

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

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### **From A to X**

On August 23, 2013, I met with the President of Tsinghua University, the leading engineering university in China. Because I'm a professor at Massachusetts Institute of Technology (MIT) and Tsinghua is known as the *MIT of China*, it's not so surprising that the two of us would meet. Perhaps more surprising is where we were meeting: at the LEGO toy company in Denmark.

The president of Tsinghua, Chen Jining, had traveled to the LEGO Group in search of a new approach to education and learning. The Chinese government had selected Tsinghua to lead a nationwide initiative on comprehensive university reform. Chen recognized that the Chinese educational system faced a serious problem—not just at the university level, but throughout the whole system, starting with the youngest children. The Chinese education system, Chen said, wasn't preparing students to meet the needs of an evolving society.

The problem wasn't visible by looking at students' grades and exam scores. In fact, many Chinese students were performing well according to traditional measures. At Tsinghua itself, almost all students had received excellent grades from elementary school through high school, and many continued to get A grades at Tsinghua. Chen referred to them as *A students*.

But Chen knew that something else was needed. He felt that many of the A students, despite their high grades and test scores, didn't have the creative, innovative spirit needed to succeed in today's society. Chen argued that China needed a new breed of students, which he called *X students*. Chen explained that X students are willing to take risks and try new things. They're eager to define their own problems rather than simply solve the ones in the textbook. It's X students who come up with the most innovative ideas and creative new directions.

Chen said that his top priority at Tsinghua was to produce more X students for Chinese society. He wanted to transform his university so that it would attract, encourage, and support X students. Chen came to visit the LEGO Group because he saw the company as a possible ally in his mission. When he watched children playfully building with LEGO bricks, he sensed that they were developing as X-style thinkers. They were constantly exploring, experimenting, and testing the boundaries—and developing as creative thinkers. He wanted to find more ways to cultivate that style of thinking at Tsinghua.

Although Chen was talking about students and schools in China, the situation is similar around the world. Most schools in most countries place a higher priority on teaching students to follow instructions and rules (becoming A students) than on helping students develop their own ideas, goals, and strategies (becoming X students). The goals and approaches of educational

systems around the world have remained largely unchanged over the past century—but a growing number of people, like Chen, are beginning to recognize the need for change.

Part of the motivation for change is economic. Today's workplace is undergoing a radical transformation. Many jobs are disappearing as computers and robots take over routine tasks (and even non-routine tasks)—and almost all jobs are changing as people and workplaces must continually adapt to a constant flow of new technologies, new sources of information, and new communication channels. In her book *Now You See It*, Cathy Davidson estimates that roughly two-thirds of today's grade-school students will end up doing work that hasn't been invented yet. For people to flourish in this rapidly changing landscape, the ability to think and act creatively is more important than ever before.

Creative thinking is needed outside of the workplace, too. The pace of change continues to accelerate in all types of activities, in all aspects of our lives. Today's young people will be confronted with new and unexpected situations throughout their lives. They must learn to deal creatively with uncertainty and change—not only in their work lives, but also in their personal lives (how to develop and sustain friendships in an era of ever-changing social networks) and their civic lives (how to participate meaningfully in communities that have ever-shifting needs and boundaries).

How can we help young people develop as creative thinkers so that they're prepared for life in this ever-changing world? That's the central question of this book—and it's the question that has motivated my work (and my life) over the past three decades.

I'm fortunate to work at the MIT Media Lab, a research lab full of X students and X researchers—people who are constantly exploring new ideas and inventing new possibilities. That's a great environment for me, but I'm frustrated so few people have access to these types of opportunities and inspirations elsewhere. My goal is to bring the Media Lab spirit of creativity and innovation to children around the world so that they too can grow up as X thinkers.

To make that happen, my research group at the Media Lab is focused on developing new technologies and activities to engage children in creative learning experiences. We've collaborated with the LEGO Group for more than 30 years, helping to develop new generations of construction kits—and helping to spread the gospel of playful learning with new partners, like Tsinghua University. We've also developed the Scratch programming language and online community, enabling millions of young people around the world to create and share their own interactive stories, games, and animations. And we helped establish the Computer Clubhouse network of after-school learning centers, where youth from low-income communities learn to express themselves creatively with new technologies.

In this book, I'll draw on stories and lessons from these projects to explore both the *why* and the *how* of creative thinking—building the case for why creative thinking is so important in today's world, and sharing strategies for how to help young people develop as creative thinkers.

The book is intended for anyone who cares about kids, learning, and creativity, whether you're a parent deciding on toys and activities for your children, an educator searching for new ways to help your students learn, a school administrator implementing new educational

initiatives, a designer creating new products or activities for children, or simply someone who is curious about kids, learning, and creativity.

I expect the book will be of special interest if you're intrigued (or concerned) by the role of new technologies in children's lives. Although I'm actively involved in developing new technologies for children, I'm skeptical and worried about the ways that many technologies are entering children's lives. Most children's apps and high-tech toys aren't designed to support or encourage creative thinking. This book presents an alternative vision. It highlights how new technologies, if properly designed and supported, can expand opportunities for all children from all backgrounds to experiment, explore, and express themselves— and, in the process, develop as creative thinkers.

In my work, my ultimate goal is a world full of creative people—X people—who are constantly developing new possibilities for themselves and their communities. I believe this book is timely: There's a greater need for creative thinking today than ever before, and new technologies are offering new ways to help young people develop as creative thinkers. But I also believe that the core message of the book is timeless. Creative thinking has always been, and will always be, a central part of what makes life worth living. Life as a creative thinker can bring not only economic rewards, but also joy, fulfillment, purpose, and meaning. Children deserve nothing less.

## **Lifelong Kindergarten**

As the year 1999 rolled into 2000, I participated in a conference session where people debated the greatest inventions of the previous thousand years. Some people argued that the printing press was the most important invention; others argued for the steam engine, the light bulb, or the computer.

My nomination for the greatest invention of the previous thousand years? Kindergarten.

That choice might seem surprising. Most people do not think of kindergarten as an invention, let alone an important invention. But kindergarten is a relatively new idea (less than 200 years old), and it represents an important departure from previous approaches to schooling. When Friedrich Froebel opened the world's first kindergarten in Germany in 1837, it wasn't simply a school for younger children. It was based on a radically different approach to education, fundamentally different from schools that came before.

Although Froebel certainly didn't know it at the time, he was inventing an approach to education that is ideally suited to the needs of the 21st century—and not just for five-year-olds, but for learners of all ages. Indeed, as I've thought about ways to help people develop as creative thinkers, much of my inspiration has come from the ways children learn in kindergarten. I've used the phrase *Lifelong Kindergarten* not just as the title of this book, but also as the name of my research group at MIT. I'm convinced that kindergarten-style learning is exactly what's needed to help people of all ages develop the creative capacities needed to thrive in today's rapidly changing society.

Before Froebel invented the first kindergarten in 1837, most schools were based on what might be called a *broadcast approach* to education; that is, the teacher stood in front of the classroom and broadcast information. Students sat in their seats and carefully wrote down the information, word for word. From time to time, students would recite back what they had written down. Classroom discussion happened rarely, if at all.

Froebel knew that this approach wouldn't work for five-year-olds. He understood that young children learn best by interacting with the world around them. So, in setting up the first kindergarten, Froebel shifted from a broadcast model of education to an interactive model, providing children with opportunities to interact with toys, craft materials, and other physical objects. But Froebel wasn't satisfied with the toys and materials that existed at the time. He set out to create new types of toys, designed specifically to support the goals of his new kindergarten.

In all, Froebel created a collection of 20 toys, which have become known as *Froebel's Gifts*. With Froebel's geometric tiles, children in his kindergarten could create mosaic patterns, like those found in parquet floors. With Froebel's blocks, children could build towers and buildings. With Froebel's colored papers, children could learn origami-style folding techniques for making shapes and patterns. With Froebel's sticks and peas, children could assemble three-dimensional structures.

All these activities were intended to give children an appreciation for the shapes, patterns, and symmetries of the natural world. Froebel wanted his kindergarten children to gain a better understanding of the world around them. One of the best ways to do that, he realized, was for children to create models of the world—to “re-create” the world through their own eyes, with their own hands. That was the ultimate goal of Froebel's Gifts: understanding through “re-creation.”

Froebel also recognized the connection between *re-creation* and *recreation*. He understood that kindergarten children are most likely to create and build when they are engaged in playful, imaginative activities. So Froebel designed his Gifts to be structured and systematic but at the same time playful and engaging. Froebel's Gifts cross many boundaries, mixing art and design with science and engineering—and, in doing so, they provide an environment for engaging children in creative thinking and creative expression.

Froebel's ideas and his Gifts attracted great attention, first in Germany, then through Europe, and eventually in the United States. His work deeply influenced other educational theorists. Maria Montessori built upon Froebel's ideas, particularly embracing the importance of engaging children's senses through physical, manipulative materials. The network of schools bearing Montessori's name owe a debt to Froebel and his ideas.

In his wonderful book *Inventing Kindergarten*, Norman Brosterman documents the influence of kindergarten—and, particularly, Froebel's Gifts—on culture and creativity in the 20th century. Many of the century's leading artists and designers pointed to their experiences in kindergarten as providing a foundation for their later creativity. Buckminster Fuller, for example, used Froebel's toothpicks and peas to experiment with triangular structures in kindergarten, and he later credited those early explorations as the underpinnings of his work on geodesic domes.

Similarly, Frank Lloyd Wright said that his boyhood experiences with Froebel's Gifts served as a foundation for his architecture.

Makers of toys and educational manipulative materials also have been inspired by Froebel's ideas. Wooden blocks, LEGO bricks, Cuisenaire rods, pattern blocks, and Tinkertoys can all be viewed as descendants of Froebel's Gifts.

Froebel's influence can still be felt in many kindergartens around the world, but there are troubling trends. In many kindergartens today, children spend time filling out math worksheets and drilling with phonics flashcards. There's more focus on delivering early-literacy instruction and less time for playful exploration. Some people have referred to today's kindergartens as *literacy boot camps*.

On March 23, 2014, the *Washington Post* ran an article about a long-time kindergarten teacher, Susan Sluyter, who resigned her position. Sluyter explained her decision:

*When I first began teaching more than 25 years ago, hands-on exploration, investigation, joy, and love of learning characterized the early childhood classroom. I'd describe our current period as a time of testing, data collection, competition and punishment. One would be hard put these days to find joy present in classrooms.*

*There is a national push, related to the push for increased academics in Early Childhood classrooms, to cut play out of the kindergarten classroom. Many kindergartens across the country no longer have sand tables, block areas, drama areas and arts and crafts centers. This is a deeply ill-informed movement, as all early childhood experts continuously report that 4, 5 and 6 year olds learn largely through play.*

In short, kindergarten is becoming like the rest of school. In this book, I argue for exactly the opposite: I believe the rest of school (indeed, the rest of life) should become more like kindergarten.

## **The Creative Learning Spiral**

What's so special about the kindergarten approach to learning? Why do I think it's a good model for learners of all ages?

To get a better understanding of the kindergarten approach to learning, it's useful to think about a typical kindergarten activity. Imagine a group of kindergarten children, playing on the floor with a collection of wooden blocks. Two of the children begin building a castle, inspired by a fairy tale their teacher read to them. They build the base of the castle and then start building a lookout tower on top. They keep adding more blocks, and the tower gets taller and taller. Eventually, the tower tips over and falls to the ground. The children start building again, trying to make the tower more stable. Meanwhile, another child starts telling a story about the family living inside the castle. Her friend extends the story, adding a new character. The two children go back and forth, continually adding to the story. As the castle grows, so does the story.

As the kindergarten children play, they learn many things. As they build towers, they develop a better understanding of structures and stability. As they create stories, they develop a better understanding of plots and characters. Most important, they learn about the creative process, and they begin to develop as creative thinkers.

I like to think of the creative process in terms of a *Creative Learning Spiral*. As kindergarten children play with blocks, build castles, and tell stories, they engage with all aspects of the creative process:

**Imagine:** In our example, the children start by imagining a fantasy castle—and the family that lives inside.

**Create:** It's not enough to imagine. The children turn their ideas into action, creating a castle, a tower, a story.

**Play:** The children are constantly tinkering and experimenting with their creations, trying to build a taller tower or adding new twists and turns to the story.

**Share:** One group of children collaborates on building the castle, another group collaborates on creating the story, and the two groups share ideas with one another. Each new addition to the castle suggests a new story and vice versa.

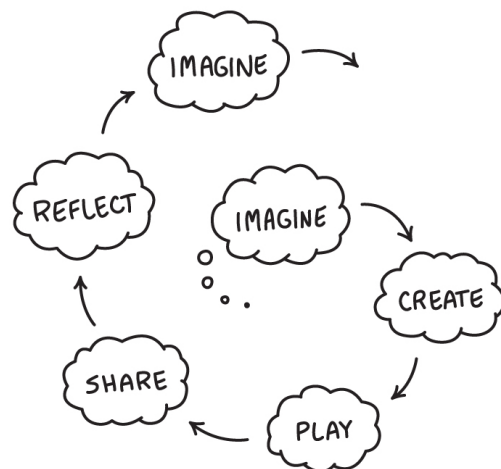
**Reflect:** When the tower collapses, the teacher comes over and encourages the children to reflect on why it fell. How could they make a more stable tower? The teacher shows them pictures of skyscrapers, and the children notice that the bottoms of the buildings are wider than the tops. They decide to rebuild their tower with a wider base than before.

**Imagine:** Based on their experiences going through the spiral, the children imagine new ideas and new directions. How about creating a village around the castle? How about creating a puppet show about life in the village?

This Creative Learning Spiral is repeated over and over in kindergarten. The materials vary (wooden blocks, crayons, glitter, construction paper) and the creations vary (castles, stories, pictures, songs), but the core process is the same.

The Creative Learning Spiral is the engine of creative thinking. As kindergarten children go through the spiral, they develop and refine their abilities as creative thinkers. They learn to develop their own ideas, try them out, experiment with alternatives, get input from others, and generate new ideas based on their experiences.

Unfortunately, after kindergarten, most schools shift away from the Creative Learning Spiral. Students spend much of their time sitting at desks, filling out worksheets, and listening to



lectures—whether from a teacher in the classroom or a video on the computer. Too often, schools focus on delivering instruction and information rather than supporting students in the creative learning process.

It doesn't need to be that way. In our graduate program at the MIT Media Lab, focused on creative uses of new technologies, we've adopted a kindergarten-like approach. Media Lab graduate students spend very little time in the classroom. Instead, they're constantly working on projects, guided by the Creative Learning Spiral. Students work on many different types of projects: Some design interactive musical instruments to support new forms of musical expression, while others develop prosthetic devices for people who lost their limbs. But the design process is similar in all cases. Students rapidly build prototypes, play with them, share their prototypes with other students, and reflect on what they've learned. Then, it's time to imagine the next version of the prototype, and they go through the spiral again—and again and again.

Of course, Media Lab students use very different tools and technologies than children in kindergarten. Media Lab students use microcontrollers and laser cutters more than finger paints and wooden blocks, but the Creative Learning Spiral is the same. The Media Lab is recognized around the world for its creativity and innovation, and I have no doubt that our project-based learning approach, based on the Creative Learning Spiral, provides the underpinning for this creativity.

The Creative Learning Spiral works in kindergartens and at the MIT Media Lab. How can we help it take root everywhere else?

## **Give P's a Chance**

In 2007, my research group at MIT launched the Scratch programming language. Over the past decade, tens of millions of children around the world have used Scratch to create their own interactive stories, games, and animations—and share their creations with one another in the Scratch online community ([scratch.mit.edu](http://scratch.mit.edu)).

One of the first children to try out Scratch, back in 2007, was an 11-year-old girl from California who signed up with the username MahoAshley. Her great passion was the Japanese art style known as *anime*, characterized by colorful graphics and vibrant characters. MahoAshley loved drawing anime characters, and she saw that Scratch provided a way to extend her work. Rather than just drawing anime characters, as she had done in the past, she could use Scratch to make her anime characters come to life. By snapping together combinations of Scratch programming blocks, MahoAshley could make her anime characters move, dance, talk, and sing.

MahoAshley started to program animated stories featuring her anime characters, and she shared her animations on the Scratch website. Other members of the Scratch community responded with great enthusiasm, posting glowing comments under her projects (such as “OMG I LUV IT!!!!!!”), along with questions about how she achieved certain visual effects (such as “How do you make a sprite look see-through?”). Encouraged, MahoAshley began to create and

share Scratch projects on a regular basis, like episodes in a TV series. Her fans in the Scratch community eagerly awaited each new episode from MahoAshley.

Occasionally, MahoAshley would add new characters to her series. One day, she got an idea: Why not involve the whole Scratch community in the process? She created a Scratch project that announced a contest, asking other community members to design a sister for one of her characters. The project listed a set of requirements for the new character, including “Must have red or blue hair, please choose” and “Has to have either cat ears or ram horns, or a combo of both.”

The project received more than 100 comments and dozens of submissions. One comment was from a community member who wanted to enter the contest but said she didn’t know how to draw anime characters. So MahoAshley produced another Scratch project: a step-by-step tutorial, demonstrating a 13-step process for drawing and coloring anime characters.

Over the course of a year, MahoAshley programmed and shared more than 200 Scratch projects, covering a range of project types—stories, contests, tutorials, and more. Her programming and artistic skills progressed, and her projects clearly resonated with the Scratch community, receiving more than 12,000 comments.

Before using Scratch, MahoAshley had never created a computer program. As she worked with Scratch, she was clearly learning new computer science concepts and skills. But in my mind, that’s not what was most important about MahoAshley’s Scratch experiences. For me, what was most impressive was the way MahoAshley was developing as a creative thinker. She was continually cycling through the Creative Learning Spiral: imagining, creating, playing, sharing, reflecting, and then imagining again.

MahoAshley was learning how to navigate a new and unfamiliar environment. She was learning how to transform her ideas into projects—and to experiment with new types of projects. She was learning how to collaborate with others and how to adapt her work based on feedback from others. These are all attributes of a creative thinker.

How can we encourage and support these types of creative learning experiences? In my research group at MIT, we’ve developed a set of four guiding principles for helping young people develop as creative thinkers: projects, passion, peers, and play. In short, we believe the best way to cultivate creativity is to support people working on *projects* based on their *passions*, in collaboration with *peers* and in a *playful* spirit.

Our continuing development of Scratch is guided by these *four P’s of creative learning*:

**Projects:** Creating projects is the central activity in the Scratch community. As MahoAshley worked with Scratch, she was continually creating projects—and continually going through the Creative Learning Spiral, developing a deeper understanding of the creative process.

**Passion:** When people work on projects they care about, they’re willing to work longer and harder. Because Scratch supports many different types of projects (games, stories, animations, and more), everyone can work on projects they care about. In the case of MahoAshley, she could create projects connected to her passion for anime—and also work on new types of projects (contests and tutorials) as new ideas emerged.



**Peers:** Creativity is a social process, with people collaborating, sharing, and building on one another's work. By integrating programming with an online community, Scratch is designed for social interaction. MahoAshley took full advantage of the social side of Scratch, sharing her expertise with the community (via tutorials) and asking other community members for input (via contests and comments).

**Play:** Scratch is designed to support playful experimentation as a pathway to creativity, encouraging young people to take risks and try new things. MahoAshley embraced this playful spirit, continually experimenting with new types of projects and new ways of interacting with the community.

These four P's don't represent radically new ideas; they build on decades of work by many researchers around the world. But I find the four P's to be a valuable framework for guiding my work. In my research group, we constantly think about projects, passion, peers, and play as we develop new technologies and new activities.

And the four P's aren't just for university researchers. They can serve as a useful framework for teachers, parents, and anyone else interested in supporting creative learning. That's why I've organized the core chapters of this book around the four P's.

With apologies to John Lennon: All we are saying is give P's a chance.