Rescuing the Beauty of Interdependence from the Bottleneck of Education

Montessori Education and an Ecological Experience for Children

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"The solution which I am urging is to eradicate the fatal disconnection of subjects which kills the vitality of our modern curriculum."

-Alfred North Whitehead*, The Aims of Education*

Introduction

The impact of the environment that one is immersed in all day long cannot be denied, especially regarding children. If a child spends hours every day from age 6 to 18 in an environment that structurally emphasizes discrete and isolated disciplines, competition, linearity and hierarchy, as does the traditional education system, the child's mind has very little choice but to be directly affected by such a system and to either take on the qualities of the environment and the principles that were used to design it, or sometimes to rebel against it. Children (and teachers) often talk about 'the real world' somewhere outside of the classroom, wondering, "When will I have to use this in The Real World?"

What if an educational approach could offer a learning experience that operates more like the real world does - the *true* real world of interdependent and non-linear systems? At this time of intensifying and wildly rapid global changes, there is growing agreement that education must help children develop minds that are adaptable, globally aware, and compassionate. A pedagogy based on natural developmental processes such as Montessori education can offer an educational experience that supports the development of a more interdependent, relational worldview for children.

The Mechanical Worldview and Education

In order to investigate this possibility, we need to explore the underlying worldviews of pedagogies. The traditional model of education is grounded in the principles of the mechanical worldview that emerged out of the Scientific Revolution. Attributes including reductionism, linearity, hierarchical structures, competition, empiricism, and cause and effect were so effective in predicting and controlling the material world that they were consequently applied

to many other (non-mechanical) disciplines, including education. Looking at the structural nature of traditional education, it is not difficult to see reflections of the mechanical worldview in how it operates. (see Table 1.)

Table 1: An Overview of Correlations Between the Mechanical Worldview and the Structural Elements of Traditional Education

Mechanical Worldview Attributes	Structural Manifestations in Traditional Education
• Hierarchical structure of reality • Competition necessary to get to the 'top'	• Rigid hierarchy: Curriculum → Administrator→Teacher→Student • Authoritarian structure. Students at the bottom of the hierarchy. • Competition is primary mode of progress.
• Objective external reality has primacy, subjectivity is minimized.	• External authority is the source of knowing. Teacher and text are the sole sources of information. • Inner world and inner knowledge of the student is ignored. • Inner world of the teacher is also ignored. The teacher is to teach objective information objectively, with no personal involvement. Subjectivity is minimized, avoided.
• Materialistic, rationalistic	• Emotional aspect of learning is denied. • Learning is isolated. Experiences outside of school are not considered 'education'.
• Empirical, quantitative	• Measurable outcomes as the goal. Testing, grades. • Non-measurable aspects of education (social skills, attitude, sense of community) are ignored. • Product-oriented. • Statistical approach to success. Bell-curve means that some must always fail.
• Reductionist	• Sharp divisions across disciplines. • Discrete and unconnected approach.
• Linear outcomes and causality. Mechanistic.	• Input-output model. Information in, test performance information out. • Uniformity of expectations from students. • Individual variation of students rarely taken into account • Reward and punishment are primary motivators. • One-size-fits-all approach with curriculum and pedagogy. • Desks often in straight lines (physically linear)

A Shift of Worldview

Although the mechanical worldview was highly effective, gradually its shortcomings became clear; it was incomplete and did not work well when applied to non-mechanical (living) systems. In the mid-20th century, a new worldview began to emerge through the work of cyberneticists and philosophers such as Alfred North Whitehead, Gregory Bateson, and other systems thinkers. This approach didn't *replace* the mechanical worldview, but instead embraced more complicated aspects of the world:

> In contrast to the previous fragmented and reductionist perspective, a new **worldview** was founded on interactions, involvement, relationship, process, story, non-linearity, complexity, systems, participation, intuition, awareness, aliveness, connection - rather than separation, fragment, linearity, causality, logic, distance, product.
>
> (Slaughter & Martin, 2002)

Complex systems and feedback loops replaced hierarchical and linear structures. Interdependence replaced reductionism. Instead of domination over nature, the new worldview embraced relationship with nature. It was a paradigm of collaboration rather than competition. Table 2 contrasts some characteristics of the mechanical worldview with this new ecological worldview with (Elgin, 2009). (NB: For ease, in this paper we will refer to this new worldview as the *ecological* worldview.)

Table 2: Comparing worldview attributes

Mechanical Worldview Characteristics	Ecological Worldview Characteristics
Structure	
• Hierarchical structure • Separateness, isolation • Fragmentation • Dualism	• Parallel structures, systems and feedback • Interdependence • Consciousness, collectivity • Wholeness
Interaction, nature of relationship	
• Domination, control • Competition • Transactional	• Ecology, interdependence • Community with nature • Collaboration • Relational
Flow	
• Linear • Causality, cause and effect • Product-oriented	• Non-linear process • Feedback loops • Process-oriented
Epistemology (sources of knowing)	
• Empirical, quantitative • Cognitive, intellect emphasis • Materialistic, rationalistic, logical • Objective external reality has primacy	• Other realms of knowing, qualitative • Somatic, emotional awareness • Intuition • Subjectivity is valued.

There are compelling reasons to wish that education offered an ecological experience to children. Rachel Briggs states that "schools have a vital role to play in building cohesion, helping to create citizens with the knowledge, confidence and curiosity to make the most of this new interdependent world." (Briggs, 2009) In addition, global competency is becoming the new literacy: "Global Competency comprises the knowledge and skills that help people understand the flat world in which they live, the skills to integrate across disciplinary domains to comprehend global affairs and events, and to create possibilities to address them." (Riemers, 2009)

So if we wish for children to have such an outlook, seeing the world in terms of systems and relationships and with the critical attribute of interdependence, they must have the chance to

experience it while their minds are still in the process of developing. Maria Montessori stated that "adults may admire an environment and remember it, but the child can absorb it unconsciously and form with it part of his psyche." (Montessori, 1946)

It is clear that the traditional education system manifests very few principles of the ecological worldview. There is a compelling argument that Montessori education provides a much better fit with the ecological worldview.

A Very Brief History of Montessori Education

In 1896, Maria Montessori became the first woman physician in Italy. In the path of her medical career, she ultimately became an expert in child development and education, establishing a developmental model and educational approach based on her own work with children and countless hours observing them in a variety of cultural and socioeconomic situations. Many of her observations were well ahead of her time, and have been proven accurate through recent research in neuroscience.[1] (Stoll Lillard, 2005) Maria Montessori successfully utilized her new educational approach in preschools Italy in the early 1900s. She later continued her work in collaboration with her son, Mario, laying out extensive pedagogy for children up to age 12.

Montessori's Developmental Model drives the pedagogy

In contrast to a school structure that subscribes to the old mechanical paradigm of separation *from* nature, Montessori pedagogy is based on collaboration *with* nature. Using Montessori's observations and model of child development as the basis for pedagogy ensures that the educational structure follows the lead of nature, and children's innate development. According to Montessori, development is teleological and non-linear, driven by the energy of nature. As with all living creatures, transitions are continuously trending in one direction towards increasing independence of the child, ultimately resulting in an independent and balanced

[1] Interested readers are also referred to *The Scientist in the Crib* by Alison Gopnik for recent research in cognitive science that upholds many of Montessori's developmental observations from 100 years ago.

adult. It is important to recognize that this model of development is transcultural and these *human* developmental characteristics are coming from nature, not culture.

Montessori's developmental model spans the time from birth to age 24, divided into four planes. Each plane is characterized by *sensitivities*, areas of growth potential that are particularly powerful during those times. Understanding the sensitivities is critical for being able to design an education structure that resonates with the natural state and needs (sensitivities) of the child. It is beyond the scope of this paper to elaborate on the details of the model, but in Table 3 is a summary of the planes of development and their corresponding sensitivities.

Table 3 – The Planes of Development (Montessori, 1938)

Developmental Plane and trend of independence	Age range (years)	Sensitivities
First Plane -towards physical independence	0 – 6	• Language development • Motor development • Sensory development, concrete experiences with the world • Sense of order
Second Plane -towards independence from the home	6-12	• Moral development (justice, fairness, right and wrong) • Abstraction and imagination • Human culture/intellectual knowledge, curiosity
Third Plane -towards financial and family independence	12-18	• Physical maturity with emotional upheaval. • Requires grounding in earth and nature • Fascination with finances/money and work • Driven by need for belonging, social connection
Fourth Plane -towards psychological independence	18-24	• Spirituality, meaning, direction in life • Facing temptations: power, possession, indolence

Considering that the developmental model is based on children's natures, perhaps it is not surprising then that the Montessori education approach is complementary to, and in fact in many ways embodies, the ecological worldview – a worldview that is based on how nature

itself works. Using this understanding of non-linear child development to inform the structure of the children's actual day to day experiences is where pedagogy and worldview meet.

How Does a Developmental Approach Translate into a Pedagogy That Supports an Ecological Worldview?

A Montessori classroom is designed with distinctive structural characteristics based on the developmental need of children as discerned and described by Maria Montessori. These essential principles are applied at all levels of development. Applying them results in classroom with an ecological structure and operation:

- **Mixed age groups.** A Montessori classroom contains children within a three-year age span from the same developmental plane. (ie, age 3-6, age 6-9 or 6-12, age 12-15, etc.) This facilitates peer collaboration and instruction, and also develops the sense of a mini-society with more natural levels of seniority and expertise in the classroom. (Each plane has a distinctive classroom design based on that plane's attributes.)
- **The Freedoms:** Children have the freedom to work without interruption and without unwanted help, the freedom to make mistakes, the freedom to explore, the freedom to choose work. These freedoms do come with boundaries and responsibilities. Children can choose what they want to work on and when, but within those boundaries.
- **Natural environment.** There are not rows of individual desks. The classroom often looks like a busy home, with children working on the floor or at tables, often in groups. Like a home, the furniture and furnishings are natural. The use of plastic and bright colors is minimized. Plants are plentiful; wall décor is natural and home-like, with quality artwork and cultural items. Beauty, order, nature and harmony are built into the structure of the classroom and the expectations of the children, who are involved in the care and maintenance of the environment.
- **Small group instruction.** Children are taught in small groups by the teacher and they then work independently and at their own pace. The teacher gives lessons based on

readiness and mastery of earlier lessons rather than on age or grade level. Often the children teach each other.

- **Uninterrupted work period**. Ideally, each day involves an uninterrupted 3 hour work period allowing children to receive lessons and fully engage in their work. This leads to periods of deep concentration, much like meditation. The students are largely self-directed; the classroom does not revolve around the teacher's actions and imposed structure.
- **Beauty, quality and creativity**. Student work is free-flowing. Beauty and quality of work are stressed and often involves self-guided practice, and artistic renderings of concepts. They are often inspired by other children's creations.
- **Learning materials.** Montessori instructional materials that provide concrete experiences with abstract concepts in all subjects are on shelves throughout the room, kept in an orderly and attractive way. The materials are designed for the developmental plane of that classroom (preschool, elementary). The children can then use whatever they need whenever they need it.
- **Community.** Proper greetings and social graces are emphasized. The development of compassion and empathy occurs naturally as the children share space and materials, work together in a free-flowing environment, and teach each other. Children regularly present their work to others. Communication happens naturally and purposefully.

The manifestation of these principles results in a classroom that does not *look* structured: at any given moment; children are moving around the room, talking to each other, sitting with a teacher, gathering materials, cleaning up, working alone, working in a group. There is no single focus of attention in the classroom. But in fact, there is a strong sense of order, harmony and pattern. This is a classroom that is not linear or hierarchical in structure, but rather is a system, a complex and interdependent community, rather than a factory.

When supervised freedom and opportunity is given, underlain with a philosophy, certain qualities can be seen to emerge which, Montessori believed, are the qualities of the natural state of children: being interested in everything [instead of having fears or dislikes of certain

subjects], being independent, responsible, empathetic, confident, curious, social, engaged with the world. (Wentworth, 1999)

Focusing on the Second Plane Characteristics (Elementary Level, Children age 6 to 12)

The 2nd Plane child's particular sensitivities emerge as important qualities that inform the Montessori pedagogy and make him especially responsive to interdependence, as we shall see:

- This age child is extremely social, and is experimenting with power and relationships. He prefers to be in a group.
- The child has an intense desire to learn, and is very intellectually curious and driven.
- The child's imagination is very strong. She has a love of learning from story.
- The child questions rules, and is extremely sensitive to issues of fairness.
- Symbolic representation is now possible for the mind, opening up worlds of human culture and knowledge to the child.
- The child is driven to understand human society and culture. She is beginning to become aware of her place and others in the wider world.

The Internalization of Interdependence

We can now look more closely at how the Montessori approach supports the development of a foundational sense of relationship and connection. The first avenue is through the cognitive experiences of the curriculum itself, which at the 2nd Plane is called Cosmic Education. The second avenue is through the structure of the environment itself and the daily operation of the classroom.

1. **<u>The Cognitive Experience of Interdependence: the Cosmic Education Curriculum</u>**

The Cosmic Education Montessori curriculum for ages 6-12 offers a rich set of knowledge based on interdependence, connection, flow, and relation. This is in contrast to the reductionism, isolation, and linearity of curricular approaches in traditional schools.

Standard content and skills of any elementary school curriculum are certainly addressed. Essential concepts are introduced concretely through work with Montessori didactic materials and the work draws on this age child's intense intellectual interest and energy. For example, children are able to use materials to find the square root of numbers such as 149,325, or to build a model of the Pythagorean Theorem, or analyze the grammatical structure of a complex sentence, and develop strong levels of abstract operations in all subject areas.

However, in cosmic education the goal is not simply the mastery of skills. Instead, these fundamental skills are the tools for being able to see the universe as a field of interdependence, evolution and change. Specific curricular elements support this process and the teacher's collaboration with the developmental forces at work in these older children. These elements include the cosmic stories, storytelling, and timelines.

I. ***The Cosmic Stories***. The introduction to interdependence begins with the Cosmic Stories, or Great Stories. Told to the children at the beginning of each year from grades 1 through 6, these stories provide a reference frame starting with the whole universe and ending with the details of human civilization. The cosmic stories are the foundation of cosmic education, presented in this order:

1. *The Story of the Universe* (about the Big Bang and the stars, solar system and earth coming into being, and the physical laws of matter)
2. *The Story of Life* (how Life slowly developed on earth, and how through creativity it evolved into the life forms we have today)
3. *The Story of The Coming of Human Beings* (that humans have three gifts: a mind that can wonder and imagine, a heart that can love others besides just their family, and hands that create)
4. *The Story of Civilization* (how written language developed around the world, the history of the alphabet, and how writing has changed humanity)
5. *The Story of Numbers* (how and why human beings have developed systems of counting and numbers over the centuries, and the history of the Hindu-Arabic number system that we use today)

On one level, these stylized and engaging stories provide historical and factual perspectives. They inspire curiosity and set the stage for study in the various subject areas. But on another level, the stories lay a foundational framework. The order of the stories is critical. It gives children a foundation for viewing reality, not through a narrow individual, nationalistic, tribal, static, or mechanical lens, but through a lens that is the entire universe. In *The Great Work,* Thomas Berry (1999, p. 16) writes of Montessori and her elementary curriculum, and the cosmic stories:

> She observes how this experience of the universe creates in children admiration and wonder, how this enables children to unify their thinking. In this manner children learn how all things are related and how the relationships of things to one another is so close that 'no matter what we touch, an atom, or a cell, we cannot explain it without knowledge of the wide universe.'

In addition, the stories are told with a strong thread of gratitude for all that came before us, including the efforts of the humans who struggled to learn and survive, and then passed on what they learned. We are now the benefactors of their struggles. Montessori's aim was high: to communicate to the children that "we shall walk together on this path of life, for all things are part of the universe, and are connected with each other to form one whole unity." (Montessori, 1948, p. 6)

II. Storytelling

Storytelling is a critical mode of sharing knowledge in cosmic education. It draws upon the human love of story as a way to pass on human culture. Storytelling is a way of learning based on relationship, and it deeply engages the children on multiple levels of awareness.

III. Timelines

The cosmic education elementary curriculum extensively utilizes timelines – large, long, meticulously detailed representations of the evolution of life, various historical eras and human

history, and the rise and fall of civilizations. These timelines graphically and concretely remind children of the flow of time and our/their own relationship to the past and the future.

Other cosmic education lessons are specifically focused on interdependence. In a vital lesson called, “Where Do We Get Our Bread?” the children discover the path of the bread they eat through queries such as, “Who ground the wheat? Where did the wheat come from? What other ingredients are in the bread? Where did they come from? Who baked the bread? How did it reach the store? “ It doesn’t take long before the children are actively noticing and exploring human interdependence all around them. As Mario Montessori (1957) wrote, “The reality of Society is that everyone is dependent on everyone else.”

Their growing awareness extends to lessons on the natural world and ecology. Each aspect of the world has a cosmic task that links it to the rest of the world: the butterfly serves to pollinate the flowers, while the flowers feed the butterfly, and eventually the butterfly may feed a bird, and the network of interdependence flows outward.

Becoming aware of interdependence is somewhat like having blinders removed from one’s eyes: one can never go back to not having that awareness. It is natural, then, for children to begin to make connections between human actions and the natural world. Environmental issues such as pollution, energy consumption, and agriculture come to the forefront as issues of human cause and effect. Because of their high sensitivity to morality and justice, children in the Second Plane are particularly attuned to these issues. They become very indignant at the ‘wrongness’, the unfairness, of issues like an animal losing its habitat due to construction, or pollution clogging the oceans due to dumping.

2. The Structural Experience of Interdependence

Cosmic Education could easily be simply an intellectual exercise. But it goes beyond the intellect in the carefully designed learning environment. Through learning collaboratively, relationally, and in community, the children in a Montessori classroom *create* interdependence for themselves.

The structural elements of this environment include Group Work, Multi-Age Classroom, and Going-Out.

I. Group Work: Collaboration, Responsibility, and Unity

The Montessori classroom is a natural laboratory for learning to be in an interdependent world. Elementary children are extremely social. Rather than struggle *against* this developmental desire to be with friends, the Montessori approach works *with* it. Group work and collaboration are encouraged. Not only do children acquire concepts better when working socially, but implicit lessons about relationship, communication, conflict and collaboration naturally emerge. The children have the freedom to learn how to be together and how to resolve conflict when the inevitable struggles arise.

The support of an energy of community can be truly inspiring, since competition is no longer the primary mode of operation. (This is also due to the absence of testing and grades in the class.) The level of caring for others in these classrooms can be astounding. Students support and help each other, and also enjoy giving each other lessons in new topics.

II. Multi-age classroom: Interdependent Learning

Since the classroom is made of mixed ages at different levels, the teacher conducts lessons for small groups of 3-5 children generally. This means the remainder of the children must help each other and work on their own. The older children act as elders, holding much responsibility and giving support to the younger ones. The younger ones in turn admire the older ones and depend on their help and guidance.

This results in a classroom structure that is not hierarchical with the teacher at the pinnacle and the students at the bottom. Instead, it is much more parallel and self-organizing, with multiple feedback loops overlapping as students interact with and depend on each other. The classroom is a complex ecosystem, a microcosm of human society. In this way, the students are experiencing a world of interdependence and flow of their own creation. They directly experience the importance of depending on others and being dependable themselves in the 'ecosystem.' This is the children's direct experience in the classroom. Children are constantly

being reminded of the value of all roles in the ecosystem of their class, including their own, and by extension, in the wider world.

These classrooms, despite having a vast range of abilities and ages compared to a traditional classroom, exemplify a remarkable level of healthy community, echoing the lessons of biodiversity in nature. There is a unity that emerges out of the diversity due to the vital roles of all parts of the system.

It is, however, important to acknowledge that the normal range of child behavior exists in a Montessori environment; the classrooms are not utopian. Children do argue, hurt, and compete. But the scale of this behavior is greatly reduced because of the classroom structure, and the children communicate and problem-solve with a skill far beyond what most people would expect of children.

Thus, the interdependence in the classroom creates a strong web of connection that echoes interdependence on a global scale. Mario Montessori reminds us that "…there is among the different components of the world an inter-dependence that makes it all one unit." (Montessori, 1956) This spiraling of convergence, from one to many and back to one, is a critical aspect of the ecological worldview. We see it exemplified all over the world, from the internet and its single voices merging into one network of communication, to global trade patterns and globalization, even as nationalism strengthens.

III. "Going-Outs": Interdependence in the Wider World

Developmentally, this age child is eager to explore the world. To meet this need, a critical element of the Montessori classroom is the 'going-out'. Going-outs provide the opportunity for children to expand their reach beyond the classroom. It may be a small trip such as walking to the store to buy pet food, or be more involved such as going to interview a baker. No matter the scale of the journey, these trips fulfill a developmental need to explore the world safely as children begin to realize that they are an integral part of society and the world.

Conclusion

Any form of education must include fundamental skills and educational content, and these are addressed solidly in a Montessori education in an environment that takes children beyond solely intellectual knowledge and skills.

What is at issue here is not content or even methodology, but the structure and underlying belief system of education and the resulting influence of a worldview. The mechanical worldview as an educational foundation no longer meets the evolving needs of human society, nor the needs of children. In his 2010 TED talk, Sir Ken Robinson stated that the linear model of education results in a lack of diversity, an emphasis on conformity, and an expectation that if a series of steps is successfully followed, an expected outcome will be met. However, “human communities depend on a diversity of talent, not a singular conception of ability.” (Robinson, 2010)

As a holistic, ecological approach becomes critically relevant in the face of global crises, we are forced to let go of the comfort of predictability and embrace the flow of process and relationship. By providing children a chance to grow up in such an environment, education can become a co-creative journey, open-ended and vibrant with possibilities, imbuing our children with a guiding sense of interdependence and connection as they rise to meet the world.

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