# CULTIVATING CURIOSITY

*in K–12 Classrooms*

## How to Promote and Sustain Deep Learning

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# Introduction

## How to Cultivate the Curiosity Classroom

*What we want to see is the child in pursuit of knowledge, not knowledge in pursuit of the child.*

—George Bernard Shaw,
*The Quintessence of G.B.S.*

Learning is what we humans do best. We learn throughout our lives by wondering and exploring, experiencing and playing. This book is about harnessing that ineffable drive in learners—the drive to know, understand, and engage in the world and its ideas. The philosopher Cicero defined curiosity as a love of knowledge without the lure of profit (1914), in other words, an intrinsic passion to know. Aristotle (1947) claimed that the desire to know is among the deepest human urges, and Francis Crick, the Nobel Prize–winning scientist who discovered the structure of DNA, was often described as childlike in his curiosity (Pincock, 2004).

Curiosity has been hailed as the major impetus behind cognitive development, education, and scientific discovery (Loewenstein, 1994).

## Children's Brains Are Optimized for Exploration and Experimentation

Seong Min moved to the United States from Korea at age 4, when her father became a graduate student in chemistry. At first, she would sit timidly in the corner of her preschool classroom, venturing over to a table once in a while to draw or have a snack between tears. With virtually no knowledge of English it was difficult for her teachers to know what Seong Min was thinking or how well she was adjusting. Within about one month, Seong Min was no longer crying and gravitating to the corner of the room. She was playing with the kids outside and participating in the learning centers. By the end of four months, Seong Min was speaking English fluently and participating fully in the classroom! How was she able to learn so quickly?

Both children's and adults' brains are constantly wired and rewired (altered in their structure and function) as they encounter new experiences, understanding, and knowledge (Hensch, 2004). This is called neuroplasticity. Since early experiences have enhanced and longer lasting impacts on the brain (or "optimal neuroplasticity"), youth is the ripest learning period of the lifespan (Knudsen, 2004; Thompson-Schill, Ramscar, & Chrysikou, 2009; White, Hutka, Williams, & Moreno, 2013). It is no wonder children are curious to the core—novelty, exploration, and experimentation are wired in them!

During infancy and childhood, neurons (the cells of the brain) are ultra-sensitive to patterns in sensory input in their environments. Perceptual systems (like seeing, smelling, hearing, and touching) zoom in on, pick up, and organize the features of the child's world. Those pieces of information that are experienced regularly (e.g., the sounds of one's native language) are prioritized in the brain. This means that their neural representations become refined, tuning the child's perceptual systems in to only those specific types of stimulation and input (Kuhl & Rivera-Gaxiola, 2008; Werker & Tees, 1984).

At birth, infants can tell the difference between any sound in any of the world's languages. They can clearly hear the difference between /r/ and /l/, for example, when someone says /rock/ or /lock/. This skill functions to optimize

# Allow Autonomous and Effortless Learning

*The aid we have from others is mechanical, compared with the discoveries of nature in us. What is thus learned is delightful in the doing, and the effect remains.*

—Ralph Waldo Emerson

As he walked to his office in Delhi, Indian educator and researcher Sugata Mitra usually saw children playing in the slum. They were too poor to attend school but nevertheless were filled with energy and a hunger for knowledge. He lamented the lack of funding for public schools, to say nothing about the skills these children would need to thrive in today's global civic society and economy. There certainly would not be enough funds to provide computers for these children, never mind the money to hire trained computer teachers. Then it hit him: Children throughout time have learned the skills they have needed to survive. Learning always finds a way.




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Mitra decided to simply give the children a computer, and see what they would do with it.

In a place where few had ever had the opportunity to see or use such technology, Mitra cut a hole in the wall outside his office and installed a new computer with Internet access. On the very day the station was set up, the children of the neighborhood (many of whom had no formal education at all) came over to check it out and play with it. There was no instructor on call; they were completely left to themselves. Astonishingly, within five hours, these children were surfing websites, downloading films, and using graphic software. When Mitra stopped by to check in, the children reassured him that things were going fine, but there was just one problem: they needed a faster processor! In fact, within days of setting up the hole-in-the-wall computer, local children of all ages had learned how to use virtually all of the common functions on a PC, such as cut and paste, drag and drop, and how to rename and save files (Mitra, 2006). Since then, Mitra and his colleagues have installed hole-in-the-wall computers throughout the developing world and found similar results, serving as a reminder of just how powerful and robust learning can be (Mitra, 2007). Given enough wonder and interest, learners can rapidly and completely understand complex content and skills entirely on their own.

As we see so clearly in the hole-in-the-wall experiments, humans come into this world curious, motivated, and ready to learn. They have an astounding capacity to respond to novelty and pick up information. Cognitive and developmental scientists have spent the last two decades trying to understand the ease with which infants and children learn new and fundamental skills. In fact, children pick up even the most challenging abilities autonomously and effortlessly. Because learners come with highly structured biology and highly structured social and cultural contexts, they are able to usher themselves into new learning (Romberg & Saffran, 2010).

Perhaps the most profound example of autonomous and effortless learning is coming to understand and speak one's native language. As a graduate student, I spent my days testing infants in the Infant Speech Perception Laboratory at Virginia Tech. New parents would come into our lab raving

## Curiosity Technique to Try: Student-Designed Pedagogy and Curriculum

*. . . two words: Trust Children. Nothing could be more simple—or more difficult. Difficult, because to trust children we must first learn to trust ourselves—and most of us were taught as children that we could not be trusted.*

—John Holt, *How Children Learn*

Veteran 5th grade teacher Richard Lauricella says he would have burned out decades ago if not for the fact that he involves his students in designing the curriculum. At the beginning of a new unit, Mr. Lauricella says to his students, "What's the most exciting way we could study this?" If individuals or groups suggest something that isn't feasible, he will say, "Okay, what's the next most exciting way we could study this?" (Lickona, 1991, p. 148). The students always come up with good proposals, and they are motivated because he's using their ideas. As a result, the 5th graders never do the unit in the same way twice. This doesn't just motivate the curiosity of the students, it allows Mr. Lauricella to learn new things, too.

Another way to appeal to student interest and curiosity is by introducing the unfamiliar through the familiar. You can use students' current knowledge, interests, and experiences with a familiar concept to bridge to a novel one. If your students are interested in a particular videogame, for example, you might bridge to the background mathematics and programming that allows the game to work. Students might then be given a choice about designing a particular game routine related to these concepts. When students have the opportunity to be involved in the lesson from the ground up, they will take ownership of the learning process. The lines will suddenly blur between what they do for work and what they do for pleasure.

In a course I teach called The Biased Brain, we spend a semester examining how the human brain, in its exquisite pattern seeking and anticipating, fills in gaps in our perception and leaves us open to being duped. When I first was designing the class, I wanted to give the students a role in running it. I picked topics and readings that I found fascinating for each week of the course (things like hallucinations, subliminal messages, sleight of hand/

## Let Students Work Together

Working together in groups is how humans have always learned. When it comes to fostering effortless learning without the surveillance of teachers, working with friends is a surefire strategy. The work quickly transforms into something social, or a game. In short, learning together is fun. Much of the effortless learning of children happens because kids feel that they are part of social clubs or communities. Education philosopher Frank Smith (2003) believes that most of the learning we do is the effortless byproduct of joining clubs. When you become part of something bigger than yourself, you suddenly get the benefit of identifying with other members. When babies are surrounded by people using language, they learn it quickly and efficiently—but not because they are setting out to achieve something cognitive. On the contrary, people learn it because of the company they keep or the communities they want to join. When you join a club (like the speaking language club), you immediately get the sense, "You are one of us" or "I am just like you." New activities, with their associated knowledge and expectations, are suddenly available to you and other members will help you do the things that interest you. You learn without realizing it.

When teacher Leah Amaru and her colleagues noticed how effortlessly and effectively kindergartners and 5th graders worked together, they decided to extend buddy time to include content lessons for both groups.

> During buddy activities, my colleague and I started to notice that these 5th graders were becoming overly excited about drawing and coloring. These 10-year-old children needed more kid-friendly events in their lives (not more multiple choice tests and essay writing lessons). So we began planning content lessons on literacy, social studies, or science for them to complete together. During one project (creating a map of our town), it was the kindergartners who were more experienced and prepared, so they took the lead! It was amazing to see children five years apart working collaboratively. They were upset when it was time to stop, so we spent three more days adding details and working on planning techniques, social and

## Freedom and Intrinsic Motivation

Sincere wonder and interest, plus a degree of freedom, is the recipe for keeping students intrinsically motivated. Being free to revel in the capriciousness and seemingly frivolous aspects of motivation—such as idle curiosity and playful tinkering—is in fact a very important feature of human development (Silvia, 2001). At a preschool in Massachusetts, when children were allowed to select the materials they used for making a collage, their work was judged as significantly more creative than the work of children who used exactly the same materials but did not get to choose them (Amabile & Gitomer, 1984). In another study, researchers recorded and catalogued 8-year-olds' questioning behaviors as they completed a problem-solving task. The questions that the children came up with on their own were much more likely to lead to further inquiry than the questions asked by others. "The critical factor [in effective problem solving] was that what the children said and did came from themselves, as a personal question, not because somebody else suggested it. Even if someone else originally asked a question, it only became a genuine question for the students when they asked it themselves, i.e., when they saw the contradiction or the puzzle they did not see before and set out to explain it" (Cifone, 2013, p. 52). In a third study, when students were given ownership of the learning situation (i.e., able to make major choices about what they would learn, how they would approach the topics, and when), the students reported being overwhelmingly more satisfied and intrinsically motivated. Importantly, these students also showed superior academic performance (de Charms, 1976).

One kindergarten teacher asked her students to circle all of the "e"s in a sentence on the board. A clever student found an "e" in his name and also circled that one. The teacher capitalized on this intrinsically motivated diversion from the original plan and directed her students to look for "e"s anywhere in the classroom. Since the children were allowed to reinterpret the original activity based on their own interests, their engagement multiplied. Later, when it came time for the students to choose a reading-related activity to work on, they initiated an "e-hunt," and virtually every student became excited

## The Socratic Method

*It is not just the held facts, retrievable knowledge, or demonstrable skills that determine whether one is truly educated, the real test is in the development of a spirit of thoughtful curiosity and the disciplined habits of inquiry to support it.*

—Charles J. Rop, "Spontaneous Inquiry Questions in High School Chemistry Classrooms," in *International Journal of Science Education*

To understand the lasting power of questioning, we need to go back almost 2,500 years to Athens, Greece. Traveling scholars called the Sophists went from town to town educating wealthy youth. They claimed to teach excellence and virtue to young noblemen and demanded pricey fees for their lessons. The Sophists were considered savvy in winning arguments, and their mode of education was to impart their students with their expert knowledge (Stewart, 2012).

In contrast, the revolutionary philosopher and teacher Socrates presented himself to his students not as a master of understanding but as a fellow questioner working toward the discovery of truth. His method of teaching was to walk around and engage people in an informal dialogue. He would claim not to know anything himself, and because of that humility, people would let their guard down. Socrates would then ask questions to help the students think for themselves and search for a deeper truth. He was skilled at asking just the right questions to force self-examination, unravel assumptions, and get his students to think and rethink their insights and perspectives. Socrates made people think more deeply about their ideas. His goal was to wake people up from their dogmatic slumber so that they could face their areas of uncertainty and search for the truth (Bedell, 1980).

Socrates's discussions were an unusual pedagogy in that no definitive knowledge ever came from them. The learning outcome was not a concrete set of content, but rather the increased tendency for his students to call into question what they saw before themselves. Ironically, non-action on the part

of Socrates had the strange effect of making his pupils very active. Socrates described himself as an "intellectual midwife, whose questioning delivers the thoughts of others into the light of day" (Stewart, 2012). He played the role of the humble inquirer—and even pretended to be ignorant. The fact that Socrates expressed a genuine equality with pupils led them to feel empowered. They became free to question the logic and ideas of the instructor, as well as to question themselves. As a result, both the teacher and student were better able to order their thoughts and arguments into stronger, more coherent theories (Stewart, 2012).

Socratic dialogue is used today when educators create space for students to engage in co-thinking and self-directed learning and to uncover what is true for them as individuals and as a group. In a Socratic seminar, teachers do not play the role of the expert or the authority. Instead they guide the classroom according to what direction begins to yield the most understanding, clarification, or insight (Stein, 1991). Socratic questioning is disciplined questioning that can be used to pursue thought in many directions: to explore complex ideas, get to the truth of things, open up issues and problems, uncover assumptions, analyze concepts, distinguish what is known from what is not known, and follow out logical implications of thought (Paul & Elder, 2007). Socrates has shown us that by questioning all things (own biases especially) we can arrive at critical thinking and knowing.

A good Socratic seminar begins and ends with questions. In the beginning questions are often for understanding, but then deeper questions begin to emerge; critical questions that are genuine—coming from the participants themselves. Questions towards the end of each Socratic seminar should focus on synthesizing ideas (e.g., "What have been the highlights? What have been the rough spots?"; "What do we now understand? What do we still not understand?"), and on the process of dialogue itself (e.g., "Whose voices didn't we hear? Why?") (Wiggins, 2013).

## Quick Recap

- Greek philosopher Socrates was skilled at asking questions, which got his students to challenge their own assumptions and think deeper.
- In a Socratic seminar, the teacher does not impart knowledge but rather guides the group in dialogue to think critically and question all things.
- Socratic seminars unearth content and insights, but they should also include reflection on the process of dialogue.