

# Preservice Computer Teachers' Selections of Game Design Dynamics Based upon Their Game Preferences, Habits and Technical Backgrounds

Turkan Karakus

Department of Computer Education and Instructional Technology  
Mersin University, Turkey  
[karakus@metu.edu.tr](mailto:karakus@metu.edu.tr)

Yavuz Inal

Department of Computer Education and Instructional Technology  
Mersin University, Ankara, Turkey  
[yinal@metu.edu.tr](mailto:yinal@metu.edu.tr)

Kursat Cagiltay

Department of Computer Education and Instructional Technology  
Middle East Technical University, Ankara, Turkey  
[kursat@metu.edu.tr](mailto:kursat@metu.edu.tr)

**Abstract:** This study aims to investigate relationships between educational game design dynamics of preservice computer teachers and their previous experiences about computer games, game preferences, game habits and opinions about discrepancies of games. 28 4th year students joined a 3D educational game design course participated to the study. They were supposed to design games before beginning to their projects. Effects of their technical backgrounds on their scenarios and motivational elements were examined according to inquiry results. To collect data, demographic questionnaire, a written-inquiry aiming to analyze dynamics of educational games that they plan to implement and reflection critics and comments about 3 different game genres were used. Results showed that they concerned with motivational and attractive elements, capability of improving thinking skills. They don't prefer designing multiplayer games for educational aims and they prefer design games as complementary activity.

Game-like learning environments are gaining popularity among the educators. Since computer games have many characteristics such as motivating students and keeping their attention high during the course hours, educators prefer using them to enhance students' learning capabilities. Besides, games provide rich interactive environment for learning (Reiber, 1996) and they are powerful tools for education when they are used appropriately (Alessi & Trollip, 2001). There are some motivating and entertaining elements in games and Squire (2003) argues that these elements can be used by instructional technologist as a guideline while they develop interactive game-like learning environments. Story of games draws a framework for setting these elements (Reiber, 1996). Because story and scenario are two well-known frameworks for computer games, it is important to compose an appropriate scenario to motivate and entertain students while playing educational games. A study conducted by (Amory et al., 1999) showed that the story lines were more interested part of games than others for children. In order to compose appropriate and intelligent scenarios, examining and playing other games to understand motivational and entertaining issues and some appropriate parts for educational context have been getting more important. Dickey (2005) argues that playing commercial games provides to understand how entertaining elements can be put into educational games.

Computer games, especially strategy games, provide several thinking skills for players. Turvey (2006) states that computer games have huge power to construct connection between virtual life and real life to think critically. Educational computer games provide several problem solving contexts which are the main goal of education (Honga & Liub, 2003). Since teachers who can create technology rich learning conditions are the most powerful people in learning environments (Bratina et. al, 2002), they should find different ways to provide students with active learning process. Teachers should design and organize the "technology- enhanced learning" for their classrooms and they should design materials with computer, internet, and other media (Rogers, 2002). Perceptions of teachers about games for educational purposes play a key role for games in terms of their entrance to the classrooms. According to Can and Cagiltay (2006), preservice computer teachers in Turkey think that educational games are effective learning environments and they plan to use games when they begin their careers, however less than half of them think that game cannot not be a main instructional tool.

Having experiences by designing a game, [Schaefer and Warren \(2004\)](#) emphasized designing a computer game is very effortful process, and limitations and opportunities of game design environment influence this process. However there are some dynamics that cannot be ignored despite of these difficulties. Educational software designers should take into consideration the interaction, help and feedback components, pedagogical and graphical aspects of the software ([Harel & Papert, 1990](#)). Designers should consider originality, feasibility, implementability, functionality of the game, game world and character ([Kanev & Sugiyama, 1998](#)). Game designers should regard the interaction and feedback components and how learning material can be put into the game in order not to bore students or not to students ignore the content. The study which was designed by [Dempsey et al. \(2002\)](#) showed that players were interested in especially the clear information and help about how to play games, challenge of the game, and then control of difficulty, timing, speed and sound. They also concerned with the lack of clear goal of games and trial and error chance. These critics about games can be useful for instructional technologist when they develop game-like learning environments [Dempsey et al. \(2002\)](#). Teachers' experiences, critics and stories can also lead to designers to develop computer games according to educational needs. Game preferences of them might be influenced their design scenarios. It is clear that because evaluation of educators, instructional technologists and teachers are important for game developers as mentioned reasons, teachers' game design preferences and dynamics are important to understand how outcomes and goals for instruction can be put into the games. This study aims to investigate relationships between educational game design dynamics of preservice computer teachers and their previous experiences about computer games, game preferences, game habits and opinions about discrepancies of games. We aimed to understand, how computer teachers' critics and opinions about games played before influences their game scenarios, how they put game components into scenarios, how they give role to learner and imagine learning environment, and whether they are influenced from their technical knowledge influence their game scenario.

## **Method**

This study was based on descriptive data analysis method implemented for examining and analyzing collected data from the participants. Data were collected through questionnaire, reflection analysis, game critics and written inquiry results.

## **Subjects**

Totally 28 preservice computer teachers who were 4<sup>th</sup> year students of Computer Education and Instructional Technology Department at METU participated in the study. Preservice computer teachers in the study joined a course which was mainly about 3D game design based upon educational context. 9 of the students were female and 19 of them male, their ages were between 23 and 24. They were asked to design 3D game by defining their game design dynamics before they begin to the development stage. All participants had computer in their home or dorm, they had unlimited internet connection opportunity in the department, and they were related with developing 3D environments and other kind of visual design environments through previous courses.

## **Instrument and Procedure**

We used a questionnaire which was developed [Durdu, Tufekci and Cagiltay \(2005\)](#). As a second data, source was students' game critiques papers. They reflect critiques and comments about "Age of Empires", "The Incredible Machine" and "Bacteria" in a report shaped by a guideline aiming to make clear that which types of dynamics they take into consideration. In this part, we examined how preservice computer teachers made critics about computer games, which part was advantage or disadvantage for them, what recommend to games and whether they wanted to use one of them in their classroom. Thirdly, paper-based interview was conducted with the preservice computer teachers. We wanted students to write their scenarios in their mind and then we asked students some questions about their scenarios like what kind of factors influenced their scenarios, whether game was multiplayer or single player, and how they will use this game in educational context. Then, we analyzed dynamics of educational games that they plan to implement. In order to analyze the results, we made content analysis of their game scenarios to categorize what type of dynamics they used to present their games and we tried to reveal a pattern they used for game elements.

## Results

In our case, although it seems role playing and simulation games majority group, apart from them, there were a lot of game genres, so we did not categorize games in a genre. We analyzed the scenarios of students according to Prensky's (2000) 6 elements of games which are rules, goals, outcomes and feedback, problem, interaction, representation or story. As a result, while interpreting the scenarios, we consider students' game critiques, Prensky's game elements, and other game elements which emerged during the content analysis.

### Game Preferences

Questionnaire results showed that 12 of students play games a few days in a week, 9 of them play daily and 7 of them do not play games. However, the students that do not play games, did not mean they have no experience with games, because 2 of them answered the question of "did your game experience influenced your game design" as "yes" and they gave the name of the game they were influenced. We also asked students' first five preference of game genres. According to the results, they are race (n=19), strategy (n=18), sports (n=14), action adventure (n=12), and puzzle (n=12). Because numbers of males were more than females, race, strategy and sports seem most preferred game genres. However, within females, most preferred genres are puzzle (n=8), quiz (n=6) and card games like Solitaire (n=6). In game critic part, we asked whether they prefer multiplayer or single player game based on their experience 19 of them indicated that they prefer multiplayer games for education.

### Game Critiques

Hence, designers should understand properly the players' preferences in terms of what gives them fun (Choi et al., 1999). The table below shows that what kind of issues teachers considered. According to Table 1, preservice teachers take care of motivational elements, usability, and the ability of improving thinking skills, attractiveness of scenarios and interface and time. It is seen that according to the preservice teachers, main advantages of strategy games like Age of Empires are acquiring higher order thinking skills, mouse skills, increase motivation and offering real life like environment. Main disadvantages of them are complex structure, complex interface and time.

	Advantages	Disadvantages
<i>Strategy (Age of Empires)</i>	Higher order thinking, motivation, mouse skills, real life like environment	Complex, not usable interface, time consuming
<i>Puzzle (The Incredible Machine)</i>	Critical thinking, simple to complex structure, challenge, curiosity, confidence, problem solving, creativity, control, real life situations	No fantasy elements, navigation problems, static, time consuming
<i>Action/Adventure (Bacteria)</i>	Mouse skills, good scenario	Complex, not include interactivity, hard to control, navigation problem

Table 1. Game Critiques of the Preservice computer Teachers

Preservice teachers stated that puzzle games like The Incredible Machine have some advantages such as improving critical thinking, having simple to complex structure, including challenge, curiosity, control, confidence, problem solving and creativity. However, disadvantages of game genre were reported as including no fantasy elements, being time consuming, navigation problems and unsatisfactory story. Lastly, according to the students, main advantages of action/adventure games were developing mouse skills and including good scenarios. Their main disadvantages were reported as having complex structure, lack of interactivity, being hard to control and navigation problems.

### Game Elements

*Rules:* According to Prensky (2000), rules make games different from each other and provide players ways to reach goal. We divide rules into five categories which are "killing something or someone", "saving something throughout the game", "making right decision", "completing mini tasks progressively" and as the fifth situation "there is no rule" when preservice teachers did not mention about rules and their goals did not give any clue about rules. Designs showed that 8 students did not mention about rules. However, 3 students preferred "killing something or someone", 8 students preferred "saving something throughout the game", 12 students preferred "making right decision" and rest of them with 4 students preferred "completing mini tasks progressively". Apart from these rules, if games are

representation of real life, real life rules are valid for the game. For example the students making a game about traffic rules said that “if a player does not apply traffic rules, s/he can make accident in the game”. Because preservice teachers focused on educational games, they preferred putting rules to improve learners’ critical thinking skills.

*Goals:* Goals are very important motivational elements of games (Prensky, 2000). In our case, scenarios implied 5 patterns for goals. The most favorites among them were “completing to discover somewhere or something” with 11 students. Other scenarios that students prefer designing were respectively “solving or preventing a problem” with 9 students, “reach somewhere without injury” with 7 students, “eradicate enemies” with 4 students, and “collecting something mostly” with 2 students. Many educational games have tendency to force learners to discover virtual environment. When we made content analysis of the scenarios, it was seen that in order to achieve goal, learners have to use information, they learned, in the next steps of the game.

*Outcome and Feedback:* Outcomes can be winning or losing in a game; however in educational games outcomes and feedback are maintained throughout the game (Prensky, 2000). However preservice teachers concentrated on learning outcomes and they are suitable Gagne (as cited in Rogers, 2002)’ classification; attitudes (moral or social development), motor skills, verbal information, cognitive strategies (drill and practice) and intellectual skills (critical thinking, problem solving). Results revealed that 5 scenario included “attitude”, 2 scenario included “motor skills”, 12 scenario included “knowledge”, 12 scenario included “drill and practice” and 9 scenario included “critical thinking and problem solving” outcomes. Because games including drill and practice provide immediate feedback to learners, students might have not mentioned about giving feedback separately. Besides, majority of the students (n=7) who stated “knowledge” as outcome preferred giving information as clue. It is clear that feedback should be used as an instructive component in educational games.

*Problem:* Prensky (2001) divided problems which should be solved in a game under four categories; competition, challenge, opposition and conflict. In our case, most of the students (n=26) selected “challenge” with some specific components as a problem. Other choices were “opposition” (n=4) as fighting someone or something, “competition” (n=2) with real person or computer and “conflict” (n=1). Because learners have to complete tasks in a level or solving problems to pass other part of the game, students emphasized challenge as a problem of games.

*Interaction:* In commercial games interaction is provided mostly by multiplayer design. In our case, preservice teachers preferred mostly single player game design, while 25 students chose designing a single player, 3 students designed multiplayer game. However, when they were making critique about games we also asked whether they prefer playing multiplayer or single player games, 20 of them stated that they would prefer multiplayer games for education. This difference may be due to they did not see themselves as sufficient for developing a multiplayer game.

*Representation or Story:* According to Prensky (2001), representation can be any story element of a game. This can be topic of the game too. In our case, because of several topics like space, discovering a place, biology, electronic or social sciences, we did not have any classification for topics. However, we analyzed player role and representation of game world, Alessi and Trollip (2000) classified scenarios into three types; intrinsic, related and arbitrary. We used this division to reveal player roles. In intrinsic scenarios, scenario and player activities are identical, in related scenarios player influences the scenario, in arbitrary scenarios, learning goals and scenario are not related. In intrinsic scenarios player takes *explorer role* and in related scenarios players are *decision maker role*. Also they divided the reality levels of games into three. In *real scenarios*, player the game world really exist in real world, in *unreal scenarios* although game world and players really exist in real life however in different forms, in *fantasy scenarios*, on the other hand, game environment and people come from imagination. In our sample, role of the player and game world were emphasized more than other dynamics and their player role and game world definitions fitted with Alessi and Trollips’ classifications. In the study, 16 scenarios assigned player “explorer” role whereas 12 of them assigned “decision maker” role. Representation of game worlds showed that 8 scenarios include “real”, 19 scenarios include “unreal” and 1 scenario includes “fantasy” worlds. Because educational context requires real life connections, fantasy like scenarios might not be considered as suitable representation of game world or scenario.

## **Other Elements**

*Target group and game play time:* Alessi and Trollip (2001) stated that most of professional educators do not find games appropriate for adults. Can and Cagiltay (2006)’s study showed that 80% of 116 preservice computer teachers

think that game is for all age groups and 86% of them disagree that game is for only children. In our case, 8 students designed games for adults and university students, 9 of them designed for secondary school students and 11 of them designed for elementary school students. These results reveal that students as the educators of future thought that games are suitable for both adults and children. Game playing time is another issue and only one student stated that his game would be played in a lesson as a main tool while 27 of them stated that their game can be played as a complementary activity which should be supported by instructional strategies.

*Previous games and technical knowledge:* We asked students whether they were influenced from their previous game experience while designing their scenarios. The results revealed that 11 of them influenced from games which they had played before. However, 17 of them said they were not influenced. Students who were influenced picked game names such as “Age of Empires”, “Still Life” and “Prince of Persia”. 7 students stated they were influenced their technical knowledge and 13 of them stated game development environment influenced their scenario. Some of them (n=4) said that because game development environment only permits shooter like games, they think that they should design a game suitable for first person shooter. Results implied that technical background and game development environment might influence both scenario and genre of games.

Students also were asked if their technical knowledge would be enough, what improvements they would like to do for their game. 8 of them stated they would make “more attractive” content representation and interface, 7 of them stated they would make “multiplayer or more interactive”, 5 of them “more realistic” environment, 6 of them stated they would put “more content” and 13 of them “more motivational elements” like fantasy, challenge. Although almost all of the students used at least one motivational element, most of them also wanted to improve motivational elements. According to Malone and Lepper (1987)’s motivational elements, games provide challenge, curiosity, control and fantasy. Students actually used “challenge” (n=15), “control” (n=12), “curiosity” (n= 8), and “fantasy” (n=8) as motivational elements. These results emphasized importance of motivational elements to attract learners in educational games, which seem to have less fun elements than commercial games.

*Social and cultural issues :* In scenarios students reflected some issues peculiar to Turkish culture. For example, one of them designed his strategy game by Gallipolis War, other one was “get to know Hittites”, two of them picked their scenarios as “bird flu” recently influenced Turkey, and one of them designed a scenario discovering Mausoleum of Atatürk in Ankara, which in school trips children visit mostly. Hence, it seems that social and cultural issues influence scenarios in some extent.

## **Discussion and Conclusion**

Reflections about games showed concerns were about motivational elements, attractiveness of scenarios and interface, how they improve thinking skills and usability. They mostly tackled with motivational issues and they concentrated on challenge and control as motivational elements, because they might think challenge to improve critical thinking skills and control provides to learn with their own pace. Reiber et al. (2001) concluded that children especially interested in *story of game, challenge, competition and their favorite subject matters* and in our study most preservice teachers selected challenge as problem. They also stated literature supporting the opinion of challenge is important part of the game. So, it is clear that challenge, or other motivational elements like competition are important for educational games both for designers and players.

Results showed that students in some extent are influenced by their previous game experiences. When they were asked what they would do if their technical background is enough for designing game like learning environment according to their scenarios, some of them stated that they would design a multiplayer game. While designing appropriate educational games, educators might prefer that students deal with only computers instead of their friends. Educational context might be forgotten or not be taken into consideration by students in classroom activities. These issues might have direct influence on students’ opinions in terms of educational games’ characteristics about single or multiplayer. Also, because game development tool (Unreal 2004) is difficult for students, they might have considered that they cannot handle to design a multiplayer game.

Attractiveness of interface and story is important for student, some of the preservice teachers stated they could do more attractive. Realistic platform were students’ another concern. For example, physics rules in game must be real life like in students’ opinion and they see it as an advantage of game. While they examine action adventure game, which is a good example for fantastic scenario, most students complained that game is not related with its story.

Although the game is related to biology, its only function is shooting the viruses, and students stated that it have no educational context. Representation of world of part showed that an educational game story and context must be related with the educational goals of game. A previous study showed that almost all of the students thought that game must have realistic goals to be effective (Can & Cagiltay, 2006). Almost all of the students designed their games as complementary of school activities, they might think that giving all content by game is difficult and it's not funny, actually it must be revealed that how games can be made more suitable for main instructional tool.

As a result preservice computer teachers in our case were affected negatively by technical issues and game development environments' limitation, and previous game experiences in some extend. Some of them wanted to design games like they played before, and if they cannot put any component they desired, they think that it is fault of their technical knowledge. Teachers must be supported for their efforts to create rich learning environments and their opinions and designs must be taken into consideration to make effective educational games.

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