for the final product attained at the end of this phase, so that the need of a radical change, which might emerge following the formative evaluations, could easily be conducted.

Literature Review (LR) Elements: Each of the above-mentioned elements should be supported by the literature.

Evaluation Phase Components: As an extension of the content analysis in the analysis phase, instructional designers should be alerted that the content is clarified in its clear-cut form by the continuing step-by-step reductions and modifications via iterations and feedbacks taken from the team members; subject matter- and IDD experts; and learners by means of formative evaluations.

Prototypes should be used to take feedback from the learners, experts and team members about both the user-interface design and the overall design itself. During these evaluations, issues about of the motivation, attention, feedback and the learning assessment elements of the design and the details of the 'user-help,' or 'technical support' are also likely to emerge.

Instructional designers should also employ formative evaluations to specify the details and components of the motivation, attention, feedback and the learning assessment elements.

5.4.4. Evaluation Phase of the FID^{2}GE Model

Although the related elements of the evaluation phase were presented in the above phases, it would be better to give the general structure and main elements of the evaluation phase. Evaluation phase has three main elements, which are formative evaluation; summative evaluation and the synthesis (see Figure 5.7.)

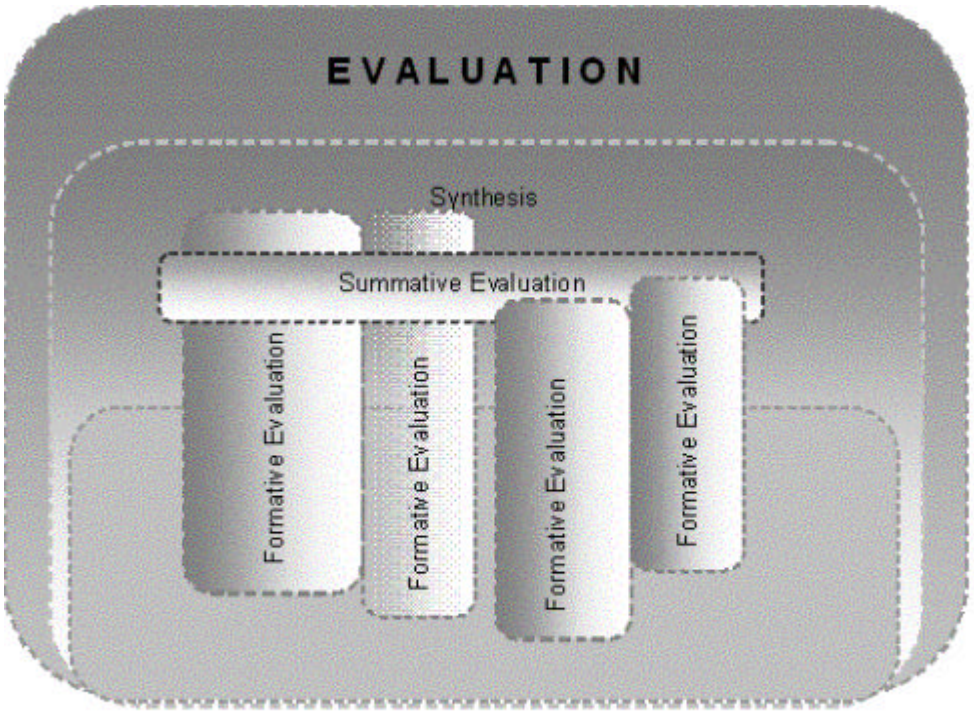

Figure 5.7. The visualization of Evaluation phase of the FID^{2}GE model.

Instructional designers should never forget that evaluations and feedback taken from the learners should be continuous and should begin as soon as they started with the pre-analysis (or alternatively, analysis) phase.

Before conducting evaluations, the instructional designers should clarify the issues, such as, by whom the product would be evaluated, how they would be reached, where the evaluations would be conducted. For data collection, instructional designers should employ rating scales, checklists and the interview guides that would be already prepared in the design/development phase.

Instructional designers should conduct the formative evaluations frequently and with shorter intervals throughout the instructional design/development process and should employ them while determining the foundation stones of the instructional design/development process.

Instructional designers should conduct formative evaluations with the team members, their peers, learners in their target group and various experts of various professions; however, as stated in the previous parts, the learners representing the variance of the target group should be in the first place. This also puts forth the usability test that should be conducted within the evaluation phase.

In the synthesis part, as its name implies, instructional designers should make a synthesis and interpretation of all the data collected from the evaluations, related literature and their own comments, when making the final decisions about the project. For these purposes, after each evaluation, collected data should be analyzed; common points should be noted and discussed with the other instructional designers in the team.

As for the summative evaluation, it will be used to evaluate the instructional system as a whole. However, summative evaluation is not as critical as it was for the traditional model, since there will not be much left, due to the continual formative evaluations conducted throughout the design-development phase.

5.5. Summary

To summarize, the FID^{2}GE model is a real-life originated model that has a dynamic, non-linear and fuzzy structure and is enriched by unique features of games and simulation, which combines the context with peopleware throughout the instructional design-development process.

The proposed model might be used in creation of educational games as well as in creation of game-like learning environments. The researcher thinks that the proposed model might be appropriate to be used by both novice and expert users. The existence of the "pre-analysis" phase of the model is the most apparent evidence that this model addresses the novice instructional designers' needs. Another evidence is that they are the affiliates of the so called "game generation," who are different from many of us in various aspects and possess differentiating characteristics and skills resulting from different experiences and the "new media society" (Prensky, 2001, p.65; Calvert & Jordan, 2001). However, they also lack sufficient instructional design experience, which would have impact on their use of this model, both positively and negatively. The probable positive effects are their untouched creativity and ingenious design habits. The probable negative effects would be the difficulty in understanding the model or misinterpretations, which would result in void and ineffective design practices.

As for the expert instructional designers, the researcher believes that this model might widen their visions and help them catch up with the current trends and changes of the coming generation.

Lastly, among the limitations of the model, the probable inheritance from the selected case and the complex and complicated nature of the model could be

asserted. The elements that constituted the model seemed to be affected by the IDD model used in the case. For instance, the use of prototypes was inherited from the "rapid prototyping" model. However, it would be meaningless to strive naming this concept in another way or to eliminate it, since it was found to be very useful. As for the complex and complicated nature of the model, it could be said that this is the first impression and it would be much easier to use this model due to its more flexible structure and fitting nature to human reasoning than other traditional models.

In conclusion, it should be kept in mind that all these issues are personal assumptions and visions of the researcher should be verified by the follow-up studies. It would be hardly possible to clarify the uses, users and the limitations of the model, earlier than the conduction of such follow-up studies.

Table 5.2.

Summary of "FID^{2}GE" Model

Participants	All of actively participating learners and experts
Team	Multidisciplinary, multi-skilled, game-player experience
Environment	Socio-organizational, cultural
Process	Dynamic, non-linear, fuzzy, creative, enriched by games' and simulations' elements (fantasy, challenge, etc.)
Change	Continuous, evaluation-based
Evaluation	Continuous, iterative, formative and summative, fused into each phase
Management	Need for a leader Well-planned and scheduled time management
Technology	Suitable, compatible
Use	By (novice /expert) instructional designers and educational game designers for game-like learning environments and educational games

5.6. Implications for Further Research and Practice

The researcher strongly believes that the current study carries an important and grand potential for practical applications. Although there is evidence that games have been used as an instructional tool for three millenniums and computer games are considered as powerful tools to increase learning (Dempsey, Lucassen, et al., 1996; Dempsey, Rasmussen, et al., 1996), the question of how to incorporate games into learning environments rather than, simply, to master the material, is much more frequently asked to the educational researchers (Dempsey, Lucassen, et al., 1996; Dede, 1996).The proposed FID^{2}GE model might provide grounding and guidance to educators and teachers for future actions of game and simulation use in education, more precisely, of creating game-like learning environments.

Moreover, the current study is also of great importance, since it also revealed the absence or the lack of sufficient literature about the related issues. In this sense, it might also be considered as being among the pioneering studies in the field, which might inspire further research and lead to the filling of the mentioned gap in the literature.

As stated above, the researcher strongly believes that the current study carries an important and grand potential for practical applications. However, it would be better to keep in mind that more work would be needed on the model to illustrate its nuances and its clear-cut boundaries.

Another further study suggestion would be about the validity and reliability issues of the model, as Gustafson and Branch (1997) pointed out. Apart from validity and reliability, there is one more additional concern that should be taken into account and critically evaluated, which is caused by the inheritance that the model possesses

for its being the first ever step taken towards a design theory. This is the preferability of the model, which was defined as "the extent to which a method is better than other known methods for attaining the desired outcome" by Reigeluth and Frick (1999, p.634). In line with this, the effectiveness, efficiency and the appeal of the model (or satisfaction of the associated people with the model) should be evaluated. However, conduction of any comparative studies to verify the proposed model's effectiveness, efficiency, and appeal would not be possible as yet, since there is no model or theory of this kind to make a comparison with the proposed model.

Furthermore, it should be evident that the development and testing of design theories or models is not just one-shot that is expected to find the bull's eye. It can be achieved by successive approximation. Such models or theories can only approximate to perfection in the infinite, maybe, but they can be improved and refined only via iterations (Reigeluth & Frick, 1999). This implies the necessity for many future studies of these iterations, which will make probable the convergence of the model to a state of perfection. This is also in line with the researcher's intention to conduct an adequate number of iterative follow-up studies to document these issues, and reach an accumulated mass of data to be able to make necessary modifications and corrections, so that the current study can be enlarged as a theory.

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APPENDIX A

INTERVEW GUIDES AND OBSERVATION PROTOCOL

The interview guides were prepared to collect data about demographics, personal experiences and backgrounds of the participants; about the reactions, perspectives and thinking of the participants on the instructional design/development process; social issues that emerged throughout the process; and lastly a hybrid one that includes questions from the first and the second interview guides prepared for the interviews with the instructors and assistants of the course.

The observation protocol was prepared to find out technical, social, organizational and IDD process related problems and solutions to those problems articulated by the participants; the social environment; the roles of the group members; the activities performed by the participants (asking questions, listening, participation, etc.) and the body language that is used in the environment in a context-related manner, with as much detail as possible.

A.1. Verbal Interview Protocol Template Used Before the First Interviews

Merhaba arkadaslar,

Öncelikle görüsme yapmayi kabul ettiginiz için tesekkür ederim. Görüsmeyi kaydetmemde bir sakinca var mi?

Bu görüsmeler oyun benzeri ortamlarin yaratilmasinda kullanilmak üzere bir ögretim sistemi tasarimi modeli gelistirebilmek için yapiliyor. Kisaca, amacim sizlerden topladigim bilgiler dogrultusunda böyle bir model gelistirmek. Sizlerle su anda içinde bulundugunuz tasarim sürecindeki her tamamladiginiz adim sonunda, ve kisisel bilgilerinizi almak ve bu süreçteki sosyal etkiesimleriniz hakkinda görüsmeler yapacagim. Her görüsmeden önce görüsme kilavuzundaki sorular size yazili olarak da sunulacaktir.

Kisisel bilgileriniz ve cevaplariniz kesinlikle gizli tutulacak, sadece bu arastirma için kullanilacak ve arastirma sonunda toplu halde sunulacaktir. Arastirma sonuçlari hakkinda bilgi edinmek isterseniz bana mail atabilirsiniz. Arastirma sonuçlandiginda size bilgi verilecektir.

Bütün bu açiklamardan sonra verdiginiz bilgilerin arastirmamda kullanmama razi misiniz?

O halde ilk soruyla baslayalim.

A.2. Interview Guide Used for "Personal Information" Interviews

1. Ögretim sistemi tasarimi konusundaki tecrübelerinizden bahsedebilir misiniz?
    - Daha önce hiç ögretim sistemi tasarimi yaptiniz mi?
      * Yaptiysaniz, ne kadar zamandir tasarim yapiyorsunuz?
      * Kaç tane tasarim yaptiniz?
      * Yaptiginiz tasarimlarda takim olarak mi, yoksa tek basiniza mi çalistiniz?
      * Takim olarak çalistiysaniz görev dagilimini nasil yaptiniz (tecrübe ve spesifik özelliklere sahip olanlar var miydi)?
      * Kullandiginiz spesifik bir ögretim sistemi tasarimi modeli var miydi?
      * Nasil bir yöntem izlediniz?
    - Bu konuyla ilgili olarak çalistiginiz bir yer var mi?

2. Ögretim sistemi tasarimi ile ilgili bölümde aldiginiz dersler disinda baska bir egitim aldiniz mi (sertifika programlari, konferanslar, atölye çalismalari (workshoplar), vb.)?

3. Yaptiginiz ögretim tasarimlarindan bahsedebilir misiniz?
    - Farkli konular üzerinde tasarim yaptiginizi varsayarsak, bu konulardan biraz bahsedebilir misiniz?
    - Yaptiginiz tasarimlar arasinda, sizi, yaptiginiz diger tasarimlardan daha fazla zorlayanlar oldu mu?
      * Olduysa, tecrübenize dayanarak, sizce bir tasarimin zorluk derecesini etkileyen ana faktörler nelerdir?
    - Yaptiginiz tasarimlar arasinda basit fakat bir ögretim tasarimcisinin isini tam anlamiyla temsil eden bir projenizden/eserinizden bahsedebilir misiniz?
    - Bu bahsettiginiz proje/eser ile ilgili örüntüsel (contextual) bilgi verebilir misiniz (içerik (konu alani), sinif mevcudu, (varsa) çalistiginiz ögretmen veya uzman, zaman çizelgesi, ögrenci profili, vb.)?
4. Ögretim sistemi tasarimi yapma konusunda böyle bir egitim almamis ancak bu alanda çalisan kisilerden ayiran özellikler nelerdir?

Kapanis: Eklemek istediginiz baska herhangi birsey var mi?

A.3. Interview Guide Used for “Analysis Phase of IDD Process” Interviews

1. Projenizi kisaca anlatir misiniz?

2. Projenizin analiz kismindaki adimlardan bahsedebilir misiniz?

3. Bu projeye basladiginizda analiz ile ilgili düsünceleriniz nelerdi?

4. Analiz kisminda neler yolunda gitti/gitmedi? Ne gibi zorluklarla karsilastiniz? Yolunda gitmeyen seylerle nasil basa çiktiniz? (Teknik, idari, lojistik, sosyal)

5. Analiz ile ilgili planlarinizda hiç degisiklik yaptiniz mi? Cevabiniz “Evet” ise ne gibi degisiklikler yaptiniz?

6. Analiz konusunda diger proje gruplarina ve genel olarak ögretim tasarimi yapan veya yapacak olanlara önerileriniz nelerdir?

7. Proje ile ilgili analiz kismini tekrar yapma firsatiniz olsa neyi/neleri farkli yapardiniz?

8. Sizce genelde bir ögretim sistemi tasarimi yapilirken analiz süreci ne kadar kritik öneme sahiptir?

9. Sizce analiz olmadan da bir ÖST yapilabilir mi?

10. Su an yaptiginiz bir projeyi gerçeklestirmek için analiz kisminda olmasi gereken baska adimlar ya da bilesenler için ne tür önerileriniz olur?

Kapanis: Eklemek istediginiz baska herhangi birsey var mi?

A.4. Interview Guide Used for “Design/Development Phase of IDD Process” Interviews

1. Projenizin tasarim ve gelistirme kismindaki adimlardan bahsedebilir misiniz?

2. Bu projeye basladiginizda tasarim ve gelistirme ile ilgili düsünceleriniz nelerdi?

3. Tasarim ve gelistirme kisminda neler yolunda gitti/gitmedi? Ne gibi zorluklarla karsilastiniz? Yolunda gitmeyen seylerle nasil basa çiktiniz? (Teknik, idari, lojistik, sosyal)

4. Tasarim ve gelistirme ile ilgili planlarinizda hiç degisiklik yaptiniz mi? Cevabiniz “Evet” ise ne gibi degisiklikler yaptiniz?

5. Tasarim ve gelistirme konusunda diger proje gruplarina ve genel olarak ögretim tasarimi yapan veya yapacak olanlara önerileriniz nelerdir?

6. Proje ile ilgili tasarim ve gelistirme kismini tekrar yapma firsatiniz olsa neyi/neleri farkli yapardiniz?

7. Sizce genelde bir ögretim sistemi tasarimi yapilirken tasarim ve gelistirme süreci ne kadar kritik öneme sahiptir?

8. Sizce tasarim ve gelistirme olmadan da bir ÖST yapilabilir mi?

9. Su an yaptiginiz bir projeyi gerçeklestirmek için tasarim ve gelistirme kisminda olmasi gereken baska adimlar ya da bilesenler için ne tür önerileriniz olur?

Kapanis: Eklemek istediginiz baska herhangi birsey var mi?

A.5. Interview Guide Used for "Evaluation Phase of IDD Process" Interviews

1. Projenizin degerlendirme kismindaki adimlardan bahsedebilir misiniz?

2. Bu projeye basladiginizda degerlendirme ile ilgili düsünceleriniz nelerdi?

3. Degerlendirme kisminda neler yolunda gitti/gitmedi? Ne gibi zorluklarla karsilastiniz? Yolunda gitmeyen seylerle nasil basa çiktiniz? (Teknik, idari, lojistik, sosyal)

4. Degerlendirme ile ilgili planlarinizda hiç degisiklik yaptiniz mi? Cevabiniz "Evet" ise ne gibi degisiklikler yaptiniz?

5. Degerlendirme konusunda diger proje gruplarina ve genel olarak ögretim tasarimi yapan veya yapacak olanlara önerileriniz nelerdir?

6. Proje ile ilgili degerlendirme kismini tekrar yapma firsatiniz olsa neyi/neleri farkli yapardiniz?

7. Sizce genelde bir ögretim sistemi tasarimi yapilirken degerlendirme süreci ne kadar kritik öneme sahiptir?

8. Sizce degerlendirme olmadan da bir ÖST yapilabilir mi?

9. Su an yaptiginiz bir projeyi gerçeklestirmek için degerlendirme kisminda olmasi gereken baska adimlar ya da bilesenler için ne tür önerileriniz olur?

Kapanis: Eklemek istediginiz baska herhangi birsey var mi?

A.6. Interview Guide Used for Interviews with Instructors and Assistants

1. Ögretim sistemi tasarimi konusundaki tecrübelerinizden bahsedebilir misiniz?
   - Daha önce hiç ögretim sistemi tasarimi yaptiniz mi?
     * Yaptiysaniz, ne kadar zamandir tasarim yapiyorsunuz?
     * Çalisma yönteminiz nedir? Takim olarak mi, yoksa tek basiniza mi çalistiniz?
     * Takim olarak çalistiysaniz görev dagilimini nasil yaptiniz (tecrübe ve spesifik özelliklere sahip olanlar var miydi)?
     * Kullandiginiz spesifik bir ögretim sistemi tasarimi modeli var miydi?
     * Hangi adimlari izlediniz?
   - Bu konuyla ilgili olarak çalistiginiz bir yer var mi?

2. Ögretim sistemi tasarimi ile ilgili bir egitim aldiniz mi?
   - Bu egitimin niteligi nedir?
   - Lisans, yüksek lisans egitimi, doktora, sertifika programlari, konferanslar, atölye çalismalari (workshoplar), vb.?

3. Yaptiginiz ögretim tasarimlarindan bahsedebilir misiniz?
   - Hangi farkli projelere katildiniz? Bunlari kisaca amaçlariyla birlikte açiklaya bilir misiniz?
   - Yaptiginiz tasarimlar arasinda, yaptiginiz diger tasarimlardan daha fazla zorlayanlar oldu mu?
     * Olduysa, tecrübenize dayanarak, sizce bir tasarimin zorluk/uygulanabirlik derecesini etkileyen ana faktörler nelerdir?
   - Yaptiginiz tasarimlar arasinda basit fakat bir ögretim tasarimcisinin isini tam anlamiyla temsil eden bir projenizden/eserinizden bahsedebilir misiniz?
   - Bu bahsettiginiz proje/eser ile ilgili örüntüsel (contextual) bilgi verebilir misiniz (içerik (konu alani), sinif mevcudu, (varsa) çalistiginiz ögretmen veya uzman, zaman çizelgesi, ögrenci profili, vb.)?

4. Ögretim sistemi tasarimi yapma konusunda böyle bir egitim almamis ancak bu alanda çalisan kisilerden sizi ayiran özellikler nelerdir?

5. Bu dönem egitim yazilimi tasarimi, gelistirilmesi ve degerlendirilmesi dersinizde rapid prototyping modelini kullandiniz.
   - Kullandiginiz modelin avantajlari, dezavantajlari var miydi? Nedir?
   - Kullandiginiz modelin uygulanabilirligi hakkindaki yorumlariniz nelerdir?
   - Kullandiginiz modelden kaynaklanan problemlerle karsilastiniz mi? Nelerdir?
     * Analiz kismi ile ilgili düsünceleriniz nelerdir? Ne gibi seylerle karsilastiniz?
     * Analiz kismi ile ilgili karsilastiginiz problemler nelerdir?

* Tasarim ve gelistirme kismi ile ilgili düsünceleriniz nelerdir? Ne gibi seylerle karsilastiniz?
* Tasarim ve gelistirme kismi ile ilgili karsilastiginiz problemler nelerdir?
* Degerlendirme kismi ile ilgili düsünceleriniz nelerdir? Ne gibi seylerle karsilastiniz?
* Degerlendirme kismi ile ilgili karsilastiginiz problemler nelerdir?

6. Kullandiginiz modelin egitimde simulasyon ve oyun türü ortamlar gelistirmeye ne kadar uygun oldugunu düsünüyorsunuz?
    - Sizin önerileriniz nelerdir?

A.7. Interview Guide Used for “Social/ Organizational Issues” Interview

1. Grup içerisindeki etkilesimden biraz bahsedebilir misin?

- Sosyal açidan olumlu seyler?
  - Nedenleri?
- Sosyal açidan olumsuz seyler?
  - Nedenleri?
- Sorumluluklar?
  - Nedenleri?
- Görev dagilimi?
  - Nasil?
- Çalisma düzeni?
- Çalisma uyumu?

2. Bu tarz bir projede gruplar belirlenirken ne yapilmali, ne yapilmasini isterdiniz siz?

- hocalar mi belirlesin? Neden?
- kendiniz mi seçmek istersiniz? Neden?
- random olarak mi atansin? Neden?
  - random olarak atanacaksa farkli insanlar biraraya getirilecekse ne gibi birsey yapilmali ki, hem grup içerisindeki çalismanin verimli olmasi, hem de sorun olmamasi saglanabilsin?

3. Bu süreç ile ilgili hisleriniz neler?

- Neden?

Kapanis: Eklemek istediginiz baska herhangi birsey var mi?

A.8. Observation Protocol

Observation Protocol for a Search for IDDM for creation of GLE

Length of Observation: Date/Time:	Observed group: (Facilitator (Coach) of the group:)

Aim:

This observation aims to find out technical, social, organizational and IDD process-related problems and solutions to those problems articulated by the participants; social environment; the roles of the group members; the activities performed by the participants (asking questions, listening, participation, etc.) and the body language that is used in the environment in a context-related manner, with as much detail as possible.

Research Questions:

4. What are the **distinctive characteristics** of an IDD process for the creation of GLE?

5. What are the **necessary** and **sufficient components** of an appropriate IDDM for the creation of GLE?

6. How do these components **come together to form a model**?

Descriptive Notes:	Reflective Notes:

Physical Environment:

Room: Light: Heat: Noise: Distracter:	Sketch of the Physical Environment:

APPENDIX B

INTERVIEWS CITED

The original quotations used in the fourth chapter were given in accordance with the subheadings of that chapter.

B.1. Quotations Used in Part "4.1.1. Background Information of Students"

[G21-PI-p1] Ben o kadar da tecrübeli oldugumuzu düsünmüyorum, çünkü yapilan projeler bir kere çok ciddi yapilmadi, son iki-üç haftada çikardik genelde, hiç bu dönem de oldugu gibi böyle çikarmadik.

[G43-PI-p1] Tecrübe diyorsaniz hocam, pek bir tecrübemiz yok ... dördüncü seneye [sinifa] kadar ... pedagojik seyler, teorik seyler, stratejiler, approach'lar verildi, ... [ama] bu ögretimsel teknoloji boyutu, ögretimin bir design boyutu, bununla ilgili seyler verilmedi ... daha önce bir part time ise girebilmek [gibi] ... bir sansimiz olmadigi için...ve bundan iyi projelerde yeralmadigimiz için de bir deneyimimiz yok [gibi geliyor bana] ... yalnizca çok temel anlamda bilgilerimiz var.

[G41-PI-p6] Bilmiyorum ben. Ne is yapiyor bilmiyorum ben, çünkü kodlarla ugrastim, tasarim isiyle ugrasmadim, sayfanin görünüsünü mü yapar bilmiyorum

ben. Simdi bizim yaptigimiz islemde bir grafik tasarimcisi, kod yazilimcisi birine ihtiyaç var. Bir de bize ihtiyaçlari var halbuki biz kendimiz yaptik bunlari.[O yüzden de] asil isimizi bilemedik.

[G51-PI-p5] Ben de ikinci sinifta Pascal projesi yapmistim. O bayagi zorlamisti...n'in toplanisini falan ögretiyordu sanirim. [Bu bir] programdi da sonuçta [ama] yine ögretim tasarimi kismina giriyor... mesela bir de Visual Basic de yaptigimiz program var.

[G31-PI-p3] Ben Flash'da ögretmenlerin derslerinde kullanabilecegi applet'ler yapmistim. Bu zaten javascript'ti de, ben de Flash'da animasyonlarini yapmistim, ögretmenlerin gerektigi zaman bunlari o kütüphaneden alip kullanabilecegi.

[G43-PI-p2] Yaptigimiz ögretim sistemi tasarimi altinda geçiyor olabilir ama su anda ögrendiklerimizle o zaman yaptiklarimizi karsilastirinca bir dersin bir nevi websayfasini gelistirme gibi birsey yapmisiz.

[G52-PI-p4&p5] ... Kültürel Evrim diye seçmeli bir dersi tekrar dizayn ettim. [mevcut durumda] alan arastirmasi yapiliyor ve onun raporlari yaziliyordu... ancak böyle bir evrimin, kültürün yorumunu yapabilmek için, geri planda iyi bir bilgi birikiminin olmasi gerekiyor. Bu da [bu dersi] seçmeli bir ders olarak alan bir ögrenciyi asiyor. O da hocadan bekleniyor daha çok. Ögretmenin de bunu verebilmesi için birebir ilgilenmenin çok olmasi gerektigi gibi bir tasarim yapmistim.

[G13-PI-p2] ...yani aslinda grup çalismasina yatkin bir insan degilim. Liseden beri hep kendi basima, derslerde falan da öyle kendi basima götürüyorum. Daha dogrusu alisamadim da grup çalismasina.

[G41-PI-p6] Bir design'la development yaptik.

[G31-PI-p2] Bilimsel olarak analiz, design, development, implementation ve en sonda da evaluation tabi ama, pratikte pek öyle degil. Yani hepsinin üzerinden geçtik ama analiz için somut olarak birsey yaptik mi ya da evaluation için somut olarak birsey yaptik mi, onu söyleyemem.

[G42-PI-p6] Programlama yapmaktan falan, test yapma, evaluation yapma imkani hiçbirzaman olmadi, yani yapmadik hiçbir zaman.

[G41-PI-p3] Zaten biz bu seyleri [analiz, design, development, implementation, evaluation] hiç bugüne kadar kullanmadik. Kendi kafamiza göre yaptik yani bir isi yaparken bunlarin farkinda degildik. Öyle bir kaygimiz yoktu.

[G31-PI-p2] [Traditional model] kullaniliyordu ama, genelde yap-boz oynuyorduk, bir yeri bozuyorduk, ondan sonra yapiyorduk.

[G41-PI-p3] Bence sadece birilerinin düsünüp kendine göre tasarladigi seyleri, ne bileyim, takip etmeyebilirsiniz, çünkü herkesin kendisine ait, kendi ihtiyaçlarina göre gelistirebilecegi sistemler olusabiliyor zaman içerisinde.

[G11-PI-p2] Biz genelde bütün dönem boyunca iste bir projemiz var ugrasacagiz diye kafamizda düsündük, biraz birseyler olustu ki, son iki-üç haftada birseyler çikiyordu, toplu halde, hepsi birarada çikiyordu hakikaten. Çünkü gerçekten, bu, bu hafta bitecek diye bir düzen, lineer bir çalisma düzeni verilmedi. Zaten hiç düzeltme de verilmedi galiba.

[G22-PI-p2] ... ilk bir iki ay programi nasil ögrenecegim diye geçiyordu, son bir ay içerisinde projenin konusu yani ne yapacagimiz bile belli olmuyordu. Son bir ay içerisinde proje veriliyordu. Yani nasil bir proje gerçeklesebilir ki son bir ay içerisinde, sadece ögrendiklerimizi uygulamaya dökmek manasinda bir olay, islemlerdi bunlar.

B.2. Quotations Used in Part "4.3.1. Analysis Related Issues"

[G11-A-IR1] Biz sözel birseyin [böyle bir ortamda anlatilmasinin] sayisaldan çok daha mümkün olacagini düsündük. Kullanicinin iste girip, evlerin arasinda, iste, ortamlarin, ressamlarin, eserlerin arasinda dolanabilecegi bir mekan yaratmayi düsündük.

[G 43-A3] Dersin amaçlarina baktik. Dersin varolan amaçlari vardi, yani dersi biz gelistirmedik. Biz bu derse ne katabiliriz? … ögrencilerin derste en çok ihtiyaç duyduklari seyleri belirledik, yani gap'leri belirledik. Iste, bu gap'leri nasil tamamlayabiliriz, ona baktik ve bunlarin hepsi zaten bizim amacimiz oldu sonra. Yani need'ler, yani ihtiyaçlar sonradan amaçlara dönüstü.

[G11-A5.1] Bence onun sistemini, formatini bilmek gerekiyor, çok net sorular sorabilmek gerekiyor ama ben genelde oradaki insanlara yapacagimiz seyi anlatmakla ugrastim. … O büyük bir problemdi hakikaten.

[G31-A7] Learner analizi kismi gerçekten çok kritik. Bu gerçekten kitaplardan alinti olmamali da, onu gerçek baglamda görmek lazim. Ona çok dikkat edilmesi gerek, çünkü genelleme yaptigimiz zaman, zaten alinti yapilan kitaplar da baska ülkelerden geldigi için pek bizi yansitmiyor. Bu konu da, o kosullar da tam hesaba katilmali bence.

[G43-A9.8] Ama o [ögrencilerin nasil bir ortamda ögrenmek istedikleri] de kendimizden bildiklerimizle yani. Yoksa bir arastirma yapsak çok uç noktalarda birseyler çikabilir. … bir arastirma yapmak ve bizim düsüncelerimizle paralellik gösterdigini ispatlamak lazimdi.

[G31-A9.5] Ögrencilere biz bu konuyu nasil vermeliyiz, yani nasil veriliyor da bu ögrenciler ögrenmiyorlar bu konuyu da, biz nasil verirsek daha iyi ögrenir'in cevabini aradik.

[G22-A9.7] Olayi saptiran özellikleri de var oldugundan bu programi nasil kullanacagiz diye arastirdik, bu programi ögretmen kontrolünde mi kullanacagiz, yoksa ögrenci yalniz mi kullanacak. En sonunda ögretmen kontrolünde kullanacagimiza karar verdik ama evinde internet varsa o programi yükledikten sonra, internete baglandiktan sonra o programi evinden de kullanabilir diye ekledik.

[G31-A4.3] Öncelikle konumuzun su anda okullarda ne gibi bir önemi var, konumuzun önemli olup olmadigini belirlememiz gerekiyordu.

[G31-A4.7] … [içerigi] tek kaynaktan bulduk, bunun verification'ini yapamadik, dogrulamasini. Elimizde fazla materyal yoktu. Direkt yazi vardi, resim veya animasyon yoktu ve tek kaynakta oldugu için o iyi degildi yani…[Tekrar yapma sansim olsaydi] daha fazla kaynak bulurdum ve ögretmenlerle konusurdum tekrar, içerikle ilgili onlardan hint'ler alirdim.

[G53-A4] Content'i biz kendimiz yazdigimiz için, daha dogrusu, kendimiz konuyu bildigimiz için, kendimizin yazdigi bir kaç cümleyle, okudugumuz zaman anliyorduk ve yeterli oldugunu düsünüyorduk. Fakat our instructor biraz daha objektif baktigi için, [bunun] yeterince açik olmadigini, bilmeyen bir kisinin bunu anlayamayacagini söyledi. Biz de o gözle bakinca farkettik. O tür konularda düzenlemeler yaptik.

[G52-A4.7] Kullanicinin bilgilerinin alinmasi ve konuyla ilgili bir uzmanin, geleneksel ögretim yapan bir kisinin, ögretmenlik yapan bir kisinin de görüslerinin

alinmasi gerektigine inaniyorum. Yani ne kadar çok kaynaktan bilgi alinip sentezlenirse, okadar verimli olacagini düsünüyorum.

[G12-A8] Bizim analizde yapmamiz gereken bir de programi incelemekti bence.

[G22-A8] Bir de kullanacagimiz programi analiz etmek gerekiyor, yani o programi kullanarak ne yapip ne yapamayacagimizi bilmemiz çok önemli. Baska seylerle karsilastiginda yapiyorsun ama ben bunu bu programla gerçeklestirebilir miyim, gerçeklestiremez miyim? Çok büyük bir sikinti oluyor yani. Bu nokta çok önemli bir nokta onu gelistirirken.

[G53-A8] Bizim analizini yapmadigimiz tek sey üstüne bina ettigimiz yazilim iste. Active worlds'ü hiç bir sekilde analiz etmedik biz. Ögrenci …kullanabilir mi, iste o tür konularda çok fazla birsey yapmadik, Biz analizi yaparken bunun güzel bir program oldugunu kabul ettik. Iste, artisi eksisi su sekilde, … Active Worlds'ü mü kullanalim, ya da alternatifi varsa onu mu kullanalim seklinde ya da direkt web sayfasi mi yapalim, gibi bir analize girmedik yani.

[G11-A4.5] …programi da ona [content'in structure'ina] göre yapalim, programin yapisi, gidisi [content'in ihtiva ettigi] tarih siralamasina göre olsun. … tarihin döngüsü bizim programda da aynen korunsun ki, kullanici programin içinde dolasirken birseylerin farkina varsin diye düsündük.

[G43-A10.4] Aslinda en önemli yer burasi, çünkü burada ne yapiyorsaniz, bütün gelisimler buradaki bilgilere göre çikiyor. Yani ihtiyaç analizi yapiyorsunuz, ihtiyaçlari ortaya koyuyorsunuz…. Learner analizi yapiyorsunuz, kitlenizin pedagojik durumuna göre, avi'dir, animasyonlar'dir, odur, budur, gelisim kismindaki birtakim seyleri buna göre tasarliyorsunuz. Yani burasi bittikten sonra, öteki tarafta

pek birsey kalmiyor. Yani, orada da ürünün çikmasi var, önemli seyler var, ama [burasi] düsünme asamasi, önünüzdeki karanlik perde kalkiyor ve önünüzü görebiliyorsunuz artik.

[G31-A10.4] Kesinlikle olmali, analizi yapmak, illa ona bagli kalmak anlaminda degil de, yol gösterici oluyor, bir yerde takildiginiz zaman, ileride takildiginiz zaman dönüp ona basvurabiliyorsunuz. O anlamda önemli, ama illa tabi siki sikiya bagli olmak anlaminda degil, ama yol gösterici olmasi anlaminda önemli.

[G43-A12] Bir bütçe varsa, cost analizi gerekir. Belki böyle bir bütçemiz olmadigi için, kullanmayacagimiz için yok, ama olmasi gerekiyor.

[G31-A13] Ben, bu hazirladigim sistemi kullanacak olanlar sistemle belirlenmis bir siklikta veya belli zamanda etkilesime geçerse en iyi sonucu, verimi alabilirim. [Bu kulllanim sikligi ve miktari] ne kadar olmali? Bunu da belirlemek gerekiyor.

[G21-A18] Kendimizi de analiz etmemiz gerekiyordur belki de, grup içerisindekileri

[G22-A*] Bir de analize sürekli dönmek lazim, öyle bastan yapip birakmamak lazim, ilerleyen zamanlarda da, development'ta, design'da da geri dönüp biz ne yapmisiz, neyi degistirsek daha iyi olur gibi sürekli kendi kendimize soru sormakta da fayda var yani.

B.3. Quotations Used in Part "4.3.2. Design and Development Related Issues"

[G44-D1.6] Senaryoyu olustururken zorlanabilirdik, ama zorlanmadik, çünkü gruptan …'in oyun kültürü çok genis, çok fazla oyun oynamis, kafasinda bir sürü senaryo var. Onlardan bir tanesini de, yani oynadigi oyunlar falan ne bilmiyorum

ama, o oyunlara benzer oyun tarzi birsey ortaya kondu. Oyüzden senaryo kolay ortaya çikti.

[G11-D27] Aslinda o anlatilacak konuya göre de çok degisebilir. Mesela interaction saglayacak birseyler olabilir belki. Bunu kullanacak insanlar nasil biraraya getirilebilir, onlarin beraberligi nasil saglanabilir, iste bir eyleme geçmeleri falan. Konu simülasyon oldugunda o [sosyal boyut] önemli birsey.

[G12-D40] Tarihsel bir süreç anlatiyoruz, sonuçta akimlardan kimisi bir digerine karsit dogmus, kimisi ayni anda ilerlemis falan. Mesela design yaparken bunu nasil verebiliriz diye çok düsündük. En sonunda [3D ortamda] U seklinde lineer bir yapi izleyelim diye karar verdik . Ona da dikkat edilirse çok güzel birsey ortaya çikiyor, yani dolanirken de bundan sonra bu geliyormus falan diyebiliyorsunuz..

[G11-D29] Sonuçta okul projelerinde onu [kullaniciyi] düsünmeye sira gelmiyor. ... Ama böyle projelerin en narin parçasi, tek demeyeyim ama, belkemigi kullanici oldugu için onun istek ve ihtiyaçlari en basta düsünülmeli bence. Yani her is kullanici odakli gitmeli.

[G11-D25] … analiz, design,... diye ayirmak zorunda da degiliz. Belki belli bir süreçte hepsi birarada çikmali. Ama ikisinin de component'larini, ugrastigimiz o ufak parçalari atmamiza imkan yok. Ama süreleri ayirip, böyle lineer bir sürece sokmak yerine, paralel isletebiliriz, onda bir problem yok.

[G12-D25] Bence hepsi ayni öneme sahip ve hatta bir sirasi da yok, çünkü hepsi birbiri içinde, çünkü design'i yaparken develop da ediyorsun, develop ederken yeniden design ve analiz yapiyorsun,... Hepsi içiçe yani ayri degil.

[G43-D25] Aslinda o basamaklarin herbiri önemli. Hepsi birbirini tamamliyor gibi yani. Analiz design için gerekli. Analiz ve analizde elde ettigimiz

veriler design için bir rehber oluyor. Design [development'ta] bizim için bir guide oluyor Bundan dolayi, aslinda hepsi birbirinin tamamlayicisi gibi.

B.4. Quotations Used in Part "4.3.3. Evaluation Related Issues"

[G31-E13.9] Evaluation'i yaptirdigimiz kullaniciyi sartlandirmamak lazim bence. Yani bir checklist verip de, mesela usability'si, kullanicinin motivation'i seklinde verdigimiz zaman saglikli olmuyor. Kullaniciya verilmesi gerekenler bunun amaci budur, bu amaca ne kadar ulasiyor, ulasamiyor, niye ulasamiyor gibi genel sorular sormak lazim. Daha çok open olmali yani yoruma, nitel olmali nicel degil de.

[G31-E16.2] Evaluation'i yapan kisinin background'ini, bilgisini de hesaba katip, o evaluation'in ne kadar degerli oldugunu belirlemek lazim, yoksa pek bir ise yaramiyor. Iste, bilgisayarla daha önceden tanismis mi, bilgi düzeyi nedir, bir sürü faktör var, yani hiç akla gelmeyecek seyler bile o anki yorumunu etkileyebilir. … belki sosyal açidan da farkli birseyleri oldugu için çok farkli yorumlayabiliyorlar.

[G32-E16.2] Mesela, bilgisayardan hoslanmiyordur, herseye kötüder, veya hemen bitirip gitmek istiyordur.. Birisi grafiklerden hoslaniyordur, sadece oraya bakar falan.

[G22-E16.2] …Oyun oynamasini sevmiyordur….

B.5. Quotations Used in Part "4.4. Hard Issues"

[G22-D8.1] Senaryoya göre oraya bir nesne koymamiz gerekiyor. Ama nesneleri arayip, bulamiyorsun.

[G51-D57] Mesela hastanedeki beyaz sedye yatagi ekleyecegiz, süslü bir yatak odasi yatagi geliyor.

[G44-D40] Müzik tarihinde belli dönemlerimiz var. O dönemlere ait bina yapilari falan düsündük, esyalar, o ortami gerçekten insanlara yasatabilmeyi düsünmüstük ama tool'un verdigi imkanlar çok da elvermiyor buna. Mesela istegimiz gibi duvarlar yok, esyalar da, bilgisayar var ama müzik aletleri falan yok mesela.

[G43-D57] Disaridan resim, obje falan import edemiyoruz. Ona da sinirlama getiriyor yani izin vermiyor. Dolayisiyla varolanlari kullanarak yapmak zorunda kaldik.

[G32-D76.3] Belli bir resim ekleyebiliyorsunuz, çok fazla 3D birseyler ekleyemiyorsunuz.

[G52-D76.3] Üç boyutlu program içinde iki boyutlu fotograf duruyor.

[G43-D76] Mesela üç boyutlu taraftan, internet sayfasina, web kismina gönderme yapabiliyorsunuz, kontrol edebiliyorsunuz. Ama web'den 3D kismini kontrol edemiyorsunuz. Bu bir sorun.

[G21-PI-p2] Biz programi ögrenecegiz, tamam herkes kendi ögrensin o ayri ama, kimden yardim alacagiz, sikistigimiz yerlerde, yani böyle bir teknik danismanlik sistemi yok, sikistigimizda ne yapacagiz?

APPENDIX C

SCREENSHOTS

The following screenshots were selected from completed student projects.

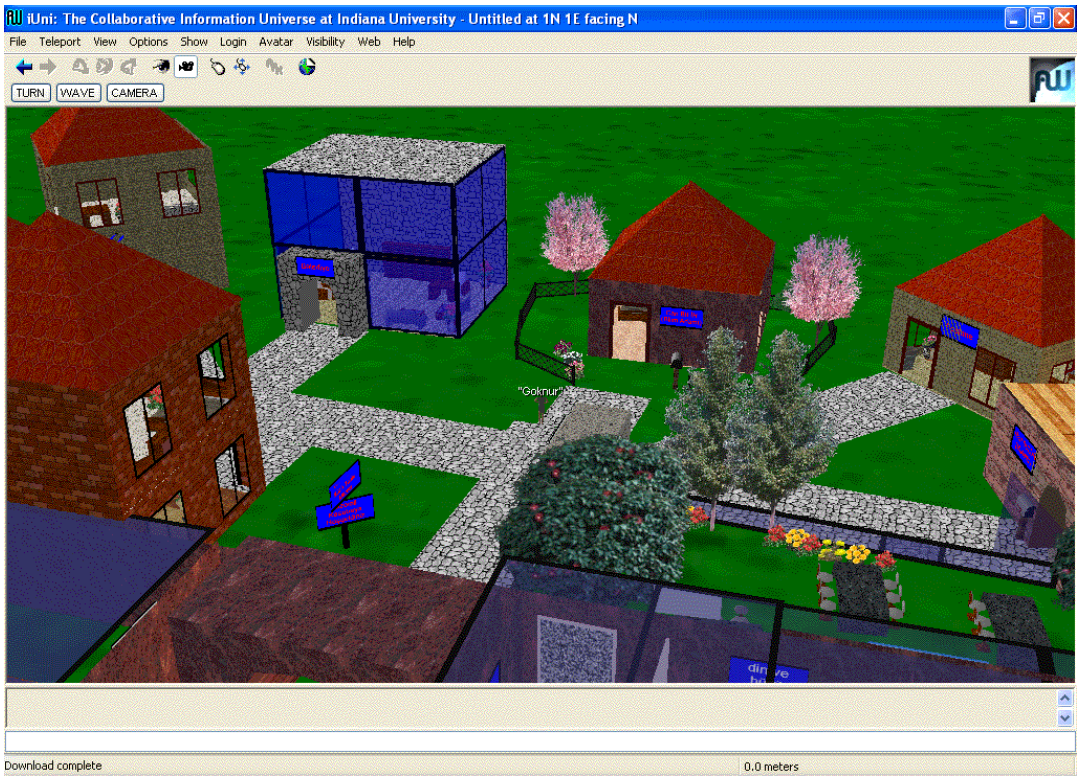

Figure C.1. A screenshot from “Mysterious Town.”

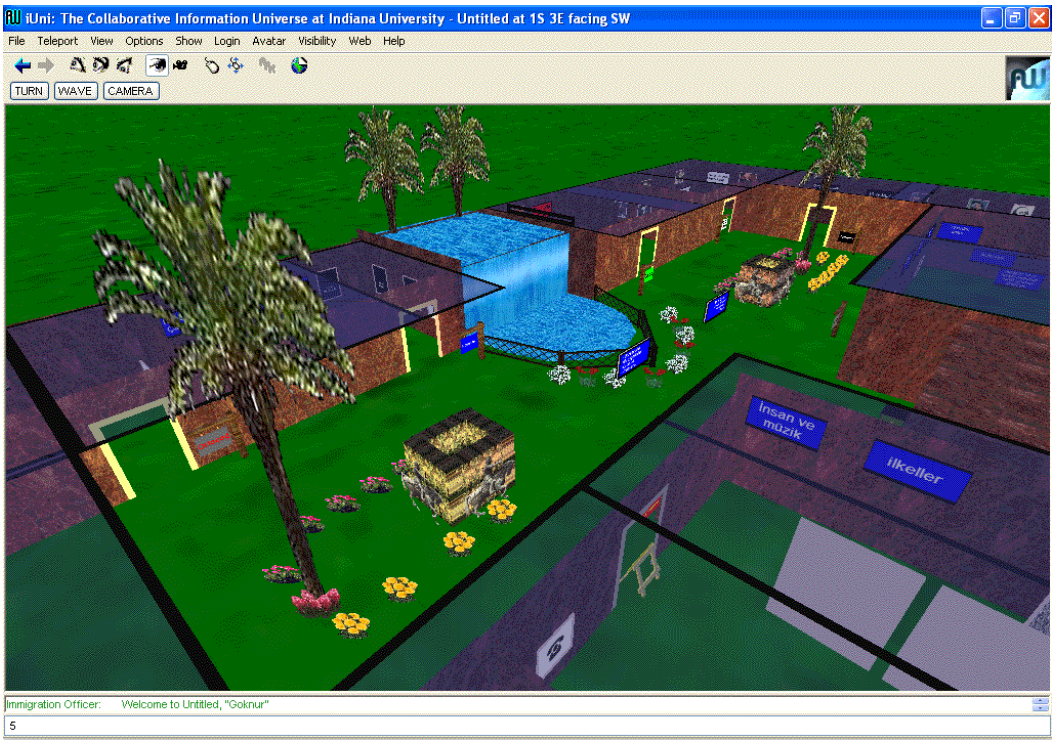

Figure C.2. A screenshot from “History of Music.”

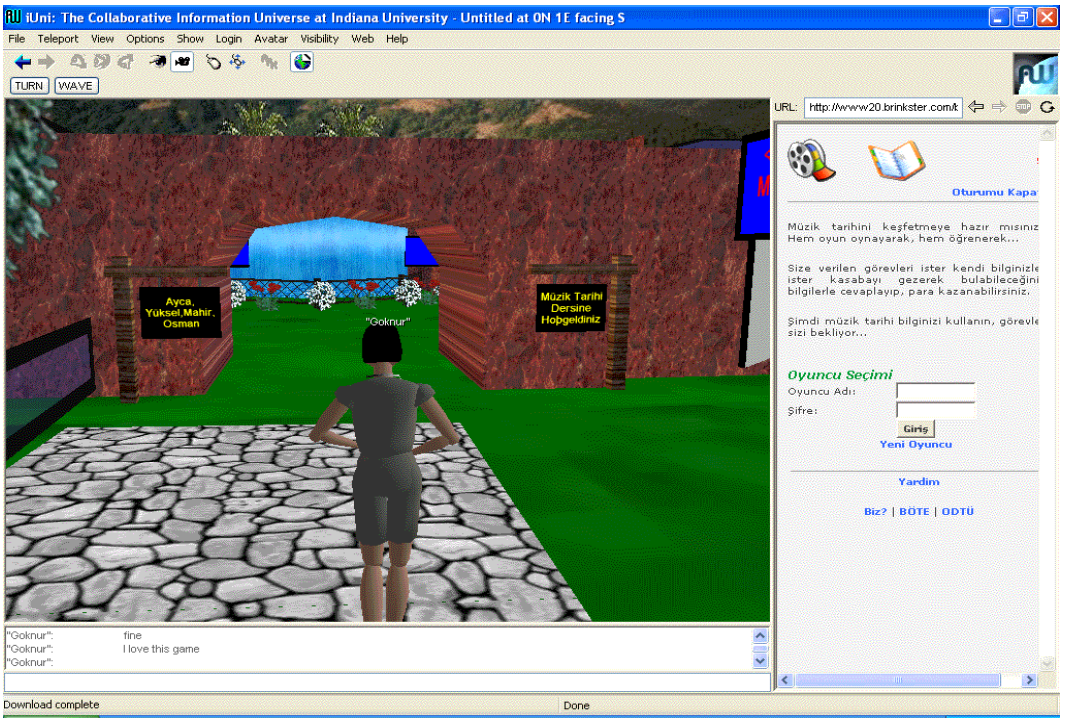

Figure C.3. A screenshot from entrance of “History of Music” and its web component.

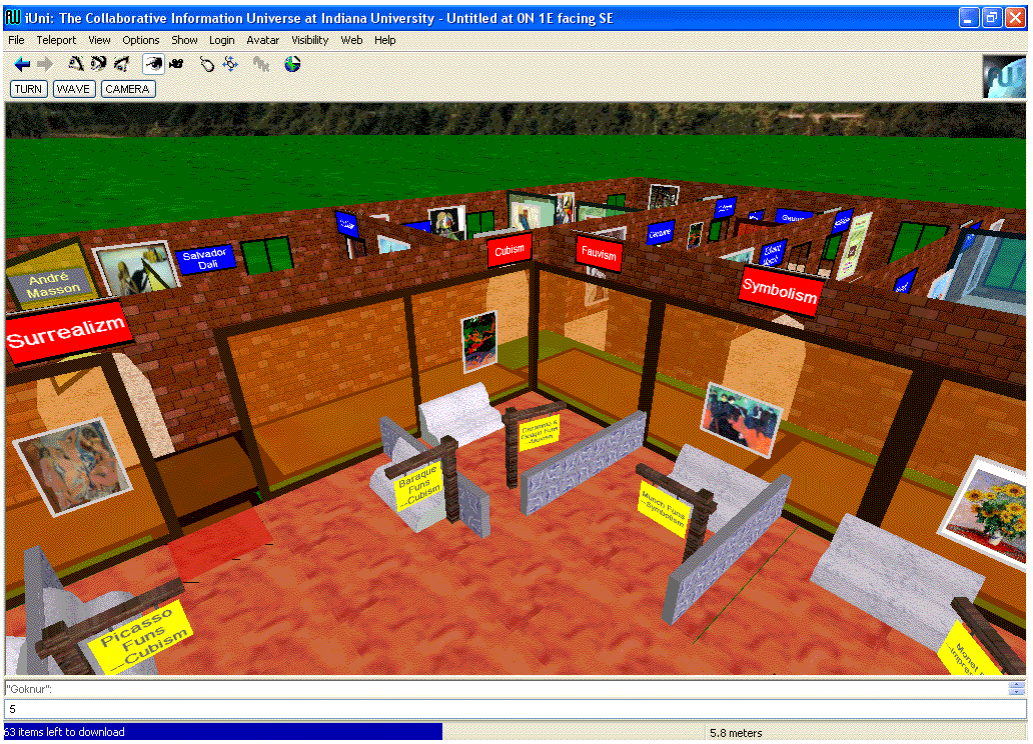

Figure C.4. A screenshot from entrance of "History of Arts."

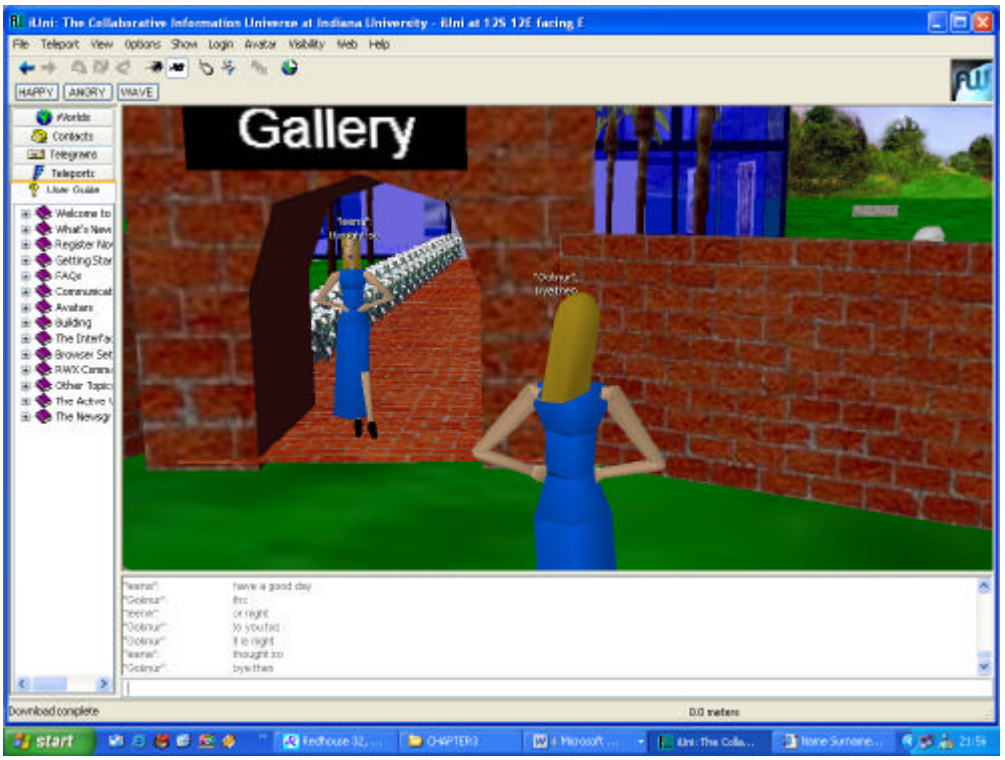

Figure C.5. A screenshot of two people "talking."