

GENDER AND GAME PLAY STYLE AND ATTITUDES : A Six Game Analysis

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This study compares gender and age (5th and 8th graders) reactions to game play experiences during the Space Pioneer Learning Adventures Game Design Camp. The research is part of Girls As Designers, a National Science Foundation funded research project directed by Carrie Heeter, Rhonda Egidio, and Punya Mishra at the Michigan State University Communication Technology Laboratory, College of Education, and Mind Games Collaboratory. The analysis distills and extends an M.A. thesis by Kaitlan Chunhui Chu.

RATIONALE

Computer games are increasingly being called upon to engage young learners and to advance science learning. But are they effective in promoting science learning among girls? Computer games, usually designed by young men for boys and other young men, epitomize technology's exclusion of girls, their interests, and their values. Less obvious but more devastating, this technological estrangement exacerbates girls' lack of interest and self confidence not just in computers specifically, but in science generally. Technology itself, and even the design of technology-enhanced science experiences, may disadvantage girls, turning them away from science, math, engineering, and technology fields instead of engaging them.

This research examines the assertion that girls are disadvantaged by today's games, reacting negatively to computer technology as well as to the games themselves. As educators begin to use games for teaching about science, girls' general negative reaction to digital games may further interfere with engaging girls in science. This research looks specifically at reactions to playing six different games during a two week space-learning and game design camp. Commonalities and differences in reactions by girls and boys and by 5th and 8th graders to game play are examined. The analysis considers game features such as genre (commercial versus academic), goals, play style, suitability for learning, and motivations for space exploration. Quantitative analysis of six surveys is combined with qualitative analysis of observation of 48 game play sessions and 48 focus group interviews.

SPACE PIONEER LEARNING ADVENTURES

Space Pioneer Learning Adventures was a two-week camp in which 20 girls and 22 boys participated (isolated by gender) to learn about space exploration by playing six computer games, watching NASA video clips, participating in a Challenger Center simulated mission, and taking part in other technology-mediated space learning activities. They participated in guided brainstorms to envision a space-related educational game designed to motivate children, like themselves, to want to become space scientists. The camp took place in Michigan in the summer of 2003.

Camp setting

Ten 5th grade girls, ten 5th grade boys, ten 8th grade girls, and twelve 8th grade boys were recruited from the greater Lansing area of Michigan. Participants were separated into five or six person teams of the same sex and same grade (e.g. two 8th grade boy teams, two 8th grade girl teams). Each team was assigned a same-sex teacher-facilitator who guided activities and discussions, and two same-sex researcher-observers who took notes of everything that occurred and was said. Participants, teacher-facilitators, and researcher-observers remained with the same team throughout the camp. After each camp event, child participants first completed a short individual written survey followed by a focus group discussion within their team, facilitated by their teacher-facilitator.

Focus groups

Focus Group interviews were moderated by the teacher-facilitators working from a specific set of questions for each game experience.

Initially, the researchers intended to ask ten nearly identical focus group questions after every camp experience. The 8th grade boys rebelled so strongly that the male teacher-facilitators requested that camp organizers change the focus group questions to make the experience less repetitive. Girl teacher-facilitators did not report problems with the repetitive focus group discussions. But changes were made for all groups to accommodate the boys but retain consistency of data collection across the 8 groups.

Four common questions were retained across every focus group interview. 1.) Let's go around the team and briefly state something you thought was good about this game. 2.) What was something you did not like about this game? 3.) Was this game a good way for you to learn? Why or why not? What could make it better? 4.) Did this game give you any brainstorms for the space learning game you were creating? What were they? Other questions related to the particular game were also asked, often related to motivations and personal interest in different aspects of space exploration.. Moderators were encouraged to prompt with follow-up questions if it seems the children had more to say on a topic.

Teams played the games in their team groups. The teacher-facilitator introduced each game by reading a short prepared script. For complex games, particularly *Galactic Civilizations*, participants were given printed instructions developed specially for the camp. Each game session was scheduled to last one hour, including the time to complete a written survey and conduct the focus group interview. Each child had her/his own computer with the game installed.

Throughout the game sessions, one game expert from the research team stayed with each group to help solve game play problems or technical difficulties. With 8 teams and 6 game or game-like experiences, this report synthesizes a total of six written surveys and 48 focus group discussions. Two different researcher-observers for each team took notes throughout the camp, including notes on what was said, by whom, during game play.

The researcher-observers were instructed to take verbatim notes on the focus group interviews. The analysis looked carefully at both sets of notes for each of the 8 child group's focus group to obtain as complete and accurate a representation of the interview as possible. Some notes were more extensive and verbatim than other notes. Where necessary for coherence,

missing words were added by the authors to facilitate the flow and flavor of the report. Every effort was made to retain the intent, style, and essence of children's comments.

Initially all 48 focus groups were analyzed separately, synthesizing and summarizing what was said and including extensive short direct quotes by participant, by name, using traditional focus group analysis methods. The result was 48 richly detailed individual reports of the eight separate gender and grade isolated team discussions following each of the 6 game play experiences.

In her 195 page MA thesis, Chu (2004) synthesized a cross-group comparison section for each game, discussing overall observed trends by gender and grade. For each game she created a chart of side by side gender comparisons, separated by grade and divided into the focus group questions for that game. She then summarized grade and age specific commonalities and differences, followed by the in-depth reports on each groups' focus chat including extensive quotes from participants.

In the current manuscript Heeter and Chu distill the findings much further, seeking to discern and report meaningful, characteristic gender and grade reactions to the games. A subset of rich quotes are included to retain the flavor of focus group research and to enhance the vividness of the observed results for the reader. The identity of the child associated with each quote is not reported, instead only their gender and grade are mentioned. This is done to help the reader focus on gender and grade differences without having to remember the name, gender and grade of 42 respondents.

Short written surveys were completed each child immediately after each game and before the focus group to assess individual responses without the peer influences common to a focus group discussion. Analysis of two questions for the survey are reported for each game. 1.) How fun was it to play [game name]? (The five point scale ranges from Very Fun to Not Fun at All.) 2.) Are games like this a good way for you to learn? (The five point scale ranged from Very Good to Not Good At All.)

The researchers also informally scanned Researcher-Observer notes about the game play experiences, looking for observations of actual play which supported, contradicted, or added new insights to the focus group findings.

Individual results are reported for each of the six game events in the order they were experienced at camp, followed by a comparative synthesis. Each event began with descriptions of the game's content, particularly elements that the participants discussed, and a screenshot of the game. This report synthesizes an enormous amount of data.

THE GREAT SOLAR SYSTEM RESCUE

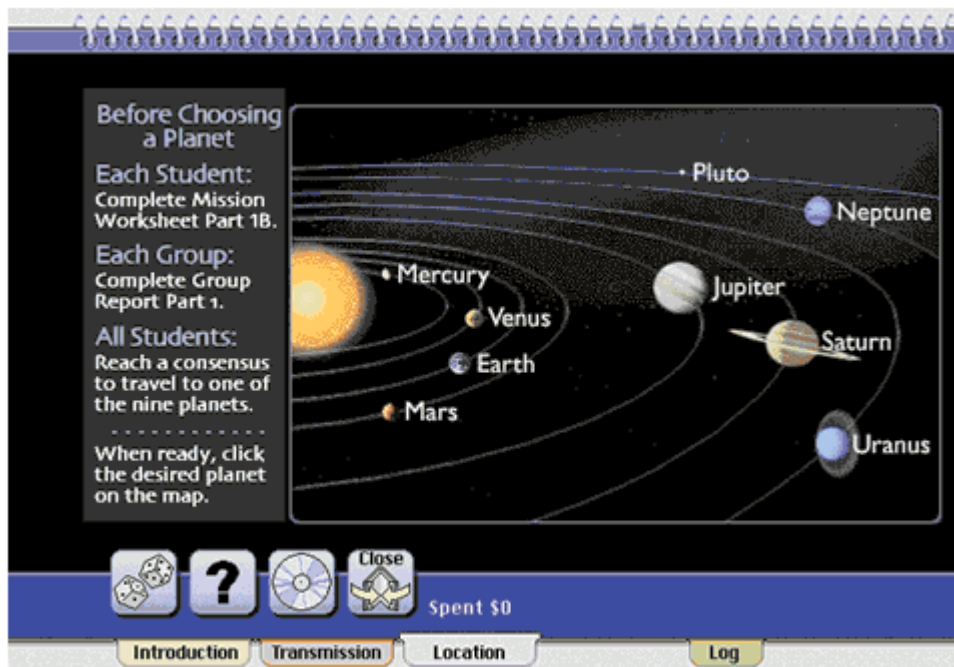
ABOUT THE GAME

The first game the participants experienced at the camp was *The Great Solar System Rescue*, a collaborative, educational role playing game sold by Tom Snyder Productions, targeting children in grades 5 to 8. Each group member role-plays a different character -- one Commander (Captain) and four experts (Astronomer, Geologist, Meteorologist, and Space Historian). Each expert reads their own player manual containing data exclusive to that expert's knowledge base. Players share their specialized information with the group and the

Commander makes final decisions at various choice points. Each team shares one computer. The Commander controls the mouse.

The game starts on a spaceship as a robot-voiced computer assistant guides the team through the game. The five scientists are gathered by Starfleet to rescue four probes lost throughout the Solar System. Clues revealed in video clips are the last transmissions from the probes. By analyzing clues, the team must identify and travel to the location of each lost probe (Figure 1), and decide on a proper rescue plan after conducting experiments to evaluate local conditions. The players are told everything has a cost, and are reminded to spend as little money as possible because excessive spending would motivate the government to cut Starfleet's budget. After the team selects a rescue plan, the computer assistant verbally confirms the plan and describes whether the probe was successfully rescued. A video clip shows the outcome of the rescue attempt.

Figure 1: Great Solar System Rescue



Students must find and rescue probes lost in our solar system.

SURVEY RESULTS: How did participants react to this game?

Table 1 How fun was it to play The Great Solar System Rescue?

Female		Male		2 WAY ANOVA (n=41)				
5 th	8 th	5 th	8 th	F	P	Gender	Grade	Interaction
4.90	4.30	3.90	3.18	3.0	.035	.014	.116	.886

Fifth grade girls rated The Great Solar System Rescue game a nearly perfect score for fun. The average across all ten 5th grade girls was 4.90 on a scale from 1 to 5 with 5 being very fun and 1 being not fun at all. Eighth grade girls were also enthusiastic, though not quite so high as the 5th grade girls (4.30). Girls enjoyed playing The Great Solar System Rescue significantly more than boys did. The grade difference was not significantly different, though the trend was for 5th graders to rate the game more highly than 8th graders.

Table 2 Are The Great Solar System Rescue TEAMS a good way to learn?

Female		Male		2 WAY ANOVA				
5 th	8 th	5 th	8 th	F	P	Gender	Grade	Interaction
4.60	4.50	4.44	2.82	5.70	.003	.018	.025	.046

Fifth and 8th grade girls and 5th grade boys enthusiastically rated the use of teams in *The Great Solar System Rescue* as being good for learning. All three group averages were near 4.5 out of 5. The exception, a significant interaction effect, was the disagreement by 8th grade boys whose average rating was only 2.82.

FOCUS GROUP AND OBSERVATIONAL RESULTS

How did participants respond to different game features?

General Likes and Dislikes

The Great Solar System Rescue strongly appealed to girls in both grades and to 5th grade boys. The two most liked aspect of the game for all three of these groups were teamwork and researching and learning about planets. (Learning was considered fun!!!)

5th graders agreed with each other they expected the game to be boring but were surprised to actually enjoy it. Eighth graders wanted a more complicated the game: the girls would like to lengthen the game and ask more questions; the boys would increase the challenge by requiring keyboard controls, having a bigger game world, and developing a more complex storyline.

Teamwork

Participants in each grade and gender said they liked being part of a science team. One 5th grade girl said that she liked “working as a team instead of fighting over what’s best.” A 5th grade boy said he enjoyed “conquering the challenge” as a team.

Although most participants strongly liked the teamwork aspect, some 8th grade girls expressed a desire to also explore individually. Two 5th grade girls complained their group was slowed down because of one member. Some 8th grade boys enjoyed teamwork but many wanted to play individually. They even suggested simulating other team members on the screen so that each person can play individually. Several 8th grade boys didn’t like working as a team because “it takes too much effort to coordinate.”

Table 4: Solar System Rescue Game Play Statistics

	AG	SS6	FE	RL	DE	KA	CH	NJ
Time spent	NA	20	20/20	40	38	30	25	20
Concern over \$	Yes	Yes	Yes	Yes	Yes	Yes	No	No
Mistake made	1	0	0/several	1	0	0	0	several

Time spent on a mission ranged from 20 to 40 minutes. Some teams finished naturally and for others the camp schedule forced them to hurry and finish, depending on the speed they played the game but also on whether they were already behind schedule from previous activities. The three teams that spent the longest (two 8th grade girl teams and one 5th grade boy team) had a leader who adopted a group dynamic of systematically soliciting input from every team member before making a decision.

Navigation and Instructions

Most girl teams did not make any mistakes while most boy teams made at least one mistake. All girl teams and most boy teams consulted the instructions and science notebooks. One 5th grade boy team played a perfect round making use of the notebooks and had time to play a second round in which they only guessed (and made many mistakes). In the focus group they talked just guessing being more fun, but less effective. One 8th grade boy team guessed from the beginning and made multiple errors.

5th grade girls and boys both disliked getting lost while trying to play. 8th grade boys and 5th grade girls proposed controlling their vehicles with keyboard or through a game interface

Players, NPCs, and Character Design

Within the game, five specific roles were assigned, one to each player on the team. After playing girls were more likely to say they prefer scientist positions (geologist, meteorologist, astronomer) rather than leadership positions, while boys more often wanted to be captain or commander.

Some 8th grade boys and a one 5th grade girl liked the artificial intelligence and talking robot, while 8th grade girls disliked the robot voice. 8th grade girls did not appreciate being tricked by the computer assistant. Some of 5th grade girls complained the video talked too fast and too much, and they were unhappy that the NonPlayer Character (NPC) did not help them find the right answer. Girls of both grades expected more cooperation than they received from the NPC.

Backstory, Game Rules and Goals

All of the girl teams and the 5th grade boy teams expressed repeated concern about spending money (following the game's instructions to spend as little as possible). One 8th grade girl group talked about integrating budgetary constraints into their own game. A 5th grade girl team considered including the idea of getting rich not so much as a constraint while playing but as a reward when you win the game.

Eighth grade boys did not worry about cost and noticed that there was no actual penalty for overspending beyond the admonition not to do so. In the end, one of the eight child

envisioned games was based on making money. It was an 8th grade boy game (The Race to Save Humanity) closely based on the existing commercial game, Moon Tycoon.

A common theme the 5th and 8th grade girl teams talked about including in their own designed games was the idea of finding targets or rescuing something. Boys did not discuss this.

At the end of camp when teams presented their final game designs, one 5th grade girl group's game (The Great Probe Mission) was based on finding probes lost on every planet in the solar system, very parallel to the idea of Great Solar System Rescue but with the twist that probes were probably stolen or hidden by different aliens on each planet or moon.

Graphics & Video

Boys of both grades noticed and commented "the graphics and video clips of clues were cool." 5th grade boys liked the realism. 8th grade boys wanted more video simulations. One 5th grade girl asked for a better-looking probe.

Aliens

In the discussion immediately following The Great Solar System Rescue, one 5th grade girl group would like to improve the game by including "aliens chasing after players", while the 8th grade boys proposed having "aliens guarding the probes" and players being able "to shoot at aliens". Another 5th grade girl group wanted the game to "go through different levels to find aliens or robots and get them home."

What learning, space, and science related reactions did participants have?

Learning from the Game

All groups except the 8th grade boys regarded the game as a good way to learn. All four girl groups and most 5th grade boys found it fun to research and learn facts from the player manuals. One 8th grade boy reported liking recording all the stuff. Fifth grade boys suggested they learned about astronauts' jobs, planet facts, and spending money wisely.

8th grade boys are the toughest audience for educational games. They commented: "this game may be good for kids or science classrooms, but not for us because it is too boring and lacks violence." Some boys said they "would not even use it in the classroom." Only one 8th grade boy suggested it could teach logic: "you can test different hypotheses about what could be wrong. "

Some boys, mostly 8th graders, didn't like having to take notes and read through the player manuals to play. One 5th grade boy preferred being the captain partly because that role doesn't require reading.

Interest in Science Careers

Counter-stereotypically, all of the 8th grade girls expressed interest in careers in NASA or Starfleet, compared to slightly less than half of the 8th grade boys. This trend was reversed for the 5th graders. More than half of the boys in the 5th grade would like to work for NASA or Starfleet compared to only one 5th grade girl.

Other Science-Related Observations

Both girl grades wondered if there is a real-life probe or ship in space right now in need of being rescued.

SPACE ACADEMY GX-1

ABOUT THE GAME

Space Academy GX-1 is an educational, single-player computer game sold by Riverdeep. It targets children aged 8 to 12, or grades 2 to 6. In the intro animation, the Academy is depicted as “out in space in orbit around the Earth”. Upon initial log in, players choose whether to be a cadet or to accept the default identity, Admiral. There is no representation of the players in any form throughout the game except for names in the text. Game play is identical whether the player picks Admiral or Cadet. Non-player characters (NPCs) dressed in space academy uniforms do appear right-top corner of each screen dressed in space academy uniforms. NPCs give verbal feedback about player performance.

The game consists of three mini games. Our child players were advised to try the mini-games in the following order: Gravity Pilot Trainer, Earth Sun Moon Simulator, and finally, Planetary Data Center. In Gravity Pilot Trainer, the player adjusts angle and thrust to launch rockets or satellites to attempt to achieve a specified goal in sequence of scenarios. If angle and thrust are correct, the launch succeeds. If either one is incorrect, the launched item crashes or drifts away into space. After a few failures, an NPC offers suggestions, such as “try another angle” or thrust. If the player still makes mistakes, the game blinks the right answer for 3 seconds, and then reverts to the incorrectly chosen setting.

Earth Sun Moon Simulator is a simulator, not a game. (There is no way to win or lose, no goals or rules.) Players change the rotation and revolution of Earth and other planets and read about dramatic changes in seasons and weather which would exist on those worlds under different rotation speeds and angles.

The third section is Planetary Data Center (Figure 2) where facts about the Solar System are provided, then players are tested with multiple choice questions. The feedback for a correct answer is always an animation of a spaceship setting out to the destination planet.

Figure 2: Space Academy GX-1 Planetary Data Center



SURVEY RESULTS: How did participants react to this game?

Table 5: How fun was it to play Space Academy GX-1?

Female		Male		2 WAY ANOVA (n=41)				
5 th	8 th	5 th	8 th	F	P	Gender	Grade	Interaction
4.80	3.70	3.80	3.27	3	0.044	0.065	0.037	0.451

Fifth grade girls had much more fun playing *Space Academy* than any of the other groups, while 8th grade boys had the least fun. The 5th graders enjoyed it significantly more than 8th graders did. The tendency for girls to enjoy the game more than boys did approach significance.

Table 6: Is Space Academy GX-1 a good way to learn?

Female		Male		2 WAY ANOVA (n=41)				
5 th	8 th	5 th	8 th	F	P	Gender	Grade	Interaction
3.30	4.22	3.50	3.27	.874	.463	.422	.457	.221

For girls, whether a game is fun is a different issue than whether it is good for learning. 5th grade girls regarded *Space Academy* as extremely fun but not overly good for learning. 8th grade girls felt the game was not as fun as 5th grade girls did, but they felt it was better for learning. For boys, learning and fun were more closely related and neither dimension was particularly strong among boys for *Space Academy*.

FOCUS GROUP AND OBSERVATIONAL RESULTS

How did participants respond to different game features?

General Likes and Dislikes

Among girls, Gravity Pilot Trainer and Planetary Data Center were the favorites, with more 5th graders preferring the former and more 8th graders the latter. They liked reading the facts and answering questions in the Planetary Data Center.

Most boys liked Gravity Pilot Trainer because “you got to shoot at something” and did not like much else about *Space Academy*. A few 5th grade boys liked the Sun Earth Moon Simulator.

Navigation and Instructions

Both grades and genders liked that the idea of training as part of game play. They like that the game required players to “be trained for awhile before they get to go to outer space.” Most groups talked about possibly incorporating training sessions into their own games similar to those in *Space Academy*.

Players, NPCs, and Character Design

Both female and male 5th grade groups talked about allowing players to choose jobs or equipment in their games.

Most of the groups dismissed the NPCs in *Space Academy* for being too talkative or trying too hard to speak in a “cool” way.

Backstory, Game Rules and Goals

Boys wanted to see more action and weapons incorporated into their game. Rockets and missiles were important to them in any game, including the game they were designing.

The craving for more shooting and action was not observed in girl’s discussions, with an exception of one 5th grade girl who wanted to be able to shoot asteroids.

Difficulty Level

Not surprisingly given that *Space Academy GX-1* is targeted at grades 2 to 6, the 8th graders complained it was too easy and boring. In addition, although within the age target of the game, some of the 5th grade boys considered it too educational and easy. They would like their own games to be more challenging. Fifth grade girls, in contrast, found the game well planned and exciting.

Girls liked that the game offered different levels of difficulty to accommodate different player abilities, and hoped their games would include this aspect too. Boys did not specifically mention the desirability of adjustable difficulty levels.

Aliens

An 8th grade boy proposed their game would “shoot missiles at aliens using fuel-efficient angles”.

What learning, space, and science related reactions did participants have?

Learning from the Game

Both girl and boy 8th graders liked the idea of requiring players to answer questions in order to proceed in their own game designs. Boys did notice they could learn facts from reading, but that was the game’s learning value, not something that made it fun.

Gravity Pilot Trainer was mentioned as being good for learning, but it wasn’t the first thing they thought of as fun. 8th grade girls have a generally favorable attitude towards games for learning. One girl commented even though she didn’t like Space Academy, “computers games in general” are good learning tools.

Most participants perceived learning value in *Space Academy* (the average rating was higher than 3 on a scale where 5 equals very good for learning). The 5th graders and 8th grade girls liked learning about planets and reading the facts. The 8th graders reported learning about “angles, thrust, and trajectories” in Gravity Pilot Trainer.

Interest in Attending a Real Space Academy

Most 8th grade girls and half of the 8th grade boys would like to attend a real space academy. Eight of the ten 5th grade boys would attend a real space academy if one existed, compared to only one 5th grade girl who definitely would do so and three others who said maybe. More 5th grade boys would consider pursuing a real-world job doing what they did in the game than 5th grade girls would, mainly for the Gravity Pilot Trainer. 8th graders weren’t interested in those specific jobs.

Most groups imagined a real space academy would focus its training on space sciences. Students would “still have do homework,” sit in chairs, and learn math and science. The 5th graders worried a real space academy might be dark or cold because it would be in space. It would be “five million times more fun and five million times more expensive.” An 8th grade boy pointed out “there would still be pranks.” 8th graders of both genders were concerned that they might not see family and friends often.

LIFTOFF

ABOUT THE GAME

Liftoff is an educational computer game created by Entertainment Technologies Inc. (ETI) for children in grades 4 to 7. The player is a trainee in an astronaut training program. The game includes various mini games, but participants were encouraged to start with “Launch

Simulator". They were also invited to explore other sections such as "Assemble Spaceship", "3D Crew Area", "Space History" or "Astronaut Nutrition".

Launch Simulator (Figure 3) has 11 training sequences where players must follow steps in order to operate a space shuttle successfully. Directions must be carried out at precisely the right moments during the launch sequence to perform each required action. An Event Timer controls the launch sequence, which parallels real world space shuttle launch timing. As they would have to during a real launch, players must wait for the proper moment to perform the tasks for their role. Successful launch sequences last 10 minutes or more. There are no player avatars or visual representations of NPCs. All instructions and feedback are communicated via computer voices.

The player acts as the Commander, with an unseen NPC Pilot sitting offscreen to their right. Frequent three-way communication among Houston, the Commander, and the Pilot dramatize the launch and move game play along. The Pilot reads aloud the flight plan (step-by-step instructions appear on the lower part of the screen) and the Commander (the player) executes the steps.

The main (unseen) NPC, a male Training Supervisor, gives a detailed briefing of the interface at the start of the game. The Training Supervisor also praises or corrects the player's actions. Failure to perform a needed operation at the correct time results in launch failure and the player must start over from the beginning.

The Launch Simulator interface is modeled after the real space shuttle control panel including screens with buttons, switches, a keypad, and CRTs (computer screens). If players are lost, clicking on a "Show Me" button rapidly flashes the correct series of operations to be performed at that point in the launch simulation.

Figure 3: Liftoff Launch Simulator



SURVEY RESULTS: How did participants react to this game?

Table 7: How fun was it to play Liftoff?

Female		Male		2 WAY ANOVA (n=41)					
5 th	8 th	5 th	8 th	F	P	Gender	Grade	Interaction	
3.90	4.44	3.80	3.56	.720	.548	.307	.754	.413	

Liftoff was more fun for 8th grade girls than other groups. Beyond that group’s unusually strong liking of the game, there were not gender or age differences.

Table 8: Is Liftoff a good way to learn?

Female		Male		2 WAY ANOVA					
5 th	8 th	5 th	8 th	F	P	Gender	Grade	Interaction	
3.70	4.89	4.25	3.44	2.235	.106	.364	.695	.049	

Both 8th grade girls and 5th grade boys found the learning value of *Liftoff* to be higher than its fun value.

FOCUS GROUP AND OBSERVATIONAL RESULTS

How did participants respond to different game features?

General Likes and Dislikes

The focus groups mainly talked about the Launch Simulator component of *Liftoff*.

Navigation and Instructions

One or more members of every group complained that the instructions could not be repeated. Those who complained apparently did not notice that the instructions were displayed in a separate screen at the bottom of the interface, available to be read at any time.

Girls expressed a need for more instructions before and while playing *Liftoff*. Eighth grade girls emphasized a desire to understand the mechanism behind the buttons, instead of just being told what button to press and when to press it. Some of the 8th grade boys proposed to eliminate instructions completely, forcing the players to memorize every step and complete the launch from memory without hints.

Some 5th grade girls discussed the importance of an in-game tutorial like the Briefing in *Liftoff*, and proposed to include visual assistance like the “Show Me” button in their games.

Boys paid a significant amount of attention to the operation of the space shuttle, and even proposed adopting switches and command keypads into their design ideas. Girls didn’t mention particularly liking any buttons or controls inspired by *Liftoff*.

Players, NPCs, and Character Design

Though they complained about a lack of instructions, some 5th grade girls disliked the Training Supervisor because he talked too much in the Briefing and they would shorten their own game’s instructions.

Instead of merely listening to NPCs in audio form, 5th grade boys suggested displaying instructions in split screens with visual images.

Backstory, Game Rules and Goals

Eighth graders discussed the pros and cons of the way the Launch Simulator handled time. Players had to keep up with events following a real time clock and if they fell behind, the launch failed and they had to start over. Eighth graders felt the time element made the game more interesting; however, many other participants, including 5th grade boys, reported impatience at waiting for events to occur.

Eighth grade boys expressed disappointment that they were not able to kill or destroy something. They wanted more explosions, proposed a “Launch Crash Simulator”, and imagined a scenario in which the characters might be “sucked into the sun.”

All groups except 5th grade girls talked about incorporating assembly of space shuttles or vehicles into their game designs.

Fifth grade boys talked about integrating mini games to their games.

Challenge/Difficulty Level

Just the right amount of difficulty in a game is complicated to achieve. There were different opinions about the game being difficult among the girls and 5th grade boys. Some of them liked Liftoff because it was challenging while some of them hated it because it was too hard. Some said once they got over the learning curve it was fine.

During final presentations, a boy in a 5th grade group said to the audience, “our game is going to be hard. If you’re looking for an easy game, you’ve come to the wrong place.” Eight grade boys wanted to make Liftoff harder. They suggested forcing players to memorize the rules, and making the game more complicated.

Girls liked that the game was hard, especially when it was hard but then they received help from the game and understood what to do. One 8th grade girl “prefers challenging games over easy ones,” yet another disliked Liftoff because it was hard to understand. Girls seem to dislike games that are hard for the wrong reasons, such as because instructions are unclear rather than the task itself being challenging.

Throughout the camp 8th grade boys often complained about games and activities, including Liftoff, for being “childish.”

Graphics & Video

Both grades of boys expressed appreciation that the space shuttle was realistic.

Three boys and one girl (representing three of the 5th grade groups) independently wished there was a way for players to see the liftoff from outside the shuttle rather than only having a single perspective from inside the cockpit.

What learning, space, and science related reactions did participants have?

Learning from the Game

The focus group reactions to Liftoff gave a different impression than the survey results about how good Liftoff was for learning. 8th grade girls who had the highest average rating in the survey were more varied in their replies in the focus group. Many said it was good for learning but some complained there was no explanation of what the buttons did, and that they were not learning about real space.

Fifth grade girls and boys were mixed in their response. Some liked that you “experienced working on a space shuttle” while others complained it was boring. Echoing the 8th grade girl complaint, a 5th grade girl said it was not good for learning because “you only pressed buttons.”

Despite lack of enthusiasm in the survey results, all of the 8th grade boys in the focus group said Liftoff was good for learning. Most participants believed that “getting trained to fly a space shuttle” was the most valuable lesson learned in *Liftoff*. Although 8th grade boys criticized *Liftoff* more than they complimented it, both groups of 8th grade boys agreed *Liftoff* was a good way to learn. Comparing the good-for-learning average rating across the six games, Liftoff was rated the highest of any of the games by 8th grade boys.

Among the girls who didn't think of *Liftoff* as a good way to learn, the main reason was "all we did was press buttons", while for boys it was due to boredom.

Most groups complained about the long periods they had to wait in the Launch Simulator between commands while the launch sequence timer reported simulated elapsed time, although several others mentioned this time aspect helped with understanding what real launch sequences are like.

NEOPETS

ABOUT THE GAME

Neopets is an online multiplayer game with approximately 23,000,000 subscribers worldwide. It is aimed at youth, and subscribers are 57% female, with 39% of subscribers under 13 years old, 40% 13 to 17, and 21% 18 and older (*Neopets* online press kit). Subscription is free because the game site is advertiser-supported. *Neopets* is not a learning game, but was included to expose the teams to an online multiplayer game experience (and a game which appeals strongly to girls), to help with their own thinking about an ideal game.

Play begins with creating one's pets (Figure 48), including choice of name, species, color, gender, personality, strengths, and weaknesses. The owner is in charge of their pets' basic needs such as well-being, hunger, intelligence, and mood. If it does not receive proper attention, a pet gets sick.

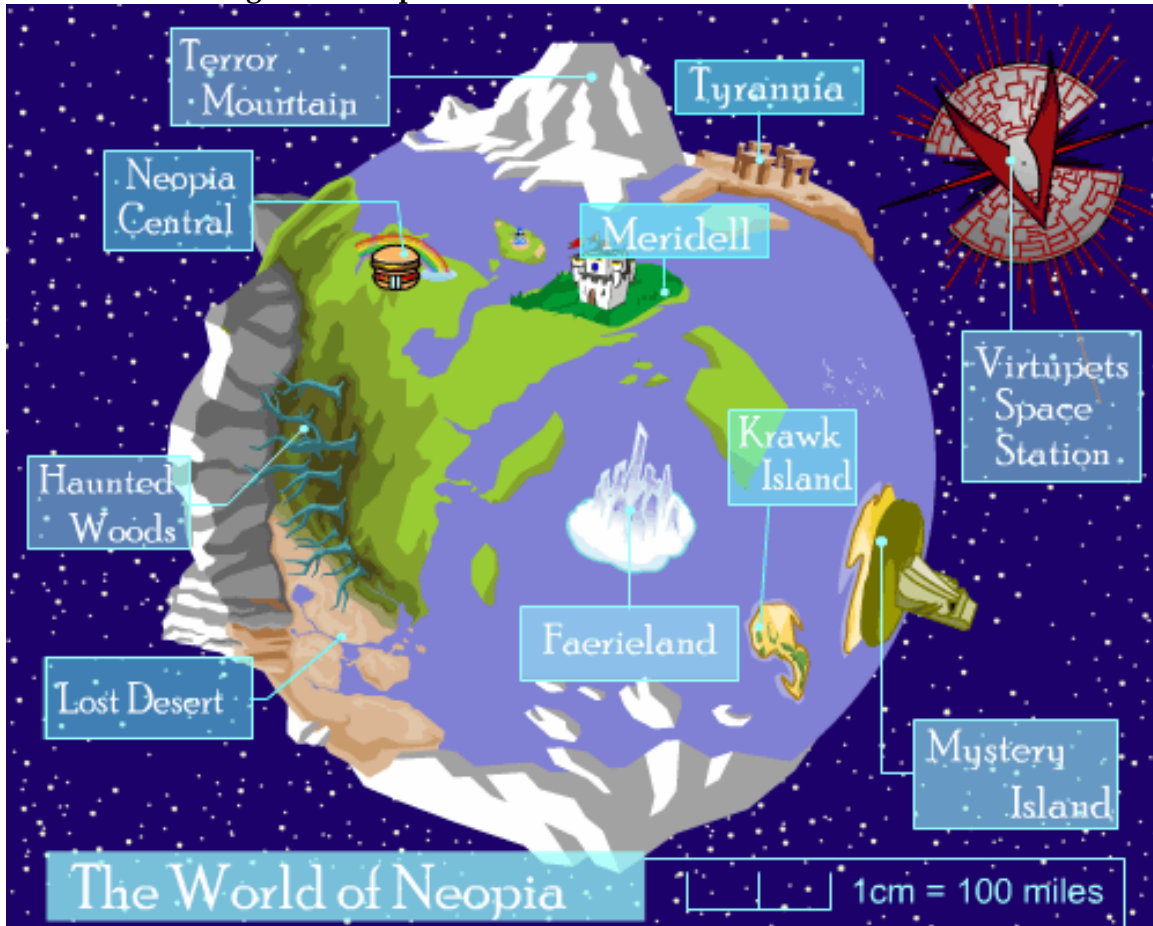
Figure 4: A Sample NeoPet (Zafara species)



In the game world of Neopia (Figure 5), earning money is an initial goal to be able to fulfill the pets' basic needs. One of the main ways to make money is winning mini games. Earning extra money enables players to pursue other goals if they want to, such as competing in the Battledome where players can fight with NPCs or challenge other players' pets, entering contests, playing mini-games, and making more money by investing. Other economic activities in Neopia include selling items in the stores, trading shares on the stock market, bidding on an item in the auction house, or exchanging items with other players at the trading post.

After initially attracting an overwhelmingly female audience, the creators of *Neopets* broadened their market by added select male-targeted features (such as fighting games and being able to choose a pet who likes to bully others and/or greets others by insulting from afar or attacking if they are weaker).

Figure 5: Neopets The Main Menu of the Game World



There are 10 sections to visit in the game world, each containing stores run by NPCs, quests assigned by faeries or witches, and mini games to play.

SURVEY RESULTS: How did participants react to this game?

Table 9 How fun was it to play Neopets?

Female		Male		2 WAY ANOVA (n=37)				
5 th	8 th	5 th	8 th	F	P	Gender	Grade	Interaction
5.00	4.50	3.00	4.20	5	0.007	0.006	0.374	0.036

Girls had significantly more fun playing *Neopets* than boys did. There was also a significant interaction effect. Fifth grade girls loved *Neopets* rating it a perfect 5, while 5th grade boys had the least fun with *Neopets*, probably in large part because they experienced significant computer problems and much of what they tried to play didn't work. Looking across all of the games played at camp, *Neopets* ranked as the 8th grade boys' most fun game.

Table 10: Is Neopets a good way to learn?

Female		Male		2 WAY ANOVA				
5 th	8 th	5 th	8 th	F	P	Gender	Grade	Interaction
3.40	4.00	3.63	3.60	.205	.892	0.874	0.602	0.571

For all groups except 5th grade boys, *Neopets* was considered more fun than it was good for learning. For all groups *Neopets* was a fairly good game for learning even though it is a commercial game not intended to be educational.

FOCUS GROUP AND OBSERVATIONAL RESULTS

How did participants respond to different game features?

General Likes and Dislikes

Neopets' popularity crossed grade and gender, appealing to most of the space camp participants. Some 5th graders had played it prior to camp. No one voiced any real criticisms about the game except for a couple of 8th grade boys who, in the focus group, said they thought it was childish like *Pokemon*. "Childish" seems to be a dreaded putdown among 8th grade boys. Several camp participants including at least two 8th grade boys created their own Neopet accounts at home that night.

Players, NPCs, and Character Design

Girls and 5th grade boy groups discussed having the players in their own game have pets follow them around. Ultimately one 8th grade girl group directly incorporated magic pets as a reward in their game, and both 5th grade girl groups' games included choosing a cute sidekick to accompany you in the game. None of the boy game designs ended up including pets or sidekicks.

All groups discussed integrating various degrees of customizability of their characters into their games, such as a range of selectable pre-designed or customizable characters.

In every group where the researcher-observer noted what gender kids' make their pets, at most of the pets created were of the same sex as the child creating the pet. One 5th grade boy did urge a fellow team member who was creating a new pet to "make him a girl." The proportion was about two opposite sex pets to one same sex pet. 8th grade boys remarked they liked that you could choose your character and your gender. Girls didn't talk about it, they just made some of their pets male.

Backstory, Game Rules and Goals

Many participants mentioned "there are so many things you can do" and "so many places to go" as one of the reasons they enjoyed *Neopets*. Fifth grade girls liked "lots of shops to look at"; 5th grade boys liked the food variety; 8th grade boys praised it as "interactive"; summing up the vast game world of activities and open style of play they appreciated.

All groups welcomed the variety of mini games that *Neopets* provides and some thought about mimicking a similar design in their own games. Eighth grade boys suggested including teleport as ways of navigating among mini game worlds.

Boys and 5th grade girls talked about liking the Neopoints “money system” and they liked playing games for money.

Cuteness and Nurturing

Girls in both grades described taking care of their pets as fun, whereas 5th grade boys found it educational. While playing *Neopets*, girls in each team remarked about how cute the pets were. Nurturing responses were elicited (“oh, that one looks scared, poor thing”). Among 8th grade girls, there was appreciation of the humor: “the names are funny!” “I’ll feed my pet a jalapeno pepper and see if it likes that [laughs] – or should I just feed it healthy stuff?”

One 5th grade boy talked baby talk to his pet, saying “you’re such a cutie... yes you are... yes you are.” Another exclaimed “I love buzz!” Yet a moment later he decided, “I’m going to make this pet really mean, it will bully others.”

8th grade boys enjoyed picking their pets, and fed them in the *Neopets*’ McDonalds over and over. One 8th grade boy explicitly rejected the caretaking role. “It is like being a mommy. I do not like being a mommy so I am going to move to other games to make some money to buy food for the pet.” Being the breadwinner was an OK, indirect, gender-appropriate way to care for his pet.

Fighting

Three of the four boy groups migrated to fighting games after creating their pets. Early in the *Neopets* experience 5th grade boys in both groups said “I want to battle” or “let’s fight.” One 8th grade boy group focused on fighting (“51 people are trying to fight me!” “I am fighting with someone, I don’t know with who.” “Fight me, fight me, hey I challenge you.” “I want you to die.”) Surprisingly, the game that team eventually created was about making money, not fighting. Also surprising, the one boy group which in *Neopets* concentrated on making money and did *not* fight in *Neopets* was the 8th grade group who ended up creating their own game based entirely on fighting aliens.

Crossing gender stereotypes, a 5th grade girl talked about beating mini games as being fun, and two other 5th grade girls played and enjoyed action or destruction games in *Neopets*. 8th grade girls did not play action or destruction games.

Making Money (NeoPoints)

Fifth grade girls enjoyed and talked about making money in *Neopets*. They often mentioned money during the camp. Eighty percent of the 5th grade girls were from low income areas. The first question 5th grade girls asked during a teleconference with a NASA rocket scientist was how much money he earned. (The scientist felt awkward and avoided giving an amount. Camp officials followed up after the teleconference and distributed a page with answers to that and other questions.) Talking about the salaries of scientists may be an important means of attracting low income girls to study science.

The non-fighting 8th grade boys’ team also focused on and enjoyed making money in *NeoPets*.

Social Interaction

The two 8th grade girl groups discovered they could send neomail to other players, and spent time sending email to each other and each others' pets. None of the other groups exchanged neomail.

What learning, space, and science related reactions did participants have?

Learning from the Game

All groups thought *Neopets* is good for learning. Girls and 5th grade boys pointed out that one can learn to take care of pets.

What Games Should Humans Take On A Long Space Flight?

When asked what games to bring on a long space flight to relieve boredom, girls specified three actual game titles, while boys made reference to nine. Girls talked about games played on computers and Game Boys. Boys brought up console games (Halo). One girl suggested taking along war games on space trips.

8th grade girls suggested traditional card games, word games, and magnetized board games to play on space trips in addition to computer games and GameBoys, while 5th grade girls only mentioned computer and GameBoy games. Boys did not consider bringing any games which were not electronic.

The digital games girls talked about tended to be specific titles, mostly based on cartoons, while games boys mentioned belonged to the genres of action and sports.

Tension arose in both 8th grade boy teams about whether sports games were important to bring to space. Some of the 8th grade boys were athletes and others were not, which became a source of frequent arguments when they brainstormed for their games. In the end the non-athletes prevailed and no child-envisioned game included sports.

ADOBE ATMOSPHERE

ABOUT THE GAME

The participants experienced Adobe *Atmosphere*, a 3D avatar-based multi-user chat environment. Visitors choose an avatar from a collection of 17 pre-made entities to be their visual representation in the chat room. The players chat via a text window with other participants, and can command their avatars through the keyboard to walk, jump, or, when gravity is turned off, move horizontally and vertically in the air. Of the 17 avatar choices, only three were female (Figure 6). The rest were male and either human, animal, alien, or robotic. One female avatar was bald, one had glasses, non stylish clothes, and looked bookish, and the third had medium length red hair, a black sleeveless dress, and was the most attractive of the three.

Atmosphere was the only event where the participants played from a 3-D perspective and communicated through a text chat channel, two elements very similar to commercial MMORPG (Massively Multiplayer Online Role Play Games) games.

The play session lasted 30 minutes. The presence of 20 simultaneous logins in both morning and afternoon caused the still-in-beta-development *Atmosphere* world to be

overloaded, resulting in painfully slow lag time between giving a navigation command and seeing the response.

Figure 6: Montage of the 3 Female Avatar Choices in Atmosphere



SURVEY RESULTS: How did participants react to this game?

Table 3: How fun was it to play Atmosphere?

Female		Male		2 WAY ANOVA (n=36)				
5 th	8 th	5 th	8 th	F	P	Gender	Grade	Interaction
3.22	4.38	4.10	3.33	1.441	.249	.862	.682	0.048

Eighth grade girls and 5th grade boys considered *Atmosphere* more fun than 5th grade girls and 8th grade boys. Although the average rating by 5th grade boys was not the highest of any age/gender group, one 5th grade boy team liked the experience so much they successfully talked their teacher-facilitator into letting them go back to Atmosphere later in the camp as a reward for finishing another activity quickly. The boy groups experienced serious computer

problems (network connection issues and computers freezing), which likely dampened their ratings for Atmosphere.

Table 4: Is Atmosphere a good way to learn?

Female		Male		2 WAY ANOVA				
5 th	8 th	5 th	8 th	F	P	Gender	Grade	Interaction
2.44	4.00	3.11	3.11	1.476	.240	.831	.142	.142

Atmosphere was considered a better way to learn by 8th grade girls than by any other group. Fifth grade girls were the most resistant to Atmosphere as a learning environment. A 5th grade girl commented “you learn to be patient and to navigate in 3D.”

FOCUS GROUP AND OBSERVATIONAL RESULTS

How did participants respond to different game features?

General Likes and Dislikes

Most groups adapted naturally to the interface, often sharing new things they learned (like how to fly, walk, chat, jump, or become invisible). Computer and network problems arose moreso in the afternoon with the boys than in the morning with the girls. Aside from the computer problems all groups seemed quite engaged in the experience.

One 8th grade boy group wanted to access *Atmosphere* on their own from home.

Navigation and Instructions

Eighth grade girls were the only ones to complain in the focus group that *Atmosphere* was hard to understand, but all groups asked for a lot of help and were confused at the beginning (“I’m lost!” ... “where am I?” ... “who is that?” “how do you move?”).

Players, NPCs, and Character Design

A majority of girls chose the one and only attractive female avatar. The result was a 3D chat world full of identical clones, making it impossible to keep track of who each avatar represented. (“There’s like 6 of me.” “That’s because everyone chose the pretty girl.” “That’s because we *are* girls.”) Clearly there was a lack of choice of female avatars appealing to young girls. Probably because there were few appealing choices, many girls did not change their avatar after making an initial selection, while boys frequently changed appearances.

The boys had a much easier time finding appealing avatars and thus also had the benefit of entering a diversely populated world of other strange looking beings. (“I’m that cat person.” “hey wait up, elephant person.” “I am following a skeleton.” “I’m the blue zombie...” “I want to be the pregnant security guard...” “There’s an alien with a giant head.. I’m going to chase him..”) One 5th grade boy selected the “hot girl with the skirt” avatar.

When asked what kinds of avatars they would like, in general girls wanted “cute” (Neo pets or animals) or girlish (pretty, famous, not bold) avatars. Eighth grade girls specifically asked for girl avatars. Boys wanted “cool” avatars (dinosaurs, ninjas, robots, aliens, action game

characters). Participants of both genders requested avatars that “look like me.” Both girl and boy 8th graders wanted to be able to pick a basic character but then mix and match and fine tune features. They wanted wide range of good choices.

Backstory, Game Rules and Goals

The kids liked walking, jumping, floating, becoming invisible, and exploring many different Atmosphere worlds. They wanted to be able to do things other than walk around and talk.

Both grades and genders complained there was no point, and in fact Atmosphere is not really a game “because you just walk around.” Despite this limitation, the kids clearly enjoyed moving around different Atmosphere worlds using the 3D navigation interface.

Some of the girls navigated to a world of storefronts, but of course could not shop. At least two boys in every boy group remarked either while playing or during the focus group, “Can you hit people and stuff?” or “do I get to shoot people in this?”

Social Interaction

8th grade girls used Chat the most within Atmosphere. Twin sisters assigned to different 5th grade girl groups used Chat to insult each other. All groups, except for 8th grade boys mentioned enjoying communicating with others, but only 5th graders talked about integrating a chat function in their games. Ultimately chat did not appear in any game design.

The camp participants talked a lot with each other in the room (not through chat) exclaiming about fun discoveries, calling on teammates to come see something, asking for and offering help about how to do things.

Graphics & Video

Both grades and genders expected their own games to be 3D, photorealistic experiences where players can navigate in any direction. The Atmosphere experience may have contributed to and certainly reinforced this expectation.

What learning, space, and science related reactions did participants have?

Space Places to Explore

Eighth graders suggested using *Atmosphere's* 3D navigation to explore planets and moons. Fifth grade boys talked about exploring outer space, under water, underground or mountain areas. Eighth grade girls suggested a “star destroyer bridge” (a space ship control room) which later emerged as part of their game.

GALACTIC CIVILIZATIONS

ABOUT THE GAME

Galactic Civilizations (GalCiv) is a single-player, commercial strategy game developed by Stardock, suitable for everyone (all ages) according to the ESRB ratings. Players take on the role of the human civilization, with a goal of dominating the other major alien races in the galaxy through four possible victory scenarios: cultural, technological, political, and military. GalCiv

differs from the other games at the camp in requiring a great deal of strategic planning to be successful. The game takes longer to learn and to play than time at camp permitted, but we wanted to expose them to at least one strategy game of this nature. The GalCiv interface is complex enough that players without prior strategy game experience find it hard to understand. Because of the steep learning curve, both the original game manuals and copies of step-by-step play examples developed specifically for the Space Pioneer camp were given to all the participants. Each group also had a game expert present to answer questions.

The criteria for each of the winning conditions directly relate to play style. For example, to win culturally one builds numerous star bases near opponents' star systems to spread human culture. To win by military conquest, one builds powerful ships to destroy the other sides' ships and invade opponents' planets.

The game starts with players customizing difficulty levels. Choices include abilities of the player's civilization, galaxy size settings, winning conditions, and opponent intelligence and alliances.

On the bottom of the main interface is the control panel. Strategy-planning involves actions such as producing ships to colonize planets or defend territories. The game is time-based. Players make choices and then advance the game in time to see what happens based on the choices they made.

Figure 7: GalCiv Planet Management



SURVEY RESULTS: How did participants react to this game?

Table 5: How fun was it to play Galactic Civilizations?

Female		Male		2 WAY ANOVA (n=34)				
5 th	8 th	5 th	8 th	F	P	Gender	Grade	Interaction
4.00	3.63	3.10	3.57	.472	.704	.413	.934	.467

There were no significant gender or age differences in fun ratings. Fifth grade girls had most fun playing *Galactic Civilizations* while 5th grade boys had the least fun.

Table 6: Is Galactic Civilizations a good way to learn?

Female		Male		2 WAY ANOVA				
5 th	8 th	5 th	8 th	F	P	Gender	Grade	Interaction
3.22	3.71	3.00	3.67	.337	.799	.827	.351	.887

There were no significant gender or age differences in perceived learning value.

FOCUS GROUP AND OBSERVATIONAL RESULTS

How did participants respond to different game features?

General Likes and Dislikes

The 5th grade girls' positive reaction to GalCiv is somewhat surprising. They did not play particularly well but seemed to appreciate the chance to play a more grownup game. Not winning did not upset them. A disgruntled 8th grade boy commented that "the adults at camp should be forced to play a difficult game in a short period of time without knowing what to do, and see how they like it." The game was clearly not designed to be used the way we used it at camp.

Navigation and Instructions

Fifth grade girls relied heavily on the game experts for help, while 8th grade girls relied heavily on the print documents whenever they ran into trouble. Girls in both grades wanted their own games to be less difficult and planned to have detailed accompanying documents to assist play. Boys not only ignored the instructions most of the time, some of the 8th grade boys were proud of having played well without having to read any instructions. Fifth grade boys relied on the game experts less than the same-age girls. They would try to solve problems themselves first then consult their peers.

More boys than girls created their own strategies that weren't included in the written instructions; the few girls who chose not to follow "how to play suggestions" pursued defensive tactics, building star bases and defense shield or trading with aliens.

Boys not only took the initiative to attack opponents, but also tried strategies of intentionally destroying their own colonies. One 8th grade girl expressed a desire to attack opponents, but couldn't figure out how to do so. Mostly girls did not attack opponents.

Players, NPCs, and Character Design

All groups liked naming the planets when colonizing them, they liked naming their own characters and opponents during game setup.

Backstory, Game Rules and Goals

Presumably inspired by the financial aspects of GalCiv, 5th grade boys talked imposing a limited budget on the players in their games as a game balance issue.

Challenge/Difficulty Level

The common theme of the complaints is that the game was too difficult or confusing to understand. However, one 5th grade boy managed to play so well he won a military conquest. One boy of each grade reported losing confidence, and feeling dumb or useless. Girls were less extreme in their reactions.

Although all groups complained about the game being difficult, only girl groups suggested that their own games should not be as difficult as *Galactic Civilizations*. Boy groups considered “hard” a positive game attribute.

Aliens

The alien in GalCiv were strange looking and certainly not cute. A common expectation of what aliens would be like in the focus group right after playing GaCiv was odd-looking (“tall and skinny, big eyes, small mouth cover with skin, face in the stomach and big fat stomach, and you can see their brains”) hostile creatures with advanced knowledge. Fifth grade girls didn’t want to be in a galaxy with aliens. Some of them worried about potential wars, drawing parallels to how humans resolve differences between cultures on Earth today.

More 5th grade boys looked forward to sharing the galaxy with aliens than other groups, even if they have to fight them. Eighth graders were less interested in sharing the galaxy with aliens. However, some of the participants believed that whether aliens are friendly or not depends on the species and that some aliens would look similar to humans, possibly as an influence from the game. Some aliens might even be cute. Some would be intelligent, some stupid, some evil.

What learning, space, and science related reactions did participants have?

Learning from the Game

8th graders thought *Galactic Civilizations* may be a good way to teach planning strategies.

Other Science-Related Observations

Fifth grade girls brainstormed about including stars in their game which players could investigate, and 5th grade boys discussed allowing players to travel to planets. Eighth grade girls brought up having research labs in their games, like those in *Galactic Civilizations*. Fifth grade boys suggested using warp engines like in TV show *Star Trek*.

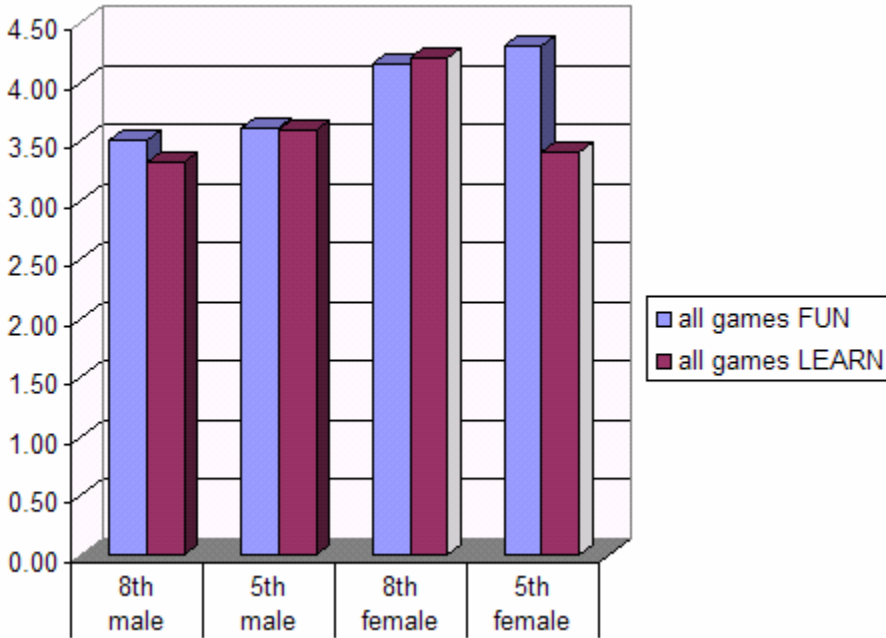
CONCLUSIONS

Some findings reinforce existing studies about girls and games. Other findings add more detail than may have been previously available. And some new insights were unearthed.

Most surprising was how much more positive girls at Space Pioneer Learning Adventures camp were than boys about the games themselves and about how good the games were for learning. Game play for the girls occurred in a girl friendly context. No males the girls' age were present to compete for computer time or to observe or pass judgment on the girls' behavior. Each girl had her own computer. A game expert/helper was available during each game to answer questions. When game play instructions seemed challenging or unclear, special instructions were written and handed out. The girls were encouraged to play critically. There were multiple purposes for playing, including learning space science and critiquing the game for their own game ideas. Under these circumstances, girls liked playing games better than boys did. K-12 teachers as well as the National Science Foundation should take notice that games in school may well be a very good way to interest girls in science, particularly 8th grade and presumably high school.

Overall, the games at Space Pioneer Learning Adventures camp were on the positive side of the fun scale and the positive side of the good for learning scale across girls and boys and across 5th and 8th graders. The games were rated MORE FUN by girls than by boys. Fifth grade girls showed the largest disparity between how fun the games were for them (strongly yes) and whether they thought the games would be good for learning (much less enthusiastically yes).

The findings from this study strongly support the idea of developing fun learning games for girls. Girls in younger grades will probably be more resistant to learning from games than older grades. 8th grade boys are resistant to hijacking the pure play they are accustomed to enjoying for learning.



GENDER AND AGE DIFFERENCES AND COMMONALITIES

The elements both genders enjoyed or planned to incorporate were variety and customizability of player avatars, personalization of game content (e.g. naming planets), open-ended game worlds, non-linear game flow, in-game tutorials, low learning curves, and NPC character design (e.g. artificial intelligence, scripts, voice-acting).

Elements girls enjoyed or planned to incorporate included storylines, character communication tools (e.g. gestures), multiple difficulty levels, sufficient instructions, online chatting, collaboration with other players, and traditional feminine themes such as pretty avatars and cute pets. The idea of pets or sidekicks ultimately showed up as part of the game designs of three of the four girl teams.

Elements boys enjoyed or planned to incorporate include weapons, fighting, challenging levels of difficulty, controlling ships via keyboard, complex interfaces with buttons, switches, or other mechanisms, game balance issues (e.g. limiting the amount of money players can own), navigating space through teleportation and warping, and multi-player split screens. Most boys enjoyed collaborating with other players, although some of the older boys preferred individual play. The younger boys enjoyed online chatting more than the older ones. The younger boys were more open to incorporating pets into their games than the older boys.

PRIOR GAME EXPERIENCES

Throughout the six focus group discussions, girls referred to four non-Camp game titles, and boys named 13 games. Eighth grade girls didn't name any non-Camp digital games at all. The only game besides ones they played at the camp that was mentioned by both genders was *The Sims*.

Similar to Kafai's (1998) research, while discussing their ideas for their own games, boys appeared more influenced by commercial games, although traces of components from games

played at camp could also be detected. One 8th grade boy group was so fascinated with the commercial console game *Halo* that they ended up bringing in the game and demonstrating the multiplayer play on an Xbox in the final presentation. The final game designs by both 8th grade boy teams were direct copies of existing commercial games, neither of which was played at camp. (One team converted Moon Tycoon into Mars Tycoon although they named it differently and the other adapted Halo to outer space battles with aliens preceded by space trivia question.) Girls seemed more influenced by games played at camp and other pop culture media content such as movies and cartoons when planning their own games. Only one girl team borrowed significantly from another game, played at camp: The Great Solar System Rescue.

The 5th grade boy who beat *GalCiv* did not do so by accident. Near the end of the camp, he approached one of the game experts and had a light discussion about another strategy game, WarCraft. Computer games of the same genre are often based on a previous model (Ray, 2003). With perhaps a swirl of luck, the 11-year-old beat the game in one hour, impressive considering that grad student gamer/researchers had to spend numerous hours to win even once.

Familiarity with a game genre advantages players when they play a new game in an already familiar genre. They already have expectations and experience of how play occurs and what strategies tend to succeed. Player who grow up playing fewer games and limited genres of games face a barrier to entry when playing a new game in an unfamiliar genre. Girls more often than boys face this challenge because they play fewer games.

GAMEPLAY LEARNING STYLES, INSTRUCTIONS, AND EASE OF USE

The game experience gap (Margolis & Fisher, 2002) and learning style differences in computers disadvantage females at figuring out (male-designed) games quickly (Ray, 2003; Turkle, 1988). More boys attempted to comprehend *GalCiv* independently than girls; some boys developed strategies and discovered alternate play mechanics not included in the basic controls and functions presented in the instructions (which themselves were rarely used).

Girls' reliance on instructions when playing the games at camp was reflected when they talked about what to implement in the games they were creating. Girls more often complained about the lack of adequate directions, while boys didn't see the need. Girls also requested more detailed instructions even when they didn't use them. In all, providing sufficient instructions for their own games was brought up several times in the girl groups, while 5th grade boys mentioned it only once, simply calling for "better instructions" in their own game.

Previous research has demonstrated that girls are less prone to take risks during game play; they want to avoid mistakes and know how things work before starting play (Gottfried, 1986; Ray, 2003; Turkle, 1988). One element in this tendency is lack of prior extensive experience with video games. In line with these findings, 5th grade girls relied on the experts, while 8th grade girls relied on the instructions, with disadvantages in previous game experience limiting their ability or desire to explore on their own. The difference in risk taking probably represents a fundamental gender difference deeper than simple lack of game experience.

This is not to say that male players want to or enjoy making mistakes. Both genders found the training sessions and "hint system" helpful in *Space Academy GX-1* and *Liftoff*. And both male and female groups talked about incorporating training features into their games. So

although the boys seemed to rely on hints, game experts, and manuals to a lesser extent than the girls, the boys do appreciate having some form of assistance available to them.

Boys exhibit a machismo, a pride in mastering a hard to use game interface without reading instructions. Girls not only do not seem to feel that same sense of challenge, they instead feel annoyed with the game for being unclear in the first place. It is curious that poor instructions and a hard-to-figure-out, hard-to-use game interface are considered not just the norm but the ideal game form to which girls are expected to adapt by embracing trial and error approaches. A different conclusion from this data would say girl games (if not all games) should have clear, well explained, helpful, easy to use interfaces. The challenge should come from within the game, not from trying to guess how to play.

Developers can help by including user-friendly in-game tutorials, hint systems, and intuitive interfaces. Additionally, detailed game manuals, FAQ resources, and an online forum function for help in answering questions on the official game websites, as well as game play customer service, should be implemented to assist players. Perhaps there are alternative ways to write instructions, if the instructions are expected to be read and followed by players rather than being provided as a last resort for novices.

Girls expect the game to be helpful and kind to them and not to be a hostile, insensitive drill sergeant. Girls reacted negatively to an irritating computer robotic voice, to an assistant who tried to trick them into making wrong choices, and to help which could not be replayed.

Girls asked for different difficulty levels to accommodate different players, while boys in the study tended to admire the difficult games. Eighth grade boys constantly, and 5th grade boys occasionally, wanted to make their own games, and games played at the camp, more challenging. For example, after playing *Liftoff*, the younger boys and the girls of the 8th grade wanted to make it easier, complaining it was too hard to understand, while some of the 8th grade boys wished to complicate it. Two girls liked games for being challenging, but their peers complained about games being too hard.

To design flexible games that everyone can enjoy, consider providing selectable difficulty levels such as “Easy”, “Medium”, or “Hard”, as seen in various commercial games. An easy to play yet challenging game with different levels might be an ideal way to appeal to most girls.

Players, NPCs, and Character Design

The Adobe Atmosphere experience was a poignant demonstration of what happens when girls pick characters from a set of mostly unacceptable choices. The girls mostly found only a single option acceptable, and therefore entered a bizarre clone world filled only with avatars exactly like their own. Many of the 17 choices appealed to the boys, who therefore picked diverse characters and entered a diversely populated world. Girl character choices need to be attractive or cute, not merely strange, weird, or funny.

Many children requested avatars that resembled themselves. Customizability of the avatars and personalization of the game content (e.g. naming planets) were important features welcomed by all groups. If they can't choose an avatar who “looks like me”, girls wanted traditionally feminine avatars (a girl, someone pretty, cute animals) while boys wanted traditionally masculine ones (robots, a ninja with big weapons, a game character from *Halo*).

The Neopets experience draws attention to how much “cute” matters. All of the girl teams talked about how cute the pets were. Girl game worlds should be beautiful. Male game worlds today tend to be dark and harsh. Neopets managed to also appeal to boys (it was the 8th grade boys’ favorite game at camp) by adding antisocial behavior to the repertoire of possible pet personalities and by adding fighting games. Game designers may not need to worry about turning off male players by having cute NPCs, so long as enough guy-appealing features are available.

Backstory, Game Rules and Goals

Participants’ pattern of interests in game themes in this study conforms to traditional gender roles. In spite of several common features being liked by both genders in *Neopets*, girls described taking care of pets as fun, while the younger boys called it educational and the older boys didn’t talk about this aspect at all. On the other hand, many boys mentioned enjoying the fighting aspect of the game, whereas few girls played those mini-games or talked about fighting in Neopets.

Boys, younger and older, pervasively requested weapons, explosions, shooting things, and fighting in games which failed to include these actions. Two fifth grade girls and one eighth grade girl expressed interest in action, destruction, or war games, but most girls were not interested in violent play.

The research literature suggests girls do not play games to win. Consistent with previous studies, boys eagerly aspired to beat the games, while girls generally took their time exploring the game world and reading the background stories. Boys like “conquering the challenge”, as one 5th grade boy proclaimed, “That was very fun. I got a domination victory”. Girls need motivation other than winning to motivate game play. Girls enjoy the process of playing games more than the outcome (Klawe et al., 2002).

Motivation beyond just winning can come in the form of the backstory and in game play itself. Neopets provided a reason for winning. The points players amassed in the game were not merely a tally of winning. Neopoint money was needed to buy food for pets and other items. Learning from games is another way to make game play meaningful. Girls’ much stronger liking of games for learning may relate to their desire for motivation to play that goes beyond just winning.

Nurturing, Fighting, and Making Money

Although both genders liked assembling spaceships in *Liftoff*, girls avoided strategies and mini-games based on fighting and destruction when playing *GalCiv* and *Neopets*, two games that allow players to develop their own play styles. In *GalCiv* most boys quickly looked for enemies to fight - even the one who beat the game took the military approach, which essentially involves blowing up opponents’ ships and invading their colonies, whereas girls built star bases and defense shields first. Likewise, in *Neopets*, girls played non-violent mini-games to earn neopoints so they could take care of their pets, while boys went quickly to the Battledome.

Educational Games

Consistent with prior research (Miller, Chaika, & Groppe, 1996), older girls are more interested in games for learning. Prior research did not prepare us for how much and how consistently the 8th grade girls liked all of the games played at camp and liked the idea of games for learning. At least based on this study, learning games are ideally suited for 8th grade girls, and even games not intended for the classroom were more strongly enjoyed by girls in the context of a learning camp.

Older girls mentioned liking trivia types of games more than the younger girls did, but neither grade of girls ended up incorporating trivia into the games they envisioned. Boys liked trivia games less than girls did, but one 5th and one 8th grade boy group incorporated space trivia experiences into their games. In both instances, trivia games were the way the boys came up with during their brainstorm to make it a learning game. Both groups even misspoke in the final presentation, calling them *trivial* games instead of trivia games for learning. Other groups apparently assumed learning happened just by playing.

Boys' attitude toward educational games is illustrated by an event that occurred when playing *Great Solar System Rescue*. Although an 8th grade boy group appeared very pleased after successfully accomplishing the missions and demonstrated seriousness and focus while solving problems during game play, during the focus group discussions many boys dismissed it as a boring educational game, and not good for learning. The younger boys (and girls) had the stereotyped impression that educational games aren't fun, but their attitudes at least for Solar System Rescue changed more easily once they experienced the game for themselves.

The criticism of the games as being "too educational", "too simple", "too kiddie" was heard from both grades of boys, especially the older ones, but rarely from the girls. Eighth grade girls only considered one game too easy, of which they were two years over-aged for, but they never used "educational" in a negative way like the boys did. Boys clearly have a preconceived notion about educational games, and as they grow older it becomes more deep-rooted.

SUGGESTIONS FOR GAME DESIGNERS

There are both social and economic reasons to include the preferences of girls in the design of commercial AND educational computer-based games. Commercial games could potentially attract a larger female market engaging girls with computers and technology. Digital games for learning are a relatively new and underdeveloped genre that need to evolve in ways good for both genders and good for learning.

These key recommendations based upon our research should help the design of girl-friendly games:

- Create games which are easy to use, with clear instructions. Girls expect a game to be clear, friendly and helpful.
- Try a new approach to writing instructions and game support which expects players to actually use the instructions. Pretest them with girls who are not avid gamers.
- Focus on interesting and useful game PLAY rather than on competition and winning.

- Include consequences for winning (perhaps in later game play) which can be useful in subsequent play.
- Make games where players learn meaningful concepts by playing.
- Make games which include play elements in which players can nurture and take care of pets, humans, the environment, civilizations, or planets.
- Include the chance to choose pets or sidekicks to accompany the player on missions.
- Include social interaction in the game, in ways more meaningful than interaction about combat.
- Create characters which are cute and appealing rather than weird looking and scary.
- Allow extensive customization of characters and game worlds, including avatars which look like the player.
- Explore the market viability of a product line of learning games for girls.
- Include game strategies or mini-games which are viable nonviolent game experiences.

LIMITATIONS OF THE CURRENT STUDY

All the focus group participants were volunteers. Most 5th graders were recruited from local schools. Eighth graders turned out to be much harder to recruit and we turned to newspaper announcements, posting announcements at community groups, and contacting local girl scouts and boy scouts leaders to secure the needed twenty 8th grade participants. Camp participants are not necessarily representative of these grades and genders in the United States.

Also, the focus group situations varied because of teacher-facilitator individual differences. The T-F's style of involvement in the groups could not be standardized, introducing variability in the camp experience and the data collection process. The group dynamics could also affect participants' interaction and responses within the groups. Research has found that adolescent males give different data in individual interviews than when in peer groups (Wight, 1994). Would boys and girls act and answer differently alone or in mixed-gender groups?

Because this research heavily depends on the researcher observers' field notes, the quality of the notes proved to be important. Individual differences of researcher-observers influenced what they recognized, interpreted, and recorded. In addition, the two researcher-observers of the same group did not always interpret the participants' statements in the same way. Gender differences existed in all aspects of the camp. We found that female ROs took more than twice as many notes about the same activities as did male ROs.

This study collected rich data on a small sample of ten 5th grade girls, ten 5th grade boys, ten 8th grade girls, and twelve 8th grade boys. The sample was self selected – parents chose to volunteer their kids to participate in camp. The participants were a mix of low, middle, and upper income families, with 5th graders more likely to be from low income parts of the city. Some of the participants came to camp because of strong personal interest in space exploration and games. Others were sent to camp primarily because parents thought it would be good for their children. All participants (or their parents) did volunteer to participate in a 2 week space pioneer learning adventure camp.

DIRECTIONS FOR FUTURE STUDIES

The game play experiences, including surveys and focus group interviews each occurred in one hour or less. These could be replicated in classrooms (where participants are not volunteers). Will the same outcomes occur in same sex, same grade teams of five? What happens in mixed gender situations? What happens when an entire class plays the game at once, in one room?

Another strand of research could involve designing learning games which adhere to the recommendations for girl-friendly game design and conducting follow-up research to assess how and what ways these games appeal to each gender.

Another interesting research question is whether some boys will enjoy, perhaps even be relieved to get to play games more in line with the girl-friendly game design tenants. The 8th grade boy strong enjoyment of Neopets suggests that with enough boy stuff included, girl friendly games could be quite appealing to boys.

The gender and gender bias of the authors of this study may be obvious. The analysis may read as if it were negative about boys and their games. The research was funded by a gender equity grant from the National Science Foundation with the goal of deepening understanding of what girls want from games, in a society where boy games currently dominate the market and do not appeal to most girls. In addition to the current focus on what girls want, our research raises questions about boys and games.

Gender differences feel more mysterious than ever to the female authors. What is the experience like of wanting to blow things up and fight? What is it like to want so badly to beat the game, to conquer the challenge? We had to rewrite every section many times because this was supposed to be a study about girls and our first draft invariably focused on 8th grade boys, because they were so different from the other three groups. Their negative response to the general idea of learning from games and to co-opting games for structured learning experiences, , loudly implies the biggest challenge for *learning* games will be to make them appeal to boys.

Although the purpose of the camp was to design games that would foster interest in space and space sciences, the actual process by which learning occurs via video games was beyond the scope of this study. Specifically, future studies could examine how, what, and to what extent children learn from both learning-targeted and commercial video games. The bulk of research in this area has focused on video game playing effects on motor, spatial perception, and cognitive skills. Gee (2003) has hypothesized extensively about learning from games but few have actually studied what children actually learn from playing games, both explicitly (i.e. things they realized that they learned) and implicitly (things they learn, but are not able to articulate).

The next generation of games for learning (those that approach the complexity, visual and character appeal, and entertainment value of commercial games) is a quickly developing educational interest and potential entrepreneurial adventure. Learning games and the idea of learning from games have been more appealing to girls and commercial games more appealing to boys. As these two cultures begin to merge, it is critical that the appeal to girls be enriched and not overtaken by the strong male bias in commercial games. Now, at this growth phase of

the computer learning game evolution, is the time to clearly identify and plan for the incorporation of girls' styles, interests, needs, and preferences in both commercial and learning games. This research, funded by the National Science Foundation, is an experience in listening to the girls tell us what they want in a space science learning game. To not incorporate girls into the early foundations of this cultural merger holds dangerous consequences for their future comfort and interests in both technology and (space) science. For more details on this research, you may visit www.spacepioneers.msu.edu

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