

# *Cosmos Chaos!*<sup>TM</sup>

## Pilot Study Report for JUMP Into Reading for Meaning

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### EXECUTIVE SUMMARY

This report presents the evaluation results for the pilot study of *Cosmos Chaos!*<sup>TM</sup>, a game-based vocabulary instruction program created for the Nintendo DS handheld platform by JUMP Into Reading for Meaning (JUMP). The *Cosmos Chaos!*<sup>TM</sup> game will eventually be offered to students in the supplemental educational services (SES) after school setting. This pilot study was a single-site test conducted in Hawai'i at a local elementary school<sup>1</sup> during the fall of 2007. *Cosmos Chaos!*<sup>TM</sup> was distributed to 12 students (5 males and 7 females), who played the game in lieu of attending after school programming for a period of 30 minutes per day for 22 days. The test provided an opportunity to investigate how students in an after school setting interact with *Cosmos Chaos!*<sup>TM</sup>.

Data collection for the pilot study utilized the following methods: (a) semistructured individual interviews of students at selected intervals during the test period, (b) weekly focus group sessions, (c) daily videotaping for confirmatory observations, and (d) student pre- and post-intervention vocabulary tests.

Several caveats about the results generated from this pilot study need to be considered. The data collected from this pilot study is limited in that the game was not tested in the exact setting of its final intended use, nor were all of the students participating in the study the exact target population—struggling 4th grade readers in SES programs. Despite the limitations of this study (e.g., small sample size, short testing time frame, limited target population), the implementation of this pilot study was expected to help the *Cosmos Chaos!*<sup>TM</sup> development team better under-

stand the strengths and weaknesses of the game design, so they can refine the game and the final implementation strategy of the game.

In reviewing the pilot test data, Pacific Resources for Education and Learning (PREL) addressed the following six questions and revealed the following findings:

1. *Are students able to navigate the different levels of Cosmos Chaos!*<sup>TM</sup>?

Summary Response: Yes, students were able to navigate within the game quite easily, although student ability and speed varied. Student socialization during play time enabled student navigation, as peers could help one another locate characters or challenge one another by competing for victories.

2. *Do students require extensive adult support as they play the game?*

Summary Response: No, students did not require extensive adult supervision. Few issues needed to be addressed by the adults present in the classrooms, and, in most cases, students were able to answer their own questions or get answers from their fellow students.

3. *Are the flow and movement of the game appropriate?*

Summary Response: Yes, in the last focus group in week 6, students noted an increase in pace from levels 1 and 2 to level 3, but they did not find the change to be a problem.

4. *Does Cosmos Chaos!*<sup>TM</sup> capture the interest of students?

Summary Response: Yes, both classroom observations and interviews with the students indicated that they were engaged in playing the game, expressing both joy and

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<sup>1</sup>The name of the elementary school is not mentioned in this report as per requirements of the Hawai'i Department of Education.

frustration as they played. Many of the students were often reluctant to stop playing at the end of the gaming session.

5. *Would students continue to play Cosmos Chaos!™ if they had more time?*

Summary Response: Yes, during the focus groups, students stated that they would like to play for the same amount of time, 30 minutes, or longer. In individual interviews, responses varied: One student wanted to play for fewer minutes, while others wanted to play longer and/or even take the game home.

6. *Are students remembering the words they use in the game?*

Summary Response: The results of the pre–post analysis suggest that students are making small gains in their knowledge of vocabulary offered through *Cosmos Chaos!™*. However, we must be cautious in our interpretation of this finding, since the pre- and post-intervention vocabulary test data were collected using a small sample size, and there was a limited amount of play time for the implementation of the intervention.

## I. OVERVIEW

JUMP Into Reading for Meaning (JUMP) is in its 3rd year of a grant funded by the U.S. Department of Education (U.S. ED) that focuses on the development and delivery of a game-based educational learning environment using emerging mobile technologies. The mission of JUMP is to develop and evaluate the impact of a game-based vocabulary instruction program delivered on a handheld platform for students participating in supplemental educational services (SES) programs. The game, *Cosmos Chaos!™*, is designed to teach vocabulary and word-learning strategies to struggling readers in the 4th grade, utilizing a gaming environment.

The primary objectives of the project are as follows:

- Develop a research-based, content-situated vocabulary program to be delivered on a handheld device to 4th grade students
- Establish the effectiveness of a game-based vocabulary development curriculum through a scientifically-based research study
- Disseminate information on how students can learn in game-based environments delivered on handheld devices

JUMP addresses its primary objectives through designing a vocabulary game anchored in research-based content and principles of learning that motivate young struggling readers to:

- Build large vocabularies rich with images and associations.
- Acquire independent word-learning strategies.

This document outlines the preproduction beta testing of *Cosmos Chaos!™*, played on the Nintendo DS as it existed as of November 2007 (i.e., levels 1–3 of game 1). The intent of this pilot study was to determine the feasibility and the ramifications of implementation in an SES-like setting, and to aid the JUMP development team to better understand the strengths and weaknesses of the game design of *Cosmos Chaos!™*, so they could refine the game and the implementation process of the game.

## II. PURPOSE

The purpose of this pilot study was to conduct a real-world evaluation of *Cosmos Chaos!™* (levels 1–3 of game 1). The pilot study process consisted of delivering a beta version of *Cosmos Chaos!™* to struggling readers in the 4th grade to verify that the game functions as expected, even though the game may have included some issues and bugs (e.g., “crashes”). For the first release, the critical game-stopping issues identified through level 1 testing at another Hawai‘i elementary school (August 28 and September 6, 2007) were corrected.

The information obtained during this pilot study enabled JUMP developers to determine how participating students use the game in an after school setting, an SES-like environment. Equipped with this information, JUMP game developers could identify how best to refine the design of the game and how the game should be administered to students in SES settings.

The pilot study was designed to answer a set of primary questions using specific indicators captured through various data collection methods (see Table 1). These questions included items focusing on various aspects of the game, such as “dosage” (i.e., how many minutes each gaming session should last), navigation, supervision level required, and game flow. Following are some of the questions that this pilot study sought to answer:

- Are students able to adequately navigate through *Cosmos Chaos!™*? (navigation)
- Do students require adult support as they play the game? (supervision level required)
- Do students feel that the pace and flow of the game are good? (game flow)
- Do students feel that the time they have to play the game is adequate? (dosage)
- Are the words students see in the game challenging enough for them? (engagement)
- Would students continue to play the game if they had the opportunity? (dosage and engagement)

Data collection for this pilot study used the following methods: (a) semistructured individual interviews of students at selected intervals during the test period, (b) weekly focus group sessions, (c) daily videotaping for confirmatory observations, and (d) student pre- and post-intervention vocabulary tests. By using more than one data collection method, we were able to triangulate

late the data by cross-checking the results of each method. This strategy helped increase the credibility and reliability of the beta test data.

### III. STUDY

#### Intervention Strategy

The pilot study was a single-site test conducted in Hawai'i at a local elementary school with approval from the Hawai'i Department of Education (HIDOE) during fall 2007. *Cosmos Chaos!™* was distributed to students during their after school program at the elementary school, and students played the game for a period of 30 minutes per day. The test provided an opportunity to investigate how students in an after school setting interact with *Cosmos Chaos!™*.

The data collection occurred at an elementary school where JUMP staff members had previously conducted informal testing to decide on the vocabulary words to be included in the game. The elementary school has approximately 20 4th grade students in its after school program (After School Plus [A+] Program) to improve reading skills.

PREL contracted with a HIDOE part-time teacher to be on-site—along with participating PREL staff members—each day of the pilot study to provide supplemental support. This individual was responsible for the following tasks on each day of the testing:

- Distributing *Cosmos Chaos!™* to participating students at the beginning of each day's test period
- Collecting the games at the end of the day's intervention
- Inventorying and securing the games in a locked cabinet provided by the HIDOE
- Administering and securing a daily "temperature check" completed by participating students
- Setting up and securing the videotaping equipment

To collect the data needed, several of PREL's R&E staff worked on the project during the data collection period. These individuals assisted in observing classes, running focus groups, interviewing students, and watching recorded sessions of the game being played. The R&E staff was also responsible for conducting all data analyses and preparing reports for the JUMP staff, although the JUMP staff did provide feedback regarding earlier drafts of this final report.

The JUMP development team also provided several of their staff members to be present during the early periods of the beta test to ensure that students were successfully oriented to the game. Their main functions were to provide information normally contained in game tutorials and to assist students with game playing in the initial phases. After the orientation period was over, JUMP staff members returned to the classroom later to provide a reorientation to the students (midway through the testing period, on October 23, 2007) and to exchange levels 1 and 2 student game cartridges for level 3 cartridges (on November 6, 2007).

TABLE 1

Primary Questions, Data Sources, and Indicators: Pilot Study

Questions	Data Methods	Indicators
Are students able to navigate the different levels of <i>Cosmos Chaos!™</i> ?	<ul style="list-style-type: none"> <li>• Focus groups</li> <li>• Classroom observations</li> <li>• Individual interviews</li> <li>• Temperature checks</li> </ul>	<ul style="list-style-type: none"> <li>• On-task behavior</li> <li>• Problem frequency</li> <li>• Student requests for guidance</li> <li>• Student perceptions</li> </ul>
Do students require extensive adult support as they play <i>Cosmos Chaos!™</i> ?	<ul style="list-style-type: none"> <li>• Focus groups</li> <li>• Classroom observations</li> <li>• Individual interviews</li> </ul>	<ul style="list-style-type: none"> <li>• Student requests for assistance</li> <li>• On-site research and evaluation (R&amp;E) staff reports on classroom environment</li> </ul>
Are the flow and movement of <i>Cosmos Chaos!™</i> appropriate?	<ul style="list-style-type: none"> <li>• Focus groups</li> <li>• Classroom observations</li> <li>• Individual interviews</li> </ul>	<ul style="list-style-type: none"> <li>• Progression through levels</li> <li>• Time on task</li> <li>• Student comments regarding pace of game</li> </ul>
Would students continue to play <i>Cosmos Chaos!™</i> if they had more time?	<ul style="list-style-type: none"> <li>• Focus groups</li> <li>• Classroom observations</li> <li>• Individual interviews</li> </ul>	<ul style="list-style-type: none"> <li>• On-task behavior</li> <li>• Student requests for guidance</li> <li>• Student comments regarding play time</li> </ul>
Are students remembering the words they use in <i>Cosmos Chaos!™</i> ?	<ul style="list-style-type: none"> <li>• Vocabulary tests</li> </ul>	<ul style="list-style-type: none"> <li>• Acceptable performance levels</li> </ul>

Each of these questions helped the JUMP team assess the strengths and weaknesses of the game design so they can refine *Cosmos Chaos!™* and the implementation process of the game.

Also, students took pre- and post-intervention vocabulary tests so that JUMP developers would have preliminary data to determine the gains in vocabulary made by students using the game. Several caveats about the results generated from this pilot study need to be considered. The data collected from this pilot test are limited in that the game was not tested in the exact setting of its final intended use, and not all of the students participating in the study were from the exact target population of struggling 4th grade readers in SES programs. Despite the limitations of this study (e.g., small sample size, short testing time frame, limited target population), this beta test offered the designers of *Cosmos Chaos!™* a great deal of important information to assist them in making decisions about the final version of the game, and the most appropriate implementation strategy for the efficacy and impact studies to occur later.

## DATA SOURCES

The main data sources for the beta test were student focus groups, student interviews, classroom observations through videotaping and audio taping, student temperature checks, and pre- and post-intervention vocabulary tests. PREL R&E staff provided oversight and administered these instruments. The supplemental data collected within *Cosmos Chaos!*<sup>TM</sup> (e.g., number of levels completed, number of words learned) were also included in the final analysis conducted by the R&E staff.

Berkeley Policy Associates (BPA) observed student play, student focus groups, and the administration of the post-intervention vocabulary test during the final 2 days of testing *Cosmos Chaos!*<sup>TM</sup>, on November 14–15, 2007.

Data collection activities occurred prior to, after, and during the pilot study period. The vocabulary pretest was administered to participating students on the 1st day of the data collection period, before the start of the gameplay. The posttest occurred on the last day, after the final gameplay period. Student focus groups and interviews took place each week, after each game-playing session.

## METHOD

The *Cosmos Chaos!*<sup>TM</sup> pilot study at a Hawai'i elementary school consisted of 22 testing sessions from October 9 to November 15, 2007. Students played *Cosmos Chaos!*<sup>TM</sup> on Nintendo DS units supplied by PREL for 30 minutes per day, with the exception of November 6, when students played for 40 minutes. On a rotating basis, three staff members from PREL's R&E staff (Dr. Melly Wilson, Dr. Scott Keir, and Ms. Eunice Brekke) were present during the testing sessions. Additionally, three staff members from the JUMP program (Ms. Meagan Rothschild, Ms. Jackie Burniske, and Mr. Javier Elizondo) attended the beginning, middle, and close to end sessions to conduct various types of orientation on October 9, October 23, and November 6, 2007. The contracted classroom monitor was present each day to set up video equipment, distribute and collect games, administer temperature checks, and assist student participants with only the most basic questions about the game.

All test subjects were 4th grade students from the elementary school in Honolulu, Hawai'i, participating in the A+ Program. A total of 12 students, 7 girls and 5 boys, participated in the testing. Despite efforts to get "struggling readers" as participants for the beta test, students' reading levels varied from above proficient to below proficient. (The estimate of students' varying reading proficiency level was shared with JUMP staff by the classroom monitor. She was already familiar with most of the participating students from her previous duties as a substitute teacher at the school.) In terms of students' knowledge and familiarity with video games, all were not avid gamers; in fact, some students had never played with a Nintendo DS before.

Prior to testing, JUMP staff introduced the overall game con-

cept and informed students that they would be testing only the first three levels of a much larger game currently under development. It was made clear to students that the game was still being developed and that their responses could help shape the final game product. Basic map navigation features and the overall goal of the game were explained; students were to "talk" to characters and complete tasks suggested by the various characters so that Hugo, the dog that was abducted in a spaceship, could be found. Staff purposefully limited the information shared with the students to find out just how much students could pick up on their own. Eventually, the game will be marketed with only a tutorial to guide players. A written tutorial containing basic instructions for the game was distributed for students to use during gameplay. Students were then asked to start playing.

Mixed methods of data collection were employed to capture the data needed for the beta test. The following five methods of data collection were used:

1. *Focus Groups*: Group interviews of subgroups of the participating students were conducted so that the R&E staff could ascertain the gaming experience of students. Along with basic questions about what they liked and disliked about the game, students were also asked about certain characters and their personalities, so the R&E staff could see another indication of whether students retained the knowledge learned from the game. Student focus groups (see Appendix A, Student Focus Group Questions) were also audiotaped for accuracy, which required parental permission (see Appendix E, Parental Consent Form).
2. *Student Interviews*: Three out of every 4 days at the end of each session, one or two students were interviewed individually by R&E staff. These interviews collected students' general impressions of the game and specific impressions about major game components (see Appendix B, Student Interview Questionnaire).
3. *Classroom Observations*: A video camera was set up in the classroom to record the entire time students were playing the game. Staff then reviewed the videotapes for indications of how students were faring with the game. School-wide waivers were obtained for permission to include students in the study, including permission to videotape each child in the classroom. A great deal of consideration and sensitivity was integrated into the data collection plan so as not to overwhelm the students in the classroom with too many R&E staff members asking too many questions while students were playing the game. We wanted students to feel comfortable and play the game on their own terms—without feeling as though they were being watched.

Examples of the types of behaviors the R&E staff looked for in their observations include: how attentive students were while playing the game, how much time they spent actually playing the game, how much social interaction occurred during the time the game was being played,

and what the students did after their 30 or 40 minutes of gameplay were finished.

4. *Temperature Checks*: An assessment tool, or temperature check, was used to assess students' daily game experiences. This instrument was used in the level 1 testing and has proven very valuable to the R&E staff because it was easily administered and provided instantaneous feedback from students (see Appendix C, Temperature Check).
5. *Vocabulary Tests*: The R&E staff also developed a proximal vocabulary test for participating students that consisted of 45 word definitions. It was used as a way to indicate whether changes had occurred in students' vocabulary. The 45 words included in the test consisted of only one-third the total number of math, social studies, and science words that students would have been exposed to in the three levels of the game. The chosen words also represented all three levels of the game, since 15 content and high-utility words came from each of the three levels (see Appendix D, Vocabulary Test).

*Pilot Study Week 6*

*Nov 12–Nov 16*

Videotaping (daily)

Focus Group (two groups of six students each)

Vocabulary Posttest

**Data Analysis**

The students' responses from focus groups, individual interviews, temperature checks, as well as the gameplay observations yielded both quantitative and qualitative data. Quantitative data were cleaned and analyzed using SPSS for descriptive and inferential statistics. Qualitative data were also analyzed to extract major themes.

The results from the data analysis were shared with the JUMP game developers at regular intervals so they could use the results from the analyses, as they became available, to further develop or revise the game. R&E staff met with the JUMP staff on a weekly basis to brief them on the data collected from the previous week.

The data collected were also shared with BPA, since they are the contractor for the external evaluation of the JUMP efficacy and impact evaluation studies. BPA plans to use the data to become more familiar with typical student behavior during gaming sessions. These data are only for research purposes, and the anonymity of students will be protected.

**Timeline for Pilot Study:**

**Dates**

<i>Pilot Study Week 1</i>	<i>Oct 9–Oct 12</i>
Orientation	
Vocabulary Pretest	
Videotaping (daily)	
Pilot Focus Groups (two pilot groups of six students each)	
Pilot Student Interviews (two one-on-one pilot interviews)	
<i>Pilot Study Week 2</i>	<i>Oct 15–Oct 19</i>
Videotaping (daily)	
Focus Groups (two groups of six students each)	
Student Interviews (three one-on-one student interviews)	
<i>Pilot Study Week 3</i>	<i>Oct 22–Oct 26</i>
Classroom Observation (weekly)	
Videotaping (daily)	
Focus Group (two groups of six students each)	
Student Interview (three one-on-one student interviews)	
<i>Pilot Study Week 4</i>	<i>Oct 29–Nov 2</i>
Student Reorientation	
Videotaping (daily)	
Focus Group (two groups of six students each)	
Student Interviews (three one-on-one student interviews)	
<i>Pilot Study Week 5</i>	<i>Nov 5–Nov 9</i>
Student Video Cartridges Exchanged	
Videotaping (daily)	
Student Interviews (five one-on-one student interviews)	

**IV. RESULTS**

The results from the various data sources utilized are discussed in this section.

**Temperature Checks**

Daily temperature checks (see Appendix C) were used to assess students' daily game experiences. Students were asked to respond to five questions by circling a thumbs-up (positive experience, value assigned = 1), thumb to the side (neutral experience, value assigned = 2), or thumbs-down (negative experience, value assigned = 3) indicator. In other words, the lower the score, the better the experience was for the students. (If the trend line in each graph—indicated in black—goes down over time, this would suggest that students' experience with the issue addressed in the question improved.) Students completed the temperature checks at the end of gameplay each day. For all five questions, results indicated that students' experiences with the game became more positive as the 6-week test period progressed.

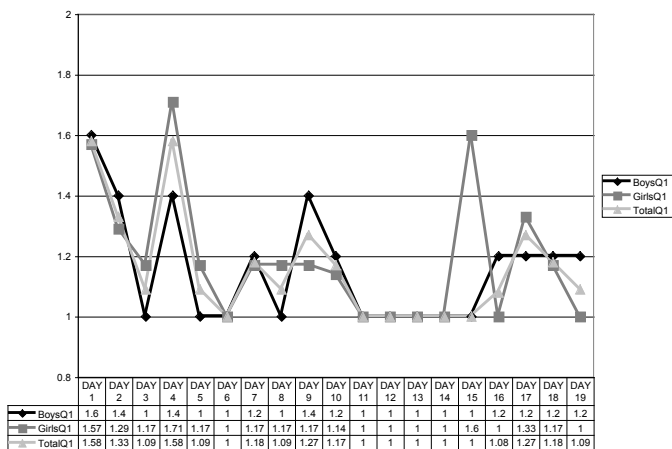


FIGURE 1

Question 1: It was easy to figure out where to go and what to do.

Question 1: Figure 1 shows how student ability to navigate through the game varied. Some students were slow to discover the watch functions (i.e., journal, mini-map, repair, word bank), but following the reorientation on October 23, 2007, students were able to clearly articulate the watch functions and became more frequent users of the journal, repair function, and word bank. Students began to complete tasks more quickly as they realized that characters had multiple conversations to share (color coded in white or pink to display new or previously read information, respectively). Student socialization during play time also enabled students to help one another in locating characters, or encouraged them in play through competition. All students began level 3 play on November 6, 2007.

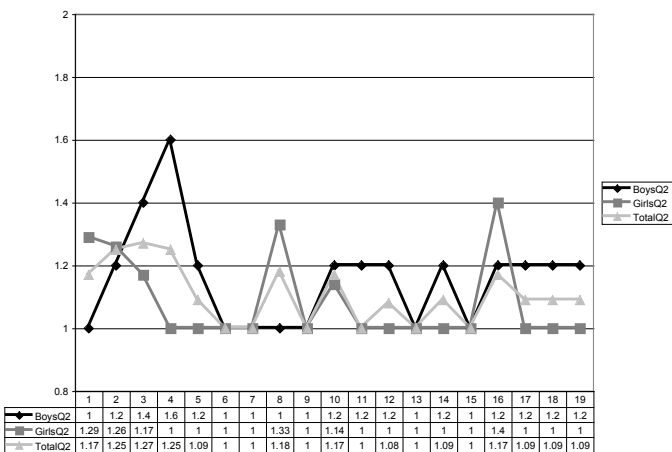


FIGURE 2

Question 2: I was able to understand the things I read.

Question 2: Figure 2 appears to show that the reading was not difficult for students, and that it actually became easier over the course of the pilot testing period. However, observations of the students suggested that a minority of students were diligent in reading through the conversations and looking up vocabulary words, while the majority rushed through the dialogues.

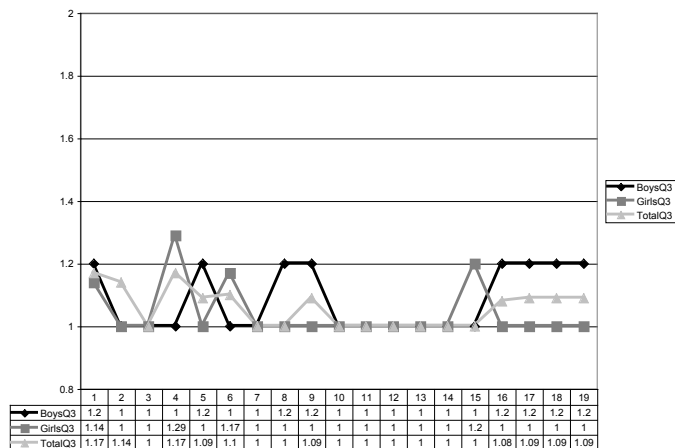


FIGURE 3

Question 3: It was easy for me to find the information I needed to play the game.

Question 3: Figure 3 shows that as students became aware of the watch and its functions (i.e., journal, mini-map, repair, word bank), they became increasingly confident with navigation. Discovery of new character conversations and information sharing among peers greatly aided students in playing the game. Adult intervention was needed only to distribute games and regulate the time of play.

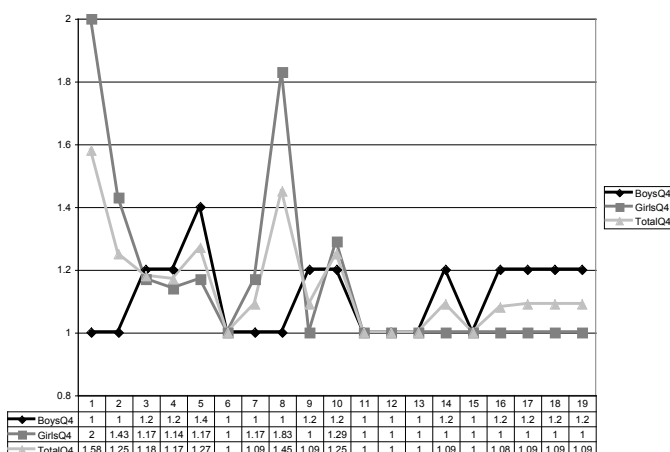


FIGURE 4

Question 4: I learned something new that I didn't know before.

Question 4: Figure 4 shows that following the reorientation session provided by JUMP staff on October 23, 2007, there was a slight rise in student confidence. Confidence dipped, however, following the exchange of game cartridges on November 6th.

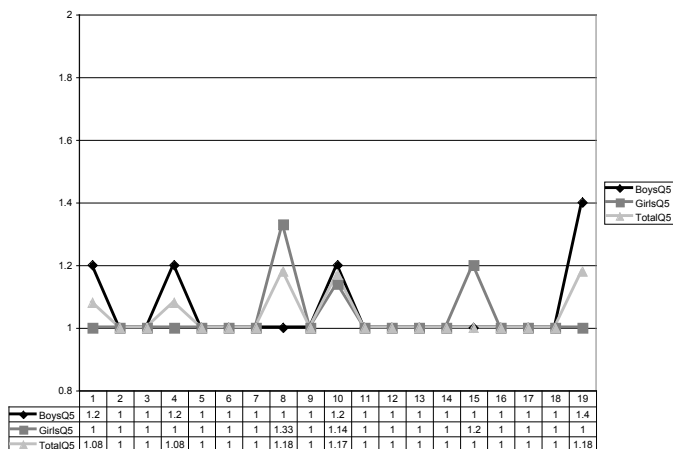


FIGURE 5  
Question 5: I had fun playing the game.

Question 5: Figure 5 shows that students consistently reported that the game was fun and that they would have enjoyed playing for longer periods of time. Students also asked to take *Cosmos Chaos!*™ home so that they could continue playing it. With students advancing to level 3 and, consequently, the change to a newer cartridge that had not been tested as extensively as the first cartridge for bugs and crashes, there was some frustration regarding crashes and the need to restart the game. The JUMP team was well aware of these issues and has worked to correct them.

### FOCUS GROUPS

Focus group interviews of subgroups of participating students were conducted so that PREL R&E staff could become more familiar with the actual gaming experiences of students. Along with the basic questions about what they liked and disliked about the game, students were also asked about certain characters and their personalities. This gave another indication of whether students retained information from playing the game (see Appendix A).

Students liked the feel of the game (e.g., very few crashes), responded well to the mission of the game (i.e., to rescue Hugo), and enjoyed the robot battles (to a certain point) and the battery launcher parts of the game. When asked about the length of play, the majority of the students wanted to play longer (30 minutes or more), and some asked to be allowed to take the game home to continue play.

Students identified the number of robot battles and length of level 1, the desert background, and the length of dialogue as points of frustration. While students did enjoy the robot battles, they were often frustrated by the sheer number of battles as they moved ahead in the game because it slowed exploration and limited students’ ability to complete quests. The desert background of level 1 was described as “dry” and “boring” by students, whereas the rain forest of level 3 was described as “fun” and “colorful.” A minority of students mentioned the difficulty of vocabulary words as a point of frustration. When commenting on the length of the dialogue, the majority of students stated that it was too long, but not difficult to read or understand. Some students used the word bank when they encountered a new word, while others simply tapped through the dialogues as quickly as possible to get through them.

### INDIVIDUAL INTERVIEWS

At selected intervals, two one-on-one interviews were conducted by PREL R&E staff at the conclusion of the day’s play. All students were interviewed once, with the exception of two who were interviewed twice. These interviews were used to collect students’ general and specific impressions, including their impressions about major game components (e.g., journal, watch; see Appendix B).

Students reported that they liked the feel of the game, but many were slow to understand how various functions worked (e.g., chip charge, lock decryption). Others progressed slowly because they did not know about the watch options for navigation, or that they could have multiple conversations with the characters. Following the reorientation on October 23, 2007, students became increasingly confident in understanding the various key game components, and visits to the word bank and the journal for game navigation increased.

When asked about their gaming experience, students compared *Cosmos Chaos!*™ to other video games they played (i.e., Brain Academy, Brain Age, Pokémon, Dora the Explorer). Several students indicated that though they found *Cosmos Chaos!*™ to be fun, it was less fun than the other games they had played. Students did, however, indicate that they would be eager to play *Cosmos Chaos!*™ for longer than 30 minutes.

Students liked the robot battles (up to a point) and enjoyed the battery launcher component. Some students reported that the battery launcher became increasingly difficult at level 3. Students’ dislikes centered around the amount of dialogue (i.e., too much) and the length and background of level 1. Students also criticized the number and length of robot battles, focusing on their frequency and the amount of health and power expended to complete them.

Level 3 presented new challenges to students as frustration rose with “getting stuck” (i.e., screen freezes) and the difficulty of lock decryption. Students also learned that the mini-map did

not precisely match the playing field. The new background and characters on level 3 were well-received; students were able to identify characters and elements of the background that they liked and found entertaining.

### CLASSROOM OBSERVATIONS

During gameplay, social interaction among students was high, with students moving around the classroom to observe or seek help from other students. As students became comfortable with the testing environment, they began to frequently share their successes with their peers and often competed with one another in obtaining battle victories. Students exuded a lot of excitement when completing new tasks and encountering new characters, but at times they also displayed frustration with the number of robot battles and the length of character dialogues.

Students often interacted with one another, and they generally sought adult advice only when encountering difficulty with the shape draw function or when level 3 of the game crashed.

### HANDHELD DATA

PREL’s R&E staff downloaded data from students’ Nintendo DS cartridges on November 6, 2007 (day 16 of the pilot study). The data included information on character name choice, total time of gameplay, words passed, journal items completed, and percentage of level completion achieved by each student.

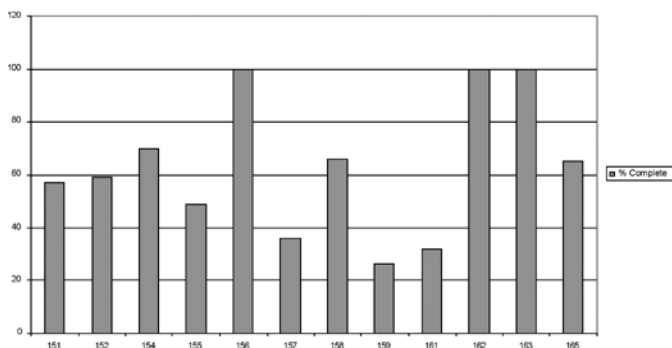


FIGURE 6  
Level 1: Percent Completed at Day 16

Figure 6 shows that on day 16, three male students (#156, #162, and #163) had completed level 1 and advanced to level 2. The total time of gameplay in level 2 for the students who had completed level 1 was under 3 hours (2:52, 2:25, and 1:10). Student #162 made the most progress (56% complete) on level 2 by day 16. All students exchanged the original cartridges (levels

1–2) for level 3 cartridges on November 6, 2007, and played level 3 through the completion of the pilot study.

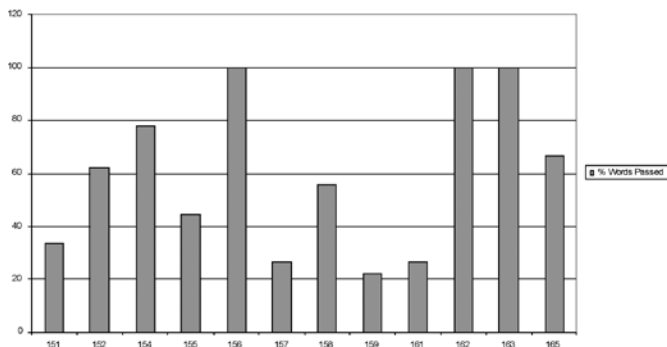


FIGURE 7  
Level 1: Percentage of Words Passed at Day 16

Each level of *Cosmos Chaos*™ includes 45 vocabulary words that students must pass prior to progressing to the next level. Figure 7 shows that at day 16, the number of words passed by students on level 1 ranged from a low of 10 to a high of 45 (all words successfully completed).

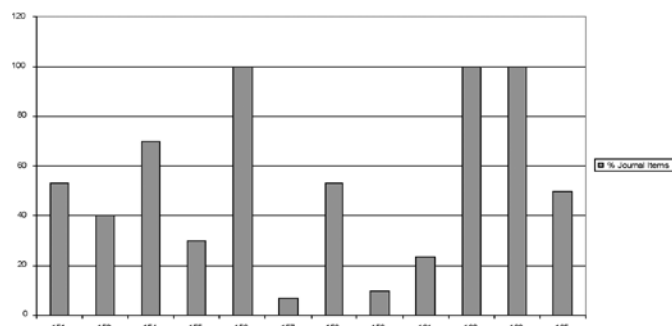


FIGURE 8  
Percentage of Journal Items Completed at Day 16

In addition to passing vocabulary words, students needed to complete a total of 30 journal items, or “quests,” before advancing to a new level. Figure 8 shows that at day 16, student completion ranged from a low of 2 items to a high of 13 items (all journal tasks completed).

### Vocabulary Pre- and Post-Test Results

PREL staff administered a vocabulary pretest on October 9, 2007, and the corresponding posttest on November 15, 2007 (see Appendix D). Both the pretest and posttest contained questions about 45 vocabulary words, including 15 words from each of the 3 levels played during the 6-week period of testing. The numbers in Table 2 refer to students’ pre- and post-test percentages. The

average increase in vocabulary knowledge from pretest to post-test was 4.1%, with 7 of 12 students showing increases, 2 of 12 students showing decreases, and 3 of 12 students remaining at the same knowledge level.

**TABLE 2**  
Vocabulary Pre- and Post-Test Differences: Percent Correct

Student #	Pre	Post	Diff
151	6.7%	28.9%	22.2%
152	31.1%	31.1%	0.0%
154	28.9%	42.2%	13.3%
155	22.2%	24.4%	2.2%
156	35.6%	35.6%	0.0%
157	31.1%	35.6%	4.4%
158	26.7%	24.4%	-2.2%
159	28.9%	33.3%	4.4%
161	17.8%	13.3%	-4.4%
162	35.6%	40.0%	4.4%
163	53.3%	53.3%	0.0%
165	31.1%	35.6%	4.4%
<b>Mean</b>	29.1%	33.1%	4.1%

It should be noted that the results of this part of the study were the most difficult to interpret, because the number of cases was small (N = 12), the total amount of time students had with the game was short (just over 12 hours total playing time), and the time between the pretest and the posttest was also relatively short (6 weeks). In addition, the design of the word-definition match instrument did not tightly link to the context-driven vocabulary instruction.

**Key Findings on Specific Aspects of the Game**

Table 3 shows important information that was conveyed to the R&E staff through interviews and focus groups, which was then transmitted back to the JUMP development team so that, whenever possible, they could address the students’ comments.

**TABLE 3**  
Summary of Specific Game Elements

<b>MAP NAVIGATION/WHERE TO GO</b>
Even with the journal and the mini-map, students had a difficult time knowing where specific people or things were and, thus, where they should go. Students suggested adding character names and/or pictures of the actual characters to the mini-map (in lieu of stars).
<b>DIALOGUE</b>
Many commented that the dialogues were too long. Many students were not reading the dialogues at all, choosing to tap through the text as quickly as possible. Others read through the dialogue, and an even smaller number of students understood the humor in it.
Some students did not initially know that characters had multiple dialogues to share.
Students rarely laughed at the intended humor in the dialogue; when asked if they found anything funny, a few mentioned the way a certain character looked or acted, but they did not comment on the dialogue itself.
Some students were tapping the middle of the screen to try to move forward in the dialogue, instead of tapping the forward arrow in the bottom right corner.
<b>COMBAT</b>
Many of the students were frustrated with the number and duration of robot fights, but they also enjoyed competing with one another for battle victories and gaining new items for combat.
Many of the students didn’t grasp the concepts of robot health as opposed to robot power (for Buddy). Following the reorientation, students were able to clearly articulate the concepts and began to play more efficiently.
The shape draw method of choosing answers for combat questions was so frustrating for some students that they just tried to get ANY shape to register, and were not worried about getting the correct answer.
Students rarely used the shield function during combat. Some complained that it did little to help them in combat.
<b>CHIP REPAIR</b>
Some students had a hard time understanding the objective of the chip repair game. The fire element was identified as fun, and, therefore, many students enjoyed providing the wrong answer for chip repair so that they could “blow out” the fire.
<b>BATTERY RECHARGE</b>
Students enjoyed the battery recharge game on all levels, but a small number of students expressed frustration with the difficulty of battery recharge in level 3. Antonym analogies were initially difficult for students to comprehend and complete. Once students came to understand the concept of analogies, their ability to succeed increased.
<b>QUEST PROGRESS</b>
In 16 days of play, three students completed level 1 and moved to level 2. All students exchanged cartridges and moved to level 3 in week 5.

**V. RECOMENDATIONS**

Some specific recommendations can be made based on the results from the 22 days of gameplay at the elementary school in Honolulu. The outside evaluators (BPA) contracted to conduct

the efficacy and impact studies will likely find the following recommendations helpful to consider in the implementation of their evaluation of *Cosmos Chaos!*<sup>TM</sup>:

- Keep the gameplay time limit at 30 minutes. Although in their interviews most students said that they would like to have played longer than the allotted 30 minutes each day, classroom observations and review of the daily videotapes suggested that many students were ready to end the gameplay after 30 minutes, and that some students' attention span began to fade as they approached 30 minutes. This was also confirmed by an earlier demonstration of the game at another elementary school, where 45-minute sessions were used, and many students' attention faded after 30 minutes.
- Allow students to interact socially, rather than making them play the game strictly on their own. We found that the game lent itself nicely to interaction between the students, and students seemed to enjoy talking to one another and sharing secrets and their successes in the game. Had they not been allowed to talk to one another, the excitement around the game may not have been as high. The idea is to have students be involved in the game, no matter what strategy they choose (i.e., work alone or share with other students). It shouldn't matter how students play the game and, hopefully, learn, as long as they play and learn with the game.
- Limit answers to questions about gameplay, especially because the tutorial for *Cosmos Chaos!*<sup>TM</sup> is included in the next version of the game. Since the goal of this project is to produce an off-the-shelf game that can be played by students without support from a teacher or adult, the implementation of the game for future studies should use the same strategy for students. While the participating students had questions, they all seemed to be able to reconcile their problems either on their own or with the help of other students.
- If a method can be created to track and monitor game use, allowing some students to take the game home to play on their own time would be another useful way to test the impact of *Cosmos Chaos!*<sup>TM</sup>. There are some clear challenges to overcome in order to collect high-quality data, but if a way to track the usage of the device can be developed, this component could allow even more high-quality, interesting information gathering.

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## APPENDIX A. STUDENT FOCUS GROUP QUESTIONS

Date: \_\_\_\_\_ No. of Students: \_\_\_\_\_ Week #: \_\_\_\_\_

1. How quickly does the game move for you?  
[Probes: Does it move along fast? Or does it move slow?]
2. What do you think about the different “worlds” the game takes you into?  
[Probes: How would you describe the desert and rainforest worlds?]
3. Did you find the game challenging?

### FOLLOW-UP QUESTIONS

- a. Did the game become easier as you played?  
If not, what caused it to remain so difficult?
- b. If they answer that the game was challenging, then ask:
  - i. Which parts did you find the most challenging?
  - ii. Did you enjoy the challenges?
- c. Were there parts that were too hard and made you frustrated?
4. When you think about other games you play, how does this game compare?

### FOLLOW-UP QUESTIONS

- a. What games does this game remind you of?
- b. Do you think this game is more fun?
- c. Is it more boring?
5. What do you like best about playing *Cosmos Chaos!*<sup>TM</sup>?  
[Probes: What specific things do you like best about it?]
6. If you could change the game to make it more fun to play, what would you change?

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APPENDIX B. STUDENT INTERVIEW  
QUESTIONNAIRE

Student: \_\_\_\_\_ Gender: \_\_\_\_  
 Student ID: \_\_\_\_\_ Date: \_\_\_\_\_  
 Week: \_\_\_\_\_  
 Level Attained: \_\_\_\_\_

**Profile Questions (first interview only):**

How old are you? \_\_\_\_\_  
 What computer or video games do you usually like to play?  
 \_\_\_\_\_  
 What other kinds of games do you play? \_\_\_\_\_  
 What is your favorite book? \_\_\_\_\_  
 What is your favorite cartoon? \_\_\_\_\_  
 What is your favorite movie? \_\_\_\_\_

**Session Questions:**

1. How far did you get in the game today?
  2. Was the game challenging for you?
- FOLLOW-UP QUESTIONS**
- a. Did the game become easier as you played?  
If no, what caused it to remain so difficult?
  - b. If they answer challenging, then:  
What parts did you find the most challenging?  
Did you enjoy the challenges?
  - c. Were there parts of the game that were too hard and made you frustrated?
3. If you could have played the game longer today, would you still continue playing the game?
  4. What did you like best about playing *Cosmos Chaos!*™?  
[Probe: What specific things do you like best about it? Did you have a favorite part of the game?]
  5. When you think about other games you play, how does this game compare?

**FOLLOW-UP QUESTIONS**

- i. What games does this game remind you of?
- ii. Do you think this game is more fun?
- iii. Is it more boring?

THIS NEXT SECTION REQUIRES DIRECTED  
RESPONSES ABOUT GAME COMPONENTS.

1. Dialogue: What did you like about it? Was there anything you didn't understand about the dialogue? Was there anything you did not like about the dialogue?
2. Map Navigation (getting around in the world): What did you like about it? Was there anything you didn't understand about the map navigation? Did you understand how to get around? Was there anything you did not like about it?
3. The Watch: What things in your watch did you use? How often did you use your journal? What did you like about the things in the watch? Was there anything you didn't understand about the watch?
4. Combat: What did you like about it? Was there anything you didn't understand about combat?
5. Battery Launcher: What did you like about the battery launcher? Was there anything you didn't understand about the battery launcher?
6. Chip Charge Semantic Mapping: What did you like about the chip charge semantic mapping? Was there anything you didn't understand about the chip charge semantic mapping?

APPENDIX C. TEMPERATURE CHECK

The temperature check is designed to assess students' experiences of the game on a daily basis. Students are informed that their feelings and experiences about the game can be different every day depending on the activities they spend time on and many other factors, and that it is okay. Students are prompted to circle the thumb that represents how they feel about particular topics. A thumbs-up is "yes," a thumbs-down is "no," and a thumb to the side is "so-so" or "neutral."

Questions:

1. It was easy to figure out where to go and what to do.



2. I was able to understand the things I read.



3. It was easy for me to find the information I needed to play the game.



4. I learned something that I didn't know before.



5. I had fun playing the game.



APPENDIX D. VOCABULARY TEST

Name \_\_\_\_\_ Date \_\_\_\_\_

1. An **adaptation** is \_\_\_\_\_.

- A) a change in a plant or animal that makes it better able to survive
- B) the act of becoming a parent and raising another person's child
- C) a way of feeling or thinking about something
- D) something that is new or newly made

2. An **organism** is \_\_\_\_\_.

- A) an instrument with keys like a piano
- B) a part of your body like your heart or eyes
- C) a way of growing crops
- D) any living thing

3. An **acute angle** is \_\_\_\_\_.

- A) an angle that measures more than 0° and less than 90°
- B) an angle that measures more than 90° and less than 180°
- C) an angle that measures exactly 90°
- D) any angle that measures less than 180°

4. To **affect** is to \_\_\_\_\_.

- A) be responsible for something
- B) cause a change in something or someone
- C) pretend
- D) be able to pay for something

5. **Continuous** means \_\_\_\_\_.

- A) going on a journey
- B) starting and stopping once in a while
- C) starting and stopping often
- D) ongoing, without stopping

6. To **determine** is to \_\_\_\_\_.

- A) stop someone from doing something
- B) be unsure about something
- C) reach a decision about something
- D) gain strength; grow stronger

7. A **gradual** change is \_\_\_\_\_.

- A) a rapid change
- B) a slow change
- C) a large change
- D) a small change

8. A **harsh** climate is \_\_\_\_\_.

- A) where most people live
- B) always close to mountains
- C) comfortable and pleasant
- D) uncomfortable or difficult to survive in

9. An **obstacle** is \_\_\_\_\_.

- A) something that gets in the way
- B) something that helps you
- C) something that you have lost
- D) something that you like to do

10. To **obtain** is to \_\_\_\_\_.

- A) lose something
- B) block something
- C) notice something
- D) get something

11. Something **rapid** \_\_\_\_\_.

- A) is unusual; not common
- B) stays in one place
- C) happens very quickly
- D) is usually free

12. To **respond** is to \_\_\_\_\_.
- react to something that was done or said
  - tell a story
  - admire someone
  - hope for something
13. **Variety** means \_\_\_\_\_.
- everything is the same
  - different kinds of things
  - heavy things
  - light things
14. If you say something **generally** happens, you mean it \_\_\_\_\_.
- happens quietly
  - happens in a loud way
  - happens most of the time
  - happens once in awhile
15. To **erode** is to \_\_\_\_\_.
- add rock or soil by the action of wind, water, or moving ice
  - wear away rock or soil by the action of wind, water, or moving ice
  - crush rock or soil using machines
  - move rock or soil with trucks and other machines
16. **Fossil fuel** is \_\_\_\_\_.
- fuel that can be renewed and used over again
  - fuel formed from energy created by nuclear power
  - fuel stored in deep natural underground caves
  - fuel formed from the remains of prehistoric animals and plants
17. **Weathering** is \_\_\_\_\_.
- being prepared to face bad weather like storms or hurricanes
  - living in a place where there is good weather
  - breaking down of rocks and soil by natural processes of weather
  - fixing your roof so it doesn't leak
18. A **quadrilateral** is \_\_\_\_\_.
- one-fourth of a circle
  - a figure with four sides
  - a figure with less than four sides
  - a figure that has more than four sides
19. If two things are **adjacent**, they are \_\_\_\_\_.
- next to each other
  - worth the same amount of money
  - easy to find
  - similar to each other
20. An **alternative** is \_\_\_\_\_.
- something that looks like something else
  - something different that could serve as a substitute
  - something that is easier to do
  - something that costs more
21. Something **coarse** is \_\_\_\_\_.
- made up of large grains or parts
  - made of very light material
  - colorful
  - very heavy
22. To **deplete** is to \_\_\_\_\_.
- use up something
  - increase the supply of something
  - discover or notice something
  - beat someone in a game or battle
23. To **deposit** is to \_\_\_\_\_.
- mine for minerals in a cave
  - take money out of a bank
  - give reasons for something
  - leave substances such as mud or sand somewhere
24. To **dissolve** something is to \_\_\_\_\_.
- add more of it to a pan
  - talk about it in a serious way
  - mix it into a liquid
  - figure out what happened
25. To **expand** something is to \_\_\_\_\_.
- spend money to buy it
  - explain it
  - make it larger
  - run away from it
26. An **impurity** is \_\_\_\_\_.
- something you put in water to make it safe to drink
  - a substance that makes something unclean
  - something that adds flavor to liquid
  - something in its purest form
27. To **occupy** a house is to \_\_\_\_\_.
- buy it
  - sell it
  - live in it
  - paint it
28. **Peculiar** means \_\_\_\_\_.
- having a happy ending
  - strange, odd, unusual
  - rare and expensive
  - very common

29. A **reservoir** is \_\_\_\_\_.
- A) an arrangement to save a room at a hotel
  - B) a player who takes someone's place in a game
  - C) a place where water is stored
  - D) a place where plants and animals are protected
30. A **vacant** building is \_\_\_\_\_.
- A) full of people
  - B) ready to sell
  - C) found in a good location
  - D) empty or not in use
31. A **consumer** is \_\_\_\_\_.
- A) an organism that eats other living things
  - B) an organism that makes its own food
  - C) a person who gives advice
  - D) an object that is inside a box or a bag
32. A **habitat** is \_\_\_\_\_.
- A) an endangered animal
  - B) a plant or animal's natural living place
  - C) something we do over and over again
  - D) a safe place to protect animals
33. The **radius** of a circle is \_\_\_\_\_.
- A) half the circumference of a circle
  - B) the distance across a circle
  - C) the distance from the center of circle to its edge
  - D) the area of a circle
34. To **abandon** something is to \_\_\_\_\_.
- A) take it away by force
  - B) stop liking it
  - C) put it up for sale
  - D) leave it completely or for a long time
35. If you have an **adequate** amount of something, it means \_\_\_\_\_.
- A) you have enough of it
  - B) you need more of it
  - C) you have an equal amount of it
  - D) you need to return some of it
36. **Dense** means \_\_\_\_\_.
- A) useful and easy to use
  - B) clean and neat
  - C) living nearby
  - D) tightly packed or crowded together
37. If something is **firm**, it is \_\_\_\_\_.
- A) strong and sure, not easily moved
  - B) light and easy to move around
  - C) hard to understand
  - D) not attached to anything
38. **Haste** is \_\_\_\_\_.
- A) being in a rush or a hurry
  - B) wasting time or money
  - C) not feeling sure
  - D) wanting something very much
39. To **identify** something is to \_\_\_\_\_.
- A) ask questions about it
  - B) pretend you don't know what it is
  - C) recognize it and say what it is
  - D) offer to buy it
40. When children **interact**, they \_\_\_\_\_.
- A) act out parts in a play
  - B) act as if they don't know each other
  - C) act on one another, such as communicating, playing, or working together
  - D) act in a curious manner
41. Something **major** is \_\_\_\_\_.
- A) expensive, valuable
  - B) of great importance
  - C) rare, hard to find
  - D) of little use to anyone
42. **Precise** means \_\_\_\_\_.
- A) almost correct
  - B) having lots of small parts
  - C) coming before something else
  - D) exact and correct in all details
43. **Sequence** means \_\_\_\_\_.
- A) small beads used for decoration on clothes
  - B) order in which things happen or are arranged
  - C) occurring without any pattern
  - D) not organized or planned
44. To **transfer** means to \_\_\_\_\_.
- A) prefer one thing over another
  - B) move someone or something from one place to another
  - C) travel by bus
  - D) mark something especially with a sticker or label
45. To **thrive** is to \_\_\_\_\_.
- A) seek something
  - B) throw things away
  - C) be healthy and strong
  - D) find a new place to live

APPENDIX E. PARENTAL CONSENT FORM

September , 2007

Dear Parent/Guardian:

Pacific Resources for Education and Learning (PREL) is requesting your permission to allow your child to assist in the evaluation of a new educational game. The game is being developed under a U.S. Department of Education grant by JUMP Into Reading for Meaning (JUMP). The goal of JUMP is to improve 4th grade students' vocabulary and reading comprehension through an interactive video game called *Cosmos Chaos!*™. The instruction contained in *Cosmos Chaos!*™ is aligned with state standards and features words from science, mathematics, and social studies textbooks. More information on the grant can be found at [www.ed.gov/programs/starschools/2005awards.html](http://www.ed.gov/programs/starschools/2005awards.html).

We have discussed the evaluation with the principal of the elementary school, and she has offered her support for the study. However, please be assured that your child's participation is strictly voluntary, and your decision regarding participation will not affect his or her academic standing with the school in any way. Moreover, any information obtained in the evaluation will be used only for the JUMP research.

Students participating in the evaluation will be asked to remain in school until at least 4:00 p.m. from Tuesday to Thursday during the week of October 9, 2007, and from Monday to Thursday during the weeks of October 15 through November 16, 2007. Thus, if your child's usual pickup time has been prior to 4:00 p.m., we ask that you delay pickup until after 4:00 p.m. during the 6-week study period. If your child's usual pickup time has been after 4:00 p.m., your child's pickup time does not have to be adjusted. Pickup points will remain at the designated A+ pickup area.

During the study, each child will be provided a handheld device called the Nintendo DS and a *Cosmos Chaos!*™ cartridge to play for 6 weeks. Staff from PREL will observe students playing the game, interview the students regarding their gaming experience, and videotape and audiotape the sessions. All students who participate in the evaluation by attending each scheduled session will receive a GameStop gift card worth \$20 at the end of the 6-week evaluation.

PREL is a Hawai'i nonprofit corporation that provides educational research and services to federal, state, and local governments, as well as directly to schools. In addition to the JUMP project, PREL administers the Regional Educational Laboratory Pacific program for the U.S. Department of Education. More information on PREL and its programs can be found at [www.prel.org](http://www.prel.org) and in the accompanying brochure.

To allow your child to participate, please sign and return one copy of this letter. Please keep the second copy for your reference.

We look forward to the opportunity to work with your child. If you have any questions about the JUMP project or your student's

participation in the study, please call Wayne Terada at (808) 441-1363 or email him at [teradaw@prel.org](mailto:teradaw@prel.org).

Sincerely,

Thomas W. Barlow, EdD  
President & CEO

PLEASE SIGN AND RETURN THIS FORM TO THE  
AFTER SCHOOL TEACHER BY:  
SEPTEMBER 27, 2007

I approve the participation of my student in the evaluation of *Cosmos Chaos!*™ as explained in the letter.

\_\_\_\_\_  
Name of Student (Please print.)

\_\_\_\_\_  
Name of Parent/Guardian (Please print.)

\_\_\_\_\_  
Parent/Guardian Signature Date

Please sign and return this form to the after school teacher by September 26, 2007.

