## Lifelong Kindergarten:
## Cultivating Creativity through Projects, Passion, Peers, and Play

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*Excerpt from Chapter 3: Passion*


### Building on Interests

In December 1989, I got a call from Natalie Rusk, then education coordinator at the Computer Museum in Boston. Natalie wanted to organize some hands-on activities for children and families who would be visiting the museum during the upcoming holiday vacation week, and she asked to borrow some of the LEGO/Logo robotics materials that we were developing at the MIT Media Lab. I saw this as a good opportunity to try out some of our new technologies and activities, so I lent a collection of our LEGO/Logo materials to the museum.

On the second day of vacation week, a group of four children showed up at the museum, speaking to each other in a combination of English and Spanish. One of the boys, age 11, picked up a small, gray LEGO motor. One of the museum mentors showed him how to turn it on. He called out excitedly for his friend to come see: "¡Mira, mira! Look at this!" The children worked together to build a car out of the LEGO materials, then learned how to create a Logo program to control the movements of the car. The children came back to the museum day after day, eager to build more and learn more. After playing with the car for a while, they built and programmed a crane to lift the car. Other children used the LEGO/Logo materials to build and program other machines, including a conveyor belt for a chocolate factory inspired by Willy Wonka.

At the end of the week, we brought the LEGO/Logo materials back to MIT. Everyone was happy with the experience: the children, the museum, our research group at MIT. But the story didn't end there. The next week, the children returned to the museum, saw Natalie, and asked: "LEGO/Logo?" Natalie explained that the materials were no longer available. The children wandered around the museum trying out the exhibits. But museum exhibits are typically designed for short-term interaction and don't offer opportunities for open-ended design experiences. The children left the museum, disappointed.

A couple weeks later, an administrator at the Computer Museum sent an email to the staff, warning them to be on the lookout for a group of children sneaking into the museum. It turned out that these were the same children who had enthusiastically participated in the LEGO/Logo activities. Now, they were getting into trouble with security.

Natalie and I were motivated to help. Here were children excited to work on creative design projects, but without anywhere to go. Natalie and I checked out community centers in the area to see if any offered after-school programs that might be of interest for these children. At the time, in 1990, community centers were just starting to offer computer-based activities. Some centers offered classes teaching the basics of word processing and spreadsheets; others offered open-access time when youth could play computer games. But none of the centers provided opportunities for youth to develop their own creative projects.

Natalie and I began to envision a new type of learning center that would address the needs and interests of the youth who had snuck into the museum, as well as other youth from local low-income neighborhoods. The result was the Computer Clubhouse, a learning space where young people have access not only to the latest digital technologies, but also to people who can inspire and support them as they develop creative projects.

As we designed the Computer Clubhouse, we paid special attention to the second of the four P's of creative learning: passion. We wanted the Clubhouse to be a place where young people could follow their interests and passions. Some people on the Computer Museum board suggested that we would need to serve pizza every afternoon to attract young people to come. Although we thought it might be nice to provide some food, we didn't think food would be the key to attracting young people. We felt that if we provided young people with opportunities to work on projects they really cared about, they would be eager to come to the Clubhouse, with or without pizza.

And that's what happened when we opened the first Computer Clubhouse in 1993. Young people interested in art, music, video, and animation started coming to the Clubhouse, and they spread the word to their friends. When young people entered the Clubhouse, staff members and adult mentors would ask them about their interests and then help them get started on projects related to those interests. For different youth, the interests took different forms:

- Some youth were excited about particular technologies or media. For example, some wanted to learn how to make videos, others wanted to learn how to mix music, and still others wanted to learn how to make robots.

- Some youth wanted to work on projects related to their hobbies. A Clubhouse member who loved skateboarding created a website with illustrations showing how to execute different skateboarding tricks.

- Some youth were inspired by particular events in their lives. A Clubhouse member whose family had recently immigrated to the United States on an airplane worked on a series of projects—a video, an animation, and a 3-D model—all featuring airplanes.

- Some youth were inspired by people they cared about. A pair of brothers, whose father had died when they were young, didn't have any photos of their two parents together, so they used Photoshop to mix together individual photos of their mother and father.

Clubhouse members often worked long hours on these projects, coming back to the Clubhouse day after day. At one point, a teacher from a local school came to visit the Clubhouse, and she was shocked to see one of her students working on a 3-D animation project. She said that he was always goofing off in the classroom. She'd never seen him working so hard.

Over the years, we've seen many similar situations with other Clubhouse members. One teenager who showed little interest in reading at school spent hours reading the reference manual for the professional animation software he was using at the Clubhouse. Other youth who seemed disinterested or distracted in school worked nonstop on projects at the Clubhouse.

Compared to most schools, the Clubhouse provides young people with much more freedom of choice. Clubhouse members continually make choices about what to do, how to do it, and whom to work with. Clubhouse staff and mentors help youth gain experience with self-directed learning, helping them recognize, trust, develop, and deepen their own interests and talents.

Much has changed since we started the first Computer Clubhouse more than 20 years ago. Back then, no one had mobile phones and few people had heard of the Internet. Today, technologies are much different, with 3-D printers and the proliferation of social networks, and the initial Clubhouse in Boston has expanded into an international network, with 100 Clubhouses in low-income communities around the world. Amid all this change, the importance of passion has remained a constant, continuing to fuel motivation and learning throughout the Clubhouse Network.

## Wide Walls

When discussing technologies to support learning and education, Seymour Papert often emphasized the importance of “low floors” and “high ceilings.” For a technology to be effective, he said, it should provide easy ways for novices to get started (low floors) but also ways for them to work on increasingly sophisticated projects over time (high ceilings). With the Logo programming language, for example, children can start by drawing simple squares and triangles but gradually create more complex geometric patterns over time.

As my Lifelong Kindergarten group develops new technologies and activities, we follow Seymour’s advice and aim for low floors and high ceilings, but we also add another dimension: wide walls. That is, we try to design technologies that support and suggest a wide range of different types of projects. It’s not enough to provide a single path from a low floor to a high ceiling; it’s important to provide multiple pathways. Why? We want all children to work on projects based on their own personal interests and passions—and because different children have different passions, we need technologies that support many different types of projects, so that all children can work on projects that are personally meaningful to them.

In developing our Scratch programming language, for example, we explicitly designed it so that people can create a wide range of projects—not just games, but also interactive stories, art, music, animations, and simulations. Similarly, as we develop and introduce new robotics technologies, our goal is to enable everyone to create projects based on their own interests—not just traditional robots, but also interactive sculptures and musical instruments. In evaluating the success of our technologies and workshops, one of our main criteria is the diversity of projects that people create. If the projects are all similar to one another, we feel that something has gone wrong; the walls weren’t wide enough.

As an example, let me describe a two-week robotics workshop that our MIT research team helped organize for a group of girls, ages 10 to 13, from a Boston-area Computer Clubhouse. We presented the girls at the workshop with a challenge: If you could invent something to improve your everyday life, what would you invent?

The girls had access to many different types of tools and materials at the workshop. There was a table full of craft materials: pom-poms, pipe cleaners, panels of felt, Styrofoam balls, yarn, construction paper, colored markers. Alongside the craft materials were rolls of masking tape, scissors, glue guns, and other tools for cutting and connecting. On another table were large buckets of LEGO bricks, including not only traditional LEGO bricks for building houses and other structures, but also LEGO motors and sensors, and a new generation of programmable bricks small enough to hold in the palm of your hand.

When Tanya saw these materials, she knew right away what she wanted to create: a house for her pet gerbil. She built the house out of LEGO bricks, then used craft materials for decorating and adding furniture. Tanya also wanted her gerbil to have some modern conveniences. She decided to add an automatic door, just like the ones at the supermarket. She connected a motor to the door of the house and placed a light sensor and a programmable brick nearby. Whenever the gerbil came near the door, it cast a shadow on the light sensor, triggering the door to open.

At first, Tanya intended the door just as a convenience for her pet gerbil. Then she realized that she could use the light sensor to collect data about her gerbil. She wondered: What did the gerbil do all night, while she was asleep? Tanya decided to run an experiment. She wrote a program to keep track of every time the gerbil triggered the light sensor (that is, every time the gerbil went in or out of the house). That way, when Tanya woke up in the morning, she could find out what the gerbil had been doing all night. What did she find? There were long stretches of time with no activity at all, when the gerbil was presumably sleeping, but other slices of times with lots of activity. During these bursts of activity, the door to the house repeatedly opened, then shut, opened, then shut, again and again, as the gerbil moved in and out of the house, over and over.

As Tanya experimented with her gerbil house, Maria worked on a very different project. Maria's favorite hobby was rollerblading. She loved racing through the nearby park on her rollerblades, as fast as she could. Maria always wondered how fast she was going as she glided through the park. Maybe the new programmable LEGO bricks could help her figure it out?

One of the adult mentors showed Maria how to attach a tiny magnet to one of the wheels of her rollerblades—and then how to use a small magnetic sensor to detect each time the magnet rotated past. With that, Maria was able to find out the number of times her rollerblade wheels rotated each second. But Maria wanted to know her speed in miles per hour. When she rode in her mother's car, she saw the speedometer read 30 or 40 miles per hour, for example. How did her rollerblading speed compare with the car's speed?

In Maria's school, the teacher had already shown the class how to convert from one unit of measurement to another, but Maria hadn't been paying attention. At the time, it didn't seem to matter much. Now, Maria cared. She really wanted to know how fast she was going on her rollerblades. With some help from a mentor at the workshop, Maria figured out how to do the multiplication and division necessary to convert rotations per second into miles per hour. The resulting speed wasn't quite as fast as she'd hoped, but she was very pleased to have figured it out.

Across the room, Latisha was working on a security system for her diary. Every night, Latisha would write an entry and draw sketches in her diary. Many of the entries were very personal, and she didn't want anyone else to see them, especially not her brother. After seeing a demonstration of the programmable LEGO bricks, Latisha wanted to come up with a way to protect her diary. She attached a touch sensor to the clasp of the diary, and she built a mechanism to press the button on her camera. She wrote a simple if-then rule for the programmable brick: If the touch sensor is pressed (on the clasp of the diary), then turn on the mechanism to press the button on the camera. So if her brother, or anyone else, tried to open the diary when Latisha wasn't around, the camera would take a photo as evidence.

Many factors contributed to the success of the workshop. The girls had easy access to a wide variety of materials—some new, some familiar, some high-tech, some low-tech—to help spark their imaginations. They had enough time to experiment and explore, to persist when they ran into stubborn problems, to reflect and find new directions when things went wrong. They were supported by a team of creative and caring mentors, who asked questions as often as they provided answers. The mentors continually encouraged the girls to try out new ideas and to share their ideas with one another.

Most important, the girls were supported in following their interests. Tanya wasn't building a house for any gerbil, but for her own gerbil. Maria was collecting data related to her favorite hobby. Latisha was protecting her most precious possession. The wide walls of the workshop led to a diversity of projects—and an outpouring of creativity.

## Hard Fun

Ben Franklin once wrote: "An investment in knowledge always pays the best interest." I'd suggest a twist on this aphorism: "An investment in interest always pays off with the best knowledge."

When people work on projects that they are interested in, it seems pretty obvious that they'll be more motivated and willing to work longer and harder— but that's not all. Their passion and motivation make them more likely to connect with new ideas and develop new ways of thinking. Their investment in interest pays off with new knowledge.

At first, some youth interests might seem to be trivial or shallow, but with the right support and encouragement, youth can build up networks of knowledge related to their interests. An interest in riding a bicycle, for example, can lead to investigations of gearing, the physics of balancing, the evolution of vehicles over time, or the environmental impact of different modes of transportation.

In visiting Computer Clubhouses, I often meet young people who are disillusioned with school and pay little attention to ideas introduced in the classroom—but when they encounter the same ideas in the context of a Clubhouse project that they care about, they become deeply engaged with them.

On a visit to a Computer Clubhouse in Los Angeles, I met a 13-year-old named Leo who loved playing video games on the computer. At the Clubhouse, working with mentors from

Yasmin Kafai's research group, he had learned to use Scratch to create his own games. He proudly showed me one of his Scratch games, and it was clear that he had worked very hard on the project. Building on his interest in playing games, Leo had developed a passion for creating games.

But the day I visited, Leo was frustrated. He felt that his game would be much more interesting to other people if the game could keep score. He wanted the score to go up every time the game's main character killed a monster, but he didn't know how to make it happen. He tried a variety of approaches, but none worked.

I showed Leo a Scratch feature that he hadn't seen before: a variable. Together, Leo and I created a variable called *score*. The Scratch software automatically added a small box on the screen displaying the value of *score*, and it also added a collection of new programming blocks for accessing and modifying the value of *score*. One of the blocks had this instruction: *change score by 1*. When Leo saw this block, he immediately knew what to do. He inserted the new block into his program, wherever he wanted the score to increase. He tried playing his game again, with the newly revised program, and he was excited to see the score increase each time he killed a monster in the game.

Leo reached out to shake my hand, exclaiming: "Thank you! Thank you! Thank you!" It made me feel good to see Leo so excited. I wondered: How many algebra teachers get thanked by their students for teaching them about variables? That doesn't happen, of course, because most algebra classes introduce variables in ways that don't connect with student interests and passions. Leo's experience at the Clubhouse was different; he cared about variables because he cared about his game.

Such stories are common in the Scratch community: A 12-year-old girl was making an animated story with two characters, and to make the characters meet at a particular point on the screen at the same time, she needed to learn about the relationship between time, speed, and distance. A nine-year-old girl was making an animated book report about *Charlotte's Web* for her third-grade class, and to make the animals appear at different distances, she needed to learn about the art concept of perspective and the math concept of scaling. This learning didn't come easily. The children in these stories worked hard to learn about variables, speed, perspective, and scaling—and they were willing to work hard because they cared about the projects they were working on.

Seymour Papert used the term *hard fun* to describe this type of learning. Too often, teachers and educational publishers try to make lessons easier, believing that children want things to be easy. But that's not the case. Most children are willing to work hard—*eager* to work hard—so long as they're excited about the things they're working on.

When children engage in a hard-fun activity, they also become engaged with the ideas associated with the activity. It's common to hear adults talk favorably about activities that are "so much fun that kids don't even know they're learning." But that shouldn't be the goal. It's valuable for kids to be reflective about their learning, to think explicitly about new ideas and new strategies. After Leo used variables to keep score in his game, he wanted to learn more about variables. What else could variables do? How else could he use them?

The best learning experiences go through alternating phases of immersion and reflection. Developmental psychologist Edith Ackermann described the process in terms of *diving in* and *stepping back*. When people work on projects they're passionate about, they're eager to dive in and immerse themselves. They're willing to work for hours, or longer, and hardly notice that time is passing. They enter a state that psychologist Mihaly Csikszentmihalyi calls *flow*—completely absorbed in the activity.

But it's also important for people to step back and reflect on their experiences. Through reflection, people make connections among ideas, develop a deeper understanding of which strategies are the most productive, and become better prepared to transfer what they've learned to new situations in the future. Immersion without reflection can be satisfying, but not fulfilling.

Passion is the fuel that drives the immersion-reflection cycle. This is true for learners of all ages. When my graduate students at MIT look for topics for their dissertations, I tell them that it's essential for them to find topics they're passionate about. I explain that researching and writing a dissertation is very hard work, with many obstacles and frustrations along the way. There will be times when they will feel like giving up. The only way that they can persist and persevere through all the challenges is if they work on topics that they're truly passionate about.