Play:
The Dynamics of Learning and Teaching Across Scales of Meaning, Abstraction, and Context

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When I was asked to write this chapter, my thoughts immediately focused on my approaches to teaching future teachers how to engage children through child-controlled inquiry. However, when I began thinking seriously, or rather playfully, about play, a central question arose: What is play? When I stumbled over this rather basic question, I fell into a rabbit hole. This particular rabbit hole has led to seeing play from a number of different perspectives, many of which are still only vague images of possibilities. But, the questions suggested by these possibilities are important for framing future research and for suggesting different ways of perceiving the nature of our world, as well as for ways in which we need to view learning, teaching, and schooling, in general.

While falling into a rabbit hole provides many opportunities to explore, play, and ponder possibilities, there are many other holes into which one can fall. But, instead of providing for a wonderland of exploration, these holes can be conceptual traps that lead to nicely ordered tunnels of increasing obscurity. I have tried to avoid falling into these traps of positivism, reductionism, and mechanism, as well as others such as anthropocentrism.

While my ultimate focus is on play as a way of learning and teaching in and out of schools, the rabbit hole led me into exploring the depth and extent of play. Who plays? What is the extent of play? Why play? However, before we begin to examine these questions, I will provide a brief description of the context of schooling in the United States, which is applicable to most of schooling in contemporary developed and developing societies.

Children go to school, where they sit down at desk or maybe tables. Teachers talk *at* them, control the flow and content of discussions, provide pre-planned worksheets and closed-ended activities, and manipulate their behavior to conform to arbitrary standards of classroom behavior. In the United States, they start drilling children as preparation for taking tests from kindergarten through high school and beyond. Children have to take four or more hours of standardized tests several times a year throughout their schooling. All children are expected to read in kindergarten. And, what they read has to be about subject matter content. The amount of reading fiction is being reduced to a small fraction of their reading time. Time for the arts has been dramatically reduced or eliminated. Recesses are being shortened or eliminated. Teachers are being required to read through scripted lessons at predetermined rates. Principals walk around with stop watches to make sure teachers are keeping to the scripts. The national science education standards in the United States (aka Next Generation Science Standards) (Achieve, Inc., 2013) have moved from emphasizing teaching and learning through inquiry to emphasizing reading *about* science. These actions and others as suggested by the Common Core State Standards (Student Achievement Partners, 2010) and the array of high stakes standardized testing are all acts of psychological violence against children, as well as teachers. We have taken childhood away from children. We have taken the professional integrity and creativity of teaching away from teachers. And, we have taken the excitement of learning, the passion of inquisitiveness, and the wonder of childhood out of schooling.

The institution of schooling has been taken over by corporate agendas and corporate profits, and, for the most part, has lost any sense of playfulness. At home, children have to make play dates. Many children are either left alone at home or scheduled with back-to-back lessons or sports teams. Children no longer have days of coming home from school, gobbling a snack, then running outside to see who is there to play. Play has been relegated to appointments, electronic boxes, and virtual worlds. I am not suggesting that the new play venues are bad, but that they have limited the scope of possibilities. For some house-bound children and adults, virtual worlds are the primary possibility for individual and social play, which has extended what was previously impossible. However, for others these virtual worlds of play have limited not only the contexts in which play can occur, but also the dynamics and possibilities offered by play.

When I began my teaching career in a New York City middle school, we viewed education as a grand experiment. We played with ways of engaging children in (a) learning, (b) following their curiosity, (c) developing social responsibility, and (d) creating. Art was as valuable as reading. Free time within the structure of the school was viewed as a time for children to play. At any given time, 50 children could be walking in the halls, hanging out in the student lounge, eating in the cafeteria, or hanging out with teachers who were not in class. Relationships, engaged learning, personal growth, and creativity were critical. Now, children have little if any free time in school. Play is considered a waste of time. And, there is no time for developing relationships, for in-depth learning through inquiry or other time-intensive approaches, for working on the personal and social growth, and for nurturing children's inherent creativity. Our schools are deserts, devoid of playfulness, intellectual stimulation, curiosity, creativity, and the fundamental spirit of humanity.

What is Play?

Most biologist and psychologists agree that play is difficult to define. Attempts to define play are characterized by descriptions of what play is not (Pellegrini, 2009) and by the use of inconsistent levels of abstraction, inconsistent interpretive frameworks, terminology with conflicting assumptions, and vague descriptors. Much of the research discusses play as a characteristic behavior of humans and many animals, but then proceeds to separate human play from other animal play. With humans, the emphasis of research focuses on children with very little mention of adult play. In Table 1, I summarize some the major descriptors of play in the contemporary biology and psychology literature, along with some of my major questions and concerns. Although some of the descriptors and categories may be useful in formulating an understanding of the dynamics of play, the overall set of these ideas falls short of providing such an understanding.

Table 1. Play from the predominant scientific view.

Predominant Scientific Views of Play	Critical Questions and Comments
a. "incompletely functional in the context in which it appears"[1]	• From *whose* perspective is play "incompletely functional?" • To which of several possible contexts is the author referring?
b. "spontaneous, pleasurable, rewarding, or voluntary"[1]	• These descriptors are of different types: play as action ("spontaneous"); play as emotional ("pleasurable, rewarding"), or play as choice ("voluntary"). Why are they lumped together?
c. "differs from other more serious behaviors, in form… or timing"[1]	• Who determines what is "serious?" • Is all play not "serious?"
d. "is repeated, but not in abnormal and unvarying stereotypic form"[1]	• Repetitive behavior appears to miss the significance of play as a learning process. • Is all play "just" repetitive?
e. "is initiated in the absence of severe stress"[1]	• Does not describe play, but points to one dimension of context. • Does this constraint always hold true?
f. Categories of play: • "solitary locomotor—rotational play"[2] • "object play"[2] • "social play"[2]	• Appears to describe play as a more fragmented and mechanistic process than it may be. • Is there any overlap between these types of play?
g. "play as observable behavior"[3]	• Limited, behaviorist view of play. • From this perspective, play is not cognitive.
h. Dispositions of play[4] • "intrinsic motivation" • "attention to means over ends" • "differentiation between play and exploration" • "relation to instrumental behavior" • "freedom from external rules" • "active engagement"	• These dispositions tend to be positivistic, mechanistic, and anthropocentric. They are based on human centered interpretations of particular behaviors. For example, exploration focuses on information gathering while play does not.
i. "Play as context"[5]	• Limited view of context as antecedent conditions, but not as span of interconnected contexts from cognitive meanings through social and physical sets of relationships.
j. "Smilansky—Parten Matrix of Play Behaviors"[6] • Solitary – Parallel – Interactive <u>across</u> • Functional – Constructive – Fantasy – Games	• Pellegrini considers inclusion of the cognitive dimension of "construction" as a "weakness" of this categorization matrix. • Assumes distinctive separations between what might be considered functional, constructive, fantasy, and games.
k. Play affects mental health Studies have shown that as play decreases psychopathology increases in children and adolescents.[7, 8]	• Intriguing findings that can lead to important research into the how play affects relationships to self and others. • Focus is on humans, but may be equally applicable to other species.
l. Play develops self-realization. [9]	• Extends notions of mental health as described by Gray (2011) to self in cultural and social contexts.

NOTES:

[1] Graham & Burgdorf (2010, p. 394)
[2] Fagan (1981, as cited in Graham & Burgdorf, 2010, p. 394)
[3] Pellegrini (2009, p.15)
[4] Pellegrini (2009, pp. 16—17)
[5] Pellegrini (2009, p. 18)
[6] Pellegrini (2009, pp. 19—20)
[7] Gray (2011)
[8] Panskepp (2010)
[9] Henricks (2014)

I am not suggesting that these descriptors are useless. They do describe some of the basic characteristics of certain kinds of play. And, they suggest some of the deeper characteristics of play. The "incompletely functional" characteristic is problematic in that it assumes some sort of direct and linear relationship or system with a definitive outcome. From a complex systems perspective, such a statement makes no sense, since such systems are not linear and definitive outcomes are neither likely nor desired. A number of other characteristics are potentially problematic in that they may be interpreted from anthropocentric, mechanistic, behavioristic, and/or reductionistic perspectives, such as "voluntary," "serious behaviors," "abnormal," "observable," and "instrumental." Other characteristics presume clear distinctions or separations, where, in actuality, the differences may be fuzzier or lie along a continuum of gradations. Are play and exploration distinctively different? Is all play spontaneous? Or, can play range from preplanned to spontaneous? Can play involve a range of emotions beyond those that are just pleasurable? In Table 1, items "k" and "l" begin to focus on more holistic views of play by suggesting that play is essential to psychological health and contextually embedded notions of self. However, most studies of play either try to establish strict categorical criteria or apply such categorical criteria to observations of behavior. While such categorization is quite seductive, they may not capture the nature and dynamics of the multiple complex systems that interact as what we call play.

However, even with such weakly framed definitions of play, researchers have found evidence of play (using their definitions) in many mammals, birds, fish, frogs, some mollusks, and some insects (Burghardt, 2010). They carefully state that they have identified play in these organisms, but do not suggest that others animals (not identified) do not play. Play may be ubiquitous, which is another part of the rabbit hole. Just how far "down" does play go?

Just how extensive is play?
Do plants, fungi, protists, and bacteria play, but we just can't see them across such different scales of time and size?
Do ecosystems play?
Is evolution play at the scales of genes, molecules, and social and environmental contexts?
Is play a fundamental characteristic of living systems?
Do ecosystems play?

Although the focus of this chapter is on play and education and not necessarily about answering these questions, pondering the possibilities of the depth and extent of play can help to frame the significance of this often ignored aspect of learning and education. Within the spirit of these questions, this chapter explores play in teaching, learning, and beyond as if play is a fundamental pattern of living systems.

Play from a Batesonian—Cybernetics and Complex Systems Perspective

The history of research on play from within the fields of biology and psychology have difficulty breaking away from the lineage of positivism, mechanism, reductionism, and their sibling of behaviorism. Over the past couple of decades, biologists have made great strides towards moving away from the times when they dismissed animal consciousness, intelligence, and emotions. However, they still are plagued by many of the same assumptions of linearity, mechanism, and distinctive separations between humans and other animals. They also have not paid much, if any, attention to Gregory Bateson's (1972/2000, 1976, 1979/2000) work on epistemology, communication, and play. Bateson's work and the general principles of complex systems provide an expansion, depth, and cohesiveness to understanding play that is not evident in the contemporary scientific views of play. Table 2 and Figure 1 provide a brief summary and graphic representation of play as a complex system. The first point in the table, about communication, may be one of the most insightful of Bateson's characterizations of play. All play involves some communication (internally or socially) "about" play. Such communication is an *abstraction* or *metacommunication*. For instance, two dogs playing must communicate that they are playing and not attacking: *this bite is not a bite* (Bateson, 1972/2000, 1976). Some play among children and adults involve the same sort of communication, as with sarcasm, irony, and playful banter. As I write this chapter, I am playing with ideas, where I am generating abstractions or models of the dynamics of play. A cat playing with a scrap piece of paper is pretending the paper is some sort of other entity, like a mouse that is not a mouse.

At the same time, play delves into *depths of meaning*, which can be viewed as deeper and more complicated sets of *relationships* (Bateson, 1976). Play signals are used in many animals to indicate that certain behaviors are playful and not serious. However, these signals are not foolproof and what starts out as play may become aggressive. These signals are "context markers" (Bateson, 1979/2002) that communicate the intensions. Over the past few years, I have watched my dog make friends with other dogs and people. At first, she approaches another dog with her head down (she is a big, 97-pound, Doberman Pinscher). She hardly ever initiates play at the time of first contact. She may take an hour or even days of contact, before she feels comfortable enough to play. After beginning to play, the nature and intensity of the play changes over time. As she develops a deeper relationship, she also develops a greater sense of trust that the other dog is not going to act aggressively. She may retreat or chase away a new dog that goes too far too quickly, but an old friend may go much further in terms of the intensity of bites and play-growls. The more we, as humans, get to know another person, the further we can go with our playfulness. If we call someone we don't know a "jerk" (or some other term of our choosing), we will probably get a nasty response. However, if we call a close friend a jerk, we're likely to get some sort playful retort. As we play with ideas, we develop deeper and more complicated

interrelationships. Both abstraction and depth of meaning and relationship are critical components of play.

Table 2. A working definition of play from complex systems and Batesonian perspectives.

Aspects of Play	Specific Characteristics of Play
DEPTH b, c, d	a. Play involves *metacommunication* or *metamessages* that span levels of *abstraction* [2] [4] and includes development of mental models, explanations, etc.
ABSTRACTION a, d	b. Play involves the development of *relationships* (i.e., dynamics, interconnections, and depths of meaning between ideas, contexts, self and contexts, and self and others)
ABDUCTION (extent) e	c. Play involves the development of *meaning* to varying degrees of *depth*

RECURSION
  a, b, c, d,
  e, f, g
	d. Play involves *cognition* (with or without a central nervous system) across contexts and levels of depth and abstraction

CONTEXT d, e, g, h	e. Play involves *learning* across dimensions of *depth* (i.e., relationships and meaning), *abstraction* (i.e., metaphor, analogy, models, etc.), and *extent* (i.e., contexts) [6] [7]
TRIGGER BY (arising from) k	f. Play involves *recursive patterns of information flow* and sense-making, which can include fantasy, humor, deception, etc.
FOCUS OF i	g. Play involves recognition of context and the use of relational meanings and abstractions across multiple, interrelated and/or embedded *contexts*
	h. Play is *determined by the individual(s)* involved, which may be designated by some sort of *context marker* [3]

INVOLVES A COMPLEX WEB OF
  a, b, c, d, e,
  f, g, i, j, k, m
	i. Play includes *interactions* with objects, ideas, and/or interspecies or intraspecies individuals

	j. Play includes at least some positive *emotional* involvement (i.e., dopamine reward circuit and related neurotransmitter processes) [9]
RESULTS IN j, k	k. Play involves *binaries* of juxtaposed "ideas" or tensions of various sorts [5]
	l. Play can find the *limits of the possible*. (Bateson, G. 1975. Personal communication.)

LEARNING AS
  a, b, c, d, e,
  f, g, i, j, k, l, m
	m. Play may be a *key process of complex, autopoeitic systems*, where finding possible solutions to problems (at present or in the future) is essential to survival

NOTES:
[1] (Bateson, 1972/2000)
[2] (Bateson, 1976)
[3] (Bateson, 1979/2002)
[4] (Bateson, 1991)
[5] (Bloom, 2001)
[6] (Bloom & Volk, 2007)
[7] (Bloom & Volk, 2012)
[8] (Graham & Burghardt, 2010)
[9] (Weems, 2014)
[10] (Wright, 2008)

Were Stilt Palms playing when they developed the ability to "walk"? (Bodley & Benson, 1980)
Are trees that send out roots that "hug" an extruding boulder playing with possibilities of growing in places that otherwise may be too difficult to live?
Were deep-sea bacteria playing when they first developed electrical conduits to warm their colonies? (Buehner, 2014; Cervallos, 2010)

PLAY SPACE

ABSTRACTION

all play is
interpretive

metacommunication
metamessages

positive emotional
involvement
----
dopamine or
other neurotransmitter
circuits

autopoietic
recursive
non-linear
learning

center
(triggers)

Binaries

**EXTENT or
ABDUCTION**
across
contexts

context
markers

contexts

possibilities for
variation--diversity
----
schismogenesis

interactions
with
· others
· objects

interspecies
intraspecies

contexts

finds the
limits of the
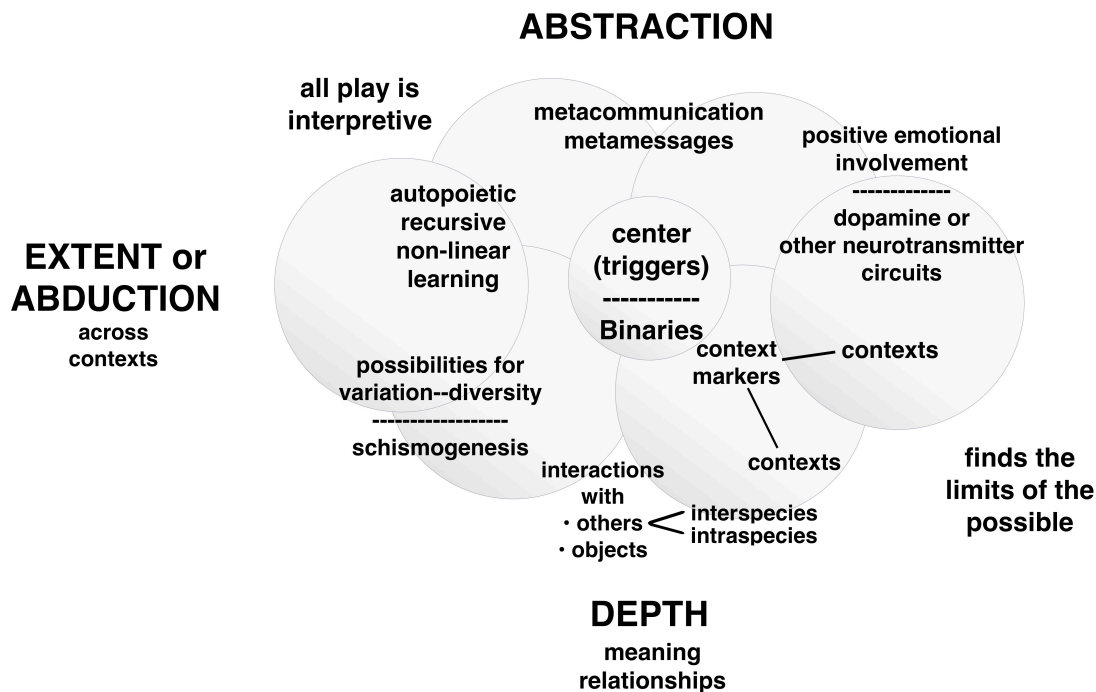possible

DEPTH
meaning
relationships

Figure 1. A visual representation of play space and play as complex phenomena.
    NOTE: Spheres are not limits to the space. They represent overlapping contexts.

As I began to formulate the models in Table 2 and Figure 1, I realized that play fit into a model of learning I developed during a project with Tyler Volk (Bloom & Volk, 2007). This model depicted learning as a recursive pattern of moving between Depth (i.e., the development of increasingly intricate interconnections, relationships, and meaning), Abstraction (i.e., the development of models, explanations, theories, etc.), and Extent or Abduction (i.e., using and testing the ideas in Depth and Abstraction across differing contexts). Play seems to fit perfectly into this model of learning. I suspect that not all learning is play, but all play is learning. Some learning is painful and excruciating and possibly transformative at the level of changing worldviews and beliefs. Play may be painful, but also involves some degree of pleasure. In soccer (or football), a player may get hurt or be disappointed in loss, but throughout the game there are moments of pleasure, where the dopamine circuit in his or her brain is activated. In some learning, the same dopamine circuit may be involved, but probably not in all learning situations.

Play involves some triggering "central" factor, which seems to involve a binary of tensions. This triggering binary may be a situation between two individuals, such as two people or teams playing or two dogs building up a playful tension. Two dogs often stalk one another or get close to each other, staring in anticipation, then breaking into play. The binary tension also may be between two or more ideas, questions, or uncertainties that

lead to playing with these ideas in different ways, while trying to develop some solution or explanatory principle.

In the scientific literature, play is characterized by repetitive behaviors, but such a view seems to be too superficial and ignores the subtleties of recursion. Two dogs playing may go back and forth biting each other. However, each bite and each play-growl extends their knowledge of the relational dynamics. They learn about one another and about the dynamics of play. Playing tennis, hitting a pitch in baseball, swinging a golf club, or playing chess involve repetitive events, but each event is a recursive process of learning. Such recursive cognition not only spans levels of abstraction and meaning, but also spans contexts. A dog may play with another dog, then move to trying the same approaches to play with a cat or person. In both the cat and person contexts, some of the processes are similar, while others need to be renegotiated or dropped. Two children playing may be constructing an "enacted story," then when an adult arrives the story may change to accommodate the new "participant."

STORY 1: Pre-Kindergarten Children – Solo & Social Play	
I visited a pre-kindergarten class of a former graduate student to observe children playing and inquiring. As a "researcher," I was planning on quietly sitting and watching the children do what they do. I had arrived during a short period of playtime. Some of the children were playing together and others were playing alone. About 2-seconds after sitting down, I became part of the interactive scenery as toy cars started running up my leg, stomach, chest, and over my head. For a couple of the children playing alone, I became part of their ongoing storylines of car-play, complete with car sounds and strings of words depicting stories they were creating spontaneously.	*Pay attention to:* • **Abstractions** in communication and ideas. • **Depth** of relationships. • **Recursions**. • **Abduction** or connecting across contexts. • **Pushing the limits** of "ideas."

Play obviously occurs within a particular species, but it also occurs across species. My dog and cats play. However, their play signals are not always the same, but they manage to negotiate terms (e.g., boundaries, rules, etc.). On YouTube, we can find a large number of examples of cross-species play, such as dogs—deer, cat—crow, dog—polar bear, dog—horse, cat—dog—monkey, dog—lion, dog—orangutan, dog—tiger, and so forth. At a friends house in the forest, deer will jump across the fence, when my dog is there. She'll chase the deer, who run and jump over the fence. Then, a few minutes later, they jump back over into the yard. This back and forth play may go on for over an hour. Play certainly helps develop communication and relationships. Different species seem to be able to share meta-messages about the terms of play. Within a species, the communication that what they are doing is play and not aggression is remarkable. But, such communication across species is extraordinary. In some way, different species create contexts within which they can communicate at meta-levels. The dog play bows, while the cat stalks. The dog chases, while

the cat hides and ambushes the dog. Somehow, dogs and cats manage to share and understand their meta-messages within the contexts they have created.

Story 2: Dog with Toy: Solo and Cross-Species Play

Much like a cat, my 97-pound dog walks over and picks up one of her squeaky toys. She squeezes it a few times, then tosses it up into the air. She runs over and steps on it a few times with more squeaks. After a minute or so of doing this she starts tossing it over towards me. If I don't respond, she picks it up, walks over to me, and looks at me with great anticipation.

Pay attention to:
- **Abstractions** in communication.
- **Depth** of relationships.
- **Recursions**.
- **Abduction** across contexts.
- **Pushing the limits**.

Story 3: Dog with Toy: Solo and Play With Other Dogs

In the dog park, my dog occasionally repeats the process of holding a squeaky toy, but instead of working her way towards people as play partners, she does it with other dogs. She holds the toy in her mouth, approaches other dogs, and squeaks the toy. Dogs that don't know her, don't know quite what to do, while her best friends try to get the toy out of her mouth.

Pay attention to:
- **Abstractions** in communication.
- **Depth** of relationships.
- **Recursions**.
- **Abduction** across contexts.
- **Pushing the limits**.

Solo play can be an accidental discovery process or one that is purposefully designed. What might be a non-playful action may turn into play. In Story 4, a crow was just hanging out on a snow-covered rooftop, when she slipped by accident. That event turned into 10-minutes of play by a dozen or so crows. In Story 5, a toddler playing with a magnet accidentally discovered a new variation on magnets and motion. In both stories, the crows and boy elaborated on their learning about the dynamics of motion through each recursive iteration.

Story 4: A Crow Discovers a Playful Activity and Shares it Socially

I was sitting in my office one winter afternoon, while a colleague and friend was doing the same in his office on the floor above me. There was about a foot of snow on the roof of a motel across the parking lot from both of our offices. About a dozen crows were at the apex of the motel roof. One crow was walking along the roof, when she slipped and slid down the roof. She managed to stop herself, just before getting to the edge. Then she stood up, looked around, and flew back to the top of the roof. Then, she purposefully slid back down the roof. In less than a minute, all of the other crows started sliding down the roof. In the middle of this event, I got a call from my friend, "Do you see what's going on across the parking lot?!"

Pay attention to:
- **Communication**.
- **Recursions**.
- **Discovering the limits**.

Story 5: Child is Playing with a Magnet and Discovers a New Variation

My son, when he was about 3-years old, was playing with a cylindrical magnet that came out of a magnetic marble. He put the magnet on the refrigerator door and began putting it into different spots and in different orientations. At one point, the magnet started rolling across the door and around the corner onto the side of the door. At this point, his eyes bugged out while he picked up the magnet and started trying to repeat the process in different ways.

Pay attention to:
- **Abstractions** in ideas.
- **Recursive** learning.
- **Discovering** the limits.

While playing, new insights and new possibilities arise that allow the theme of the play to branch off into new directions. In Story 6, my son's play with a toy car on the deck opens up into a playing with a ramp after seeing and incorporating a rain gutter into the play scenario. In Story 7, the discussions in an ornithologist's lab lead to new avenues of hypothesizing and research. Without the contexts of play, such possibilities may not have arisen. Because of play, new ideas and possibilities can be seen, included, and elaborated upon. A certain degree of openness to novelty occurs within play. In the absence of play, new possibilities will likely be overlooked or dismissed.

Story 6: Toddler with Toy Cars

My son when he was about 3-years old was playing on our back deck with a toy car. He ran it all over the deck up the legs of a chair while leaping through the air to the table, then back down on the deck. After about 10-minutes of doing this, he stopped. He looked over to one end of the deck where a rain gutter was lying (where we had put the piece of gutter while working on replacing some of the gutter on the roof). He stared at the gutter for several seconds, the ran over, picked up the end and propped in against the railing of the deck, then proceeded to let the car run down the newly constructed ramp.

Pay attention to:
- **Abstractions**.
- **Depth**.
- **Recursions**..
- **Abduction** across contexts.
- **Pushing the limits**.

Story 7: *An Ornithologist and Graduate Students* – **Playing with Ideas**	
A biologist and his graduate students are sitting in the lab for their weekly lunch, wine, and discussion. The biologist has been studying the flocking behavior of birds.	*Pay attention to:*
O So, how can these flocks of mixed blackbirds maneuver without collisions?	• **Abstractions** in communication and ideas.
GS1 They must have a leader.	• **Depth** of interrelationships being discussed.
O But, there must be at least 3,000 birds of three different species in these flocks. How can those at the back see the leader?	• **Recursions** in the dialogue.
GS2 Maybe, they use some sort of sound to communicate?	• Intermixing of seriousness and **humor**.
O But, we already know that their reactions times to stimuli are much slower than the time it would take for the sound to travel to the back of the flock. And, besides, they're all chirping. It's pretty damn noisy in the middle of those flocks.	• **Abduction** or connecting across contexts.
GS3 And, the birds are always changing positions, so they can't really have one leader, if there is a leader.	• **Pushing or testing the limits** of "ideas."
GS1 Yeah, the birds at the back become the birds in the front, when they do a 180.	
O Maybe it's ESP…? Maybe, that what people who think they have ESP are really experiencing?	
GS3 Wait a minute… That's nuts!?	
All [laughter]	
O Well, what if their bodies… nervous systems… act like mini-radio wave transmitters and ESP is just radio wave communication? They all could be communicating with each other almost instantaneously…	
These ideas were presented, with great trepidation, at conferences, but were received with interest by those in the military. Many years later, the ornithologist figured out that organized flocks were probably acting as a complex system, rather than a leader-follower system.	
NOTE: Fictional dialogue based on actual events. Special thanks to Frank Heppner (who is the ornithologist) for comments and clarifications on the story.	

Throughout all of the examples thus far, learning has been a key component of play. And, maybe this statement also works the other way around in that play is a key component of learning. Either way, learning focuses on the depths and dimensions of relationships and meaning, on communication and ideas as abstract representations, and on using these previous two areas of thinking and learning across differing contexts. Play provides the freedom to make connections, take risks, and explore that may otherwise be

dismissed or regarded as frivolous or irrational. We may consider play as providing "play space" in which rational boundaries to thinking and behavior are stretched or disregarded.

In Story 7, two girls walk into a room with two piles of materials. One pile has an assortment of scrap materials (wood strips and blocks, metal pipes, ABS pipe, etc.). The other pile has two pieces of cardboard cut into two different shapes (one is roundish and the other U-shaped) that can be balanced on a tennis ball in a cup, along with a pile of cubic wood blocks. With no instructions from the adults, the two girls begin building towers with the one pile and then try to place as many blocks as they can on the two pieces of cardboard. For close to 30-minutes, the girls played intently with these materials. When they succeeded, they raised their arms and cheered. When their towers or balanced cardboard toppled, they re-assessed and tried again.

Story 7: Children's Play with Balance

On a Saturday afternoon in the spring, my elementary education students put on an event for parents and children. They were supposed to create contexts that promoted engagement in inquiry about whatever topic, set of objects, or events they wanted. Most of my students have trouble letting go and trusting that children will engage without a great deal of structure and direction from the teacher. One student wanted to explore balance, but was running into difficulty with the notion of "playing with balance." With some encouragement and some suggestions, she put out two different sets of objects. One set included a large variety of objects, such as slats of wood, pieces of dowels, various pieces of plastic and metal, and so forth. The other set of materials involved a couple pieces of cardboard cut into different shapes and balanced on tennis balls. A box of wooden blocks was placed next to these cardboard sheets. Much to her surprise, when children entered the room they gravitated to the objects she had spread out on the floor. With little or no prompting, they started building towers with the objects. They also worked diligently at putting as many blocks as they could onto the balanced cardboard sheets. When their towers toppled, they immediately re-assessed what they had done and began building again. When they were successful with their towers and balanced blocks on cardboard, they stood up, cheered and gave various high signs. Throughout the periods of time the children played with balance, they were totally engaged. Without much if any talking, they carefully assessed each move they made with great precision, but also with great speed.

In Story 8, two grade-3 girls were playing with mirrors and light. They worked with these materials for 45-minutes. On their hands and knees, they rearranged their mirrors, while exploring the variations on the reflection of light and on the reflection of their own faces. During this time, they brainstormed, stumbled upon new insights, argued, evaluated,

fantasized, and reacted with various emotions. This play probed the depths of meaning and relationships between light and reflection (i.e., Depth). They developed explanations and mental models (i.e., Abstraction). And, they extended their play into fantasy stories (i.e., Abduction).

Story 8: Two Grade-3 Girls Playing with Mirrors	
During an open time following their science session, two grade-3 girls (Mary and Grace) were on their hands and knees under a table over which they had spread big pieces of cloth. They had created a little dark "cave," where they were exploring the dynamics of light (from flashlights) and mirrors. They had set up about a dozen mirrors positioned at angles so that they could reflect in various ways. In the following transcript, look for how their inquiries were characteristic of free-form play.	
G. *I'm just experimenting to see what I can do with the mirrors.*	**playing around**
M. *She… she wants this to go there and then go up there…. Holy look. Will you look in those mirrors… it looks… it looks so weird.*	**aesthetic-emotional**
G. *Well… look in what mirrors? Oh yeah, it looks weird.*	
M. *And, then you can see it up there. Aah…*	
G. *I want to try to put a mirror here… here I…*	
M. *I've got a better idea.*	
G. *I need some dominoes… no, no, don't put the dominoes there. Yeah, yeah, put the dominoes there. I only need 3 dominoes. Let's see if I can do anything. Oh smaaaa… get in there. I've gotta put some more behind, because I'm gonna put a mirror up here. See, like that. So, put some more behind…. put some more behind, Mary. Don't tip, Mary. You took them from underneath there and… and now it's off… oh rats. There…. don't take any from underneath there be careful when you take something from there. Wait, we need more back here to see if I can get a mirror to stay there then we can see what we can do. Wait, more back there.*	**trying new objects elaborating**
M. *There! We have to protect it… still…*	
G. *And Mary don't take any from underneath there… 'cause it… and it doesn't work as well*	**evaluating**
M. *Holy, holy that looks weird… It's sort of going there… and you can see your face…. Looks like it's so far away*	**aesthetic-emotional insight**
G. *It does. Let me see. Oh, yeah.*	
G. *I want to try… it's really far away. It isn't as good as it normally is.*	**insight; evaluating**
M. *Okay, now try it.*	
G. *Wait, if we put one there…. wonder if that… no put one here.*	**wondering**
M. *Wow, look…. .Oh, yeah, that's so cool, Grace.*	**aesthetic-emotional**
G. *Let me, let me see… my eyes…. You can only see half of my eye. There's my aah, when you aah, oh, oh, I knocked everything over (laughs). I know how to do it, Mary. Oh, wait a minute. I've gotta move that uh up a little bit up.*	**laughing**
M. *Now we have to move it again… the king and queen aren't doing anything.*	**evaluating; fantasy arguing**
G. *Well, I don't care…. Don't have the king and queen.*	
M. *Yes we are…*	
G. *We don't need the king and queen…. Mary, if the king and queen aren't any use then let's try… I'm going to go and see if there's anything else that we can use.*	**evaluating**
M. *It's making 3000 pictures on the…*	
G. *It's making… you can see it in all the pictures only they're at different angles. Don't put it like that because then it won't stay like that. There, put that there just in case it falls backwards, try to make it not fall any which way*	**evaluating new approach**
M. *Um…. found all the old books under there.*	
G. *What are you doing?*	
M. *I'm going to be seven… I mean eight paces away.*	
G. *I can see 1,2, 3, 4, 5, 6, 7, 8… I can see 8 of me, too.*	**insight**

JB. Eight of you?	
G. Yeah, because if you look in here... like you can see... you can see one of you in the small mirrors because they are reflecting up into there.	**explaining**
G. So, it looks really neat.	**aesthetic-emotional**

<div align="center">Bloom (1988)</div>

Play in Teaching and Learning

Play in school is being eliminated with the increase in high-stakes testing, national curricular frameworks, and initiatives that limit the professionalism of teachers. The few exceptions to such mechanistic trends exist in some pre-school programs and private schools that do not have to meet government standards and in some classrooms where courageous teachers resist the pressures from other teachers and administrators.

However, play is crucial to learning and thinking in ways that are essential to our well-being. Play has been shown to be necessary for psychological health (Gray, 2011). And, as we have seen previously, play opens up a world of possibilities. Play as learning and learning as play are crucial components of developing depths of meaning and understanding; of developing relationships to self, others, the environments, and the world of ideas; of developing abstract models, explanations, and modes of communication; and of abduction of meaning and abstraction across contexts. The learning and thinking that is developed through play is important in a world of increasing threats to our survival as a species and as individuals. Yet, our institutions of learning, from kindergarten through university are becoming increasingly deadened. By deadened, I am referring to a state of lifelessness, where play and the joy of learning are absent.

In order to promote play and learning, schools need to disconnect from state and national politics and to disconnect from corporate rule that is tightly intertwined with the politics of schooling. We also need to reinstate trust in teachers and children. The money spent on testing can be used to support teachers through the development of professional communities, where teachers can share insights and approaches, and through transformations in the contexts of schools. Such transformations can focus on developing schools as communities of play, learning, and knowledge production.

Teaching as play is quite different from what typically exists in classrooms, where teachers control all of the action. Teaching as play needs a fundamental change in perspective or philosophy.

- *Teachers who play:*
  - see children as co-participants in play. The interactions are not about control or exerting power, but about instigating curiosity, inquiry, creativity, the breaking of rules, exploration, and novels ways of representing and communicating ideas.

- see children as co-instigators of play. Children are respected and valued as having as much or more to offer as adults.
- are not threatened by the individuality of children. They see the diversity of children as essential to vibrant play—learning environments.
- create play—learning communities in their classrooms. Teachers and students share responsibility for creating and maintaining the community.
- work with children and their issues with compassion and humor. A child expressing aggression is not met with aggression from the teacher, but with more skillful approaches to working with their shared humanity.
- understand that play:
  - is critical to interpreting contexts.
  - develops and strengthens relationships.
  - pushes the limits of possibilities.
  - is essential for psychological health and well-being.
- *Learning—Playing communities:*
  - are flexible in structure and function.
  - balance the binaries of stimulation—relaxation, intensity—spaciousness, playfulness—seriousness, noise—quiet, and movement—stillness.
  - have or create—dismantle spaces for quiet, for noise, for movement, for talk, for building—making—creating, for arguing, for collaborating, for competing for fun, for imagining, for pretending, for creating knowledge, for communicating, for acting, etc.
  - establish healthy relationships among all participants.
  - have accessible resources for exploring possibilities and communicating through various media.
- *Students who play:*
  - develop a wide range of personal and social abilities involving:
    - language, mathematics, patterns, relationships, drama, visual arts, movement, music, etc.
  - are risk-takers.
  - maintain their creativity.
  - develop deeper, more meaningful, and more complex or complicated understandings that involve many disciplines and contexts.

Play in and as education can transform learning environments and the people within these environments. Both teachers and students can transform as learning through play changes ideas, relationships, and experiences self. Such changes involve one's views and understandings of active participants and agents of change, who can manipulate objects, modify, break, or make "rules," and explore the world of relationships. Where most of schooling solidifies notions of appropriate behavior, of manifestations of self, of how to

learn, of how to think, and what to learn, schooling that is based on play views everything as malleable.

Teachers who play value relationships and are more adaptable to changing dynamics and emergent events. Most schools and teacher training programs promote approaches to classroom management, which arose out of behaviorist traditions and corporate notions of control. A play approach or way of being in classrooms presents possibilities for very different kinds of relationships with children and their behavior. Through play, we can see children's behaviors as inherently positive. An aggressive child, who normally would be punished in some form, may be seen as a future leader or independent entrepreneur. A playful approach can help a child realign his or her relationships to the world in ways that help the child grow in more socially responsive ways. Without a playful approach, problems can become monolithic and solidified. With a playful approach, problems are yet another obstacle in a course of challenges requiring creative approaches and solutions.

References

Achieve, Inc. (2013). *Next generation science standards*. Washington, DC: Achieve, Inc. Available at: http://www.nextgenscience.org/next-generation-science-standards

Bateson, G. (1972/2000). *Steps to an ecology of mind*. Chicago: University of Chicago Press.

Bateson, G. (1979/2002). *Mind and nature: A necessary unity.* Cresskill, NJ: Hampton Press.

Bateson, G. (1991). *Sacred unity: Further steps to an ecology of mind* (R. E. Donaldson, ed.). New York: Harper Collins.

Bateson. G. (1976). A theory of play and fantasy. In J. S. Bruner, A. Jolly, and K. Sylva (Eds.), *Play: Its role in development and evolution*. New York: Basic Books.

Bloom, J. W. (2001). Discourse, cognition, and chaotic systems: An examination of students' argument about density. *Journal of the Learning Sciences, 10*(4), 447-492.

Bloom, J. W., & Volk, T. (2007). The use of metapatterns for research into complex systems of teaching, learning, and schooling. Part II: Applications. *Complicity: An International Journal of Complexity and Education, 4*(1), 45—68 (Available at: http://ejournals.library.ualberta.ca/index.php/complicity/issue/archive).

Bloom, J. W., & Volk, T. (2012). Metapatterns for research into complex systems of learning. In N. M. Seel, (Ed.), *Encyclopedia of the Sciences of Learning* (pp. 2243—2247). Heidelberg, Germany: Springer—Verlag.

Bodley, J. H., & Benson, F. C. (1980). Stilt-root walking by an Iriateoid palm in the Peruvian Amazon. *Biotropica, 12*(1), 67—71.

Buehner, S. H. (2014). *Plant intelligence and the imaginal realm: Beyond the doors of perception into the dreaming of Earth.* Rochester, VT: Bear & Company.

Burghardt, G. M. (2010). The comparative reach of play and brain: Perspective, evidence, and implications. *American Journal of Play, 2*(3), 338—356.

Cervallos, M. (2010). Microbes do the electric boogaloo. *Science News, 178*(10), 8.

Graham, K. L., & Burghardt, G. M. (2010). Current perspectives on the biological study of play: Signs of progress. *The Quarterly Review of Biology, 85*(4), 393—418.

Gray, P. (2011). The decline of play and the rise of psychopathology in children and adolescents. *American Journal of Play, 3*(4), 443—463.

Henricks, T. S. (2014). Play as self-realization: Toward a general theory of play. *American Journal of Play, 6*(2), 190—213.

Panskepp, J. (2010). Science of the brain as a gateway to understanding play: An interview with Jaak Panskepp. *American Journal of Play, 2*(3), 245—277.

Pellegrini, A. D. (2009). *The role of play in human development.* New York: Oxford University Press.

Student Achievement Partners. (2010). *Common core state standards.* New York: Student Achievement Partners, Inc. Available at: http://www.corestandards.org

Weems, S. (2014). *Ha! The science of when we laugh and why.* New York: Basic Books.

Wright, E. (2008). Gregory Bateson: Epistemology, language, play, and the double bind. Anthropoetics, 14(1), 1—15. (Retrieved from: http://www.anthropoetics.ucla.edu/ap1401/1401wright.htm)