The Social Neuroscience of Education

Optimizing Attachment and Learning in the Classroom

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W. W. Norton & Company
New York • London

Printed in the United States of America
First Edition

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Manufacturing by Courier Westford
Book design by Paradigm Graphics
Production manager: Leeann Graham

Library of Congress Cataloging-in-Publication Data

Cozolino, Louis J.
The social neuroscience of education : optimizing
attachment and learning in the classroom / Louis Cozolino.
p. cm. — (Norton books in education)
Includes bibliographical references and index.
ISBN 978-0-393-70609-3 (hardcover)
1. Learning, Psychology of—Social aspects.
2. Learning—Physiological aspects.
3. Neurosciences—Social aspects. 4. Brain. I. Title.
LB1060.C696 2013
370.15—dc23
2012031666

W. W. Norton & Company, Inc.
500 Fifth Avenue, New York, N.Y. 10110
www.wwnorton.com

W. W. Norton & Company Ltd.
Castle House, 75/76 Wells Street, London W1T 3QT

1 2 3 4 5 6 7 8 9 0

Chapter 11

How Play Became Nature's Pedagogy

Study forced on the mind will not abide there. . . .
Train your children in their studies not by compulsion
but by games.

—Plato

Humans are a playful species, as are marsupials, birds, turtles, lizards, and fish (Burghardt, 2005). We choose to play not because we have to but because it's rewarding and fun. For most of us, play conjures up images of children running, jumping, and laughing. But what exactly is play and what relationship does it have to learning?

A stumbling block to grasping the importance of play in Western educational theory is our tradition of idealizing rationality, memorization, and abstract thinking. Most of us were raised with the notion of learning as the "work" of childhood as opposed to a natural state of brain, mind, and body. In fact, the brain's evolution and development are based on the actions and reactions of the body. These physical and somatic experiences turn out to be the infrastructure for our rational and abstract capabilities. Although little formal study has been dedicated to the relationship of play to learning, it appears that play can be utilized as a teaching tool to enhance motivation and learning (Mann, 1996). It appears that learning while playing is rooted in our deep history.

Early evolutionary theorists felt it unnecessary to study play because it appeared to have no role in survival. They now believe that the adaptive function of play must be in proportion to the amount of energy it requires and the number of neurobiological systems that support it (Caro, 1988). It is now thought that play has many important roles in building skills required for adaptation and survival (Byers & Walker, 1995; Pellegrini et al., 2007). Seagulls purposely drop and catch objects in a manner that simulates the skills they need to hunt, while dolphins create rings of bubbles to swim through in order to perfect the accuracy of their swimming (Gamble & Cristol, 2002; McCowan et al., 2000). Many animals, including humans, engage in rough-and-tumble play to test their strength and establish social hierarchies.

Play is thought to have evolved in mammals along with the emergence of maternal behavior, nursing, and social vocalizations, pointing to its importance in forming bonds and sustaining ongoing attachment relationships (MacLean, 1985). From the early months of life, a game of peek-a-boo brings joy to both children and adults by stimulating the biochemistry of attachment, well-being, and reward. Play among males and females serves as a means of rehearsal for later courtship and mating behavior (Pellis, 1993; Pellis & Iwaniuk, 1999). Throughout life, playful actions are experienced as expressions of positive feelings, safety, and togetherness (Hannikainen, 2001). The play that animals engage in is moderated by factors such as the amount of social contact, the availability of food, and their familiarity with the environment. Just like learning, play only occurs in the absence of danger, when food is available, and when the physical and social environments are conducive to well-being.

Within the brain, play behavior is organized within the basal ganglia and cerebellum as well as cortical and subcortical regions dedicated to sensory, motor, and emotional behavior. A game such as Simon Says stimulates all of these brain regions, providing the opportunity to practice and improve inhibitory motor control while building cortical executive networks. Play is reinforced within these neural networks through the activation of dopamine, endorphins, and serotonin. The stimulation of these biochemicals associates play with social connectivity, feelings of well-being, and a sense of accomplishment. The types and amounts of rough-and-tumble play are modulated within each species by neurochemicals such as testosterone and adrenaline and specific aspects of their social structure (Vanderschuren et al., 1997).

With the emergence of language in humans, physical play was reshaped into word games, debate, arguments, and verbal banter. All this verbal play strengthens the organization of mental structures, while sustaining interest and excitement about remembering and learning (Singer & Lythcott, 2002). Although imaginative behavior seems disconnected from physical activity, the two are inextricably interwoven evolutionarily and neurobiologically. We know that imagining behavior helps subsequent performance just as our abstract and imaginative processes are replete with physical metaphors. For example, we "try on" new ideas or "explore" novel solutions, while the use of imagination can certainly be considered a form of mental play.

Freud saw play as the first crucible of self-expression while Bettelheim (1987) felt that children's play helps us learn how they see the world. Play provides learning experiences that result in expanded behavioral repertoires in social animals and expanded abstract abilities in humans (Baldwin & Baldwin, 1974). As children age, we witness that the level of abstraction involved in play grows in sophistication (Elder & Pederson, 1978).

Play and Social Learning

> *Children's playings are not sports and should be deemed their most serious actions.*
>
> —Montaigne

Most male animals engage in play fighting, referred to as rough-and-tumble play (RTP). RTP builds strength, stamina, and the skills needed for hunting and protection (Barber, 1991; Bell et al., 2009). On a group level, RTP enhances group coordination among animals that hunt in packs and serves as a context for learning turn taking, sharing, and developing a sense of fairness (Bekoff, 2001; Pellis & Pellis, 1991). RTP also stimulates all of the actions of fighting in the absence of physical injury, distress, or regret and allows for skill building and social bonding (Boulton & Smith, 1992). The positive emotions generated during RTP inhibit aggression against those whom you are attached to and may need on your side in real-life battles. The exaggerated moves, fakes, and attempts at deception may all be related to predicting, anticipating, and thwarting the behaviors of other players (Smith, 1982; Spinka et al., 2001). Football, rugby, and many other sports are obvious descendants of more primitive survival-based activities.

Tickling is a mock attack on vulnerable parts of the body that tests one's strength and methods of escape in a friendly manner. Like play, tickling is also shared by other species. As hard as it is to believe, rats have been found to emit ultrasonic sounds in anticipation of play, suggesting that they also find play both desirable and rewarding (Knutson et al., 1998). These vocalizations can be increased by tickling an area of the rats' bodies that is a target point for play, like the nape of the neck (Panksepp, 2007b). Because they occur only in response to positive and playful social interactions, rats appear to be laughing when they are enjoying themselves.

Play appears to be necessary for the normal development of social communication and the appropriate use of aggression (van den Berg et al., 1999). Play fighting helps to establish a dominance hierarchy in a controlled manner while modulating aggression (Drea, 1996; Smith et al., 1999). Playful approaches of a subordinate animal to a dominant one serve to maintain friendships while participation in RTP enhances likeability (Pellis, 1993, Smith & Lewis, 1985). Children are usually able to differentiate RTP from real fighting via facial expressions, verbalizations, and inferences about intent (Costabile et al., 1991; Smith & Lewis, 1985). Boys are generally much more aware of the importance of RTP in establishing a dominance hierarchy while girls are much more likely to see it as simple play (Pellegrini, 2003).

I received a lesson in establishing dominance many years ago. I spent a week on a reservation in southern Arizona with some very interesting people, one of whom owned an even more interesting Alaskan albino wolf. After a few days, it became clear that the wolf was not just a big dog—he was stronger, more agile, and more intelligent than any dog I had ever encountered. He understood very complex commands and was able to jump to the top of a six-foot wall and quickly walk along it without a slip. When he became too warm, he could dig down many feet until finding a temperature that suited him. One such den had actually undermined the foundation of his owner's house.

One day, we pulled onto the campus of the University of Arizona in Tucson with the wolf in the back of a pickup truck. When the wolf jumped from the cab, a dog of about the same size ran up to him and they immediately began to sniff each other in all the appropriate places. Within seconds they had darted from the sidewalk into a large grassy area surrounded by hedges. They both took off at full speed and when they got to the hedge, the dog crashed out of control into the bushes while the wolf gracefully sprang over them onto the far wall. The dog, composing itself, shot once again across the courtyard with the wolf in pursuit. In no time, the wolf was on the dog's tail. He subtly tripped the dog, which again went rolling in a cloud of dust. The dog jumped up, shook off the dust, and headed straight for us. It arrived at our feet simultaneously with the wolf, rolled on its back, and bared its neck to the wolf. In under a minute, we had witnessed the establishment of the dominance hierarchy of a new pack. These two could now cooperate and get along clearly, each knowing who was boss.

Play serves many important roles in social learning and the solidification of group structure (Parrott & Gleitman, 1989; Poirier & Smith, 1974). As a fan of sports radio, I listen to endless discussions about the relative merits of players, teams, and how they match up against one another. Common topics include relative strengths, skill sets, and how the athletes' emotional maturity impacts their performances and abilities to play well with others. Because sports are so popular, I have to assume that the interest, intensity, and emotion we invest in them is somehow connected with our deep history.

It certainly appears that athletes and sports fans are engaging in the same interpersonal and abstract processes involved in organizing hunting or warrior parties. Bats and balls have replaced spears and swords, and man-made rules are substituted for the variables encountered in nature or on the battlefield. But the same mental and social skills required for survival during most of our evolutionary history are all employed in sports. Perhaps this is why guys who play ball on the weekends are called weekend warriors and why teams are said to battle, fight it out, and clash with one another.

Our natural interest in play can also serve as a platform for acquiring new skills. I first learned how to calculate averages and percentages by figuring out baseball statistics in elementary school, making my interest in sports a motivational tool for skills in other areas of learning. I am also able to recognize the thousands of faces I saw on baseball cards half a century ago and even remember a lot of the players' names. Table 11.1 summarizes some of the research findings from a variety of studies on learning, play, and the brain.

Table 11.1
Learning, Play, and the Brain

The amount of play is regulated by endorphins, dopamine, and serotonin.[1,2,3,4]
The frequency of play correlates with cerebellum size across species.[5]
Early social isolation results in an increase of play during adolescence.[6]
Social isolation increases play fighting.[7]
Play deprivation brings about a rebound when play is reintroduced.[8]
RTP is regulated by testosterone and adrenaline.[9]
RTP stimulates neuroplasticity in the amygdala, the dorsolateral prefrontal cortex, and in many other areas of the brain.[10]
Play stimulates the growth of the medial portions of the prefrontal cortex.[11]
Social play correlates with prolonged development and proximity.[12]
The amount of play correlates with brain size in rodents, marsupials, and primates.[13]
Species with more postnatal development play more and engage in more complex play.[14]
Adult-on-adult play fighting correlates with larger amygdala and nonvisual cortices.[15]

As we can see from the research, play enhances sensorimotor development, social-emotional skills, abstract thinking, problem solving, and academic achievement (Hofferth & Sandberg, 2001). It also suggests that the dichotomy that exists in our culture between education and play may have little grounding in our evolution or neurobiology (Burghardt, 2005). Whether we call it learning or play, we have a natural drive to engage in some endeavor in a productive and meaningful way that stimulates our brain to be "turned on and tuned in." In the recording studio, on a ballfield, or in the classroom, attaining and maintaining this state of mind is the goal of most teachers in the service of creating lifelong learners. The best way to teach the brain of a student may be to wrap lessons in play.

The Acting and Reacting Brain

Earlier we discussed how the brain came to be a social organ by evolving within a matrix of others. We now take another step back into our deep history to explore an even more fundamental reality, the fact that we live in a three-dimensional world as we move through time. The most basic role of a nervous system is to react to the physical environment in ways that support survival. And although we in the West tend to think of our minds as separate from our brains and bodies, the infrastructure of our brains and our abilities to think are grounded in physical experience. As we gradually unravel the mysteries of brain functioning, we face the challenge of figuring out how the brain has adapted to both physical space and the passing of time. As we do, we see more clearly the fundamental unity of mind, brain, and body.

Mirror neurons reveal an intricate, interdependent relationship between the frontal and parietal cortices and how our brains process the dimensions of time and space. Among other things, the frontal lobes specialize in sequencing cause-and-effect relationships and connecting them to future goals. The parietal lobes organize and interconnect spatial maps of the body and the environment. Together, the frontal and parietal lobes construct our experience of space and time, allowing us to navigate the physical world. In fact, neural circuits that connect and coordinate the frontal and parietal lobes may function together to organize executive functioning in ways that were previously attributed only to the frontal lobes.

The implications for education include a deeper appreciation of the sensorimotor contribution to conceptual and abstract learning. Even when we engage in imaginative processes, we are still relying on images of three-dimensional space, which activate and involve parietal regions. This neurological reality parallels discoveries in modern physics that space and time are inextricably interwoven.

Table 11.2
General Functions of the Prefrontal Cortex

Orbital and Medial Regions	
attachment[1]	estimating reward value and magnitude[8]
social cognition[2]	sensitivity to future consequences[9]
thinking about a similar other[3]	achieving goals[10]
self-referential mental activity[4]	stimulus of independent thought[11]
appreciating humor[5]	inhibitory control in emotional processing[12]
encoding new information[6]	
sensory-visceral-motor integration[7]	decisions based on emotional information[13]
Dorsal and Lateral Regions	
cognitive control[14]	voluntary suppression of sadness[19]
directing attention[15]	learning motor sequences[20]
organizing temporal experience[16]	decisions based on complex information[21]
organizing working memory[17]	thinking about a dissimilar other[22]
organizing episodic memory (right brain)[18]	the integration of emotion and cognition[23]

Neural fibers that connect the middle portions of the frontal and parietal lobes serve the integrative function of linking the right and left hemispheres, limbic and cortical structures, as well as anterior and posterior regions of the cortex (Lou et al., 2004). This may give rise to a global workspace or "central representation," allowing for sustained focus, conscious working memory, and self-reflection (Baars, 2002; Cornette et al., 2001; Edin et al., 2007; Sauseng et al., 2005; Taylor, 2001). They also work together to analyze the context and location of specific aspects of the environment and interrupt ongoing behavior in order to direct attention to new targets (Corbetta & Shulman, 2002; Peers et al., 2005).

Research suggests that the parietal lobes participate in the creation of internal representations of physical objects as well as the actions of others (Shmuelof & Zohary, 2006). In other words, they allow us to internalize others by creating representations of them in the three-dimensional spaces of our imaginations. This allows us both to learn from others and to carry the memories of others within us when they are absent. Frontal-parietal networks may be primarily responsible for the construction of the experience of self and others (Lou et al., 2005). These inner "objects," as described by psychotherapists, likely contribute to emotional regulation and a sense of continuity of self through time (Banfield et al., 2004; Tanji & Hoshi, 2001). See Table 11.3 for a summary of what is known about the functions of the parietal lobes.

Table 11.3
Specific Functions of the Parietal Lobes

Hemispheric Function	
Left	**Right**
Verbal manipulation of numbers[1]	Analysis of sound movement[2]
Mathematics[3]	General comparison of amounts[4]
Multiplication[4]	Attention[5]
Motor attention[6]	Own-face recognition[7]

Bilateral Findings

Visual-spatial workspace[5]

Visual-spatial problem solving[5]

Visual motion[8]

Construction of a sensorimotor representation of the internal world in relation to the body[9]

Internal representation of the state of the body[10]

Verbal working memory[11]

continued on next page

Table 11.3 continued

Retrieval from episodic memory[12]
Ordering of info in working memory[13]
Controlling attention to salient events and maintaining attention across time[14]
Preparation for pointing to an object[15]
Grasping[16]
Movement of three-dimensional objects[17]
A sense of "numerosity" defined as nonsymbolic approximations of quantities[18]
Processing of abstract knowledge[19]
Perspective taking[20]
Processing of social information[21]

As we discussed earlier, Western thought is characterized by equating intelligence with abstract thought as opposed to emotional judgment, physical abilities, and introspection. Contrary to popular belief, studies of primate brain evolution suggest that it is the expansion of the parietal and not the frontal lobes that is the benchmark of the transition to the human brain (von Bonin, 1963). Could the fact that we don't generally think of the parietal lobes as a component of the executive brain reflect a cultural bias toward thinking over lived experience?

The emergence of self-awareness was likely built in a stepwise manner during evolution through a series of overlapping "maps," first of the physical environment, then of the self *in* the environment, and later of the self *as* the environment. The emergence of imaginal abilities allows us to create an increasingly sophisticated inner topography grounded in the structure of our physical environments.

The imaginal workspace afforded by the combination of good frontal and parietal functions allows for the creation of an inner reality organized by and grounded in both space and time. Within this inner world we can imagine ourselves, experiment with alternative perspectives and emotions, and rehearse for future actions in the external world (Knight & Grabowecky, 1995). Our ability to be "mindful" relies on learning how to use these frontal-parietal capacities as we build and elaborate the architecture of our mental experiences. Without the ability to reflect on, imagine alternatives to, and sometimes cancel automatic responses, there is little freedom beyond simple reactions to the environment (Schall, 2001).

Navigating Physical and Social Space

It is better to travel well than to arrive.

—Buddha

Our usual focus on teaching conceptual and abstract information makes it easy to discount the role of the body in learning and neuroplasticity. Yet the evolutionary history of all learning is grounded in the navigation of space with a body. This may be why the hippocampus, which serves as a cognitive map of the environment in mammals, is the portal to all explicit learning in humans. It is also why using the large muscles in our legs results in the secretion of neural growth hormones that cross the blood–brain barrier and trigger plasticity and learning. Our muscles have evolved to tell the brain to pay attention and learn while we are moving around.

Knowing where to go and how to get there requires at least two interwoven spatial maps: one for physical environments and another of our bodies. The hippocampus organizes a spatial map of the environment, and this map grows and shrinks based on the navigational demands placed on it. At the same time, the parietal lobes, which evolved from the hippocampus, construct maps of the body and the body in space to allow for goal-directed navigation (Maguire et al., 1998). We witness the development of these neural networks in a child's sensorimotor development through learned behaviors such as walking, throwing a ball, or being able to open a box of cookies.

Another central aspect of living is navigating our many interpersonal relationships. The sensory, motor, and spatial components of our attachment systems become interwoven with our experiences of self, other, and the physical environment. Think for a moment about how we describe our interpersonal emotions—we *fall* in love, *fly* into a rage, or have a hard time *handling* what a loved one has told us. Even the words bonding and attachment evoke an image of the joining together of two separate objects in space. Attachment schema are not abstract concepts; they are stored in systems of procedural memory and are manifest in our musculature, postures, gaits, and interpersonal stances. People can tell us they love us but we also have to feel it in our hearts. We learn to love with our brains and bodies and to store these experiences within our implicit procedural memory.

Procedural Memory

Memory is the mother of all wisdom.

—Aeschylus

Procedural memory is a primitive form of memory we share with all other mammals. It does not involve or require conscious awareness or self-reflection. Procedural memory is a subcategory of implicit memory that involves the storage of sensorimotor, visceral, and emotional experiences that allow us to engage with our physical and social worlds. Physical abilities such as walking down stairs, serving a tennis ball, or brushing your teeth would all be examples of procedural memories. Once we get to the stairs, walk onto the tennis court, or look at ourselves in the bathroom mirror, these behaviors go on automatic pilot and free us to think about other things. In fact, consciously thinking about doing things stored in implicit memory can impair performance. Golfers spend a lifetime perfecting their swing while simultaneously trying to empty their minds.

A basic biological strategy is to approach or avoid the things around us depending on their value to us. We approach what we need, what feels good and what reduces anxiety, while avoiding what is frightening or causes us pain. Our movements by definition are goal-oriented and the neural networks controlling movement, motivation, and goals have evolved in an interwoven fashion (Rizzolatti & Sinigaglia, 2008). As we navigate our worlds, our brains automatically generate myriad options, paths, and potential strategies designed to get us what we need based on a combination of present realities and past experience. In other words, when we encounter something or someone in our environment, our brains activate preexisting procedural memories that allow us to engage with it. These systems create *affordance*, or our ability to engage meaningfully with the objects and people around us. An affordance is neither objective nor subjective; but emerges from the interaction between self and world (Heft, 1989; Kytta, 2002).

A familiar example might be when you are sitting in a café talking with a friend and the waiter sets before you a cup of coffee, sugar, cream, and a spoon. Your implicit procedural memory allows you to use your hands automatically to engage these objects such that you are able to mix your personal blend of ingredients while not missing a word of the conversation. This is a complex goal-directed task that allows you to utilize the environment (affordance) with minimal conscious attention. At the same time, your abilities to use language, read facial expressions, and empathetically attune allow you to establish affordance with your friend.

In his study of how English children interact with natural environments, Moore (1986) discovered that children tend to focus on specific features with which to interact. Some examples were relatively smooth surfaces for *running*, things for *climbing* (trees), places for *hiding* (bushes), slopes for *sliding* down, obstacles for *jumping* over, and objects for *throwing*. This suggests that children naturally generate affordance categories, making connections between objects and what to do with them. It is not coincidental that the salient environmental features related to their play are also those that were historically relevant for survival—to hunt for food and escape from danger.

We can easily expand the idea of procedural learning to attachment relationships. Imagine sitting with a new friend and his 3-year-old son, paying special attention to their many interactions. When you first enter the house, the child holds his father's leg, leans into it, and rolls around the back so as to watch you from a safe vantage point. A little later he presents his finger, which he has pinched in the door of a toy car, for his father to kiss. At another point, he sneaks up from behind with a pillow and hits his father on the head as an introduction to some rough-and-tumble play. Still later, he finishes his juice box and hands it to his father with the words "all done." These interactions demonstrate the boy's ability to successfully use his father for safety, solace, stimulation, and service. These affordances are driven by mutual instinct and emotion, and they are reinforced through decreases in anxiety and increases in positive feelings.

Based on experiences like these, this child will likely enter school with the expectation of similar positive and useful connections with his teacher. He may assume that the teacher will also be a source of safety, solace, stimulation, and service and he will then build on the affordances he has developed at home. In interacting with the teacher, he will learn affordance strategies for the classroom such as raising his hand, sharing with his classmates, and approaching his teacher for comfort.

Thus, when a child has had positive and rewarding experiences with parents and other authority figures, she is more likely to be able to use her teacher as a source of emotional regulation and learning. This ability is reflected in a relaxed body, leaning toward the teacher when something interests her, curiosity, and optimism about being a successful learner. In turn, this state of mind optimizes neural plasticity and learning in the student and promotes enthusiasm in the teacher. The opposite stance would be seen in the anxious or traumatized learner who experiences the teacher as a threat and lacks the skills and affordance patterns to utilize the materials placed in front of her. As we know, many children enter school without many of the affordance skills required to successfully utilize teachers and classrooms. In many instances, affordance needs to be taught before content to establish the possibility of learning.

Why students succeed or fail in school is strongly determined by whether they possess affordance patterns that match the context and climate of the classroom. Culture, language, and the values in their families are parts of this, as are the social and emotional factors necessary for neural plasticity. A child from the Sahara Desert who is flown to the English countryside may have the affordance for a tree as a source of shade rather than as something to climb. This would have to be demonstrated and learned over time. In a similar way, we shouldn't assume that when presented with rows of desks, books, and a smiling face at the front of the room, a student sees and experiences the same thing we would if we were in his seat. While this disconnection is more obvious for a recent immigrant, it is less obvious when the disconnection has an invisible emotional cause. Because a lack of affordance is often tied to neglectful or traumatic attachment experiences, anxiety and fear usually go hand-in-hand with learning difficulties. In these cases, building affordance patterns needs to precede attention to the curriculum.

In our old way of thinking, perception was the emergence into consciousness of what was impinging on our senses. We now know that perception involves the active construction of experience within our brains. Thus, to perceive is to shape the current situation based on past learning. Affordance is the flip side of ergonomics, the study of how usable the tools in our environment are to us. Affordance determines our mind's ability to grasp the tools and opportunities in front of us. Therefore, physical activities, expressive movements, and social interactions as play are all necessary for optimal learning. An elementary schoolteacher with a profound understanding of these principles was Albert Cullum.

Albert Cullum

We are most nearly ourselves when we achieve
the seriousness of the child at play.

—Heraclitus

Over the course of his long career, Albert Cullum, an actor turned elementary school teacher, wove his loves of theater and teaching into a living classroom experience. As a teacher in a middle-class suburb, he did not face the challenges of poverty or community violence. As he saw it, his enemies were complacency, mediocrity, and a blind acceptance of the status quo. He faced these challenges by making education a sensory, motor, and emotional experience through the skills he learned on the stage. While initially drawn to the classroom to be a star, his goal became to make a star of each of his students.

Early on, Cullum realized that when play becomes the modus operandi of the classroom, disciplinary problems decrease while attention and learning increase. He felt that it was the nature of children to learn through active and imaginative play, which, in turn, stimulated enthusiasm, imagination, and openness to new ideas. He structured all of his learning activities to channel his students' youthful energy toward productive ends. Cullum used the works of Shakespeare and Shaw as vehicles to teach language, history, and human values, while encouraging self-expression and personal transformation.

Cullum's use of plays to teach elementary school was something many of his colleagues believed impossible. In an era characterized by "Dick and Jane," Cullum opted for Romeo and Juliet, Macbeth, and King Lear. He presented his students with highly challenging content while communicating a message of confidence and faith in their intelligence, maturity, and capabilities. Cullum found that when he presented even his youngest students with a worthy challenge they rose to the occasion, bonded more closely with one another, and gained self-confidence. The engagement with the material via performance led to an embodiment of knowledge and made each student a hero by being a cast member of a timeless story.

His classroom was always filled with the kind of noise you hear at a birthday party with children playing, laughing, moving, and touching everything around them. He created a learning environment that activated both explicit and implicit memory systems by blending history, art, music, literature, and math into fun, tactile, and emotionally engaging activities. Mr. Cullum was always in the middle of the fun. Never quite getting over being an actor, he would teach about the geography of Canada and Alaska while wearing a bear costume. His lessons were never dull or passive experiences.

When they weren't "swimming" down the Mississippi River they created out of construction paper that flowed through the classroom, students were taking part in the math Olympics, geography races, or art shows.

Cullum assumed that a sense of safety and belonging were essential elements of successful education. He endeavored to communicate love, compassion, and respect to his students, and he saw these qualities carried into their relationships with one another, in ways that transcended age, race, and status. As the sole African American student in one of his classes stated at a reunion decades later, "I felt as though my classmates loved me. I felt as though my teacher loved me." As an expression of his caring, Cullum established a democratic classroom environment to maximize the sense of investment and pride in being a member of the group.

Into his senior years, Cullum retained the rare ability to see the world through the eyes of a child. As a professor of aspiring teachers at Boston University later in his career, he engaged his students in ways that helped to remind them of the world of children and to rediscover the child within. In order to transform what he described as a "cancer of mediocrity" that he saw undermining his profession, Cullum believed that teacher training should include guided self-development and ever-deepening personal awareness. Much of Cullum's success lay in his ability to give voice to the perspective of children, his sense of accountability for his students' education, and his revolutionary curricula and teaching methods. By becoming fully engaged in the way children learn—through movement, emotions, activities, and play—he felt that teachers could open the floodgates to learning. To see him in action, see the documentary film *A Touch of Greatness*, filmed partly by his friend, director Robert Downey, Sr.