The Possible Role of Intuition in Education

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Abstract

U.S. schools teach predominantly to the analytical, left brain, which has foundations in behaviorism. Since the mid-1900s, education in the U.S. uses a mechanistic paradigm that influences teaching. The result is that learning is impeded. Using discourse analysis of a historical set of Piagetian children, this study re-analyzed Piaget's work. It found that, although the participating children answered from both an intuitive and an analytical perspective, Piaget's analysis of the interviews ignored the value in the intuitive, right-brain answers; Piaget essentially stated that the children were only doing valuable thinking when they were analytical and logical. Using other comparable re-analyses as the yardstick, this study extended Piaget's original interpretations. Implications for teaching and learning are also described. Since education in the U.S. has not challenged Piaget's omissions, but rather, has followed earlier behaviorist recommendations, this study is a call for research into a pedagogical balance between analytic and intuitive teaching.

Keywords: *intuition, analysis, deficit, diversity, holistic, right-brain*

Introduction

When you hear the word *intuition*, you may think of different ways it is used in casual conversation. A special type of intuition is described in this study - a holistic intuition. The definition used for holistic intuition is *a perception for which the source may be unknown and for which the whole content of the idea is at first perceived without knowledge of the parts*. One example of a child being *intuitive* occurs when they are strictly observing – not reacting. To react to a thought; to handle it in any way would begin the process of *analysis*. To keep looking at a science experiment is intuitive – to name the parts and think of the cause is analytical. To appreciate the beauty of a mathematical pattern is intuitive, to find the equation is analytical. To remain in the mood of a story is intuitive, to outline the plot is analytical. Intuition receives impressions and preserves relationships; analysis uses reasoning to check out if you think a thought is true, or to associate a thought to other things you already know. In general, intuition comes from right-brain activity and analysis comes from left-brain. Since it is not possible, however, to isolate intuitive thought from analytic thought because every thought we have comes in as intuitive, then ends as analytic (Arnheim, 1986b).

Therefore, it does not make sense to ask, "When is a person thinking intuitively?" All children and all adults think both intuitively and analytically. The results of this study suggest that the best learning posture is one where children are given a balance between intuitive and analytical activities in school. Since analysis has historically been accented, this study calls for increased awareness and reinforcement of intuition to achieve balance. The following three cases exemplify how the role of intuition in education may be helpful.

Case #1 - *Mark makes off point remarks*

“If you turn your head sideward, then squint your eyes, that looks like a face!” Mark, a highly intelligent and intuitive high school student, was looking at a mathematical formula on the board. Mark was one of those students who tended to make comments that are off point or only tangentially related to the topic at hand. Mark could be counted on to join a discussion with a view that was in from left field. Almost every time he did this, the class was stopped. None of us could make the connection to what Mark was saying, and if asked, he usually could not explain it himself. I came to know Mark quite well because he was in three of my courses: geometry, physics, and an advanced science seminar. It turns out that he was an extremely perceptive and creative thinker. But he was in touch with larger ideas than he could articulate clearly, so in touch with these ideas that he was often compelled to share them by blurting them out in class.

What would good pedagogical technique say to do about Mark when he compares a mathematical formula to a face? I guess I should redirect him back to the point. Then, bring the entire class, who was amused by this time, back to the lesson at hand. Perhaps using humor or a slight reprimand, I could have said, “Ok, very funny, but the meaning of this formula is ...” But what actually happened was entirely different, and better.

Hearing Mark's exclamation, I turned around to face the class, paused to consider how to react and then it happened – an exclamation of my own went off in my head, “*Here is a chance to honor intuition!*” So, I said aloud, “I think I see the face, Mark! You are amazing; you are looking well past what most of us see!” He was quite satisfied, the class responded with a chuckle and returned to the point of the lesson, and the respect in the room could almost be seen with the naked eye.

How does one handle, and even honor, the intuitive? And how does a teacher balance the intuitive with the analytic? On the one hand, even when I came to respect that Mark had something of value, I could not entertain every one of his comments – the class did need to stay on topic and analytically reason through ideas that need concentrated effort to understand. I could, however, outwardly demonstrate my respect. Perhaps this act of respecting Mark may be a form of what Dan Goleman (2005) claims is a good use of emotional intelligence. In another book about working with presence, Goleman and Senge (2007) recommend a stronger form of listening where the teacher leaves room for the possible wisdom that a student might be seeing, even if it could not be fully brought up to the conscious discussion level. So, what could I do as an intuitive teacher? I could tell Mark and the class that there must be something interesting in what Mark is seeing, but we will not be able to follow it right now. Occasionally, I stopped the class and helped Mark bring out his ideas. In these cases, we were almost always rewarded for the cleverness or refreshing effect his ideas had because they could often show the class a view that no one else had thought of.

The result of handling Mark's ideas this way was validating for other students. They saw that there are many ways to look at a problem. This built creative problem solving. They also saw a respect for diversity and appreciation of multiple intelligences as Howard Gardner recommends (1993, 2008). In addition, they saw a tolerance for multiple worldviews (Hutchison, 2005, 2010), even in the face of some worldviews being at odds or slowing down the predominant one, namely, the teacher's agenda for the class that day. A possible objection to this example might be that teachers do not often have time to stop and entertain ideas that are tangential to the lesson. This is true. We must work within the constraints of keeping to state and national curricular mandates. That is why it is so important to see the value in teaching intuitively. If we see that not only do Mark and the class become validated, but that their thinking becomes more productive for later problem solving in real life problems, then perhaps we can afford to lessen the need to stay within the curriculum so strictly and to test the information so extensively.

Case #2 - *Mary constantly lags behind*

A first-grade teacher was showing the class three kinds of soil: red clay, dark brown humus, and tan sand. The students were standing, touching the samples, running them through their fingers. The teacher asked, “Now class, who can tell me the names of these soil samples ... Mary, do you know?” But Mary was not even listening. She was absorbed in the feeling of the moist, rich humus, squeezing it with both hands. “Mary, re-focus. Class let's all pay attention, now. Who else heard my question?”

What has happened here? What are alternatives? When Mary stays absorbed in examining the humus, good pedagogical technique often suggests that some gentle method of regaining her attention is in order. An alternative view might question whether there is value for Mary to stay immersed in observation. Even if the teacher feels that she must move on, she could have demonstrated respect for Mary's rapt attention to the humus, so that the class would learn the lesson that pure observation of the soil is as important as naming and analyzing it. Mary would have been allowed to have a moment of connection and relationship with a part of nature, which could have a beneficial effect. The teacher never knows when an experiential moment is important for any given student, so there is a need to watch for such opportunities – as much as watching for the opportunity for a student to make a rational or reasoning connection. In this case, who is to say that the observation, an *intuitive* act, is more or less important than naming the soils, which is an *analytical* act. Passing over Mary, without acknowledging that in fact she is engaged in the class, may be treating her as if she has some deficit, perhaps an attention deficit. But it may be that Mary has such a strong ability to pay close attention, that she cannot easily disengage from her observation.

If children are taught from the earliest years in school to walk away from activities that do not produce new factual, tangible, testable results, they will learn that intuitive acts like observing, appreciating, and connecting are unimportant. They will also learn that they are operating from a deficiency to include such diverse forms of cognition. So, pedagogically, the teacher may be unwittingly beginning the trend of deficit modeling and lack of appreciation of diversity with Mary by shunning the *intuitive* form of learning in favor of the *analytic*.

Case #3 - *Roy does not understand science*

Roy was a six-year-old French speaking child, in Switzerland, in the middle of the twentieth century. Piaget (1929/2007) expressed that Roy's interview so encapsulated the typical responses of the children he interviewed, that it was published almost in its entirety in Piaget's book, *The Child's Conception of the World.* At more than one point in the interview, Roy expresses how the sun and moon get big "because we get big" (Piaget, 1929/2007, p. 259). Piaget summarizes that the foundation of the child's belief that nature is alive, and that nature was made by humankind is in the child's feelings of participation, meaning that nature is aware of and participates in the affairs of humankind. He further claims that when the child seeks to systematize these feelings (in answer to adult questioning), that the child has recourse to myth, meaning that he makes up a story as an explanation. In the half century since Piaget gathered his rich data set of child interviews, pedagogical technique has evolved to the point where much effort is spent to move children out of such myths, teaching the children the current scientific explanations instead of such beliefs. Schools in the U.S. today tell the children that the sun and moon are not connected in any way to people. In this study, many such interviews were re-analyzed to explore the possibility that the children were misinterpreted. In this case, an alternative analysis of Roy's comments might be thus: could it be that Roy was searching for a way to articulate somehow that parts of nature are *interconnected*? Repeatedly, the child interviews alluded to this. The children also made conclusions that were *paradoxical* and did not agree, logically, with previous statements. In addition, the children also implied with great frequency that parts of nature have *consciousness*, that adults call inanimate. With these proclamations of *interconnectedness, paradox,* and *consciousness,* the children further attributed *purpose* and *intention* to nature in comments like Vern's, explaining how the sun “wants to make things warm” (Piaget, 1929/2007, p. 223). One question this study asked is, “Can education really say that these views are not useful?” In social diversity issues, schools constantly teach tolerance and the need for socially acceptable relations among students, but in cognition, Roy is told to favor separatist thinking as the way to understanding.

In generalizing from Roy to all children in the intuitive stage, Piaget says that the child believes that the universe is a society of like beings, living according to a well-ordered code of rules. But educational practice does not honor the way children sense interconnections and relations, they move them past this intuitive stage to usher in an analytical stage that breaks down ideas into parts in order to rationally understand them. Why cannot both forms of thinking exist side by side?

Problem Statement: Intuition versus Analysis in Education

Education in the U.S. needs more than minor revisions, it needs fundamental change (Darling-Hammond, 2010, p. 260). Increases in testing and teacher accountability for delivering curricula and improving test scores have been criticized for years for going in the wrong direction (Bruner, 1986). The problem is that educational research has not sufficiently researched an alternative to the over 50 year old behaviorist model that sees the human being as a machine, nature as a controllable factory, and the physical world as atomistic parts (Skinner, 1953; Thorndike, 1913/2010). The result of this model causes education to reinforce the child's *analytical* thinking while ignoring the child's *intuitive* thinking (Bruner, 1960, 1983, 1986; Nisbett, 2003;

Whorf & Carroll, 1964). Several theorists, including Piaget, Vygotsky, James, Dewey, Bruner, and Bandura contend that before schooling, the child has a way of knowing and learning (Bandura, 1971; Bruner, 1960, 1983, 1986; Dewey, 1910, 1916/2005; James, 1984; Piaget, 1929/2007, 1950, 1959, 1976; Piaget & Inhelder, 1969; Piaget & Valsiner, 1927/2001; Vygotsky, 1962, 1966/2002, 1979; Vygotsky & Cole, 1978). At first, the child cannot analyze these whole ideas into parts and explain what they see. The child's intuitive perceptions of: *interconnectedness*, *paradox, and consciousness* in nature set up ways of learning that directly oppose logic and reason (Piaget, 1929/2007, 1950; Piaget & Valsiner, 1927/2001). Since these three types of intuitive perceptions are basic to Piaget's definition of intuition, an example of each will be given. An example of *egocentricity* in the intuitive child can be seen if the child thinks the sun is shining just for them, perhaps so that the child can have fun playing outside. This overlaps with an example of assigning *purpose or intention* to the sun in that the child refers to the reason that the sun is out *so that it could make nice weather*. Both of these examples overlap with an example of *interconnectedness* in that the child refers to the sun as having some connection to what they are doing as if the sun is affected by and conscious of the child. According to Piaget, the intuitive child does not yet have the analytical ability to separate parts of the external world and keep them apart in the abstraction of thought. "Compared with us he would experience much less the sensation of the thinking self within him, the feeling of being independent of the external world" (Piaget, 1929/2007, p. 37). Thus, the intuitive child is embedded in and interconnected with the world. This strong connection causes two things. A way of learning that lets the child remain close and in contact with the things they are learning about. But it also causes a conflict with a logical, reasoning approach to learning. The question that was raised in this study is whether both ways of learning are useful. Currently, education suppresses the ability to stay intuitively connected while learning in order to reinforce the ability to use formal reasoning. Therefore, adults often dismiss the child's way of knowing and learning by saying that, "He does not understand, yet," or "She is still learning that." Vygotsky claims that Piaget erroneously treated this intuitive phase of childhood as a stepping-stone toward more formal thinking (1962).

The train of thought I used to call for further research into the role of intuition in education, if stated in skeletal form, is this: In the last two-and-a-half centuries since Newton, scientists have evolved from a logical positivism to a posture willing to consider such paradoxical notions as the simultaneous wholeness and separateness of nature. Science has moved past positivism. However, while science has evolved, education in the U.S. has not. It treats the right-brain activities of intuitive thought (Gardner, 1993, 2008) as a stepping-stone stage of early childhood that should be discarded as thinking reaches the supposedly more useful skills of logic, reasoning, and analysis. Where modern science has started to employ both the ability to intuitively embrace paradoxes and wholes – in balance with reasoning and analyzing – education has discouraged intuition and spent its resources encouraging analytical forms of knowing and learning (Bruner, 1986).

Quantum Physics – Where Intuition is Equally Useful to Analysis

The object of this study was to correlate the children's responses on wholeness to that of the observations and descriptions of wholeness of

quantum physicists (Einstein, 1920/2010, 1950/2011; Schrodinger, 1944/1992). Specifically, issues of wholeness are directly related to two basic tenets of quantum physics: 1) *entanglement*, and 2) *complementarity*. In both theoretical concepts, the conventional sense of formal logic is challenged – but theoretical conclusions seem to match intuitive notions that children express.
Complementarity was first defined by Bohr in discussion with Einstein as an idea "which provides room for new physical laws, the coexistence of which might at first sight appear irreconcilable with the basic principles of science" (Bohr, 1949). One can compare Bohr's notion of complementarity with the Eastern principle of dialectism - the principle of change that states that what is currently true will shortly be false (Nisbett, 2003). Further, complementarity and dialectism line up directly with the child's holistic ideas that allow for opposites to be true at the same time.
Entanglement is described by Schrodinger as a tenet of quantum physics whereby one might know the whole without knowing much about the parts. The child seems to be able to do this. This confounds logic but supports certain aspects of the mechanics of quantum effects.
Piaget (1929/2007) reports that most of the children in the intuitive stage that he interviewed had similar notions of feeling connected to the sun. For example, many children believe that the sun and moon participate in our lives and that they know "what we are doing" (p. 223). This directly maps to the kind of thinking a quantum physicist must do to entertain experimental results in studying certain of the quantum effects in entanglement phenomena. Certain entanglement experiments imply that individual material particles in one way are separate and simultaneously, in another way are connected. There are two parts to this comparison of the thinking of the quantum physicist and the child. First, both the quantum physicist and the child need a way of thinking that allows for connectedness of matter that, at least on some level appears to be separate. Second, both need a way of thinking that allows the thinker to hold these two paradoxical ideas together as one whole concept, which, at times, one necessarily must not take back apart. So, both the child and the quantum physicist exhibit the same aspects of an epistemic belief that can entertain paradox; they both can know whole ideas without knowledge of the parts, even though this confounds the normal use of logic.

Literature

Intuition. Intuition in education has been partially unexplained and understudied. The role of intuition in learning has been documented (Arnheim, 1986; Bruner, 1960, 1983, 1986, 2004; Burton, 1999a, 1999b, 2010; Eisner, 1985; Haskins, 2009; Johansson & Kroksmark, 2004; Kelemen & DiYanni, 2005; Pariser, 2008; Vygotsky, 1966/2002, 1979; Vygotsky & Cole, 1978; Wertsch, 1985). Notwithstanding, some current researchers who contradict such calls for further exploration of the uses of intuition refer to the children's intuitions in the negative – as misconceptions, or unfounded perceptions (Babai, Sekal, & Stavy, 2010; Smith & Hungwe, 1998; Tretter et al., 2006; Watson & Kelly, 2005; Yair & Yair, 2004).

The Deficit Model in Education versus Appreciation of Diversity. One might caste the role of intuition within the larger framework of seeing it as a victim of deficit modeling. Much has been written over the last three decades about sociological differences that are looked upon as deficits because they do not follow the dominant norm (Apple, 2004; Asante, 1991; Delpit, 2006; Delpit & Dowdy, 2002; Dewey, 1916/2005; Du Bois & Edwards, 2007; Freire, 1998a, 1998b, 2000; Freire

& Freire, 1994). Basically, these are deficit models where students are seen as a glass half empty (Rebell & Wolff, 2008; Wiggan, 2007; Woodson, 1968, 2005). Rather than applying principles of diversity, appreciating the multiple realities of an individual's epistemic beliefs, or embracing multicultural education, deficit models in U.S. education have been detracting from attempts to be inclusive, democratic, and critical for over a century (Anderson, 1988; Baglieri et al., 2010; Delpit & Dowdy, 2002; Eisner, 1985; Guo, 2010; Hirsch, 2006; Horvat & O'Connor, 2006; Ladson-Billings, 2009; Louv, 2005; Lyons, 2010; McIntosh, 1988; Murray, 1968; O'Malley & Pierce, 1996; Olsen, 2010; Sercombe, 2010; Tangen & Spooner-Lane, 2008). What were formerly seen as deficits are starting to become defined in the positive, as aspects of diversity (Ladson-Billings, 2009). In the last decade, an increasing awareness of a lack of respect for new forms of diversity has led to much research in the literature. Studies are emerging that address equal opportunities for both genders (Curry, 2000; Deegan, 1991; McIntosh, 1988; Stone, 1976), acceptance of sexual preference (McIntosh, 1988), recognition without lowered expectations of disabilities (Baglieri et al., 2010), awareness of environmental sustainability (Louv, 2005), and detection for alternate forms of cognition (Acredolo & Acredolo, 1980; Case, 1988; Eisner, 1985; Murray, 1968; Sercombe, 2010). Thus, in extending the definition of diversity, research shows that society is receiving pressure to include issues of globalization and a re-examination of educational origins (Asante, 1991; Hutchison, 2010; Stiglitz, 2002; Wiggan & Hutchison, 2009). This has spawned a third, ancillary trend of studies that investigate original, historical indigenous methods of learning and their application to today's students (Asante, 1991; Diop, 1974; Kunjufu, 2002; Ladson-Billings, 2009; Melear & Pitchford, 1991; Norman et al., 2001; Thomas, 2008; Traoré, 2007; Traoré & Lukens, 2006; Whorf & Carroll, 1964; Wiggan, 2010).

Cognition and Learning. If one entertains alternate forms of thinking as a type of diversity to be appreciated, many possibilities open. Research on group thinking, circle thinking, and collaborative thinking (Asante, 1991) necessitate an intuitive epistemic belief that embraces whole ideas (Bruner, 1960, 1983, 1986, 2004; Wynter, 2001). Another group of studies look at how the world is becoming flat due to globalization and therefore need multicultural learning paradigms (Darling-Hammond, 2010; DeMarrais & LeCompte, 1995; King, 2005; Lemert, 1999, 2004; Lipman, 2004; Senge & Barker, 2008; Stiglitz, 2002; Wang, 1997; Wiggan & Hutchison, 2009; Xie, 2010). One research trend studies the origins of various learning methodologies, and what may be relevantly resurrected to be of benefit today (Asante, 1991; Brown, 1923; Darwin, 2007; Darwin & Dawkins, 2009; Dewey, 1916/2005; Diop, 1974; Du Bois & Edwards, 2007; Houston, 2007; King, 2005; Loewen, 1995; Swann, 2009; Teresi, 2003; Traoré, 2007; Wiggan, 2010; Woodson, 1968, 2005).

Method

The purpose of this study was to explore whether the intuitive, pre-formal child has a viable epistemic belief in place. This study therefore compared children's intuitive discourse analysis to a purposefully selected set of key scientists who use both intuitive and analytical investigative processes in varying proportions, namely, Newton, Faraday, Maxwell, Goethe, Einstein, and Schrodinger. This methodology is similar to other scholarly studies (Pramling, 2006; Pramling & Samuelsson, 2001) that have performed a re-analysis of Piaget's interviews of intuitive

children and concluded by a method of discourse analysis of meta-communicative markers in the children's answers that the children are making claims. They indicate that children know something that they cannot articulate to the adults. Similarly, this study sought to re-analyze Piaget's interviews using discourse analysis of inferred attributes of interconnectedness of parts to the whole. Therefore, in the same vein that Pramling's (2006) methodology compared children's meta-communicative markers to infer a possible viability of the children's notions, this study compared intuitive, scientific references to the wholeness of nature that are shared between children and scientists, in order to look for possible inferences to the viability of the children's intuitions.

Limitations of the Study

It is a possible limitation of this study that the researcher is left in the ironic position of having to slay the master, with the master's own sword, as it were – to criticize Piaget for favoring the analytic side of the mind by using a non-positivistic re-analysis of Piaget's original analyses of the children's interviews. The researcher recognizes that he himself has epistemic beliefs that he may have imposed on Piaget's work. Further, since these epistemic frameworks may be embedded in the very notion of thought, it may be that the researcher and Piaget are talking about two different aspects of thinking. Human beings have epistemic beliefs that span the analytic to the intuitive-holistic spectrum. It may be a limitation of this study to favor the singular position of a balance between analysis and intuition.

Selection of Children and Scientists

42 child interviews were purposefully selected from among the 198 interviews by narrowing the entire dataset in two ways. First, it was limited to the set of children between the ages of five and seven, inclusive. These children, according to Piaget (1959), are most likely to be in the intuitive stage. Then the selection was narrowed to take all of those child interviews that were in chapters of the book that most dealt with questions of thinking. The three chapters were: Part I. *Realism*: Chapter I. The Notion of Thought (22 of the 198 interviews), Part II. *Animism*: Chapter V. Consciousness Attributed to Things (9 of the 198 interviews), and Part III. *Artificialism*: Chapter VIII. The Origin of the Sun and Moon (11 of the 198 interviews). Thus, 42 5–7-year-old child interviews were selected.

The six scientists were a unique purposeful selection. The criteria for the purposeful selection involved those scientists who demonstrated clear examples of intuitive thinking at times and clear examples of analytical thinking at other times. The uniqueness of these individuals has to do with their historically documented contributions as leaders in their field, and the fact that they are known for the clarity of their thinking.

Results

Following is a summarization of the re-reading this study performed of Piaget's discourse analysis. It will give two cases from the child's intuitive discourse. Each case discusses: Piaget's discourse analysis, then a re-analysis, and finally a mapping of the child's epistemic beliefs onto that of a scientist. Each excerpt includes the child's age in years and months with interviewer's questions followed by the child's answers in italics.

Case #1: Interconnectedness

In a series of interviews about the notion of thought, Piaget asks the children directly, what they think thought is. The following is one example:

Mont. (7; 0): "You know what it means to think? —*Yes*.—Then think of your house. What do you think with?—*The mouth*.—Can you think with the mouth shut?—*No*.—With the eyes shut?—*Yes*.—With the ears stopped up?—*Yes*.—Now shut your mouth and think of your house. Are you thinking?—*Yes*.—What did you think with?—*The mouth*." (p. 39)

In Piaget's discourse analysis of the child's notion of thought, he describes the child as a being who is interconnected to the world to such a high degree that inner thought and outer, physical reality blend together:

Let us imagine a being, knowing nothing of the distinction between mind and body. Such a being would be aware of his desires and feelings but his notions of self would undoubtedly be much less clear than ours. Compared with us he would experience much less the sensation of the thinking self within him, the feeling of a being independent of the external world. The knowledge that we are thinking of things severs us in fact from the actual things. (p. 37)

Piaget describes here the intuitive child as being embedded in the world and not experiencing disconnection. He clearly describes how an adult can separate the thinking self from the world and that this "severs us" from the actual things. This study agrees with this analysis of Piaget. The disagreement lies in the fact that Piaget does not mention the value of being able to be embedded in the phenomenon you are observing. It is precisely this ability that has made some scientists great.

Einstein (1920/2010, 1950/2011) speaks of this interconnectedness that the ancients hypothesized (Diop, 1974; Stone, 1976), but was all but forgotten by Newton's (1730/1974; 1979) time. He recaps a portion of scientific history much like Kuhn's analysis of paradigmatic revolutions (2004), whereby scientists had a conflicting dual set of notions in the belief in action at a distance versus the connectedness of fields – but in many cases, he concludes that allegiance to Newton's doctrine was stronger than reasoning:

Newton's theory is probably the greatest stride ever made in the effort towards the causal nexus of natural phenomena. And yet this theory evoked a lively sense of discomfort among Newton's contemporaries, because it seemed to be in conflict with the principle springing from the rest of experience, that there can be reciprocal action only through contact, and not through immediate action at a distance. It is only with reluctance that man's desire for knowledge endures a dualism of this kind. (Einstein, 1920/2010, p. 3)

Mont, the child in Piaget's interview, speaks of interconnectedness in a rudimentary, non-articulate form, but it is nevertheless not to be mistaken as very different from the interconnectedness that Einstein voices. The Piagetian discourse analysis, on the other hand, maps into the positivist, separateness in Newton's thinking.

Case #2: Paradox

When the children express themselves, they do not keep ideas in neatly separated categories. Often the child mixes tendencies to expressing *interconnectedness, paradox,* and *consciousness*.

This is evident when Roy explains how the sun and moon get big "*because we get big*" (p. 259). At a later time Roy continues:

Can we make the clouds grow bigger?—*No*.—Why do they grow bigger?—*Because we grow bigger* (Roy admits thus what he has just denied).—Why do you grow bigger?—*Because I eat*.—Does that make the clouds bigger too?—*No, they grow because they know that we do*." And after a moment: "How did the clouds start?— *Because we were growing*.—Is it we who make them grow bigger?—*No, it isn't us, but the clouds know we are growing*. (p. 262)

Piaget comments on the fact that Roy can contradict himself without being bothered by paradox, then in another moment he can use language that implies that the universe is ordered, with logical rules:

In other words, the universe is a society of like beings living according to a well-ordered code of rules; every analogy is at the same time a logical relationship since analogy signifies common or interacting purposes and every purpose is a cause. One even feels that, for Roy, the members of this universe necessarily imitate each other so that when we grow the moon and the clouds are forced to follow suit. Clearly, when Roy is made to define his ideas his participations develop into animistic explanations. (p. 262)

Piaget may be projecting an adult's ability to reason onto Roy when he implies that when Roy is defining his ideas, he develops them into animistic explanations. Piaget implies that Roy invented the idea that the universe is alive, as a myth that was needed in order to explain what he sees. Perhaps this is so, but what is missed is the possibility that at the same time, in a paradoxical way, Roy may be explaining an opposite idea. Roy may be starting from a larger whole idea that all things have purpose, connection, and intention – that things first exist outside of a place where formal reasoning can touch them. Roy may be trying to say two ideas that are simultaneously true to him, but not logically possible – that the world is well-ordered by logical rules, and that it is not always logical. To use normal language to do this is difficult, so Roy needs to speak in a type of metaphorical language that allows the sun and moon and wind to come alive to show their obedience to purposeful intention. In using such metaphorical language, Roy resorts, probably unwittingly, to paradox.

Roy sometimes assigns God as the agent of nature's changes, and sometimes he assigns humans as the agent, then at other times, he assigns agency to the object itself ("*they grow because they know that we do*") (p. 262). So, once again, my re-analysis agrees with Piaget, that the child starts from premises that the universe is connected and has the intention to participate in the affairs of humankind. The disagreement is with Piaget's omission to signify this as important or useful. This time, it appears that Piaget does not allow for paradoxical statements to be true at the same time. So, if Roy may be using metaphorical language that contradicts itself in grammar or in fact, Piaget categorizes Roy's statements, but dismisses them soon afterward. Piaget simply moves on to discuss how to make use of constructivist techniques of developing the formal reasoning of the child, thus discarding the intuitive contribution.

As Donaldson (1989) points out in her re-analysis of Piaget, the child is often trying to use the language of the interviewer, thus constraining or distorting the answer to some degree. The child's language does not simply have word meanings that differ, more importantly it has different

grammar. Whorf (1964) compares statements of process of the child to those of indigenous peoples like the Hopi and Aztecs. He points out that the Hopi often does not conjugate verbs because of the connection of a thing to where it was and how it is manifesting in the present and future. Roy may very well be teaching the adult interviewer a wise lesson when he refuses to separate the intentions of the sun and moon from his own, much like the Hopi expresses a flash of light. The Hopi says "flash" for the event. There is no subject, such as light, as in "the light flashes." If the Hopi used a subject, it would require a predicate with a verb that does the flashing. To the Hopi, this is an assumption that some separate object is doing the flashing. This to the Hopi would be a projection of the observer onto the phenomenon, to assume that something performed the act of the flash, and it would be a further assumption to assign a verb tense to this act since no one knows when and where it came from, nor where it is going. Like the child speaking of the sun and moon as participating with the human, the Hopi uses the epistemology that starts from connectedness and must be proven otherwise. In the modern, technological west we start from the assumption that all things are separate and must be proven to be connected (Kuhn, 2004).

Thus, Piaget may be projecting a reasoning, analytical process of thought onto the child in the very way he asks the question. Then, when he interprets the child, he may be missing that the child is simply saying that he cannot conceive of separateness, so mythical answers for impossible conjectures must be invented.

Conclusion

The problem that caused the re-analysis of this study is not a lack of accuracy or depth of Piaget's scientific observations of the intuitive children. It is that he followed a positivistic bias of his time to pass over potentially valuable uses of the alternative way of thinking that the children expressed. This happened in three forms:

1. When the children spoke of an *interconnectedness* of the physical world. This is mapped onto, or is similar to, the quantum effect of *entanglement* because both the children and the scientists allude to physical entities being separate in one sense and connected in another.

2. When they expressed the ability to believe both sides of *paradoxical* ideas that many Eastern and indigenous cultures have historically embraced - a concept that Western science is only beginning to embrace. This mapped onto or is similar to the quantum principle of *complementarity*.

3. When the children implied that many aspects of the physical world have an awareness and *consciousness* capable of intention and participation in human affairs. This mapped onto, or is similar to, a controversial concept that is currently being entertained by some quantum scientists in one interpretation of the *observer effect*.

As the re-analysis shows, Piaget is quite careful to note such forms of intuitive thought, but he does not fully underscore the viability of it as an epistemic belief system that can be leveraged for productive learning. Often, he sees it as a stepping-stone to more formal reasoning. Sometimes he labels it as childish misconceptions, but most often he simply notes and categorizes intuitive notions with the implication that they are of no use and must be distanced in favor of logical thought. The pedagogical practices across the

United States, which followed on the behaviorist heels of Skinner (1953) and Thorndike (1913/2010), used this logical, positivist bias toward a mechanized view of teaching. This caused rational, analytical reasoning to be favored over intuitive epistemic beliefs. This causes an imbalance that was obstructs the most efficient form of learning (Bruner, 1960, 1983, 1986). From the re-analysis in this study of the children's discourse and Piaget's analysis of that discourse, Piaget was seen carrying out this bias such that three themes surfaced in his comments:

*Projection***:** Asking questions or interpreting answers as if the child has reasoned in a similar way to an adult.

*Denouncement***:** Proclaiming that the child has made a misconception without looking for possible meaning or use of the child's way of looking at things.

Discredit: Minimization or discarding of the child's intuitive discourse altogether.

Discussion

U.S. schools teach predominantly to the analytical, left-brain with foundations in behaviorism using a mechanistic paradigm that influences epistemic beliefs of how learning takes place. The result of this imbalance is that learning suffers (Bruner, 1960, 1983, 1986). The problem is that there is a misalignment. On the one hand, the U.S. still has school curricula, standards, and tests, which are tied to behaviorism. On the other hand, there exists an emphasis on pushing teaching towards constructivist and socio-constructivist learning models (VanSledright, 2002, 2008).

In order to discuss the implications of an intuitive education, consider five questions which are oriented to different philosophical orientations. These questions are posed as mutually exclusive choices; this is not to imply that both choices are not possible.

1. Should education teach students how to divide and conquer or to seek connectedness and oneness?
2. Is it better for a student to become successful and compete or to have character and integrity?
3. Do we make more productive citizens by improving student test scores or through increased appreciation of multiple worldviews, intelligences, cultures, and realities?
4. Must schools choose between improving performance in reading, writing, and arithmetic versus improving the ability to relate to people, nature, and beauty?
5. Do we want to see our youth grow up to conquer space, dominate species, and survive, or to seek a sustainable relationship with that which is other than yourself?

When you went to school, did you lean more toward your creative or business-like side? From 1970 to 2004 the U.S. had a 30 percent increase in writers, where 240 universities have established creative writing MFA (Master of Fine Arts) programs, up from fewer than twenty (Pink, 2006). In other words, we prefer the creative, intuitive, right side of our brains! Recently, Harvard admitted 10 percent of their MBA applicants, while UCLA admitted 3 percent MFA applicants. In other words, UCLA had to turn more MFA applicants away than Harvard had to turn down MBA applicants. This signals movement toward the creative, right-brain MFA degree programs as

opposed to the left-brain MBA degree programs. Perhaps this means that there is more competition for the intuitive art of writing and creating or possibly a shift in priorities. MFAs are the new, hot MBAs. More than 50 U.S. medical schools include spirituality, moving away from old school, analytical, and information-based work and toward empathy, narrative medicine, and holistic care. Financial groups are contracting to Indian MBAs, giving cause for U.S. schools to sharpen their competitive skills; yet U.S. education is still encouraging left-brain activities over right-brain ones. Clearly, society is calling out for a more creative, intuitive individual and education can help.

The research problem for this study emerged from the point above; that science and business in the U.S. is realizing that people walk on two legs, yet often use only half a brain. This research is a call for a brain balance in schools of analysis and intuition. This has foundations in behaviorism that believe that humans are machines that can be fixed by taking them apart.

U.S. schools to this day emphasize facts and figures, testing children and rating teachers according to student scores. Our CEOs wonder why new employees cannot solve open-ended problems. Our federal government wonders why we are having globalization issues. One change might really make a difference – to allow teachers to be creative and have time to be fascinated by life along with their students. The right-brain fully supports this, and it works quite well with the left-brain. The whole brain person can have fun, be creative, love beautiful things; and at the same time, can be a smart, decisive, and successful member of society. Brain balance can be achieved and may be significant.

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Author Bio

John Bickart likes to work in the background and let good ideas speak for themselves. He believes that children, and sometimes adults, know what they want and that they empower themselves when they listen to their hearts.

In the 80s and 90s, he consulted on adult education in the corporate world to Fortune 500 companies. He has taught every age group from preschool to adult and every type of student from emotionally disturbed to gifted in public and private schools as well as state prisons. He has taught in Shanghai to Peewaukie - New York City to San Francisco.