Constructivism(s): Shared roots, crossed paths, multiple legacies

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Abstract

This paper examines the shared roots and crossed paths between Jean Piaget's constructivism, what Seymour Paper refers to as "constructionism", and socio-cultural theories as epitomized by Lev Vygotsky. We do so in the light of more situated, pragmatic, and ecological approaches to human cognition. All these views are *developmental* (stressing the genesis children's interests and abilities over time), *experiential* (in the sense that knowledge is rooted in sensori-motor activity) and *interactionist* (people are seen as constructing their knowledge by transforming the world). Yet, the views also differ, each highlighting some aspects of how children grow and learn, while leaving other questions unanswered.

Piaget's main contribution was to flesh out what is common in children's ways of thinking at different stages of their cognitive development and, more important, how consistent, robust, and generally "adapted" their views are. The theory stresses the progressive de-contextualization of knowledge (from here-and-now to then-and-there) and identifies some of the hidden mechanisms (internal reorganizations) that drive human cognitive development. Papert, in contrast, stresses how individuals learn in context and how they use their own—and other people's—externalizations as objects to think with, especially as their convictions break down. His approach is more situated. Papert is particularly interested the role of new media in human learning. Both Papert and Vygotsky shed light on the articulations between direct and mediated experience (from action and tool-use to enactments, language, and symbol-use). Yet Vygotsky and the Russian school have paid much closer attention to the role of caring adults and peers in a child's initiation to her culture. They remind us that it takes a whole village to raise a child.

Integrating the views helps rethink how children come to make sense of their experiences, and how they find their own places—and voices—in the world. At once world-makers, world-readers, and dwellers in the world, human infants are granted from birth with the abilities to optimize exchanges with people and things by moving in and out of contexts, by shifting perspectives, and by switching roles or standpoint. They are extraordinary learners, and much can be learned from them. Lastly, while mostly inner-driven and curious, children need caring adults, secure grounds, and engaging peers and props to thrive and grow, Tools, media, and cultural artifacts are the tangible forms through which they explore their surrounds, express their thoughts, and share the fun with others—and the traces left by those who came before (cultural heritage) become a terrain for newcomers to create their paths.

Keywords

Constructivism, Piaget, Papert, Vygotsky, situated learning, embodied cognition, ecology of mind

Note

Introduction

The beliefs we held about children's learning are deeply ingrained in our own convictions on what it means to be knowledgeable, intelligent, or literate and what it takes to become so. Whether tacit or explicitly stated, these convictions drive our attitudes and practices as parents, educators, and researchers. If we think, for example, that intelligence is innate and talents are given, we are likely to gear our interventions toward helping learners unfold their gifts; and we may do so at the cost of not giving a chance to those we think of as less "gifted". If we believe, on the other hand, that knowledge or intelligence are a reflection of a child's surrounds, then we may be quick to "pass on" our own truths and values. And we sometimes do so at the cost of ignoring a person's own ways of being, thinking, and relating to the world. And if we believe, as constructivists do, that knowledge is actively constructed through relating to others and transforming the world, then we may tend to step aside and just set the stage for kids to engage in hands-on explorations and creative activities that fuel the constructive process. We may do so at the cost of letting learners "rediscover the wheel" or drift endlessly when shortcuts could be welcome.

Clearly, there is nothing wrong in helping a gifted child unravel her talents, in telling pupils how we see the world, or in offering opportunities for students to discover things by themselves. Yet, the believe in either extreme fixity or malleability of mind can be a formula for disaster when world views are at odds, or when value systems clash. My own life-long interest in constructivism grows out of a personal belief that wherever diversity reigns, the mere transmission of traditional values won't suffice. That's when people(s), young and old, need to find their own paths, speak their voices, and bring their personal and collective experience to the world.

What unifies constructivists across the board, is the notion that children are active builders of their own cognitive tools, as well as of their external realities. In other words, knowledge and the world are both construed and interpreted through action, and mediated through tool- and symbol use. Each gains existence and form through the construction of the other. In Piaget's worlds: "intelligence organizes the world by organizing itself " (Piaget, 1937, p. 311). What's more, knowledge, to constructivists, is not a mere commodity to be transmitted—delivered at one end, encoded, retained, and re-applied at the other. Likewise, the world is not just sitting out there waiting to be uncovered, but gets progressively shaped and reshaped as people interact with it.

Most psychologists and educators of constructivist obedience indeed would agree that learning is less about acquiring information or transmitting existing ideas or values, than it is about individually and collectively imagining and creating a world in which it is worth living. In what follows, I present some aspects of Piaget's constructivist theory, and I contrast them with Papert's constructionism and Vygotsky's socio-constructivism. I highlight what each captures and leaves out, thus setting the stage for my own attempt at integrating the views. I conclude by reframing some of the constructivist/constructionist legacies through the lens of more pragmatic, "situated", and ecological approaches to human learning and development.

The "logic" behind the stages — Piaget, the rationalist

Piaget is best known for his stages, which offer a window into what children are generally up to and capable of at different levels of their cognitive development. While this is an important contribution, there is more to Piaget than his stages. Piaget has shown that children have their own views on things—which differ from those of adults—and that these views are extremely coherent and robust. They are stubborn, if you wish, i.e., not very easy to shake. Children, in other words, are not incomplete adults. Instead, their ways of thinking have a reason to be, and are mostly well suited to their current needs and possibilities. This is not to say that children's belief systems do not change through contact with people and things. The views are continually evolving. Yet knowledge, to Piaget, grows according to complex laws of self-organization, which

operate in the background, and the function of which it is to ensure the viability of the organism. Thus, for a child—or an adult—to let go of her current 'theories' requires more than being exposed to a better theory. Conceptual changes in children (Carey, 1987), like theoretical breakthroughs in scientists (Kuhn, 1970), emerge as a result of people's action-in-the-world in conjunction with "hidden" regulatory processes at play to compensate for surface perturbations while, at the same time, not jeopardizing the inner equilibrium of the system as a whole.

From here-and-now to there-and-there…

Piaget's developmental theory emphasizes how children become progressively detached from the world of concrete objects and local contingencies, and gradually able to mentally manipulate symbolic objects within a realm of hypothetical worlds. The focus is on the construction of ever more stable and mobile knowledge structures, through which the growing child interprets and organizes the world, and expands her experiential field. Piaget's empirical studies shed light on the inner and outer conditions under which learners are likely to maintain or change their views of a phenomenon when interacting with it during a significant period of time.

The child that Piaget portrays in his theory is an idealized child (Aries, 1962). Often referred to as an *epistemic subject*, s/he is a representative of the most common way of thinking at a given level of development. And this "common way" is depicted as that of a young scientist mostly driven by the urge to bring some order into a bewildering and exciting world. Piaget's child is a young Robinson in the conquest of an uncharted territory. His conquest is somewhat solitary yet deeply engaging since the explorer himself is curious, inner-driven, and an independent agent. The ultimate goal beyond the journey itself is the joy of mastering the territory under exploration.

In essence, Piaget the rationalist portrays children's intellectual development as a progressive move away from intuitive toward logical thinking, from everyday cognition towards scientific reasoning. In his view, the path leading to higher forms of reasoning, or "formal operations", proceeds from local to general, from context-bound to context-free, from the concrete (tangible) to the abstract (mental). Accordingly, cognitive achievements are gauged against three major acts of distancing. 1. The ability to emerge from here-and-now contingencies, which are characteristic of practical intelligence; 2. The ability to extract knowledge from its 'substrate": i.e., specific uses, appearances, and material properties of things; and 3. The ability to act mentally on virtual worlds, i.e, carry out operations in the head instead of playing them out externally.

Wait wait, don't tell me…

The implications of Piaget's theory for education are profound, even if Piaget didn't think of himself as an educator. Let me mention three lessons that I learned from working with Piaget.

1. Teaching can never be direct, whether we like it or not! Children don't just take in what's being said. Instead, they interpret what they hear in the light of their knowledge and experience. A more radical formulation of lesson 1 would be to say that learning doesn't occur as a result of teaching or, in Piaget's own provocative terms: 'whatever you tell a child, you won't allow her to discover by herself'.

2. Knowledge is not information (a commodity to be delivered at one end and received, unchanged, at the other) but lessons from experience. To equate knowledge with information (using a computational metaphor) confuses matters. As Reddy and Lakoff put it, the "conduit metaphor" of human communication has been over-rated and time has come to move toward what Reddy coins "the tool-maker's paradigm:" a mutual desire to reach shared understanding and negotiate differences through co-creation, and design (Reddy. 1993, Lakoff, 1993).

3. A theory of learning that ignores resistances misses the point, and it is our view that most "misconception" models are doing just that! As we have seen, children have good reasons not to abandon their current views. And this is true no matter how relevant a proposed alternative may be. A good teacher, in this sense, is not a sage on the stage but a guide on the side. She helps learners explore, express, exchange—and ultimately expand— their views from within.

To conclude, while capturing what is common in children's ways of thinking at different developmental stages—and describing how this commonality evolves over time—Piaget's theory tends to overlook the role of context, uses, and media, as well as the importance of individual preferences, or styles, in human learning and development. That's where Papert's "constructionism" comes in handy!

Media Matter— Papert, the intuitionist

If Piaget did not see himself as an educator, Papert, on the other hand, used what Piaget has taught us about children as his basis for rethinking education in the digital age. He coined his theory "constructionism". In his words, "*Constructionism—the N word as opposed to the V word— shares contructivism's view of learning as "building knowledge structures" through progressive internalization of actions... It then adds the idea that this happens especially felicitously in a context where the learner is consciously engaged in constructing a public entity, whether it's a sand castle on the beach or a theory of the universe"* (Papert, 1991, p.1).

To Papert, externalizing—or projecting out—inner feelings and ideas is both the flip side and a pre-requisit to internalizing action. In expressing their thoughts, or giving them form, learners make their ideas tangible and shareable which, in turn, helps shape and sharpen the ideas. Externalizing is a key to communicating and to negotiating meaning. The cycle of self-directed learning, to Papert, is an iterative process by which learners invent for themselves the very tools and mediations that best support the exploration of things they most care about. Because of his focus on learning-through-making at a micro-genetic scale, Papert's "constructionism" sheds light on how ideas get formed and transformed when expressed through different media, when actualized in particular contexts, and when worked out by individual minds. The emphasis has shifted from stages to styles, and from general laws of development to individuals' conversation with their own representations, artifacts, or objects-to-think with.

Learning as design—a conversation with artifacts

Stressing the importance of external supports as a means to augment the unaided mind is not new. As will become clear in the next section, Vygotsky has spent his entire life studying the role of cultural mediations as a lever to expand learners' experience, broaden their horizon, and augment their potential. So have many other researchers in the socio-constructivist tradition (Leont'ev, 1932; Wertsch, 1991; Cole, 1996; Gee, 1992, 2004). The difference, as I see it, resides in: 1. The role such external aids are meant to play at higher levels of development. 2. The types of external aid or media studied (Papert focuses on digital media). and lastly, 3. The type of initiative the learner takes in the design of her own objects-to-think with.

More than Piaget, Papert stresses that "diving into" situations rather than looking at them from a distance, that connectedness rather than separation, are powerful means of gaining understanding. Becoming one with a phenomenon under study, in other words, is a key to learning. In Mindstorms, Papert (1980) states: "*A [robotic] turtle has a position and a heading. In this, it is like a person or an animal or a boat (p.55). Children can identify with the turtle and are thus able to bring their knowledge about their bodies and how they move into the work of formal geometry (...) Drawing a circle in turtle geometry is body syntonic in that the circle is firmly related to children's sense of and knowledge about their own bodies. It is ego syntonic in that it is coherent with children's sense of themselves* " (p.63).

Papert's constructionism is more situated than Piaget's, even if Papert himself doesn't explicitly use the term when describing his enterprise. One of its contributions is to remind us that intelligence should be defined and studied in-situ; alas, that being intelligent means being grounded, connected, and sensitive to variations in the environment. To Papert, abstract or formal thinking may well be a powerful tool. Yet, it is not necessarily the most appropriate in all situations, and certainly not every one's cup of tea!

The child that Papert is interested in is more relational than Piaget's Robinson. S/he likes to get in touch with people and things. S/he resembles what Sherry Turkle described as a "soft" master (Turkle, 1984). Like Piaget's Robinson, s/he enjoys discovering novelties, yet more than him, she wants to be in the flow of things, and in tune with people. S/he feels at one with them. Like Robinson, she tries out things and is inquisitive. Unlike him, S/he is more of a conversationalist than a builder. She prefers sharing her experience in context, rather than telling what s/he learned in retrospect: She is a *reflective practitioner* in Schoen's sense (Schoen, 1983).

To Papert, like to Schoen, *learning is design* and design[ing] is an iterative process of *mindful concretization*, or materialization of ideas. It is the flipside of, and needed complement to, Piaget's abstractive reflection, or process of ideation. Without it no ideas would live very long!

Implications for education

To Papert, like to Piaget, better learning won't come from finding better ways for the teacher to instruct, but from giving the learner better opportunities to construct. In his view, students best learn when engaged over long periods of time in the construction of personally meaningful products - or products they truly care about. Open-ended design projects, under teacher's guidance, usually offer greater opportunities for students to actively engage, collaborate, and contribute. Creating better opportunities for learners to build has led Papert and his research team at MIT to design a variety of construction materials for children, as well as settings or learning environments in which such materials can be used (Harel and Papert, 1991)

To conclude, while Piaget best described the genesis of children's interests and abilities (ways of thinking) in terms of successive plateaus of equilibrium, Papert is most interested in the dynamics of change. He stresses the fragility of thought during transitional periods. His great contribution, as an educator, is to focus on how people think once their convictions break down, once alternative views sink in, once adjusting, stretching, and expanding current views becomes a necessity. Papert always points toward this fragility, contextuality, and flexibility of knowledge under construction. A strong believer in the idea that mistakes are a key to learning, and that especially children are experts at using the little the know as a lever to grow (learning to learn), Papert has spent much of his life creating technology-enhanced environments, or microworlds, in which learners are invited to mess around with otherwise risky ideas, on safe ground.

Born to bond—Vygotsky, the "socialite"

At the heart of Vygotsky's socio-constructivism lays a simple idea. From the day they are born, human infants learn, thrive, and grow in connection with others. We "are" because we relate. The theory stresses the importance of caring and knowledgeable adults and peers; and emphasizes the role of language and other cultural mediations as motors in human learning and development. In spite of his focus on culture as a *teaching tool*, Vygotsky sees a child's intellectual development as a constructive process. This is why, in our view, his socio-cultural approach is not fundamentally at odds with Piaget, Papert, Bruner, and other constructivists.

To Vygotsky, as well as activity- and socio-cultural theorists, the "social" has a primacy over the "individual" in a very special and important sense: Society is the bearer of a cultural heritage without which the development of individuals is simply unthinkable. Parents and other members of a social group form a living habitat to which all contribute yet that also reflects —and to an extent embodies— its own history and thus impacts, however indirectly, the generations to come. In other words, our cultural heritage is at once a niche and a medium. It is at once a "terrain," or stage for human experience, and a lens, or interpretive frame, at the disposal of the terrain's inhabitants.

Vygotsky introduced the concept of psychological tool to capture the idea that the cultural artifacts at our avail become part of our own "psychology" once we appropriate them. Psychological tools include: various systems for counting; mnemonic techniques; algebraic

symbol systems; works of art; writing; schemes, diagrams, maps, and technical drawings; all sorts of conventional signs, and so on. (Vygotsky, 1982:137, cited in Cole & Wertsch, 1996).

It takes a village to raise a child

Piaget and Papert no doubt would agree that co-operating with others is co-constitutive of operating on one's own. Yet, Vygotsky put greater emphasis on how the presence of caring adults and peers can both cater and "speed up" a child's self-directed learning, and how cultural artifacts are used, from the outset, to help mediate this process.

To Vygotsky, a person's cognitive development proceeds outside-in, i.e., from other to self: "Every function in the child's development appears twice: first, on the social level, and later on the individual level; first, between people, and then inside the child" (Vygotsky, 1978:57 in Lock, 1989). Inter-personal relations, to him, are the precursors, and necessary conditions, for the emergence of individual/intra-mental processes: Youngsters first share their experience with others, before they become able to master and understand them for themselves. Their development proceeds from socio-centric to egocentric.

Vygotsky's child, as I see it, may be more of an intelligent *trusting disciple*, in Harris's sense (Harris, 2000), than an *autonomous agent* (Papert, 1980). While curious, active, inner-driven, and autonomous, s/he also trusts that others, more experienced, may tell her things that she cannot yet understand or maybe won't be able to experience directly. In other words, s/he knows that she can learn vicariously by listening to what others have to say about what interests her. The autonomous agent, in contrast, is not comfortable if he cannot check out for himself what others propose, at the cost – sometimes – of re-inventing the wheel! or forgetting that others have come before or even inspired her!

Implications for education

One of the key concepts in Vygotsky's theory is the notion of "zone of proximal development" (ZPD). Much quoted and often misunderstood, the ZPD defines a potential area of expansion for individuals to overcome their limits, provided the social environment "pitches in". In other words, the zone of proximal development tells us "how far" individuals can stretch the envelope of what they know, when supported and guided by others. It is, again, through social interaction, that learners can mobilize, and best use, the resources at their avail.

To conclude, Vygotsky's socio-cultural theory can be read as being in line or at odds with Piaget and Papert's contributions depending how much agency and autonomy we think each theory lends to individuals (children and adults) and/or their groups of affiliation (social actors) to re-invent their lives. In this respect, the term *enculturation*, used by socio-culturalists continues to feed polemics among scholars and may be usefully substituted by the twin-notions of object-[or environmental] affordances and personal appropriation. Likewise, the chicken-and-egg duality of inside-out versus outside-in seems less interesting than notion of co-evolution (present in Vygotsky and further developed by activity theorists): The idea that, from the outset, child, care-takers, and objects or tools form a mutually enriching triad that cannot be broken down.

Moving between worlds—Integrating the views

In The Evolving Self, Kegan defines human development as a lifelong attempt to resolve the unsolvable tension between *being embedded* in situations and *emerging from embeddedness* (Kegan, 1982). In a similar way, a person's cognitive or affective growth can be seen as a lifelong attempt to find a viable balance between fusion and separation, openness and closure, or in Piaget's words, between *assimilation* and *accommodation*. Said otherwise, imposing one's order upon things and looking at the unknown in terms of the familiar (assimilation) goes hand in hand with being sensitive to variations in the environment and letting go of previously held believes (accommodation). Any unbalance in favor of one or the other pole can lead to

evolutionary unstable strategies, i.e, less viable ways of regulating exchanges with others and things, and compensating for surface perturbations. Our own attempts at integrating the views and coming to grips with the multiple legacies from the three forefathers can be summarized as follows:

- Along with Papert, we suggest that diving into the unknown, at the cost of experiencing a momentary sense of loss, is a crucial part of learning. Without immersion there is no empathy, and without empathy there is no way to feel for others, or grasp a situation from-within.

- Along with Piaget, we view separateness through progressive de-centering as a necessary step toward relating ever more intimately and sensitively to both people and things. In any situation, no matter how engaging, there comes a time when we need to remove ourselves and look at things from a distance. To advocate the importance of separateness does not preclude the value of being embedded in one's experience. It only suggests not to get locked in it forever.

- What Vygotsky adds to the equation is the notion that no human can be or grow without the presence and support of other people. Children are bound to their cultures because the people, places, and tools they interact with form the *holding structure* out of which they grow: their intelligence is collective because we are all in it together, whether by choice or by necessity!

Only when a learner actually moves in, around, and between worlds, by adopting different perspectives, or putting on different lenses, can a dialogue begin between initially fragmented, or partial, views. Indeed, how could anyone learn from experience as long as they are totally immersed or forever distant? Likewise, how could anyone know who they are (and what they are worth) if they are not "held" by others? As mentioned before, there are times when pushing back and extracting oneself from the deep waters becomes a necessity. And that's when a new cycle can begin, and the stage is set for new and deeper connectedness and understanding.

Making sense of the legacies

People spend a great deal of their time carving out their niches –virtual and physical– so that they fit their needs, support their purposes, and augment their potential. They build cities and homes, they invent computers and airplanes, and they create alphabets and geometries. People are also busy keeping track of their experience and leaving traces behind. They mark their grounds and they use the traces they leave behind as anchors to orient themselves. Newcomers to a culture are left to live with the marks traced by others.

In addition to being world-makers and leaving traces behind, people are also devoting much of their time 'reading' meaning into existing forms, be they their own or those produced by other. And they do so in creative ways. Readers, in other words, are in no ways passive consumers. Instead, they engage designed artifacts by reconstructing them through the lens of their interests and experiences. As Bordwell points out about film audiences: "The artwork sets limits on what the spectator does. But within these limits, the viewer literally recasts the play" (Bordwell, 1986, p. 30). Viewers impose their order by rearranging or replacing clues, by filling in blanks or 'creating phantoms', by ignoring clues, and by forcing causal-temporal connections. In Piaget's parlance, they assimilate incoming signals (in this case, a narrative, which they interpret through the lens of previously constructed experience), and they accommodate their views only insofar some unexpected puzzlements or surprises are called upon by the materials.

- In his work, Piaget has extensively written about intelligence as adaptation, and adaptation as a viable balance between accommodation and assimilation. It is our contention, however, that Piaget, as a thinker, was himself more of an "assimilator" than an "accommodator". Hence his interest in children as "assimilators", or world-makers!

- Papert in contrast, has always shown a personal *penchant* for the meanderings of individual minds in context, especially as they navigate their ways through uncharted territory. His interest is in the navigator's abilities to deal with unexpected obstacles, as she moves along. Hence his

interest in children as "accommodators," and world-dwellers (one may say world-travelers)!

- Vygotsky, for his part, liked to think of youngsters and their groups of affiliation as intelligent listeners and creative team-players. His dilemma, as a scholar, was to reconcile the processes of individuation and enculturation, and to open up spaces for children and their caretakers to grow as autonomous agent and responsible citizen. Hence his interest in collective intelligence!

From interaction to co-evolution

As learners outgrow some of their previously held beliefs, they sometimes forget that "what they know depends on how came to know it!" (Watzlawick,1984, p.9). They then act *as-if* their construed "realities" had always been out there waiting to be uncovered, and they rely upon them and refer to them as tangible and shareable entities. While this cognitive amnesia poses a problem to constructivists, it holds the advantage of sharpening our sensitivity to "their" qualities independent of our immediate relation with them. Treating others and our own creations *as-if* they had an existence beyond our rapports with them (even if we know that we cannot know their whereabouts) and "celebrating them for what they are" (at the risk of over-interpreting)—is ultimately a viable mental attribution, provided we remember that the attribution itself is a construct. Its function is to elevate human transactions (between me/not me) beyond blind projections, or assimilation pure, with its unfortunate consequence: reducing anything that is other to a mirror-of-self (over-assimilation).

From a pragmatic-ecological standpoint, it seems essential for designers and educators to take responsibility for their offerings by not assuming –I caricature the constructivist's stance– that learners will use them as Rorschach stains anyway. Designers should acknowledge that their products will survive after them, and that it is ultimately the built artifact, rather than the builder's intentions, that becomes part of other people's cultural heritage. It is 'its' qualities that will persist and signal potential uses to newcomers who encounter it for the first time.

Clearly, designers cannot predict or be accountable for how their creations will be appropriated by others. What designers can, however, is be attentive to the idea that, once conceived, their creations are no longer a mere extension of themselves. Instead, they come to exist as separate entities, and an integral part of the cultural landscape in which other newcomers will live and grow. People read into artifacts because of who they are, but also because artifacts offer clues. Like archeological sites or eroded landscapes, they are marked by—and in this sense embody— the knowledge or collective experience that went into their being. The constructivist's nightmare may well come true! Yes, human-made artifacts can call upon certain experiences and uses, and discourage others. And they sometime impose their logic, much in the same way as a partner or conversationalist does. To deny the power of places and things to impact people can bread a culture of 'not caring'.

From an epistemological standpoint, it seems important for learning researchers and educators to rethink the role of accommodation in cognitive adaptation. To Piaget, we have seen, intelligence is adaptation, and adaptation is the ability to maintain the maximum of what is acquired while opening up to the maximum of novelty. In his words: "*Assimilation is by its very nature conservative, in the sense that its primary function is to make the unfamiliar familiar, to reduce the new to the old*" (Piaget, 1954, p. 352-353). Accommodation, by contrast, de-crystallizes existing schemes so that they fit our expectations. Its primary function is to make what is familiar unfamiliar again, and to question the old by listening to the new. Question is: what would Piaget's legacy be had he paid closer attention to the opportunistic nature of minds in context.

It is not exaggerated to say that human beings at once create their worlds, inhabit their creations, and become "inhabited" by them. In their imagination, fusion (becoming one) and separation (removing oneself) coexist, and both contribute to their personal and cognitive development. It is the dance that matters.

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