CURI

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This case study takes you through a human-centered design process used in developing an "Active Learning" tool, CurioCity, a game for 7th-10th grade students. Used in conjunction with urban field trips, the goal is to better understand multiculturalism and to bridge formal in-school learning with informal field trip learning. This game was developed by a team of three designers that just happened to be multicultural themselves, representing Japan, Korea and the United States as part of the "future of learning" initiative at the Illinois Institute of Technology's Institute of Design in Chicago.

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O C I T Y

Developing an "Active Learning" Game

In the media rich environment in which most students live, there is a need for new "active learning" tools that will help them deal with the challenging issues that face them in their future. Addressing the sometimes complementary and sometimes contradictory tasks of developing both a game and appropriate learning opportunities, this case study focuses on a user-centered design process.

Why develop an educational learning tool with a focus on multiculturalism?

Classrooms in America are changing in significant ways. Students come from a broad mix of cultural, racial, linguistic and economic backgrounds. For example, student enrollment in Chicago Public Schools from 1995-1996 according to a Chicago Board of Education demographic study was made up of: 54.4% African American, 31.3% Latino, 10.8% White, 3.2% Asian/Pacific Islander and 0.2% Native American. Seventy-nine percent of the students come from low-income families and nearly fifteen percent have limited proficiency in English. This increase in diversity among the student population is one of the greatest challenges facing teachers in the 90's. These statistics clearly demonstrate the importance of equipping teachers with "active learning" tools that both engage and educate students in dealing with sensitive issues like multiculturalism.

Having identified the problem of helping children develop an understanding and respect for other cultures, additional information was needed with which to explore possible solutions and to more deeply understand the problem.

Where do you start when developing an "Active Learning" game?

Rather than design a game in isolation and then launch it on its projected users, with a vague game idea in mind, we went into the field to see and experience classrooms. In addition to observing activities and interactions among our selected age group, it was important for the two team members from other countries to get firsthand experience with an American school. It was important to invest time upfront in this human-centered process of observation and research in order to confront the reality of the student's lives rather than work from common stereotypes.

Establishing a school site for investigation and feedback allowed us to interview and document through tape recording for later review teachers as they discuss their current issues and needs. Observation and documentation of student neighborhoods, classrooms and field trip environments using video ethnography (fascilitated by video and 35mm cameras) allowed us to capture student and teacher behavior in their natural environment as a means to gain insights about how students learn and interact with their teachers and each other. Taking observation notes, collecting data and analyzing the collected material helped us to better understand the student's real life framework.

This led us to prototyping concepts, creating conceptual and behavioral mock-ups which were tested with teachers and students, resulting in later revisions, and a cycle of design developments, re-testing and analysis of test results followed by continuing design refinement. This process of development let the design develop naturally and in touch

with reality as we learned from our final users what was interesting, memorable and fun.

Establishing a site and grade level, an inner city school was chosen within the Chicago Public School System that at first seemed to reflect a diverse demographic student population living in or around the school neighborhood. The seventh grade was selected based on students' cognitive skills of reading, writing and retaining information, which is fairly well developed by this time. Equally important, it is around the seventh grade that students come increasingly in contact with multicultural conflicts and issues, as they engage socially in more independent activities. (We later expanded the grade level from seventh to tenth grade after behavioral prototyping revealed that mixed grade levels could interact, understand the game and mutually enjoy the game interaction).

INTERVIEWS

A discussion with three seventh grade teachers who teach separate classes with the same students alternating study in the subject areas of: Reading, English and Real-World (giving students practical "real-life" hands-on experiences in writing resumes and doing cover letters, etc.) gave us a perspective on classroom goals. We needed to understand the teaching philosophy and discover what tools the teachers needed to help engage their students both in the classroom and on field trips, while at the same time fulfilling the Chicago Public School Curriculum requirements.

Among the questions asked were: *With different cultural backgrounds in your classroom how does this alter your teaching agenda? Do cultural background differences change the classroom? In what ways? What are the current attitudes regarding multiculturalism in your school? Are there any connections between classroom activities and the neighborhood? Are you currently using field trips to stimulate learning activities?*

During subsequent interviews we discussed three initial design concepts in order to get feedback from the teachers before proceeding:

1 *Cultural Calendar*: Kids learn about different cultures, their holidays and practices and incorporate it into their classroom by understanding why some students are not in school for Cinco de Mayo, Hanukkah or Chinese New Year etc.
2 *Mentor Buddy*: Students communicate with other students around the world to understand and help each other resolve conflicts or problems.
3 *Neighborhood Excursions*: Students act like archeologists uncovering facts and clues about cultures within Chicago neighborhoods.

Exploration of these ideas during interviews with teachers resulted in combining the Cultural Calendar and Neighborhood Excursions programs after teachers told us they were searching for new ways to stimulate students into learning things about their own heritage and culture in addition to that of others around them. They even recommended some constraints on the project's development with regard to technology and time.

Why a game?

We wanted to explore the area of games to get students more stimulated and engaged with learning. We discussed this with both students and teachers and they seemed quite interested in the idea. Students told us which games they liked to play the most and why. This helped us gain a better understanding of what motivated them and held their interest. Teachers told us that whatever we came up with should be available both as a computer-based game and as a gameboard as some teachers did not have computers in their classrooms. Length of play was another consideration as time was precious and students' attention tends to wander.

NEIGHBORHOOD OBSERVATIONS

A visual audit using 35mm cameras explored and documented the surrounding neighborhood (which revealed from the interviews that most of the students lived within the districts of five surrounding schools and either walked to school, were bused in or their parents dropped them off). This led to documenting the five "feeder school neighborhoods" that represented the school student population of African-American, Mexican-American, Chinese-American, Korean-American and Polish-American. (Mexican-Americans were predominant). As a complementary activity, a set of box cameras were distributed to the seventh grade students to record their neighborhoods through their own experiences and eyes. Students were asked to document where they lived, who they saw in the neighborhood, where they went to play after school, where they shopped and ate. These photographs were then collected and added to a wall of images with descriptions of activities that represented the students' points-of-view.

figure 1

CLASSROOM OBSERVATIONS

The Reading, English and Real-World classrooms were observed using the AEIOU observation method.[1] This method lets you record short descriptions of what you observe in an environment (*see table* 1).

Two video cameras were mounted in the classrooms to record the daily activities of students which were then reviewed with screen grabs pulled from the videotape and transferred onto electronic files to be used to document activities and behaviors. Students have lots of energy that needs to be harnessed and directed during the time they spend in school (*see figure* 1).

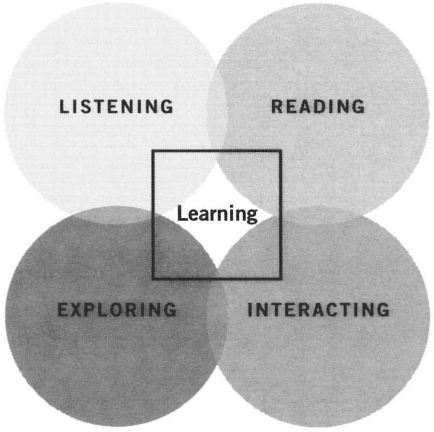


table 1: AEIOU Analysis of classroom

ACTIVITIES
chatting
raising hands
standing
answering
asking question
yawning
making noise
passing
adding to chaos
note taking
reading
writing
pushing
collecting
distributing
sitting
listening
sharing
grouping
touching
erasing
staring
fighting
arguing
walking
playing
turning
drifting
delivering
giving/taking
discussing
ordering
sleeping
thinking
dropping

ENVIRONMENTS
classroom
inner-city
school
lots of trash
multi-cultural

INTERACTIONS
teacher and student
teacher and students
student and student
students and students
student teacher and student
student teacher and students
teacher and student teacher
teacher and reading material
student and reading material
teacher and textbook
student and textbook
student and dictionary
teacher and blackboard
student teacher and blackboard
students and chair
students and desk
students and notebook
teacher and lights
students and lights
student and pencil
student and candies

OBJECTS
desks
chairs
textbooks
computers
notebooks
papers
book shelves
blackboard
information boards
pencils
dictionaries

USERS
teacher
student teacher
students
other teachers
administrators
principal

FIELD TRIP OBSERVATIONS

We not only needed to concentrate on the classroom but also on how learning occurred outside the classroom on field trips. Research has shown that field trips are important for many reasons: they increase student knowledge and understanding of a subject; they add realism to the topic of study; they provide an opportunity to develop and enhance student skills; they build socialization skills (to enable a student to participate actively in a group); and they build citizenship skills (enabling students to become an active member in a community).

Using the AEIOU method along with videotaping, we observed three classrooms on a field trip to a Nature Center north of Chicago (*see table* 2).

Students find field trips "boring" unless they are meaningfully organized. Learning on a field trip is more informative and exploratory, but can be derailed if not explained or contextualized (*see figure* 2).

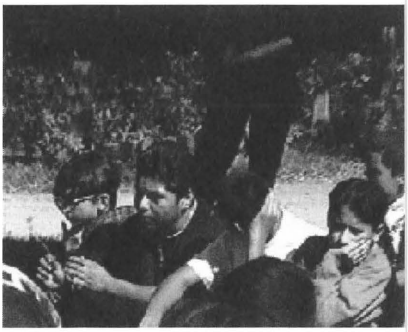


figure 2

DATA COLLECTION AND ANALYSIS

The scale of this project required collecting a large amount of data from field work: interviews, observational research, library research, photographic research, field trip research and box camera/questionnaires from students which were then analyzed and synthesized (*see table* 3).

DEFINING CULTURE

We realized that we could not take culture for granted but had to define and agree on a definition. We wanted to make sure that all the project designers had a similar vision and understanding before continuing to develop the project in detail. After reviewing the ethnic neighborhoods, we went back to examine what culture is. Avoiding stereotyping, as

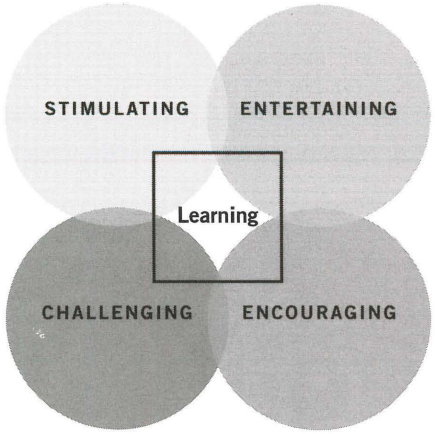


table 2: AEIOU Analysis of fieldtrip

ACTIVITIES
talking
standing
answering
asking question
yawning
running
reading
pushing
photo taking
yelling
crying
screaming
sitting
listening
grouping
touching
observing
walking
playing
giving/taking
ordering
eating
following
picking trash up
explaining
complaining

ENVIRONMENTS
river trail
nature center
woods

INTERACTIONS
teacher and student
teacher and students
student and student
students and students
teacher and teacher
teacher and teachers
students and teachers
students and foods
teachers and foods
students and animals
teacher and animals
students and plants
teacher and plants
teacher, mushroom and students
teacher, student and school bus
students and speaker
students and information tags
students and cameras
students and water pump
students and museum

OBJECTS
trees
animals
water pump
balls
foods
plants
school buses
information booklets
information tags
backpacks
coats/jackets
string

USERS
teacher
students
principal
chaparones
nature center workers

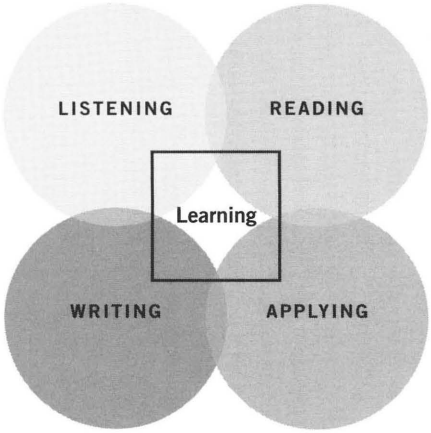


table 3: AEIOU Analysis of student box camera/questionnaires

ACTIVITIES
staring
talking
passing
shopping
eating
walking
running
driving
sitting
waiting
standing
yelling
playing
grouping
fearing
parking
playing
singing
observing
paying
selecting
window shopping
relaxing
gathering
pushing
browsing
caring
holding
yawning
entertaining

ENVIRONMENTS
houses
apartments
schools
churches
restaurants
grocery stores
pharmacies
bakeries
flower shops
libraries
book stores
park
gas stations
foreign languages
gang signs
banks
fire department
police department
community center
fast food stores
noise
laundries
theaters

INTERACTIONS
people and people
neighbors and neighbors
customers and seller
children and children
adults and children
people and food cart
children and ball
children and park
people and road
people and stores
people and bus station
people and cars
people and parking meter
people and dog
people and houses/ apartments
people and chairs
people and money
people and policeman
people and traffic signals
people and foods
people and signs

OBJECTS
gang signs
road
buses
traffic signals
cultural items
flags
signs
foreign language signs
trash cans
gate
cars
trees
money
police cars
garbage trucks
school buses
wall painting
baby stroller
ATM
newspapers
shopping bags
garages
food cart
foods
road name signs

USERS
women
men
girls
boys
cats
dogs
neighbors
visitors
students
shoppers
salesman
constructors
policeman

we created the game cards became a serious issue. Whether we should cover only "nationality" (sharing a heritage and history) or "ethnicity" (based on traditions, rituals, codes of language, norms) or both on the game cards became the main issue and focus of deliberation. (Remember, we had three designers working on this project who themselves represented vast differences in both nationality and ethnicity, each was a citizen of a different country and culture: Japan, Korea and the United States. Each of us saw the images on the cards in a different way.)

We broke down types of cultures and looked at the effects that gender, profession, geography, organizations, community (homogeneous-heterogeneous) and types of relationships have on defining a culture while avoiding stereotypes.

In addition, we understood nationality as defining a person born in a particular country, who has spent a significant number of years socializing in that country. We understood nationality as being fairly abstract and generalized. On the other hand, we looked at ethnicity as being defined by most people as sharing physical racial characteristics and sharing a specific history of having experienced discrimination. Most share a sense of heritage/history (which for some was origin from an area outside of/preceding the creation of their present nation-state of residence).

Our informal understanding created some insecurity so we consulted formal definitions and found: "Culture is defined as a historically transmitted system of symbols, meanings, and norms."[2] "The integrated pattern of human behavior that includes thought, speech, action and artifacts and depends upon man's capacity for learning and transmitting knowledge to succeeding generations. The customary beliefs, social forms, and material traits of a racial, religious, or social group."[3]

This led us to believe that we should focus on constructing a game with a focus on ethnicity (history and heritage)

and to use each culture's national flags to represent each neighborhood after observing that within Chicago neighborhoods flags of many nations are proudly displayed not only in yards, but also on car antennas.

A game concept began to emerge – developing a metaphor.

We decided to explore the possibility of using a metaphor to define what CurioCity could be as a game. Several directions were explored based on games structured like Space Invaders, Scavenger Hunt, or Archeological Expedition. After reviewing the metaphors, we decided to combine the Scavenger Hunt/Archeological Expedition into the neighborhood scenario. Out of this process came an idea to create a gameboard that focused on an expedition through multiculturalism in Chicago neighborhoods.

Students learn and remember concepts better when they are integrated into a redundant scheme and are actually used or manipulated by them. We positioned this game to be an important process in the field trip experience. The diagram indicates how the game would be able to connect the entire field trip experience including before and after the trip back into the classroom (*see figure* 3).

PROTOTYPE DEVELOPMENT

The key features of an educational game became the next area for exploration. After talking with several people at museums and in the neighborhoods and completing cultural diversity research, additional research was needed to design a gameboard. In a way games are ubiquitous. We all have experience with them, but we do not usually examine them analytically. First we explored and played with several board-games and computer games like: *Monopoly, Clue, Candyland, Myst, Where In The World Is Carmen Sandiego?* and *SimCity* in an attempt to analyze the advantages and

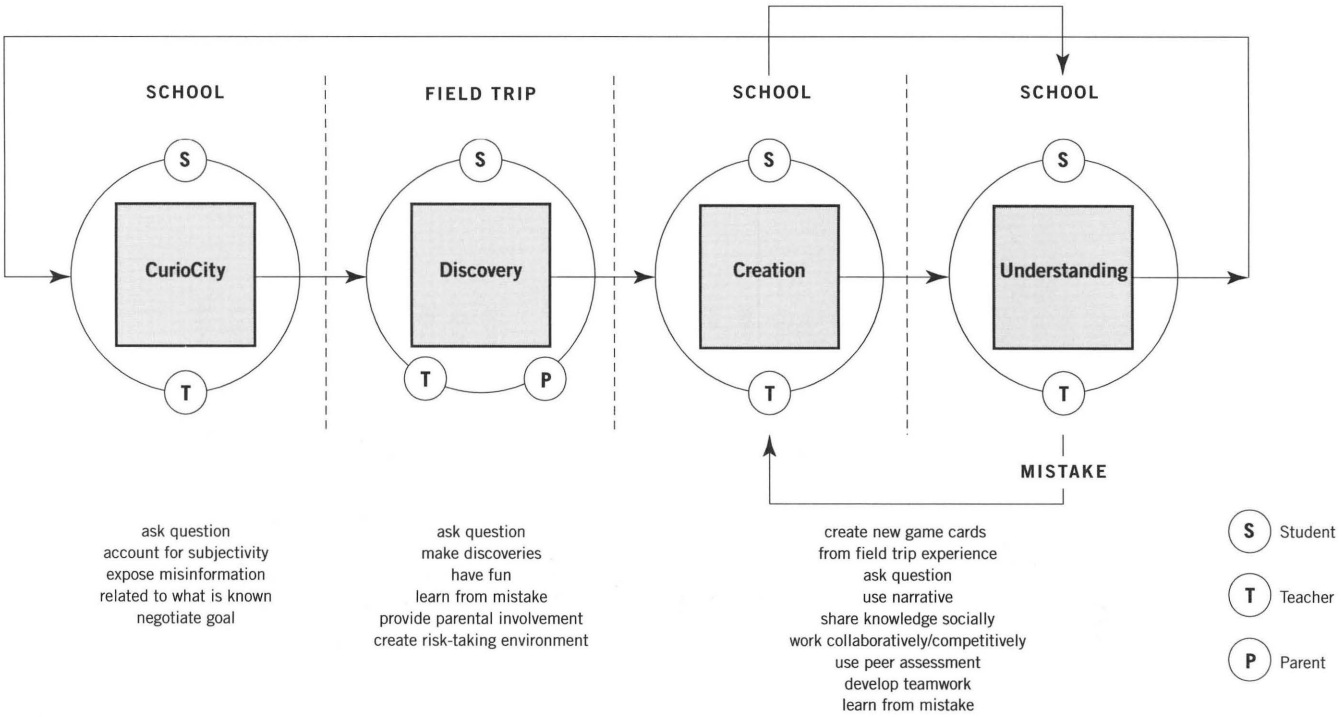


figure 3: Game Concept Development

We positioned this game to be an important process in the field trip experience. The diagram above indicates how our game will be able to connect whole field trip experiences including before and after the trip.

disadvantages when engaging one or more players, to observe how various control techniques like rolling dice and making decisions go together, how long a "turn" lasts and how this alters the players attention.

We identified five stages in developing a game:

1 *analysis of the ideas* (what the game should be about),
2 *the actual design of the game* (looking at what form it should have, what size it should be, etc.),
3 *development* (making prototypes which explored different layout configurations),
4 *implementation* (actually putting paper prototypes together for testing) and then
5 *evaluation* (video-taping students and teachers actually playing the game to test the potential of the game).

There were also two very different format directions that had to be examined:

1 *non-computer formats like*: card games, board games and role playing games; and
2 *computer-based formats like*: arcade games, adventure games, fantasy games, interactive stories, causal simulations and procedural simulations.

Before advancing to the next step in building a prototype we had to be clear about the objective of this game, which we identified as:

TEACHING STUDENTS ABOUT CULTURAL DIFFERENCES AND RESPECTING EACH CULTURE USING A VARIETY OF CHICAGO NEIGHBORHOODS; MAKING OUT-OF-CLASS ACTIVITIES MORE EFFECTIVE BY CONNECTING BEFORE AND AFTER FIELD TRIP EXPERIENCES AND THE FIELD TRIP ITSELF; AND ENCOURAGING STUDENTS TO WORK AS A TEAM.

We created a check list for game priorities by answering the following questions: *Is the game simple to understand and use? Can this game be played in a limited time? Is this*

game fun to play as a group? How small or large? Does this game encourage students' curiosity about their neighborhoods? Does this game make learning fun? Is this game about "Questions & Answers?" (We decided against the later approach as the game should challenge students beyond answering questions by engaging them beyond memorization into a more active learning role.)

A prototype for the game cards began to emerge. We went to each of the five neighborhoods in question, Chinese, Mexican, Korean, Polish and African-American and photographed architecture, signs, costumes, food and stores. We visited each of the libraries within those neighborhoods to research images that best represented each culture. The Chicago Historical Society, DuSable/Afro-American Museum and the Polish Museum provided indepth clues for the back of the cards and images for the front of the cards. Photos were taken and scanned into the computer and then mounted to the card front (image side) with the card back (word clues side) containing information to read about the image and its "neighborhood" (*see figure* 4).

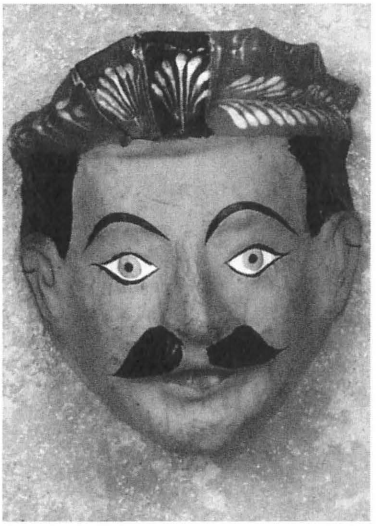


figure 4: Front of card

Paper maché mask used in festivals

Mexican American Neighborhood

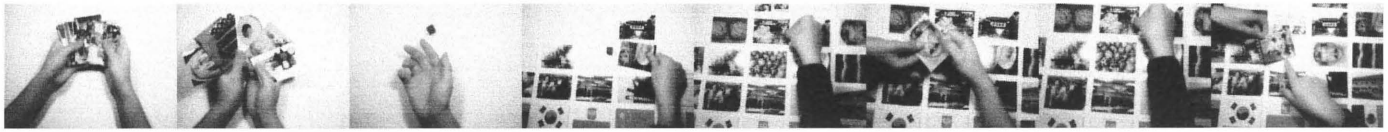
Back of card

A prototype of the gameboard emerged.

We made a simple white foamcore prototype of the gameboard that had five ruled boxes defining the neighborhoods where the cards were to be placed. (We did not want a colored version of the gameboard for the behavioral prototype test as we didn't want it to look too finished since we were testing for ease-of-use to see if the cards were interesting). There were five boxes across the bottom of the gameboard that were numbered 1 thru 5 and had colored cards placed on each square identifying the neighborhood. *Example: Chinese American card had the flag of China and the words Chinese Amercan underneath the flag.* In total there were twenty-five squares on the board on which to play and build neighborhoods. The gameboard was a standard 20" x 20" square that could be folded and stored in the limited space of a classroom. The game cards were the size of standard vertical (3 1/2" x 2 1/2") playing cards so students could comfortably hold up to six in their hands at once.

Prototyping game rules was important when we took the game to the school for play. Could students read the rules and understand how to play the game without help? Game instructions were devised for 2-4 players and 4-8 players. These contained visual descriptions with supporting copy underneath them (*see figure* 5).

The gameboard was developed first because it is a less labor intensive prototype than a working computer game. Recall that teachers preferred to have the game both as a boardgame and computer-based game. A game-board was also useful as a prototype prior to moving into a computer-based game as user problems could be effectively worked out and the game play could be interactively tuned.



1
Shuffle the cards.

2
Each player gets six cards.

3
Roll the dice. The one with the highest number goes first. Person on left side of first player goes next.

4
The one who goes first rolls dice to see what neighborhood they play first. If you get six on dice, you can pick any neighborhood. There are five Chicago neighborhoods that you can play.

5
Pick a card out of the six cards you are holding and place anywhere on the vertical row neighborhood that matches the number on the dice with the number on the gameboard. If someone challenges you that your card is wrong, but your card is correct, the challenger has to take one of your cards.

6
If you don't have a card for the neighborhood you need:
a. Ask other players if they have the card you need and place this card on the gameboard.
b. You can bluff and put a card down hoping that nobody notices that it is wrong. If anyone notices, they can challenge you and if you are wrong you have to pick up the wrong card and take one card from the challenger and add to your cards. You know that the card is wrong by turning it over for information about that neighborhood.

7
The next player to roll dice puts down card on the neighborhood that matches dice and gameboard number. Follow instruction four. If neighborhood is filled up roll dice only once. But, if you notice there is a wrong card in filled in neighborhood and you still have a card, you can replace the wrong card with your card.

8
Remember, the person to use up all their cards first wins! But the other players should continue to play. When game is over, all players should complete any missing spots on the gameboard together.

figure 5: Game Instructions Development

For Four Players: The object of this game is to use up all the cards in your hand as you build and learn about Chicago neighborhoods. The one who uses up all their cards first wins.

For Eight Players: There are two players on each team that make one decision. The object of this game is to use up all the cards in your hand as you build and learn about Chicago neighborhoods. The one who uses up all their cards first wins.

HOW TO PLAY THE GAME

Prior to leaving the classroom, students learn about Chicago neighborhoods through clues given on the back of neighborhood cards they played on a the CurioCity gameboard. The prototype gameboard focused on five neighborhoods for simultaneous play: Chinese-American, African-American, Mexican-American, Polish-American and Korean-American. (Eventually the real gameboard could have up to twenty Chicago neighborhoods that players could choose from for play, but only five could be "in play" at one time). Students could play one-on-one or in teams of four. The idea was to role a dice to begin the game to see who went first and to establish a playing order. Throughout the game, students had the option of either putting a card down on a correct neighborhood, or putting an incorrect card down (*Bluffing*) on a neighborhood and hoping an opponent didn't catch it (*Challenge*), or they could (*Ask*) request a card from another player if they didn't have the correct one. The game objective is to unload all your cards first. Even though you won after doing this, the other players continue to play until there is only one player with a card still remaining. Students then have to cooperatively figure out if all the cards are in the correct neighborhoods and work together to make them correct. It is through this "active learning" process that we expect to engage students, beyond the game's fun and competition, by leading them into reading and learning information about their city's multiculturalism from the cards.

THE FIELD TRIP

The game is part of a total experience. After playing the game, the teacher also gives students information through readings and discussion and defines the purpose of the field trip they are about to embark on prior to leaving the

classroom. Students then act as archeologists observing, photographing, sketching and collecting artifacts as they explore and discover the neighborhoods. Upon their return to the classroom, students could choose to play the game again or go into a collective Excursion Journal (paper-based) to learn additional things about the neighborhoods or begin to archive and record what they had learned in their own personal journals. The teacher might even want to have students build a "Cultural Museum" in the classroom from artifacts collected during the field-trip. These artifacts can also be used to create new cards for the game.

FINAL PROTOTYPE TESTING

Two video cameras were set up in a classroom to observe several sets of students playing the game using the foamcore gameboard and full color game cards. We tested: 4-individual players, 4-players with 2 on each team, 8-players with two players on each team, students playing each other and teacher and students playing each other. When 4 players played it took twelve minutes and when 8 players played it took fourteen minutes.

Reviewing the video tapes along with several AEIOU observations we discovered that: the students not only understood the game and how to play it, but were speaking in English and Spanish as they played. Teachers were just as engaged while playing with students as the students were. Students relied more on reading the clues on the back of the cards than on the images on the front of the cards. Students were retaining and remembering information when they were "Challenged" or "Bluffed" and when a card went down on the gameboard in an incorrect location.

We identified several advantages to gameboard play.

1 *Face to face interaction.* We observed that players were more excited when they were interacting with other players. For example, when one player (or team) was "Bluffing,"

the other players were trying to decode facial expressions, posture, etc.

2 *Team partner*. Students wanted to play both with a partner and as an individual player. Students seemed to enjoy the game more when they had partners. Sharing knowledge with a team mate became a strategy to win the game.

3 *Game rules*. First time players asked students who had already played the game questions about the rules of the game. Students preferred to learn the rules from each other rather than through reading them.

4 *No special equipment was required*. To play the game all that was needed were players, a place to play, a table and chairs and the game itself.

After testing and analysis were completed, we prototyped the Excursion Journal which teachers could use as a guide with suggestions to extend program applications so that things didn't just end after playing the game or after returning from a field trip. This program was designed to fulfill Chicago Public School Curriculum Requirements of Reading, Writing and Real-World applications in addition to creating an "active learning" tool that teachers could use to stimulate learning.

In addition to using the game cards that were included with the gameboard, students could also keep the game alive by creating new cards for the game after they returned from neighborhood field trips, drawing on their "archeological" photographs, drawings and other research.

In the end, CurioCity initiates new ways to "actively learn" about multiculturalism through an integrated field trip/game into Chicago neighborhoods that gives students "hands-on" practical knowledge and skills that can't be gained through textbooks alone. It could also be expanded into other subject areas such as math and science and serve as an across the curriculum bridge. CurioCity could be further developed as a template which could accomodate other cities around the United States where students not only

learn about cultures in their backyard, but about those in other regions of the country. In this way the game can be both customized to local culture and shared nationally.

As far as developing a computer-based game for CurioCity a similar study was conducted using a Chicago Charter School (grades seventh to tenth) with a new team of designers. Adapting the game to an interactive computer environment presented new challenges. The process of prototype development and observation of users interacting with the game was similar to the study presented here, but that's an entirely new and interesting story in itself.

ACKNOWLEDGEMENT

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Lynne Ferguson is combining her years of professional design experience with Texas Instruments, an undergraduate degree in graphic design from Art Center College of Design with her current graduate program in human-centered communication design at the Illinois Institute of Technology's Institute of Design. Her professional interests include: user-centered social science processes in design, writing, photography and film.

ENDNOTES

1 The AEIUO framework was developed by Dr. Rick E. Robinson, E-Lab, Chicago.

2 Collier & Thomas, 1988; Geertz, 1983; Schneider, 1976.

3 Webster Dictionary, 1989.

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