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ABSTRACT

As one of the major schools of thought in ancient China, Taoism centers on the concept of "Tao", the Way, which has two distinct characteristics: (1) Tao itself can be deemed as a final "reality" that is equivalent to the ontology of the Universe; and (2) Tao itself cannot be defined directly by human language. Taoism posits a holistically cosmological view on the universe as an organic Whole and illuminates that there is always a tendency to establish a dynamic balance within the Universe. Based on these characteristics and the belief that, to a certain degree, relationships exist between Taoism, modern science, and the contemporary environmental crisis, this paper attempts to render a number of implications for science education including: (1) providing a philosophical ground to loosen the tension resulting from current arguments on science education research in the postmodern era; (2) setting an alternative possibility for developing science curricula; and (3) serving as a practical ideology for self-reflection on science teaching. (Contains 22 references.) (Author/NB)

Taoism and Its Implications for Science Education

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Taoism and Its Implications for Science Education

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Abstract: As one of the major schools of thought in ancient China, Taoism centers on the concept of "*Tao*," the Way, which has two distinct characteristics: (1) *Tao* itself can be deemed as a final "reality" that is equivalent to the ontology of the Universe, (2) *Tao* itself cannot be defined directly by human language. Taoism posits a holistically cosmological view on the Universe as an organic Whole, and illuminates that there is always a tendency of establishing a dynamic balance within the Universe. Based on these characteristics and the belief that relationships exist between Taoism, modern science, and contemporary environmental crisis to a certain degree, the authors attempt to render a number of implications for science education including: (1) providing a philosophical ground to loose the tension resulting from current arguments on science education research in the postmodern era; (2) setting an alternative possibility for developing science curriculum; and (3) serving as a practical ideology for self-reflection on science teaching.

Recently, there has been a call for refining the direction of contemporary science education after past decades' worldwide endeavors. In order to move the science education community ahead to the twenty-first century, this call is very timely and important because it refreshes our thinking toward the issue in a reconstructive manner. This is demonstrated by the theme of the 1999 conference of the National Association for Research in Science Teaching (NARST): *Looking forward, looking backward: reflections on the future and past on science education.* Without any doubt, there will be many advocacies proposed by different scholars from all over the world for the improvement of future science education. Since many science educators today begin to emphasize the importance of multicultural science education, the authors perceive that it might be timely to present certain traditional Eastern thought for the consideration of the issue based on a different worldview.

The authors, being Chinese will employ our tradition, the thought of Taoism, to address the issue. In the paper, we shall describe the essence of Taoism in ancient China while seeking a compatibility between Taoism and modern science, propose a subtle relationship between Taoism, modern science, and contemporary environmental crisis, and finally try to render some implications for science education. Although this paper may involve a broad scope of topics related to science education, it should be emphasized that this paper does not try to answer all the questions that the authors raise. It is our hope that by presenting

alternative possibilities we would make some thought provoking contributions to the science education community as we head toward the next century through this tentative and preliminary endeavor.

Taoism

The classical period of philosophical thought in China, a general inquiry into the nature of humanity, the meaning of life, and their political sense for application, covers about three hundred years (550 to 250 B.C.). Originating in this period, Taoism soon becomes one of the major schools of thought in subsequent Chinese history. Classical Taoism is represented by *Tao Te Ching* of Lao Tzu (~ fourth century B.C., dates and person actually uncertain) as a founder, and *Chuang Tzu* of Chuang Tzu (middle of fourth~ beginning of third century B.C.) as a later continuer, who would be recognized as the best illuminator to clarify and broaden the advocacy of Lao Tzu's doctrines. According to historical evidences and strict inspection by scholars, Lao Tzu wrote concisely about five thousand sinographs or eighty-one chapters in *Tao Te Ching*, and Chuang Tzu himself only wrote the first seven Inner Chapters (1-7) in *Chunag Tzu*. Outer Chapters (8-22) and Miscellaneous Chapters (23-33) were written by later Taoists to reflect on Chuang Tzu's major ideas.

Since Taoism of Lao Tzu and Chuang Tzu has permanently influenced all subsequent Chinese history and philosophy, people in a broad sense might agree that all major schools of Chinese philosophy tend to be "Taoist" (e.g., Merton, 1969). On the other hand, two other important schools of thought—Confucianism and Buddhism, have also influenced Taoism to some degree in later ages, and vice versa. To facilitate simplification the authors in this paper only mention the scientifically philosophical insight of the "primordial" Taoism (Tao Chia) by the two Chinese sages without making a connection to other forms of Taoism such as the religious Taoism (Tao Chiao) which evolved in later China.

Moreover, since there are many English versions of modern translation to highlight the two classic texts, the authors have decided to present the two most prevalent versions written by Dim Cheuk Lau (1963) for *Tao Te Ching* and Burton Watson (1964) for *Chuang Tzu* as our modern translators. Where we have found a word or sentence quoted in our paper to have insufficient meaning, clarification can be found in the proceeding parenthetical auxiliary.

Tao

The gist of Taoism can be grasped by reviewing the concept of "*Tao*," the Way. In very general terms, the central pivot of *Tao* has two distinct characteristics manifesting the special metaphysics of Taoism as follows:

First, *Tao* itself can be deemed as a final "reality" that is equivalent to the ontology of

Universe. Ontologically speaking, Taoism would assume a final reality exists and this reality is named as "*Tao*."

Second, *Tao* itself can not be defined directly by human language. Epistemologically speaking, *Tao* in Taoism is transcendentally used to refer to the inexpressible ontology of the Universe. According to Lao Tzu:

> The way [*Tao*] that can be spoken of
> Is not the constant [external] way [*Tao*]." (*Tao Te Ching*, Chap. 1)

Also, shown in *Chuang Tzu*:

> If the Way [*Tao*] is made clear, it is not the Way [*Tao*]. If discriminations are put into words, they do not suffice. (*Chuang Tzu*, Inner Chap. 2)

Thus, each time language is used to describe the *Tao*, the essence of the *Tao* is lost.

The difficulty of using language to express the complex, ultimate reality *Tao* implies the limitation of human language. Realizing this difficulty, Lao Tzu attempted to present the closest concrete example by using the analogy of the natural phenomenon of water to manifest *Tao*'s properties. He expressed that water is most approximate to the *Tao* due to its most submissive quality, spontaneous accord to patterns of the *Tao* (the Way). Alternatively, Chuang Tzu used poetically-styled story telling in terms of dialectical-paradoxical metaphors to represent the essence of the *Tao*.

However, combining the two special characteristics of *Tao* into the philosophical system of Taoism, Taoists often hold a middle-way ideology to grasp as closely as possible the reality of Tao. Chuang Tzu well expressed this kind of ideology:

> As to what is beyond the Six Realms [heaven, earth, and the four directions-- the Universe], the sage admits it but does not theorize. As to what is within the Six Realms, he theorizes but does not debate. (*Chuang Tzu*, Inner Chap. 2)

Reflecting further upon Chuang Tzu's sophist writing style, we find that almost everywhere in Inner Chapter 2 Chuang Tzu humorously indicated the problem of using words and logical formulas to form a statement to argue with someone:

> Suppose you and I have had an argument. If you have beaten me instead of my beating you, then are you necessarily right and am I necessarily wrong? If I have beaten you instead of your beating me, then am I necessarily right and are you necessarily wrong? Is one of us right and the other wrong? Are both of us right or are both of us wrong? If you and I don't know the answer, then other people are bound to be even more in the dark. (*Chuang Tzu*, Inner Chap. 2)

Thus, for Taoists, it is acknowledged that an attempt to validate one's argument to *fully* grasp the reality of *Tao*, or even *part thereof*, is likely to result in the above situation inevitably, for we can never approach an objective knowledge of one statement that can serve

as a basis for our arguments and interpretations.

A way of scientific understanding about the Universe (Cosmos)

Generally speaking, the philosophy of Taoism in the texts of both *Tao Te Ching* and *Chunag Tzu* displays the *natural* cosmology that humans express a mystically intuitive, primordial scientific attitude toward the Universe (Cosmos) as an organic Whole (One). Both Lao Tzu and Chuang Tzu embrace this conception of Wholeness (Oneness), and posit a holistically cosmological worldview on the Universe to enjoy its intrinsic beauty. Lao Tzu indicated the presence of the all-pervasive Tao from the very beginning of the Universe:

> Of old, these [heaven, earth, all creatures...] came to be in possession of the One: ...(*Tao Te Ching*, Chap. 39)

And Chuang Tzu further expressed the following famous statement in Taoism to reflect this interconnected life-kin relationship among heaven, earth, and all creatures within the Universe:

> Heaven and earth were born at the same time I was [the Universe and I sustain a relation of co-existence], and the ten thousand things [all creatures] are one with me. (*Chuang Tzu*, Inner Chap. 2)

This kind of holistic thinking has been treated as the thought of "organicism" (Fang, 1980a, b, p. 30) or "organismic naturalism" (Needham, 1956, p. 302) in ancient China. From the viewpoint of modern physics, this organismic idea, although primitive, appears to be comparable to the big bang theory's advocates, where all substances and energy within the Universe have the same origin and are all interrelated. Such an organic worldview opposes a Newtonian mechanistic worldview by the attempt to hold any "rigid" separation from the Universe and to treat the Universe as an inertial material system like a machine (Fang, 1980a, b). This view has been acknowledged by early modern physicists, such as Werner Heisenberg and Niels Bohr in 1950s. Since Fritjof Capra's striking book *The Tao of Physics* first published in 1975, a clear parallel between this Eastern mysticism and the modern physics has been systematically analyzed. Both theories emphasize the unity of things by interrelating all inseparable parts within the Universe into a whole (Capra, 1991), and such a thinking process can be termed "systems thinking" (Capra, 1996).

To explicate the very beginning of this organic world, the word *Tao* in Taoism is used as a gerund, and it offers significant meaning on behalf of its power of dynamic creativity. The *Tao*'s dynamic creativity manifests itself as continuously creative processes among all beings, simply described by Lao Tzu:

> The way [*Tao*] begets one; one begets two; two begets three; three begets the myriad creatures. (*Tao Te Ching*, Chap. 42)

For better comprehension, Lao Tzu further borrowed from ancient Chinese ideas of the principles of *yin* (feminine, e.g., "sunless") and *yang* (masculine, e.g., "sunny") to illuminate the properties of the creative power:

> The myriad creatures carry on their backs the *yin* and embrace in their arms the *yang* and are the blending the generative forces of the two [taking the *chi*, flux of energy, in between as harmony]. (*Tao Te Ching*, Chap. 42)

These two opposite but complementary forces, yin and yang, are dynamically integrated as a whole within the Universe. Within the frame of the great *Tao*, these two forces as the pairs of opposites have to obey the cosmic rule of the identity of opposites all the time, similar to the classic idea proposed by ancient Greek Heraclitus in the sixth century B.C. Under the pervasive energy flow of the Universe, it is the dynamic interaction between these two mutual forces that forms all creatures and phenomena. Not only are all things in the state of energy flux, but also their transformation and change do not become static.

Moreover, relying on the dynamic function of *Tao*, there is always a tendency of establishing a dynamic balance within the Universe. In other words, if any "*dysfunctional*" phenomenon such as an extreme-sided, non-balanced event occurs, an inevitable opposing event to reestablish a dynamic balance will occur. Accordingly, Lao Tzu embedded this striking idea into his natural philosophy with the loud expression, "Turning back is how the way [*Tao*] moves..." (*Tao Te Ching*, Chap. 40). As a scientific naturalist, Lao Tzu always prudently observed natural phenomena in Nature and described:

> ... a gusty wind cannot last all morning, and a sudden downpour cannot last all day. (*Tao Te Ching*, Chap. 23)

> If you would have a thing shrink,
> You must first stretch it;
> If you would have a thing weakened,
> You must first strengthen it; .... (*Tao Te Ching*, Chap. 36)

Similar to the entropy concept in the second law of thermodynamics, Lao Tzu again murmured in a naively scientific manner:

> It is the way of heaven to take from what has in excess in order to make good what is deficient. The way of man is otherwise. It takes from those who are in want in order to offer this to those who already have more than enough. (*Tao Te Ching*, Chap. 77)

Although having no strongly based mathematics to develop concrete scientific knowledge into a theory during his time, Lao Tzu had already envisioned something inappropriate regarding humans' behaviors, thusly, warning:

> Knowledge of the constant [normal status] is known as discernment.
> Woe to him who wilfully innovates

> While ignorant of the constant [normal status], ... (*Tao Te Ching*, Chap. 16)
>
> That which goes against the way [*Tao*] will come to an early end. (*Tao Te Ching*, Chap. 30)

To avoid this reversion, Taoism presents the position of *wu wei* (nonegocentric and spontaneous actions) that the operation of the human world in Nature, ideally, should be continuous with that of the natural order (e.g., Tucker, 1993), instead of running the risk of standing in an abruptly discontinuous status caused by human presumptuous behaviors, which can be said to be in opposition to the external *Tao*.

Taoism, modern Science, and contemporary Environmental Crisis

Since Rene Descartes, Father of Modern Western Philosophy, claimed the legitimacy of separation of human body and mind, it is not uncommon to find that Modern Western Philosophy extends the idea of Cartesian dualism resulting in humans' alienation from Nature. Following Cartesian hierarchical, dualistic thought has resulted in humans being placed above and apart from Nature and not as being within and part of Nature. Put more simply, humans are *outsiders* alienated from Nature, not *withiners* residing as part of Nature. This then results in a situation of *vicious bifurcation* as described by Whitehead in his book *The Concept of Nature* (1964).

In contrast, Taoism holds a totally different view on Nature. According to Fang (1980b), it has generally been recognized in Chinese culture that Nature is the "infinite realm wherein the universal Flux of Life is revealing itself and fulfilling everything with its intrinsic worth" (p. 18). Following this meaning of Nature, Taoism of Lau Tzu and Chuang Tzu appear to assume respect for Nature. It is an aesthetic cosmology (e.g., Ames, 1986) that appreciates its intrinsic beauty underlying the sacred unity with all inseparable parts integrated into an organic whole. In this respectful sense, Taoism does not view Nature as simply having instrumental value, but rather views it from an intrinsic value model—wherein all things have a value in themselves, and are not valued simply for the purposes of human utilization and manipulation. Further, Nature evokes appreciative, emotional responses from humans positioned within and as part of Nature, rather than from an Archemedian point apart from and outside of Nature. All beings are *withiners* interwoven into and being part of a much greater interconnected living organism—Nature.

Since one is a *withiner* interrelating and integrating into a whole system, thus one can never "jump out" of the system independently to objectively describe any part of the system. Heisenberg has previously addressed this conception. Interestingly, this presents the premise of a circular reasoning dilemma. How can it be determined whether an event brought about

by abhorrent human behaviors can be considered to stand in opposition to the eternal *Tao,* when human beings are considered immanent in Nature as a whole? The authors argue confidently that humans may use science as an effective inquiry method to progressively understand the normal (*functional*) rhythms of Nature, and, to exist symbiotically within Nature rather than in opposition.

By using probability theory relying on mathematics as a thought experiment, for example, we may envision that many events in Nature obey the rule of the central limit theorem in a normal distribution, and we can detect that their probabilities of occurrence are extremely low near its two ends. Here at hand, scientists have already found an amount of natural events happening in the past earth history. The so-called *environmental crisis* may be attributed to changes occurring too quickly over too short time frames as opposed to *normally* occurring natural events. The imposition of unnatural time frames may result in the creation of ordinarily natural events occurring either too early or too late, equally in a *dysfunctional* manner. Thus, to maintain the normal functioning of cyclical natural events, it is imperative to maintain the recently quasi-stabilized dynamic balance in the past hundred thousand years of earth evolution history.

A Taoist holistic attitude along with science being holistically cosmological literate, would validate that the Universe and Nature are an indivisible whole and cannot be presumptuously severed either through a Newtonian mechanistic worldview, which invalidates the holistically systems-thinking ideology of "*the whole is greater than the sum of its all parts*," or through Cartesian dualism, resulting in humans' alienation from Nature. This raises the question of whether the contemporary environmental crisis introduced by aggregated human-made adverse effects on earth, especially since the Industrial Revolution could have been avoided by following a more systems oriented paradigm. In order to avoid the occurrence of possible severe *dysfunctional* events resulting in an *insolvable* environmental crisis, it is not so surprising that a modern Taoist-centered scientist would appreciate both ecology and earth sciences wherein the importance of the ecological principle of integrity in diversity to maximize sustainability on earth is recognized.

This meaningful idea from the correlation between holistic systems thinking and contemporary environmental crisis has recently been scientifically endorsed by both Gaia hypothesis (Lovelock, 1979) and Biophilia hypothesis (Kellert & Wilson, 1993). Although still in the developmental stage of a firm scientific theory, these two hypotheses collectively reveal that all lives on the sacred earth exist in a self-organizing way wherein all parts of a single organism spontaneously regulate themselves to maintain diversity for maximal stability in living systems. For life-enhancing continual survival, the authors argue that the

holistically scientific ideology of a systems view of Nature will be one of the most important conceptions laying a strong foundation for the next century's science education and for facilitating Capra's advocacy of cultural transition (1983) from a mechanistic worldview to an ecological worldview.

Implications for Science Education

As a way of knowing the Universe and Nature, Taoism and modern science seem to be compatible with each other to some degree. Therefore by infusing Taoism as a different cultural perspective on science into science education, science education community may be able to achieve the common goal of multicultural science education. Based on the Taoism's two philosophical characteristics of the *Tao*, its scientific merits, and a subtle correlation to contemporary environmental crisis solving, the authors render a number of possible implications for the improvement of future science education.

Taoism could loose the tension caused by current major arguments on science education research in postmodern era

Given that language has its own limitations according to Taoism, it is not possible to simply use language to describe the *Tao*, the reality, and nor does even use the logic based on the language as well. Any attempt to claim one statement for argument to grasp the reality is considered futile. It is not uncommon to find that one author in the paper of a specific academic field would be inclined to argue with someone to validate his/her arguments, but more often than not it could be a never-ending story, especially in contemporary postmodern era.

One typical example in science education research about the nature of science follows. In 1996, Osborne wrote a paper *Beyond Constructivism* (Osborne, 1996) to respond to the challenge from the advocacy of constructivism toward the nature of science. As science education scholars, we do acclaim that he defended gracefully and skillfully his ideas about regarding his position. However, since the author can not speak out against all possible forms of constructivism, the author's arguments were inevitably refuted by some constructivist scholars. Indeed, he just gave the readers several papers which are lacking a better complete spectrum to represent constructivists' advocacy, and therefore the author's analysis can not be satisfied by some constructivists (e.g., Staver, 1998).

More specifically, Taoism could provide a philosophical ground that helps to clarify ontological and epistemological issues about the nature of science. Taoism would guarantee an ultimate reality's existence, and also acknowledge the limitation of using human language to describe the reality. In our own philosophical judgements based on Taoism, the authors

believe that the tension of a "science war" caused by the legitimacy of science-related claims between (strong) realism and radical constructivism (a strong postmodernism sense) will be mitigated to a large degree. This kind of middle-way ideology toward the nature of science has been recently acknowledged by three philosophers of science. For better science teaching and learning, they suggested that a *natively* realist view is most appropriate for science education, and that the sense of strong social constructivism should be avoided (Eflin, Glennan, & Reisch, 1999).

In educational practice, we believe that a Taoist-centered science educator would recognize the merits of both realism and constructivism's advocacy toward philosophical debates in science education, instead of feeling confrontation toward his/her initial conflicting beliefs. When teaching the nature of science, the teacher through transferring his/her own learning experience to his/her students could also help them clarify their beliefs toward science learning.

Taoism might set an alternative possibility for the development of science curriculum

We are now living in the era of environmental crisis, and it has become increasingly important for humans to realize the necessity of living harmoniously with Nature. Therefore, science education must present learners opportunities by teaching them ecological processes and holistically cosmological literacy. However, as David Orr (1994) recently indicated, the environmental crisis is *of* education, but not *in* education. Based on Taoism's point of view, a *dysfunctional* ideology in science curriculum has taken place for a long while. In contemporary times, we still seem to have done better in dealing with issues on specific science curriculum design, but not the case of choosing the contents needed to implement as an interdisciplinary or, ideally, transdisciplinary curriculum. Although it may be currently more popular to specialize in a certain field of science, this form of study cannot be extrapolated to the real world where disciplines do not exist in isolation, but rather in a holistic synergism. We probably see the trees well, but not the forest and the inseparable relationship between them. Thus, a conventional science curriculum is probably sacrificing the chance for teachers and learners to realize the important holistic ideology eminent in systems thinking—*the whole is greater than the sum of its all parts*—toward the Universe.

Consequently, science curricula often ignore ecological processes and holistically cosmological literacy that could help learners to nurture systems thinking and acquire a better understanding of Nature's processes with the appreciation of its intrinsic beauty. Fortunately, several efforts have been proposed during the last decade in curriculum design. For example, there is a call for refining contemporary curricula with more holistic contents of

interdependence and ecological sustainability on earth proposed by Slattery's advocacy (1995) in his book of *Curriculum development in the postmodern era*. In addition, recently the Earth Systems Education (ESE) by using the whole earth systems as the central conceptual frame to integrate the science curriculum (see Mayer, 1995) should be highly regarded from a Taoist's viewpoint. It is an excellent exemplar in science curriculum design to amend the above uneasy-perceived problem that results in the lack of appreciation the essence of imperative Wholeness toward the earth integrity and its beauty.

Beyond its criticism on the majority of science curricula, Taoism's advocacy of its scientific attitude toward the Universe/Nature can be simplified and introduced into a science curriculum for science educators to teach students about ancient Taoist Chinese toward the nature of science through a historical viewpoint. As mentioned before, there are several scientific observations and interesting stories as the metaphor of scientific ideas shown in the texts of *Tao Te Ching* and *Chuang Tzu*. Science curriculum may include several live examples, such as water, wind, and force, from the Taoist classic, although naively in a modern scientific sense, to help teachers teach related science subjects for meaningful learning of their students. Also, if part of a science curriculum could be written by a story-telling style often seen in *Chuang Tzu*, it would motivate young learners to study science keeping with a larger sense of wonder. Rachel Carson through her combination of literary/scientific writing style brought new attention to global environmental issues and was responsible for shining the light on our problems, which exist still today. If non-Eastern science educators could do both, the authors believe that it will be an effective way to achieve the common goal of multicultural science education, through the input of this ancient Chinese history & philosophy of science under a special cultural context of teaching.

Taoism's advocacy may serve as a practical ideology for self-reflection on science teaching

In Taoism, the authors mention that if there is no yin (feminine), there is no yang (masculine), and vice versa; these two are co-existed and integrated as a whole (*Tao Te Ching*, Chap. 42). However, it should be noted that the feminine is deliberately glorified in many places in *Tao Te Ching* to overcome a *dysfunctional* ideology in his time of the contemporary China society. As Lao Tzu described the feminine quality of water, "The submissive and weak [yielding] will overcome the hard and strong" (*Tao Te Ching*, Chap. 36), he implies that things are not always won over at one side, the masculine. This intention has its merit for science education community in today's society. Moreover, we can find that a hermeneutic way to reflect the behavior and thinking of oneself can be found frequently in Taoism's classics, especially in Chuang Tzu's writing.

Combining these two modes of thought, when dealing with gender issues in science education, a science educator would then realize that it would be inappropriate to discriminate against students or to stereotype based on gender and, indeed would present a more balanced scientific viewpoint. Actually, he/she should know that female learners are not inferior to male learners, and the roles of both communities are equally important during the history of his/her science educational practice. From the Taoist viewpoint, the authors contend that the recent application of ecofeminism into school during science teaching (see Zell, 1998) is very promising. Not only does it emphasize a person's self ecological identity with the earth as a whole in order to appreciate its intrinsic beauty, but also this practical approach has paid special attention to gender issues in science education as shown by other forms of feminism's advocacy in the past decade.

Furthermore, when concerning equity issue in science education, it has once been argued that the minority such as black people has the superior chance to learn science compared to the majority such as white people, or vice verse. Form a Taoist viewpoint, both the minority and majority groups constitute a whole group; the dichotomy of the two groups is for people to conceive the whole group. For better exploration of the Taoist viewpoint, the authors would say, for example, the color black cannot be perceived without also the color white being perceived. In other words, if there is no existence of black color, there is no existence of white color; in fact, both colors are parts of COLOR. Such an artificial separation by humans is at best for convenience such as to do academic research, and should be used for non-prejudicial, harmless purposes.

Of most importance, the authors believe that the emphasis on the educator's personal self-reflection on science teaching can offer the practical opportunity of nurturing one's retrospective ability and introspective wisdom, possibly equal to the intrapersonal intelligence proposed by Gardner (1983). When each time a science educator has a deep reflection on the processes of his or her teaching practice to a certain science topic related to impending environmental crisis, he or she as a Taoist-centered educator would strive hard to contribute some beneficial teaching outcomes to help the fragile earth upon which all creatures live.

Conclusion

Although originating in Ancient China, Taoism through the authors' recapitulation in an emancipatory attitude seems to have a number of contemporary meanings for offering the reflective opportunity to improve today's and tomorrow's science education. It is a holistic way of scientific understanding about the Universe, similar to modern science, and always

reminds of us that there is a need of studying Nature's processes in order to live in harmony with Nature. Relying on its systems thinking ideology, Taoism would help the science education community in a synergistic manner to clarify their views on the nature of science, design an effective "green" science curriculum, and enhance their teaching effectiveness within a special cultural context.

The authors endeavor here to infuse Taoism into the science education community as a way of conducting multicultural science education, though it is still in its beginning stage. Our effort should be simply described by literally translating a Chinese saying "Throwing a brick draws a jade." For nurturing fruit, any Taoist-centered science educator must strive for ultimate cooperation with other science educators in the near future. To save the fragile earth upon which all creatures live, we contend that maturing the fruit is the ultimate goal of science education in the next century.

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