

The Mathematics Education into the 21st Century Project

The Future of Mathematics Education

Pod Tezniami, Ciechocinek, Poland

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RICH LEARNING TASKS OCCUPIES THE BODY, FEEDS THE MIND, TOUCHES THE SPIRIT

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Formal education is primarily an activity that isolates the mind, gives little to engage the body and mostly fails to touch the spirit.

The only structural pattern is the triangle. It is foundational to all shapes and forms. Four is the form of pattern three. The tetrahedron pattern is the four-mation of three. Four spheres in the closest packed order is a balanced and perfectly symmetrical triangulated pattern of four spherical locations and six points of connection ($4+6=10$). In polyhedron form this 10-pattern shows a 2-frequency tetrahedron with a defined open octahedron space. When the tetrahedron is traditionally defined by four points in space, six octahedron defining points are missing and the space gets filled in. The relationship of four spheres is a single patterned reformation of spherical unity. There is no separation between the four spheres and the space that is created. This structural pattern is observed in biological formation, mental reformulation, and through metaphysical direction. Spherical order is completely informing to the abstracted mathematical systems we have constructed. Individual parts are a function of division within unity where separation emerges as the appearance of surfaces. The symbol ten, of the tetrahedron pattern, is a straight line and a circle. When folding the circle a straight line is generated with no separation between circle and line. In the folded symmetry of the circle the straight line diameter is the measure, bisector, and the axis to spherical movement. The sphere is principle; the circle is the first reformation towards all subsequent generation. The first form we give infants to play with is a ball, for which they display an extraordinary interest. The ball, a spherical egg cell, is our physical origin.

We are evolving on a spherical planet of and among countless unexplainable spherical forms of energy. Energy exists as movement and interaction. Spherical unity is origin to structural pattern and the forming of all individualized parts. The inclusive nature of the sphere provides the mind with the greatest amount of information for making sense. It has the greatest yield for the least input. Folding circles is proportional movement, it is not about measurement and static concepts of fixed positions.

The tetrahedral pattern of carbon suggests the importance of structural pattern in the development of physical life formation. This pattern is the physical that gives form to mind function which is developing capacity to conceive beyond the physical and mindal awareness to what is called spirit. Awareness of this third unseen component completes the *body/mind/spirit* pattern as a functional evolving form, structurally based and directed within movement of the Whole of spherical origin.

The spirit/mind/body triangle pattern is the functioning human potential. The greater the balance between the three the closer we have to an equilateral triangle, a patterned relationship of spherical order. The triangulation of balance is reflected in the mathematical equation; two sides and the point of balance symbolized by the equal = sign. There are many ways to formulate the balance of any equation. Change one variable and everything shifts. Mathematics is a symbol language representing abstract generalizations of inter-relatedness between endless parts within the Whole. It is difficult to teach students the developing abstractions of the mind, let alone the creativeness of spirit, when there is little understanding of our physical reality, structural pattern, and what is principle to the largest context of origin.

We either start with the Whole or with parts. One yields more and one yields less. The classroom is where we learn, discuss, and reflect on a small portion of a very few selected human experiences. Education has become fragmented, stored in books, in boxes, and classrooms. Cubic containers fill space. Structural ordering of multiply spheres reveals space. Without space nothing can grow. The maximum learning experience is spatial which supports the evolution of the imagination for discovering what is yet unknown. We have allowed the tyranny of traditional authority to contain the mind in an attempt to anticipate and regulate the unknown. We tend to fill space with refuse salvaged from the past. Without space to move there is no room for play. The most important generalization we can make about play is that we learn by doing it.

The 'biggest picture' is not an educational concept, it is the reality of the combined *body, mind,* and *spirit* life activities. We are structurally created to use what we know to embrace everything that we

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do not know, both the seen and the unseen. When the unknown is factored out there is no context, no greater thing to be discovered, imagination without direction. The unknown is the constant that necessitates a continuous movement towards balance. To teach what we do not know challenges what we do know.

Anything students bring to a class of study is instructive when the context is large enough. Mostly we do not look for extended connections, but are confined by the limited and detailed curriculum students are expected to learn. Fear gets in the way of being able to create a rich learning environment. There is fear of failure. We fear that to engage the body will take away from the development of the mind. We do not introduce anything of spiritual nature because we do not yet understand, and fear it will turn into somebody's religion. Two of the three parts for meaningful human growth are rarely present in the classroom. Six of the ten points of the tetrahedron pattern are missing in our textbooks. We do not teach from structural understanding. How can students learn, much less have a rich learning experience when taught to the authority of past limitations?

Our minds look for truth, seek beauty, and derive value in the goodness of experiential interaction. The mind coordinates the physical and spiritual aspects of our being, giving meaning to universal rhythms and harmonies of a greater structural reality. To separate and emphasize one part over the others causes break down. We need only to look around to see evidence of inadequate leaning experiences that have resulted in the unbalanced, fragmented, and ill-stated equations of human interactions.

To pursuit what is larger than ourselves furthers the evolutionary purpose for learning and provides the richness that is presently lacking for most teachers and students.

Unity is not about bringing separated parts together, rather it is in acknowledging pre-existent unity; in the inclusive singularity of the Whole reflected in the multifunctional, interrelated associations of endlessly forming parts. Discrete information when not presented in this largest context gets separated and we lose connections and opportunity for greater understanding. It is only through expanded *experience* that we discover *meaning* which gives *value*. Without opening to the largest context possible the minds potential for making sense is limited and space for play is diminished.

Making sense is not so much about parts as it is in understanding the contextual meaning of relationships. Making sense comes out of reflecting on individual experience and how that directly relates to the *information outside* of ourselves. What makes sense is appropriate action that supports the expression of the Whole through the sustainability of all parts. Sustainability is a quality of pattern. Pattern is the structurally functioning of Wholeness. The ethics in being precedes the ethics of doing. Moving parts are the flow of evolving, branching, and breathing of individualized, interconnected systems giving expression to the Whole. A triangle can not be anticipated or even sustained by defining and understanding one part alone. The equilateral triangle does not reveal spherical order. A right triangle drawn on paper gives no indication of the Pythagorean theorem. Folding the circle provides the context that gives meaning to these functions. Because we do not fold circles understanding the right angle, the tetrahedron, the quadrilateral, the sphere, gets lost in isolation. Without understanding the context of common origin, meaning becomes meaning less. We would not be able to construct the things we do if they did not already exist inherent in the greater potential of the circle/sphere. The origin is where we need to go to understand what it is that informs us. Pick any part or fragment and trace it back through an extended contextual net of in-formation to spherical origin. Now, that is a rich learning experience.

The entire world of geometry opens when we see that a point is just a small circle and the circle is a compressed sphere. If the starting point is large enough everything is observed in the context of everything else. The absolute has not been violated, rather as greater reality, the concept supports and gives meaning to the relativity of all parts.

Overtones can not be predicted by listening to one note. There is nothing in the form of the circle to predict that one fold will form ten parts in a tetrahedron pattern. Nothing in the equation of $3 \times 3 = 9$ suggests that nine sequential folds in the circle will form an enclosed regular tetrahedron. There is nothing to indicate that the tetrahedron opened is an octahedron pattern, and that four opened tetrahedra will form an icosahedron. There is no indication from these three individually formed polyhedron "solids" that they can be generated from the nine lines folded into the circle. There is exquisite sense to this self-reflecting

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interweaving of structural pattern. Buckminster Fuller's understanding of synergetics enlarged our sense-making through expanding understanding to a structural patterned, without-limits Whole. We have gained depth that stimulates excitement towards comprehensive, integrated learning. Our definition of *geometry*, "earth measure" limits our understanding of the process of *Wholemovement*, self-referential movement of the Whole. One is exclusive to the earth, measurement, and control. The other is inclusive to all movement including the earth, within spherical order, and principled to the Whole.

Expanding human experience is the richest possible learning. To go with less means we get less. Because of the diverse interest and individual ways of processing information among any group of students, to give less means fewer students will find points of connection. Not only will there be more students that won't understand, it depletes the overall human potential to even become interested. The richness of physical experience stimulates the mind to become active and observant, to make sense connections that sparks the creative spirit to imagine and discover new things, which changes the stimulus that re-charges the mind that re-sparks the spirit that keeps life moving. Human beings are a structurally patterned process with individualized personality for conscious sensing making and choosing towards the greater unknown.

The more comprehensive our approach the more inclusive and exciting learning becomes. It is the quality of our education and personal understanding of our relationship to the whole that directs the choices we make. It is the choices of our sense making mind that brings together the physical and the spiritual which reveals proportional formation of the unknown. That is the part we each play in creation. When we produce things that are not appropriate, without principle, and do not support the greater context, we create conflict and confusion that makes understanding difficult. That does not make sense, nor is it responsible to our part within this ongoing creation.

Comprehensive education needs to start at the primary grade level. Children naturally make sense of the unseen, the imaginative and spiritual nature of reality. To educate a child's mind to the truth of structural pattern will enable them to function in a healthier and a more balanced way. As they learned about the physical world their mind will develop as an integrate part of all three experiential levels. This will help them to avoid physical entrapments in the mind, and the trappings of various religious dogmas. To recognize beauty in the physical and the goodness of spirit liberates the mind to find greater truth in the expanding realities of the Whole of creation.

In what ever ways we can provide a rich learning experience for ourselves and our students we must first address this triangulation of human potential. Children play because it is fun to model what is in their minds and what they see. Physical play informs the mind that engages the sense of imagination. We all do this in various ways, but can only go as deep as the information allows. Unfortunately most of us have not been educated to go deep, and when we do, it is usually a narrow vertical hole rather than the inclusiveness of the Whole. We are conditioned to fear the unknown, a component in every mathematical equation. The unconditioned creative spirit in children freely seeks to understand the unknown. That expression needs to be supported with serious consideration to the ideas, formulas, toys, and the tools of direction that we create for children and ourselves. Unknowingly we set a trap for our minds by separating parts from any comprehensive context that might provide greater meaning. We can only advance understanding through individual experience and reflection in co-operative thinking and imagining about the largest ideas we can have.

There is worthwhile information available with specific suggestions to change classrooms towards richer environments. There is valuable discussion in some of the papers from the *Future in Mathematical Education Publications, 2002 and 2003*. These and other writings about rich leaning need to be considered in the largest possible context, enable to find what works best for us. This does not assure that it will also work for our students. But if it does not work for us, we know it will not work for them. By continued searching for better understanding of the principles that extend beyond what is mathematically important, we will be better able to engage our students providing what is necessary for them to develop greater mathematically awareness and skills.

Starting with limited information limits the students ability to connect and respond, leaving little room for interaction. The history of mathematics, as in all areas of human development, shows intuitive and creative interaction that directs the reasoning of the mind within the experiential, always evolving

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towards greater understanding. The evolution of the human mind seems to be towards greater integration of the creative spirit with the physical world. Only active minds are able to provide the balance necessary to appropriately act to assure continued sustainability of life patterned formations.

As often shown the Fibonacci series starts with two ones. This is not structural and is inconsistent to the non-duplicating, infinitely revealed series of numbers. This series has origin and starts with the Whole, the circle, and through one division becomes two parts which is a tri-unity. The two and first division of the Whole reveals the number three. From the three the two parts are brought forward catching up to reveal five. The five brings everything in the three to the present revealing eight, and so on. Previous number relationships are always present in the accumulating number to reveal what is emerging. Nothing is left behind; it is all embedded in the present becoming the future. This function shows the entirety of the extending past to be ever present in order to reveal the unknown. Similarly in the collective human experience there is no separation in the appearance of accumulation towards evolving what is greater. The origin is the Whole circle/sphere that is moving endlessly towards the unknown of what it is. Education is the constantly changing balance insuring continuation of this process. It is not easy, but it is always exciting and is continually revealing what is unexpected and cannot be anticipated.

The relationship of each part to the whole is what directs the interrelationships between parts. None of this can be determined by looking at the parts in separation. Rich learning uses many parts, but it is not about parts, it is about connections, process, and the evolution of forming structural pattern. Rich learning comes out of the experience that is reflected in the mind that moves the spirit to touch beyond its own reach. It is about revealing the invisible within what is visible, very much evident in the Fibonacci series.

The structural pattern base for geometry and mathematics is best understood through triangulation of the physical, the mental, and spiritual interaction.

These three aspects in concert have played an important part in the development of geometry and mathematics. This is rarely addressed when teaching mathematics, particularly in lower grades. There is long standing evidence of a spiritual interest in the physical world and a physical interest in the spiritual world. Again using the circle disk; one edge can not be seen completely and the two sides can not be seen together at one time. The symbol is easy, we imagine we see it all; draw one line on a surface plane. This is a linear flat way of thinking. This is not greater sense making in a three dimensional universe where the fourth dimension is interaction through movement. There are numerous circle configurations where parts of both sides can be seen together, but are difficult to differentiate unless marked in some way. It is important to mark the difference between the physical, mental, and spiritual, to see how they fold together in a totally synergetic universe. By not addressing the dynamics of inclusive life patterns in teaching geometry and mathematics we tend to disadvantage ourselves through misreading the abstracted understanding of somebody else's past and limited experience.

Geometry is a primary form used by the mind to observe movements between the physical and spiritual. Without spirit-guided intuition directing the mind towards generalized physical information mathematics could not have happened. Mathematics is not just a mental process. Focus often shifts creating mental paths littered with fragments and discarded ideas because of our conflicts about the physical and the spiritual. We draw pictures of circles because of the authority that comes with the compass. One beautiful, elegant line has become a static boundary where nothing moves, nothing is generated, and there is no life, only static construction by formulation. There is logic to call this symbol of the circle empty, zero, nothing, because it makes little sense.

Because of the physicality of geometry it is crucial for young minds to have hands-on experience. Without experience, math starts as an abstraction in the mind. Our experience does not count for the child's lack of experience. It is unfair and makes no sense when we ask a child to learn abstracted ideas without first having the experience. If we were more vigilant about giving children principled materials and more comprehensive information, with guidance, they would discover the basic functions of geometry and mathematics for themselves. They would find excitement in the process of discovering growing mathematical complexities from very simple activities that have not been experientially removed. They would make connections that can then grow into rich and meaningful ideas and concepts that would nurture life-long learning experiences.

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There is no form more comprehensive and more complete with information than the circle disk in space. The fundamentals to geometry and mathematics can be discovered by consistent proportional folding of the circle. This can not happen with folding squares because the square is a truncated circle with the circumference cut off in four places. The circle is no longer Whole, it is five pieces. We throw away four pieces leaving one square. This is easy math, but it is wasteful and without principle. The richness of potential has been discarded and the unity of the circle destroyed.

The straight line between two points on the circumference is called a cord, the rope used as an early construction device. We do not know what a line means until we fold the circle. With that experience we can represent the circle/line relationship with greater understanding. Folding a circle in half and talking about it is a far richer learning experience than reading about symbols, learning separated formulations, and memorizing descriptive words for mathematical functions. There is great value to seeing everything interconnected in the context of everything else, all in the same place. It is easy to keep track of everything and it makes greater sense. It is even possibly to then make connections to things we didn't know we knew. Going deeper into Wholeness will facilitate a rich and meaningful learning experience where the facts are secondary to the endless variables and shifting connections of multifunctional relationships between parts within the movement of a single, unified, boundless context.

The mind without the physical context is groundless, without the spiritual is directionless, and unable to transcend the physical. It takes all three to move from the experiential plane into a higher reality of understanding. While this may not be the current curriculum of local education, it certainly is in the evolving interest of the human mind and spirit towards elevating our understanding of purpose. The ongoing development of geometry and the achievements of abstracting information to higher orders of mathematical functions can only continue within the directives of structural pattern that is principled without exception to the greater realities of the Whole.

By providing principled materials, mindful activities, and support for individual creative spiritual initiative, students will begin to educate themselves. If we give attention to the beauty of our physical world, recognizing the truth and goodness of a greater reality, the classroom environment can then enhance rather than discourage. If the context is sufficiently large to individually and collectively engage the structural pattern of our being human, then we will have offered our students a Rich Learning Experience.

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