

# Audience in Computer Learning: A Constructionist Interpretation

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**Abstract:** Adolescents often anticipate the reactions of other people in social situations. We believe this construction of imaginary audiences serves as a stimulant to youth engagement in activities and their abilities to become proficient in the use of technology. In this paper, we examine the role of audience at one Intel Computer Clubhouse, a radical constructionist learning environment.

**Keywords:** learning environments, mentoring, motivation.

## *At the Clubhouse, Friday February 14, 2003*

*Today Ileana<sup>1</sup> (girl, age 10) sat away from other clubhouse members and played the Sims for the first half hour. When Ann, the clubhouse coordinator, noticed that Ileana was playing the Sims, she commented, "Ileana, it's time for you to do something productive." Ileana muttered under her breath, "I know, I know, something productive" and proceeded to close the Sims.*

*Ileana looked up from her monitor at the empty music studio and promptly asked Karen, a friend from school, to work with her in the space. The girls walked into the studio quickly and signaled for Anne Marie, a mentor, to join them. Ileana demonstrated beats in FruityLoops™ and then began to scream loudly into the microphones. Anne Marie commented, "Let's do something more productive than yelling into the microphones. Do you want to record a vocal track?" Ileana replied, "I know, we need to do something constructive." The girls looked up in the direction of another group of musicians standing outside the studio door, not participating in any activities. Before starting a vocal track as they had just discussed, Ileana commented, "It's ok, they [the other group] can use it now. Karen, let's go do a play!"*

*The group that had been standing outside the music studio entered the space, and within moments, filled the clubhouse with the sounds of a creation in progress. Ileana and Karen (girl, age 10) headed over to the couch area and began to videotape an impromptu skit. Anne Marie was instructed by the girls to record the skit while they acted. When finished recording, Ileana showed Karen how to upload the video segments to a computer. Before leaving the clubhouse, Ileana and Karen made plans to continue their skit.*

*(Summarized from field notes, Friday February 14, 2003)*

## Introduction

Today's global society can be divided into people who do and people who do not have access to, nor the capability to use, modern information technologies, such as the telephone, television, or the Internet. In response to growing concern over this "digital divide," many efforts have been made to introduce inner-city youths, who are often underserved when it comes to learning how to use computing technologies. Despite efforts to close the divide, it continues to expand (United States Department of Commerce, 2000), leaving frustrated educators to wonder what can be done. In 1993, a group of individuals from The Computer Museum, in collaboration with MIT Media Lab, responded to the challenge to close the divide by organizing a new type of computer center, the Computer Clubhouse, in Boston, MA. The clubhouse founders aimed at promoting true "technological fluency," allowing participants not only to consume computer applications but also to create, design, and implement their own ideas through technical mediation (Resnick & Rusk, 1996; Resnick, Rusk, & Cooke, 1998). The clubhouse learning environment is based on four core principles: (1) support learning through design experiences, (2) help youth build

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<sup>1</sup> All names have been changed to preserve confidentiality.

on their own interests, (3) cultivate “emergent communities”, and (4) create an environment of respect and trust (Resnick, Rusk, & Cooke, 1998).

At the outset, members of MIT’s Media Lab and the Saint Paul, Minnesota’s Youth Computer Center carefully studied the “flagship” clubhouse (Resnick & Rusk, 1996b). With funding from Intel, the original clubhouse network has been expanded to include 57 clubhouses across 14 states and the District of Columbia in addition to 22 clubhouses in 13 other countries.

The Intel Computer Clubhouse network uses a radical constructionist model, which is atypical when compared to other after-school technology programs (Resnick, Rusk & Cooke, 1998). Constructionists advocate learning through working on personally meaningful projects (Harel & Papert, 1991). In more conservative implementations in traditional school contexts, constructionist learning activities become similar to project-based or problem-based learning (Barron, 1998). Learners are given specific projects or problems on which to work, but are free to explore a variety of approaches to the solution. In more radical implementations, the environment is largely unstructured, leaving learners free to set their own goals and work on things meaningful to them at all times. The choice of project or whether to do a project at all is left up to the individual. The belief is that they will become motivated to complete work on those projects which are most relevant to personal interests. Furthermore, support for learning from other members of the community will help them to persevere through the difficulties encountered in project work (Bruckman, 1998). Through this project work, students not only develop useful skills and knowledge, but also a mental model for using the skills and knowledge and a way to apply their knowledge to this new emerging society (Lieberman, 1992).

To what extent does this model work in practice? The question seems straightforward, but coming up with a meaningful answer is overwhelmingly complicated. First, each clubhouse is different. The enactment of the clubhouse model must then be different. Within a single clubhouse, the practices and tacit rules for participation may shift over time and suddenly when there are staff changes. Even in a single day at a single clubhouse, what constitutes “success” is unclear, given the goal of technological fluency. Objectives for meeting that goal may include, but are not limited to, getting the youths to attend the clubhouse, retaining them, teaching them technology, and engaging them in interesting projects. The vignette that opens this paper provides one concrete example of a day against which we might frame this discussion. To what extent did Ileana and Karen have a “successful” day? To what extent is this day typical of youth experiences at this clubhouse? By observing activity at clubhouses, can we develop strategies for better meeting the expectation of the stakeholders including funding agencies and the designers of the clubhouse model? Through such observations, can we test the assumptions of the underlying clubhouse model?

In an effort to answer these questions, a team of six researchers conducted an ethnographic study of one computer clubhouse. To uncover some of the common components of projects in the clubhouse that lead members to learn new technologies cooperatively over an extended period of time, we collected data on multiple activities in the clubhouse, both involving technology and not, through direct observation and interviews.

### **Egocentrism and the Role of Audience in Adolescent Learning**

Within Piaget’s theory of intellectual development, the concept of egocentrism generally denotes a lack of differentiation in some area of subject-object interaction (Piaget, 1962). Elkind describes the role that adolescent egocentrism plays in the construction of audiences for adolescent behaviors and activities:

*One consequence of adolescent egocentrism is that, in actual or impending social situations, the young person anticipates the reactions of other people to himself. These anticipations, however, are based on the premise that others are as admiring or as critical of him as he is of himself. In a sense, the adolescent is continually constructing, or reacting to, an imaginary audience. It is an audience because the adolescent believes that he will be the focus of attention, and it is imaginary because, in actual social situations, this is not usually the case (unless he contrives to make it so). The construction of imaginary audiences would seem to account, in part at least, for a wide variety of typical adolescent behaviors and experiences (Elkind, 1974).*

We believe that this construction of imaginary audiences also serves as a stimulant to youth engagement in activities and their abilities to become proficient in the use of technology. What we found at the computer clubhouse echoes themes of audience found in other domains. Researchers have found elements of Elkind and

Piaget's descriptions of imaginary and anticipatory audiences in adolescents learning a variety of skills, some of which are discussed in the following paragraphs. In all of these areas, it is clear that there is no single variable that guarantees project success. The anticipation of a large approving audience for the work, however, can serve as a strong motivator and its presence encourages a greater probability of project success, as defined by the acquisition of new knowledge and skills through project work.

Petraglia found that considering the reader motivates students learning to write to create more advanced work (Petraglia, 1998). Students learning to write are taught to familiarize themselves with the attitudes, beliefs, and knowledge of the audience for whom they are writing. In this way, they are taught how to approach their audience on the topic. The consideration of who might read the essay when completed not only improved their understanding of the uses and writing of rhetoric but also motivated them to write quality essays when they might not ordinarily.

In reflecting on the needs of their audience, student software designers, as part of the Instructional Software Design Project (ISDP), became aware of their own learning issues in new and authentic ways (Harel & Papert, 1990). In this project, Harel and colleagues asked fourth graders to write instructional software to teach third graders about fractions. It was not so much the actual interaction with younger children (which was quite time limited) but the anticipation of having the approval of that audience that proved to be beneficial for student software designers. Having an appreciative audience for whom the work is produced, encouraged students to persevere in their work, and also supported the growth of meta-cognition (Harel, 1991).

Similarly, in the MOOSE Crossing project, Bruckman found the audience of peers helps motivate students to work on self-selected projects (Bruckman, 1998). Children at MOOSE Crossing are part of the project itself. That is, they are built in as in an anticipatory way to be judges of the outcome. In this way they're a special kind of audience to the outcome and not to the process itself. In an unsolicited email, one thirteen-year-old girl commented, "I like learning and doing stuff on my own, but the real reason I come to MOOSE Crossing is that I feel needed, and wanted. While programming is a lot of fun, I don't think I'd do it, if there wasn't anyone who would appreciate it" (Bruckman, 1998). Kids at the computer clubhouse behave similarly—they are most likely to engage in significant projects when they believe that others who view their work will appreciate them.

## **Method**

The majority of the study discussed in this paper was conducted over a period of six months at one site with follow up interviews during the next three months; this "clubhouse" included one coordinator, two assistant coordinators, eight mentors, and approximately forty clubhouse members. Interviews with individuals from all levels of the organization were conducted and using participatory observation, field notes from site visits were faithfully recorded. In total, the research team conducted 18 interviews and collected field data for 48 days during the time period of this study. Some members of the research team had begun related work at the clubhouse prior to this study and are continuing that work now.

In this study, we used a naturalistic inquiry approach. Although this approach includes a range of methods such as participant observation, respondent interviewing, artifact collection and the generation of field notes, special emphasis is placed on participant observation, in which the research team informally interacts with actors in their natural environment, while remaining careful to continue to treat them as informants and observe their actions for cultural knowledge (Spradley, 1979). Because the computer clubhouse model stresses the interests of its members, the naturalistic inquiry-based participatory approach was used to generate a greater understanding of these interests. Throughout the research period, the authors acted as mentors, a designation for adults with technical skills who volunteer at the clubhouse. In this way, the authors were able to interact informally with the members of the clubhouse and develop rapport with the individuals who were later interviewed.

In order to develop a more complete understanding of the activities at the clubhouse, field research was supplemented with a review of the literature of the clubhouse model and constructionist learning of technology, particularly research that involves children from underserved communities. Census data were collected from the surrounding areas and the descriptive statistical data from the "feeder" schools that send children to the clubhouse. Copies of the mentor and coordinator training manuals and an evaluation of the clubhouse network prepared by the Center for Children and Technology were also used as supplemental materials.

## **The Clubhouse Membership**

During the period of the study, the coordinator, Ann, was chiefly responsible for the clubhouse, including the allocation of physical space and assignment of both the youth members and adult mentors. She was also responsible for linking the clubhouse to the greater network by communicating regularly with the other clubhouses and central board. At the time of the study, Ann had been working as coordinator for approximately two years. Two assistant coordinators assisted Ann some days of the week during the time of the study by opening and closing the clubhouse as well as monitoring the activities of the mentors and members. One of the coordinators also was responsible for organizing and implementing the schedule of activities for one day each week that was dedicated to serving the needs of the female members of the clubhouse.

The mentors at the clubhouse range in age from eighteen to sixty years old. They have a variety of artistic and technical expertise, and many of them either attend or work at a local engineering university. Although the mentors are representative of a variety of racial, ethnic, and socio-economic backgrounds, the youth are all African-American and largely come from families whose income is below the poverty line. The majority of computer clubhouse youths walk to the clubhouse from school or from their homes in the surrounding area. In that neighborhood, Census 2000 data measured that between 58.5% and 65.6% of the households have "female head-of-households with no husband present living below the poverty line." These youth range in age from 8 to 17 years.

## **Typical Engagement in Clubhouse Activities Lacking an Identified Audience**

During the period of the study, we observed clubhouse members experimenting with technology by beginning new projects. However, the members typically participated in these activities briefly by themselves and then dismissed them when they seemed to anticipate that the products of their efforts would neither be viewed nor evaluated by the members of an audience. Instead, they tended to check e-mail, watch on-line music videos, play games, and browse the internet. Members often started a new project each afternoon. Finished work is often not saved, or saved only briefly. Dan, age 9, typically creates movies, sometimes three or four in a day. When asked about how many he has made, he answered, "A lot, but I never save [them]." This discarding of work necessarily reduces the complexity of individual projects, and potentially reduces opportunities to learn through project work.

Schools and community centers are forming new goals in an effort to become emergent communities of learners, teaching youths to become effective citizens (Lieberman, 1992). One of the four core principles of the clubhouse learning model is to "cultivate emergent communities" (Resnick, Rusk & Cooke, 1998). The predominance of individual work undermines the emergence of community and cooperation. "Cooperative learning experiences, compared with competitive and individualistic ones, have been found to result in stronger beliefs that one is liked, supported, and accepted by other students, and that other students care about how much one learns and want to help one learn" (Johnson & Johnson, 1987). The clubhouse trend towards individualistic learning contributes to members "not wanting to participate in social interaction" (Johnson & Johnson, 1987) and this isolation hinders the growth of a community of learners (Rogoff, 1994). Typical activities observed at the clubhouse do not tend to be naturally cooperative. Members often work alone, and when they need assistance, they tend to consult adult mentors. They often appear reluctant to ask questions of peers or to help peers who ask them.

*Today was Ian's (boy, age 13) first day at the clubhouse. He sat beside Kim (girl, age 13) and looking towards her and her monitor as she edited her webpage with Anne Marie, a mentor. Then he moved to a nearby workstation and asked Kim for help starting a webpage of his own. Ian asked Kim how to get started, but she shook her head, smiled, and refused to answer his questions. Anne Marie observed Kim's response and began the following conversation:*

AMP: This is Ian's first day. Why won't you help him?

Kim: I don't want people to know I can make websites.

AMP: Why don't you want people to know you're good at designing websites?

Kim: I don't want people bothering me.

AMP: Doesn't it feel good when people come to you because you're good at web design?

Kim: No. I can't get any of my own work done when I'm always answering other people's questions.

AMP: What about the boys in the music studio? Don't people always ask them things about the music studio?

Kim: Yeah, but they don't like giving help. It annoys them, just like it annoys me.

(Summarized from field notes August 5, 2003)

Despite the observed pattern that members do not tend to work cooperatively for a long period of time, several specific exceptions to this trend emerged over the time of our observations: work done to be displayed in the physical space, work completed in the music studio, and work in preparation for community events organized by the clubhouse staff. These exceptions have one intriguing property in common: member anticipation of a large appreciative audience. We discuss these exceptions in detail in the sections that follow.

## **Encouraging Audience Involvement through the Physical Space**

Clubhouse members (both youth and adults) can enter through one of two doors: a direct entrance to the building or through a door to the attached community center. Regardless of which door is used, people wishing to enter must ring a doorbell for entry through a locked door. An experienced mentor or member will then open the door, greeting the person entering. Upon entering, members and mentors often informed each other about what they had done since last seeing each other. The walls and ceiling of the clubhouse serve as exhibit space for the members. The large wall that includes the door to the community center is glass and covered with pictures of the members, quotes from them, and examples of their creations. Thus, visitors to the community center serve as an audience external to the clubhouse for clubhouse activities, and clubhouse members can look out into the world through the unobstructed areas. The wall opposite the glass wall, which includes the door to the external hallway, is nearly covered with work created by the members. More laminated creations hang from the ceiling a few feet in front of that wall.

When beginning a project, members often asked whether the end result could be printed and displayed on the wall. When new mentors first toured the clubhouse, members would often point to the wall hangings created by them. Also, members began to bring their “report cards,” indicating assessment of schoolwork, from school for display on the walls. This sort of behavior is not uncommon in many homes, but clubhouse members reported that they don’t get this type of support at home, possibly contributing to the realization of this reinforcement and support at the clubhouse.

The ability to display work for an audience inside the clubhouse appears to influence member motivation. Physical spaces within the clubhouse that afford the creation of work for a larger audience outside the clubhouse may have even more influence. Adjacent to the coordinator’s office is a digital sound recording studio, commonly referred to as “the music studio.” This ten by six foot room is isolated from other workstations. It has one door, which opens into the clubhouse common area, but is nearly always closed. Black and white pictures of clubhouse musicians cover the studio walls. In these pictures, the clubhouse members mimic popular poses by musicians typically observed on the Internet through other computers in the clubhouse. Pages of notebook paper filled with scribbled song lyrics are scattered over the desk surface. Youths pull chairs around this desk or sit on a small couch against the opposite wall. Clubhouse members most commonly close the studio door and turn off all lights in the space. This minimal amount of visibility from outsiders creates an area of privacy, making the studio a “mentor-free zone,” comments Rod, a Graduate Student and clubhouse mentor. In this “mentor-free zone,” the members create music for sharing with individuals not associated with the clubhouse. The music studio provides a physically separate space in which members rarely appear to use the clubhouse community as an audience, but instead appear to construct a larger audience that exists for them in the world outside the clubhouse.

## **Creation of Music as a Means of Expressing Self to a Greater Audience**

A clubhouse music studio provides opportunities for youths to work cooperatively to create musical beats, record vocals, and produce demo albums through a technical medium (e.g., digital sound recording equipment). Based on our observations at the computer clubhouse, youth appear to complete music studio projects with greater cooperation and iteration than on any other clubhouse project. Rather than individually creating and discarding project work in a single day, youths in the music studio tend to work together on projects saved between days. Ann, the clubhouse coordinator commented:

*The music studio...is the most used resource in the clubhouse among older members, particularly boys. Because the end product, a song or rap, is such a hot commodity among their peers, the teenage boys will make a more concerted effort to learn the technology behind the equipment. Recording a song or producing a CD is a highly prized goal so the members will typically put more effort into learning how to do it.*

Youths commonly form clubhouse music groups and express interest in entertaining people through careers in the music industry. Members use clubhouse resources in the following ways to support goals related to music:

- Use the digital sound studio hardware and software to record vocals and mix original sounds
- “Burn” CDs to share with friends
- Create music videos with multi-media equipment
- Upload original music to review web sites
- Create a web site for the group viewable by the public

Members of this group mentioned using the clubhouse music studio as a place to gain fame and recognition in the music industry. Les, also a group member, explained: “We come to the clubhouse because we’re trying to get known. We make songs on ACID® and then put it on a website called ACIDplanet® (ACIDplanet, n.d.). Different people listen to our songs and we get judged by them.” The ACIDplanet® website serves as an online medium for musicians to exchange feedback on artifacts. This group uploaded over 40 songs to ACIDPlanet®, knowing that people look at their tracks because they receive ratings and commentary on their work. ACIDplanet® does not divulge each reviewer’s identity or relation to the music industry; nevertheless, the online medium provides aspiring musicians with a vehicle for displaying artifacts for an audience larger than clubhouse mentors and peers.

Sheila, a clubhouse regular and avid music studio user, noted how important it was that audiences larger than her family know her work:

*The clubhouse is a place for me to fulfill my dreams of what I want to be. I want to be a professional rapper. So, the clubhouse has what I want to do that. They have a studio where I can work. I use the studio to record my songs and make demos for me to send out to people...I want to become a rapper because I want to be known for what I do best. My family already knows what I’m capable of doing. I want other people to know what I’m capable of doing.*

The work surrounding music in the clubhouse has the common characteristic of using clubhouse resources to receive recognition from a potentially large external audience. This recognition comes in a variety of ways including praise posted on music review web sites, comments left by visitors to the music group’s web site, and verbal recognition from friends after listening to a custom made music CD. “While the adolescent is often self-critical, he is frequently self-admiring too. At such times, the audience takes on the same affective coloration.” (Elkind, 1974) Consistent with this interpretation, the members working in the music studio appear to anticipate receiving praise, a powerful reinforcer for their behaviors. It motivates them to continue learning and developing their skills in relation to producing music for this approving audience.

## **Performing for a Live Audience through Community Events**

Throughout our observations, activities that seem to foster the most sustained effort and cooperation are those that involve participation in the greater community outside of the clubhouse. In the case of the music studio, the audience interaction is largely online via music sharing websites, though a larger audience is also imagined by the youth. This audience exists primarily in the youths’ construction of a future when they will become famous as part of a career in the music industry. We also noticed that members, including those who commonly work in the music studio, respond to the anticipation of immediate praise provided by a live audience, as evidenced by their increased levels of motivation prior to live audience events. Local face-to-face events held at the clubhouse appear to provide some of the same motivational benefits. During our period of observation a Parent Appreciation Night and a Talent Show were planned.

One active member, Mike (boy, age 13), sporadically created Flash™ movies. We noticed, however, that he generally discarded the movies upon completion and often appeared to lose interest in any one particular movie before completion. When he was not creating movies, he used instant messaging, played video games, listened to music, checked his email, and browsed the Internet—all typical activities for youth at the clubhouse but comparatively passive clubhouse activities. Once the Talent Show was announced, however, he became much more actively engaged with Flash while time spent doing the other activities diminished. His skills, which had been slowly maturing, became noticeably more advanced. He was able to produce more complex movies, an

advancement in his skills that appears to have been recognized by his peers who began to refer to him as the “Flash Master.” In an interview during this period, we asked him about his motivation in making movies:

Mike: I like to add titles and making the movie look like a real movie in the movie theatre.

Interviewer (BA): What do you want to do with all your stuff when you're done with it?

Mike: Probably put it on a CD for my friends to see. And umm, there's a talent show coming up. I want to enter that.

Whether members focused on one or multiple projects during the time leading up to the Talent Show, nearly all clubhouse members mentioned wanting to participate in the Talent Show. In some cases, they simultaneously developed multiple projects for the show over the weeks leading up to the performance.

Nina (girl, age 9): The first project is a play, and it's about how you shouldn't talk about people.

And my second play is going to be a song, and my third play is a dance.

Interviewer (KB): Wow - that's a lot of plays. Is that a lot of work?

Nina: Yes. But I've been working on them [because] a while ago, we were going to have the talent show but we never did have it, so I had saved my work. I've been working on [them] since then.

During this time period, Nina became proficient with a word processing program and learned to type. She consistently typed the scripts of her play, and then passed them out to the members of the cast. She and several others also learned to use the video cameras and corresponding software while saving their plays, songs, and dances.

Community events can spur members to become actively involved with the technology and projects in the clubhouse. They might also serve to engage the outside community in clubhouse activities and reinforce those activities through this type of greater community recognition and participation. Attendance at the parent night was less than was expected by the mentors, coordinators, and members. Many kids expressed disappointment. Ann commented, “I had some girls in tears because their moms wouldn't come down.” The Talent Show was ultimately cancelled. However, the flurry of activity around it, even after the minimal attendance at Parent Night, demonstrates the power that the anticipation of an appreciative audience can have in motivating member projects. The realization of a different audience than anticipated may have learning effects as well, as described by Elkind:

*What appears to happen is that the imaginary audience, which is primarily an anticipatory audience, is progressively modified in the direction of the reactions of the real audience. In a way, the imaginary audience can be regarded as an hypothesis, or better as a series of hypotheses, which the young person tests against reality. As a consequence of this testing, he gradually comes to recognize the difference between his own preoccupations and the interests and concerns of others. (1974)*

It may be interesting to observe, over time, the clubhouse membership's subsequent reactions to community events as they adjust their expectations based on actual attendance rates.

## Conclusion and Future Work

How successful is the clubhouse learning model? There are no easy answers to this fundamental question. Ann notes that it's a victory simply that the kids are at the clubhouse, and not hanging out on a nearby basketball court known for drug and gang activity. That answer might satisfy parents and community leaders, but it likely would not be sufficient for those interested in sustaining projects that help children learn technology cooperatively. To what extent are students engaging in these sustained projects, and achieving technological fluency through them? This question also is hard to answer. For example, although Dan may throw out the Flash movie he makes each day, his movies have slowly gotten more technically and artistically sophisticated over time. Furthermore, during a time of intense motivation, seemingly spurred by a chance to demonstrate his work at the talent show, his skills advanced rapidly, and built on the foundation he had laid slowly in the months prior.

We have begun to see some trends in the projects and activities that most notably foster learning technology through on-going cooperative work. One of these trends is the anticipation of an audience in those activities in which the members are consistently most actively engaged and the absence of audience in those activities that are the least likely to foster cooperative long-term engagement. As in other disciplines (Elkind, 1974; Petraglia, 1998), we anticipate that the realization of this important component to technology projects will encourage

technological learning environments to create physical and learning structures that leverage the motivation inherent to performing for an audience.

Although we cannot determine a formula for successful projects, one feature seems important: from a radical constructionist perspective, the concept of an appreciative audience for completed work appears to play a strong, positive role in helping initiate and sustain learning among youth. We imagine that more events like talent shows and parent appreciation nights might help strengthen participation in the learning community, especially if such events were better attended.

Similarly, youths from this clubhouse tend to have a strong appreciation for rap music that appears to translate into a greater motivation for sustained, cooperative project work in the music studio. In future work, Bruckman and colleagues are exploring ways to build on the idea of producing work for large on-line audiences as was observed with musical review web sites. The first of these further explorations is the creation of an online animation festival. It is anticipated that the potential to participate in this festival will make learning through programming animations more meaningful for clubhouse youth in ways similar to rap music.

Our research at the Computer Clubhouse continues as we seek to understand some of the larger underlying theoretical and practical issues related to how youth learn. One fundamental pedagogical issue raised by the clubhouse network is the role of structure in learning. We plan to examine the ways in which a less structured environment can complement a structured school environment. Most after-school programs provide more structure than the Intel Computer Clubhouse network. We are also interested in examining the tradeoffs involved in this design choice. Understanding how the activities in the clubhouse are related to student learning and motivation will serve in building a more comprehensive model that effectively address these larger and more complicated issues.

## References

- ACIDplanet. (n.d.). Retrieved November 21, 2003, from <http://www.acidplanet.com/>
- Barron, B. J. S., Schwartz, D. L., Vye, N., J., Moore, A., Petrosino, A., Zech, L., Bransford, J. D., & Vanderbilt, T. C. (1998). Doing with understanding: Lessons from research on problem- and project-based learning. *Journal of the Learning Sciences*, 7(3&4), 271-310.
- Bruckman, A. (1998). Community support for constructionist learning. *Computer Supported Collaborative Work: The Journal of Collaborative Computing*, 7, 47-86.
- Elkind, D. (1974). *Children and adolescents: Interpretive Essays on Jean Piaget*, second edition. New York, NY: Oxford University Press.
- Harel, I., & Papert, S. (1990). Software design as a learning environment. *Interactive Learning Environments*, 1(1), 1-32.
- Harel, I. (1991). *Children designers: Interdisciplinary constructions for learning and knowing mathematics in a computer-rich school*. Norwood, NJ: Ablex Publishing.
- Harel, I. & Papert, S. (eds.) (1991). *Constructionism*. Norwood, NJ: Ablex Publishing.
- Johnson, D. & Johnson, R. (1987). *Learning together and alone: cooperative, competitive, and individualistic learning*, second edition. Englewood Cliffs, NJ: Prentice-Hall.
- Kohlberg, L. (1969). Stage and sequence: The cognitive-developmental approach to socialization. In D. Goslin (Ed.), *Handbook of socialization theory and research*, 347-480. Chicago: Rand McNally.
- Lieberman, A. (1992). The meaning of scholarly activity and the building of community. *Educational Researcher*, 21(6), 5-12.
- Petraglia, J. (1998). *Reality by design: The rhetoric and technology of authenticity in education*. Mahwah, NJ: Lawrence Erlbaum.
- Piaget, J. (1962). *Comments on Vygotsky's critical remarks concerning 'The Language and Thought of the Child' and 'Judgment and Reasoning in the child'*. Cambridge, MA: MIT Press.
- Resnick, M., & Rusk, N. (1996). The computer clubhouse: Preparing for life in a digital world. *IBM Systems Journal*, 35 (3-4), 431-440.
- Resnick, M., Rusk, N., & Cooke, S. (1998). The computer clubhouse: Technological fluency in the inner city. In D. Schon, B. Sanyal, and W. Mitchell (eds.), *High Technology and Low-Income Communities*, 266-286. Cambridge, MA: MIT Press.
- Rogoff, B. (1994). Developing understanding of the idea of the community of learners. *Mind, Culture and Activity*, 1, 209-229.

United States Department of Commerce. Economic and Statistics Administration. National Telecommunications and Information Administration. (2000). *Falling through the net: Toward digital inclusion*. Retrieved November 21, 2003, from <http://search.ntia.doc.gov/pdf/fttn00.pdf>