The Computer Clubhouse: Helping Youth Develop Fluency with New Media

Mitchel Resnick
The Media Laboratory
Massachusetts Institute of Technology
Cambridge, MA 02140
mres@media.mit.edu
http://www.media.mit.edu/~mres/

Natalie Rusk
Science Museum of Minnesota
St. Paul, MN 55101
nrusk@sci.mus.mn.us

Abstract: The gap between the technological haves and have-nots is widening, leading to dangerous economic and cultural rifts in our society. But access to technology alone is not enough to bridge this gap. This paper describes a new model of a learning community, called the Computer Clubhouse, that breaks away from the traditional computer lab. At the Clubhouse, inner-city youth become designers and creators—not just consumers—of computer-based products. The paper describes four core principles of the Clubhouse educational approach—and discusses how the Clubhouse helps prepare today's youth for life and work in tomorrow's world.

Introduction

Ever since the personal computer was invented in the late 1970s, there have been concerns about inequities in access to this new technology [Piller, 1992]. Over the years, the gap between the technological haves and have-nots has widened, leading to dangerous economic and cultural rifts in our society. In an effort to narrow these rifts, some groups have worked to acquire computers for inner-city schools. Other groups have opened community-access centers, recognizing that schools are not the only (or necessarily the best) place for learning to occur. At these community-access centers, members of inner-city communities (youth and adults alike) can use computers at little or no charge.

The Computer Clubhouse (organized by The Computer Museum in collaboration with the MIT Media Laboratory) grows out of this tradition, but with important differences. At many other centers, the main goal is to teach youth basic computer techniques (such as keyboard and mouse skills) and basic computer applications (such as word processing). The Clubhouse views the computer with a different mindset. The point is not to provide a few classes to teach a few skills; the goal is for participants to learn to express themselves *fluently* with new technological media. Technological fluency means much more than the ability to use technological tools; that would be equivalent to understanding a few common phrases in a language (like English or French). True fluency involves the ability to express, explore, and realize ideas [Papert & Resnick, 1995]. At the Clubhouse, young people become designers and creators—not just consumers—of computer-based products.

Images of the Clubhouse

The first Clubhouse was opened in 1993, in a 1000-square-foot space on the ground floor of The Computer Museum in downtown Boston. During its first two years of operation, it attracted more than 1000 young people ages 10-16, with 98% coming from underserved communities. Participants were from diverse cultural backgrounds, including African American (61%), Asian (13%), and Latino (11%). To attract participants, the Clubhouse initially established connections with community centers and housing projects in target communities; since then, it has relied primarily on word of mouth. Youth do not have to sign up for time at the Clubhouse; they can "drop in" whenever the Clubhouse is open.

What does the Clubhouse learning community look like? Here are some quick "snapshots" from the Computer Clubhouse.

Binh moved to the United States from Vietnam three years ago. He and his friend Liem learned from Clubhouse staff how to build a computer interface to control motors. Binh and Liem are now showing other Clubhouse members how to build interfaces to control motorized devices, such as robot arms and toy dune buggies.

Essam, a ninth grader from Roxbury, designs and programs his own computer games at the Clubhouse. He usually uses the Logo programming language, but Michael, a student from Wentworth Institute, is mentoring him to program in C, a professional programming language that Essam had been wanting to learn. Essam's work has attracted the interest of other Clubhouse participants, and he is in turn helping other youth learn to design and program their own games. Michael is also gaining confidence and learning from his experience as a mentor.

Sandi is developing an interactive multimedia project for an independent study course at her school. She chose to research the history of Native Americans to learn more about her heritage. Her project combines text, graphics, photographs, and sound. Sandi's teachers are impressed by what she has produced, and they hope that more of their students will start producing multimedia reports.

Emilio saw a laser-light show at another museum, and wants to create something similar at the Clubhouse. He glues small mirrors onto a few LEGO motors, writes a short computer program to control the motion of the motors, and bounces a laser light off of the mirrors to create wonderful Lissajous-like patterns. Throughout the project, Emilio is involved in mathematical thinking, modifying angles and speeds to create new laser patterns.

Several Clubhouse members are creating an Online Art Gallery on the World Wide Web . Once a week, they meet with a local artist who agreed to be a mentor for the project. After a year, their online art show is accepted as an exhibition at SIGGRAPH, the premiere computer-graphics conference.

Paul's art teacher recommended he visit the Clubhouse, just two weeks after Paul moved to Boston from Trinidad. Paul had always enjoyed drawing but had never used a computer before coming to the Clubhouse. He now comes to the Clubhouse three or four days a week. Last summer, based on his Clubhouse experiences, Paul got a job designing Web pages for a local company. He designed a series of original character drawings, and he reliably met demanding deadlines. Now, Paul is interested in pursuing a college program in computer animation and graphic design.

Clubhouse Principles

The development of the Clubhouse learning environment has been guided by four core principles.

- Support learning through design experiences
- Help youth build on their own interests
- Cultivate "emergent community"
- Create an environment of respect and trust

Principle 1: Support learning through design experiences

Activities at the Clubhouse vary widely, from constructing and controlling LEGO robots to orchestrating virtual dancers. But these varied activities are based on a common framework: engaging youth in learning through design. In recent years, a growing number of researchers and educators have argued that design projects provide rich opportunities for learning [Harel, 1991; Lehrer, 1993; Papert, 1993; Soloway, Guzdial, & Hay, 1994]. There are many reasons for this interest in design-based learning:

• Design activities engage youth as *active participants*, giving them a greater sense of control (and responsibility) over the learning process.

• Design activities encourage *creative problem-solving* avoiding the right/wrong dichotomy prevalent in most school math and science activities, suggesting instead that multiple strategies and solutions are possible.

• Design activities can facilitate *personal connections* to knowledge, since designers often develop a special sense of ownership (and caring) for the products (and ideas) that they design.

• Design activities are often *interdisciplinary*, bringing together concepts from the arts, math, and sciences.

• Design activities promote a *sense of audience*, encouraging youth to consider how other people will use and react to the products they create.

• Design activities provide a context for *reflection and discussion*, enabling youth to gain a deeper understanding of the ideas underlying hands-on activities.

At the Clubhouse, youth work on a variety of different design activities. Participants use leading-edge software to create their own artwork, animations, simulations, multimedia presentations, virtual worlds, video games, musical creations, Web sites, and robotic constructions.Youth learn not only technical skills, but the heuristics of being a good designer: how to conceptualize a project, how to make use of the materials available, how to persist and find alternatives when things go wrong, and how to view a project through the eyes of others. In short, they learn how to manage a complex project from start to finish.

The design tools at the Clubhouse were chosen, in part, because they connect with children's imaginations and interests. But at the same time, these tools connect with important mathematical and scientific concepts. The tools don't directly teach mathematical and scientific ideas; rather, youth use (and learn) these ideas as an integral part of their design projects. For example, as Clubhouse youth work on robotics projects with LEGO/Logo [Resnick, 1993] and the Programmable Brick [Sargent, Resnick, Martin, & Silverman, 1996], they naturally engage in thinking about important scientific concepts such as mechanical advantage and feedback.

Principle 2: Help youth build on their own interests

In schools of education, the focus is usually on methods of teaching, not motivations for learning. When the issue of motivation is addressed, the emphasis is often on extrinsic motivators and incentives, such as grades and prizes based on performance. Yet if you look outside of school, you can find many examples of people learning—in fact, learning exceptionally well—without explicit "rewards." Youth who seem to have short attention spans in school often display great concentration on projects that they are truly interested in. They might spend hours learning to play the guitar or play basketball. Clearly, youth interests are a great untapped resource. As Roger Schank has written: "An interest is a terrible thing to waste" [Schank, 1994].

At first, some youth interests might seem to be trivial or shallow, but youth can build up large networks of knowledge related to their interests. Pursuing any topic in depth can lead to connections to other subjects and disciplines. The educational challenge is to find ways to help youth make those connections and develop them more fully. For example, an interest in riding a bicycle can lead to investigations of gearing, the physics of balancing, the evolution of vehicles over time, or the environmental effects of different transportation modes.

The Clubhouse is designed to support youth in developing their interests. While youth from middle-class households generally have many opportunities to build on their interests (music lessons, specialty camps, etc.), the target audience of the Clubhouse has few such opportunities. For most Clubhouse participants, there are no other constructive after-school options. And many do not even have a clear sense of their interests, let alone how to build on them.

Clubhouse participants are encouraged to make their own choices. Just coming to the Clubhouse involves a choice: all of the youth at the Clubhouse have chosen to be there, and they can come and go as they please.

Once inside the Clubhouse, participants continually confront choices on what to do, how to do it, and whom to work with. The Clubhouse helps these youth gain experience with self-directed learning, helping them recognize, trust, develop, and deepen their own interests and talents.

Helping youth develop their interests is not just a matter of letting them do what they want. Young people must be given the freedom to follow their fantasies but also the support to make those fantasies come to life. On the walls, shelves, and hard drives of the Clubhouse, there is a large collection of sample projects, designed to provide participants with a sense of the possible and with multiple entry points for getting started. In one corner of the Clubhouse is a library of books, magazines, and manuals filled with more project ideas (and a sofa to make reading more comfortable). Many youth begin by mimicking a sample project, then work on variations on the theme, and soon develop their own personal path, stemming from their personal interests.

This approach works only if the environment supports a great diversity of possible projects and paths. The computer plays a key role here. The computer is a type of "universal machine," supporting design projects in many different domains: music, art, science, math. At any time, a pair of youth might be using a computer to create a graphic animation, while at the next computer another participant might be using a similar computer to control a robotic construction.

Of course, the technology alone does not ensure diversity. In schools, more teachers are beginning to include design experiences in their classroom activities. But in many cases, these design activities are very restrictive. Students do little more than follow someone else's "recipe." In classes working with LEGO/Logo, students are often told precisely how and what to build. For example, a teacher might instruct every student to build the exact same LEGO car, using the same bricks, same gears, same wheels, and the same computer program to control it. The Clubhouse takes a very different approach; it has the feel of an invention workshop. In working with LEGO/Logo, Clubhouse youth have built, programmed, and experimented with a wide assortment of projects, from an automated hair curler to a computer-controlled LEGO city. The LEGO materials and computer technology allow this diversity—even more important, the Clubhouse community supports and encourages it.

Principle 3: Cultivate "emergent community"

How do people become fluent in a natural language? It is now common wisdom that people learn French much better by living in Paris than by taking French classes in school [Papert, 1980]. Many American students take several years of French class in high school, but still can't communicate fluently in the language. The language is learned best by living in the culture, by going to the store to buy a baguette, by joking with the vendor who sells Le Monde, by overhearing conversations in the café, by interacting with people who know and care about the language.

For young people to become technologically fluent, they need a similar type of immersion. They need to live in a "digital community," interacting not only with technological equipment, but with people who know how to explore, experiment, and express themselves with the technology. To foster this type of community, the Computer Clubhouse includes a culturally-diverse team of adult *mentors*—professionals and college students in art, music, science, and technology. Mentors act as coaches, catalysts, and consultants, bringing new project ideas to the Clubhouse. Most mentors volunteer their time. On a typical day, there are two or three mentors at the Clubhouse. For example, engineers might be working on robotics projects with Clubhouse participants, artists on graphics and animation projects, programmers on interactive games. For youth who have never interacted with an adult involved in academic or professional careers, this opportunity is pivotal to envisioning themselves following similar career paths.

In this way, the Clubhouse deals with the "access issue" at a deeper level. In addition to access to new technology, inner-city youth need access to people using technology in interesting ways. This type of access is not possible in a classroom with 30 children and a single teacher. The Clubhouse takes advantage of an untapped local resource, providing a new way for people in the community to share their skills with local youth. By involving mentors, the Clubhouse provides inner-city youth with a rare opportunity to see adults working on projects. Mentors do not simply provide "support" or "help"; many work on their own projects and encourage Clubhouse youth to join in. John Holt argued that children learn best from adults who are working on things that they themselves care about. As Holt wrote: "I'm not going to take up painting in the hope that, seeing me,

children will get interested in painting. Let people who *already* like to paint, paint where children can see them" [Holt, 1977].

At the Clubhouse, youth also get a chance to see adults *learning*. In today's rapidly-changing society, perhaps the most important skill of all is the ability to learn new things. It might seem obvious that youth, in order to become good learners, should observe adults learning. But that is rarely the case in schools. Teachers often avoid situations where students will see them learning: they don't want students to see their lack of knowledge. In contrast, Clubhouse youth often see adults in the act of learning.

Projects at the Clubhouse are not a fixed entity; they grow and evolve over time. A mentor might start with one idea, a few youth will join for a while, then a few others will start working on a related project. For example, two graduate students from Boston University decided to start a new robotics project at the Clubhouse. For several days, they worked on their own; none of the youth seemed particularly interested. But as the project began to take shape, a few youth took notice. One decided to build a new structure to fit on top of the robot, another saw the project as an opportunity to learn about programming. After a month, there was a small team of people working on several robots. Some youth were integrally involved, working on the project every day. Others chipped in from time to time, moving in and out of the project team. The process allowed different youth to contribute to different degrees, at different times—a process that some researchers call "legitimate peripheral participation" [Lave & Wenger, 1991].

This approach to collaboration is strikingly different from what occurs in most school classrooms. In recent years, there has been a surge of interest among educators in "collaborative learning" and "communities of learners." In many schools, students work in teams to solve problems. Often, each student is assigned a distinct role in the collaborative effort. At the Clubhouse, collaboration has a different flavor. No one is assigned to work on any particular team. Rather, communities "emerge" over time. Design teams form informally, coalescing around common interests. Communities are dynamic and flexible, evolving to meet the needs of the project and the interests of the participants [Resnick, 1996]. A large green table in the middle of the Clubhouse acts as a type of village common, where people come together to share ideas, visions, and information (not to mention food).

As youth become more fluent with the technologies at the Clubhouse, they too start to act as mentors. During the first year of the Clubhouse, a group of six youth emerged as "regulars," coming to the Clubhouse nearly every day (even on days when the Clubhouse was officially closed). Over time, these youth began to take on more mentoring roles, helping introduce newcomers to the equipment, projects, and ideas of the Clubhouse.

Principle 4: Create an environment of respect and trust

When visitors walk into the Clubhouse, they are often amazed at the artistic creations and the technical abilities of Clubhouse participants. But just as often, they are struck by the way Clubhouse youth interact with one another. Indeed, the Clubhouse approach puts a high priority on developing a culture of respect and trust. These values not only make the Clubhouse an inviting place to spend time, but they are essential for enabling Clubhouse youth to try out new ideas, take risks, follow their interests, and develop fluency with new technologies.

There are many dimensions to "respect" at the Clubhouse: respect for people, respect for ideas, respect for the tools and equipment. Mentors and staff set the tone by treating Clubhouse youth with respect. Right from the start, participants are given access to expensive equipment and encouraged to develop their own ideas. "You mean I can use this?" is a common question for youth to ask when they first visit the Clubhouse and find out about the resources and options available to them.

Even with all these options, youth won't take advantage of the opportunities unless they feel "safe" to try out new ideas. In many settings, youth are reluctant to do so, for fear of being judged or even ridiculed. At the Clubhouse, the goal is to make participants feel safe to experiment and explore. No one gets criticized for mistakes or "silly" ideas.

Youth are given the time they need to play out their ideas; it is understood that ideas (and people) need time to develop. One new Clubhouse participant spent weeks manipulating a few images, over and over. But then, like

a toddler who is late learning to talk but then starts speaking in full sentences, he suddenly started using these images to create spectacular graphic animations.

Clubhouse youth are given lots of freedom and choice. But with this freedom come high standards and high expectations. Clubhouse staff and mentors do not simply dole out praise to improve the "self esteem" of the youth. They treat youth more like colleagues, giving them genuine feedback, and pushing them to consider new possibilities. They are always asking: What could you do next? What other ideas do you have?

Clubhouse youth learn not only new computer skills, but new styles of interaction. Participants are treated with respect and trust—and they are expected to treat others the same way.

Beyond Rodin

When people think about thinking, they often imagine Rodin's famous sculpture The Thinker. Rodin's Thinker is a solitary thinker, sitting by himself, with his head resting on his hand. This image seems to say: if you just sit by yourself quietly, and concentrate hard, you will do your best thinking.

But that image provides a very restricted view of thinking—and one that is becoming less and less relevant in today's world. In recent years, there has been a growing recognition that thinking usually happens through *interactions*—interactions with other people and interactions with media and technologies. New media and technologies support new representations of knowledge, which in turn enable new ways of thinking about problems.

The Clubhouse helps young people become fluent with these new "tools for thought." Two product managers from Adobe, a leading software company, spent several days at the Clubhouse, hoping to gain insights on how they might change and improve their products. Afterwards they wrote [Mashima, 1994]:

> *We were amazed at the incredible rate the kids learned complex products such as Photoshop and Director and how they used the software almost as an extension of themselves. The kids seem to have a lot more enthusiasm and creativity in the work since they choose their own projects and determine for themselves what they want to do. I liked how the more experienced members trained the new members how to do things and how they took responsibility for the computers and their setups. Clearly the Clubhouse is their clubhouse, not someone else's place.*

Their comments capture some of the core ideas underlying the Clubhouse approach: young people working on design projects, following their own interests, developing fluency with new technologies, sharing knowledge as a member of a community, and becoming self-confident as learners.

Of course, creating this type of learning environment isn't easy. At times, the Clubhouse might seem chaotic. It takes trust and patience to allow youth to follow their own interests and learn from their experiences. But the Clubhouse should not be seen as an unstructured environment: although youth have great freedom in choosing their projects, there is structure embedded in the design of the materials, space, and community. Through its choice of mentors, sample projects, and software tools, the Clubhouse provides a framework in which rich learning experiences are likely to develop.

Our long-term goal is to make these types of experiences available to youth in many more low-income neighborhoods. We are currently establishing an nationwide network of Computer Clubhouses. As part of this effort, we are developing workshops and materials to help other sites start their own Clubhouses. In addition, we are creating the infrastructure for network-based interaction among the sites, so that youth at different Clubhouses can collaborate on joint design projects, and mentors and staff can share ideas with one another. Ideally, these new Clubhouses will serve as models, sparking people to rethink their notions of technology, learning, and community, and contributing to a broader discussion of how to help today's youth prepare for tomorrow's world.

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