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Letter to my sister about Doll's 4 R's

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Abstract
This article applies William Doll's postmodern perspective on curriculum to the education of the author's 4-year-old niece. It is written as a letter to the child's mother (the author's sister) and thus offers an interpretation of the applicability of Doll's theory to education in the People's Republic of China. The article begins by introducing some key concepts in theorizing a postmodernist curriculum and draws attention to the differences between a modernist curriculum and a postmodernist curriculum. The article then examines Doll's 4R's (richness, recursion, relations, and rigor), with particular reference to their implications for Chinese education, and their patterns (in ambiguity, webbing and play) when understood as a whole. The article concludes with the author's reflections on how postmodernist curriculum theorizing has influenced her personal worldview.

Background information
Dongdong is my niece. She is 4 years old. She is studying in Shenzhen Lotus Kindergarten, where they are using Montessori's education methods and advocating Gardner's multiple intelligences. Dongdong's education is always a major topic of conversation between my sister and myself.

Letter to my sister

Dear Sister,

I have learned about postmodernism with Dr William Doll for two months. It is a very exciting learning process because my mind is opened wider and wider. Now it is time to share some thoughts with you. I hope it can trigger change in your mind, too. In the following letter, I will first explain some of my favorite concepts, and then introduce *a* postmodernist curriculum to you.

Difference
To talk about difference, I need to start with Piaget. According to Piaget, cognitive development follows an 'equilibrium-disequilibrium-reequilibration' model, which means that for mind to develop, a person who is in one stable status must be stimulated to enter into a status of disturbance, then come through it and arrive at a new stable status.

What stimulates this process? Difference does. Difference can be either a difference between two things or a change between a thing in time 1 and the same thing in time 2 (Bateson, 1979/2002). The news of difference or change is information for a living system. Our body needs difference to function. In the human mind, 'the interaction between parts of mind is triggered by difference' (p.89). Our sensory system also can operate only with changes. For example, if you happen to put your finger close to a fire, you'll draw your hand back from it immediately. It's the difference between the temperature of your finger and the one of the fire that stimulates your body to respond.

Not all difference is an important difference. For example, you might not taste sweetness if you add too little sugar in a glass of water. The difference is too slight to perceive. Then, there is no difference, for you. Everyone has a different threshold of difference. If the difference is too big, the organism might just refuse it. For instance, if you are asked to learn a chemistry course at graduate level now, you might find it is hard for you to understand because you lack the necessary chemistry knowledge. The difference between your prior knowledge and new knowledge is too much for you to accept. This understanding of difference has very important implications in education. In order to make learning possible, we need to make the difference between students' former knowledge and present information perceivable and acceptable for students. As such, the learning tasks we provide to students should be slightly higher than students' existing ability and can be finished by students with teachers' help. In other words, they should be within a student's zone of proximal development. In Chinese, these tasks are 'the peaches that you can pick by jumping'. As you reflect how you teach Dongdong to speak, you will understand how important it is to pay attention to the zone of proximal development.

On the other hand, information, the news of difference, 'consists of differences that make a difference' (Bateson, 1979/2002, p. 92). Different people might notice different differences in a piece of information. Not all differences in it are effective for an individual. Given a piece of cake and a sponge, you might notice that they have different densities whereas Dongdong finds that only one of them is edible. So, to teach, educators need to try to perceive difference from students' perspectives. That's why some early childhood educators advocate adults lower themselves occasionally and see from children's height. This will help them to better understand children's views. Next time, if you give something to her and she is not interested in it, try to think about whether the problem is in what you offer.

Differences bring us depth. Without differences, the world would be flat. Multiple visions of an object help us to view it more deeply. Reading two books by one author lets us understand the author better than reading one. Also, differences facilitate understanding. Using pictures and words to explain a phenomenon can assist people to understand faster than just using one. So, diversity should be celebrated. As you know, there is multiple intelligences education in Dongdong's kindergarten. But, this way of education is still rare in most elementary schools. Hence, it is you, as her mother, who needs to encourage her to learn and present in different ways, not just reading and writing.

Pattern

Pattern can be understood as regularity, nature, type and character. It can be personality, the calendar, regular office hours, and so on. Pattern is hierarchy: pattern can be a pattern of patterns. For example, I can say pigs are similar to chickens because they have a similar pattern. That is, 'Both of them have patterns.' From a lower level of pattern to a higher level of pattern, we need abstraction ability, which is exactly what education aims to help us to improve. For instance, first we learn to use number 8 to present 8 concrete items. Later, we begin to use X to present concrete numbers. Pattern is a key in apprehending the world. If we can see a pattern at a higher level, we can understand the world more and better.

Paying attention to pattern can liberate our mind from explicit cause-effect relationships and linear thinking. For instance, in China, people always view model classes as teachers' shows. They often just focus on the concrete ways of instruction. However, copying those methods is not guaranteed to succeed. For example, the concrete ways used in a model class in Beijing might not be effective in a classroom in Tibet, because school environments are different and students are too. The ways used by Beijing's teachers might be suitable for Beijing's children who feel more comfortable to learn from reading and writing than Tibetans since Beijing's children have more chances to be immersed in a literary environment. Sticking

to the concrete instructional approaches is linear cause-effect thinking, which can limit our minds. Actually, what we need to learn from a model class should be the pattern in it and we need to be more aware of its context. We should make our classes more locally fit.

Last time, you told me that you were too busy to teach Dongdong. I don't really think so. Education is not a thing that you need to spend special time doing in a particular place. What we need to think about is: What is education? What is knowledge? What are their patterns? There are many people who could not learn well in formal education who have succeeded by learning informally. Also, many famous people who were born into illiterate families succeeded, even though their parents had not the time or ability to teach them. One of the reasons is that these people, in their daily lives, acquired diligence and persistence, which helped them to achieve success later. There is not one particular way of doing what we call education, or of producing knowledge either. Learning can be anytime, anywhere and from anybody and anything. Approaches to learning and to forms of knowledge can be numerous. But, they all have a similar pattern – they help people to improve an ability to abstract and they cultivate a habit of thinking. A famous Chinese educator, Tao Xingzhi says: 'Life is education'. Education takes place in every day, or every minute of life. Education is a habit.

Levels of learning

Bateson's theory of levels of learning is a pattern of humans' and animals' mental development. Bateson believes that there are three levels of learning in humans and animals. Learning I is a kind of learning when you begin to know how to respond to something or to solve a specific problem. For example, you learn that you cannot touch fire. In Learning II, 'the subject discovers the nature of the context itself, that is he [sic] not only solves the problems that confront him, but becomes more skilled in solving problems in general' (Berman, 1981, p. 216). The person in Learning II begins to understand the pattern inside a class of problems. For instance, if you learn that you cannot touch not only fire, but also all objects with high temperatures, you are in Learning II. Learning III is hard to achieve. At this level, 'it is not a matter of one paradigm versus another, but an understanding of the nature of paradigm itself. Such changes involve a profound reorganization of personality – a change in form, not just content' (p. 217).

Here is an example of three levels of learning. You design an experiment to test whether mice can learn the routes of a maze. The hungry mice that can remember the routes to the food in the maze are in Learning I. They build connections between different points along the routes. But if they can realize, like you, as the person who designs the maze, that the map of the maze is a star, they will be in Learning II. Now, just imagine, the mice have figured out this pattern, and use it as a rule to test other mazes in other experiments. If the new mazes are different, they will fail to get the food. If, as many humans in Learning II do, they refuse to give up *this* pattern, they will get confused and finally be mad because of anomalie*s*. But, if they can realize that the design of mazes is actually decided by the researcher, and the whole matter is just an experiment, a game to play – that it is impossible for the mazes to have one stable pattern – then they jump into Learning III. They will begin to explore the maze and use the new map they develop to get the food. Once they fail, they will just *try to explore again* without confusion.

I think this status of Learning III is, in Chinese, *hua*, which means 'melt' and is highly valued in Buddhism. In Learning III, all patterns are melted into a whole pattern – all patterns are relatively valid. *The truth is that there is no truth*. The person at this stage will not persist with each individual pattern any more. As such, this person will not be limited to one pattern, one box. He or she will be more flexible to think outside the box and explore alternative patterns.

Systems thinking

To jump from a lower level of learning to a higher one, we need systems thinking. As a famous Chinese poem says: 'You cannot see the mountain, because you are in the mountain'. In order to see a pattern at higher level, we need to leave the parts and view all parts as a whole. According to systems thinking, the essential properties of a system 'arise from the interactions and relationships among the parts… they are destroyed when the system is dissected… the nature of the whole is always different from the mere sum of its parts' (Capra, 1996, p. 29). Systems thinking focuses on connectedness, relationships and context. While 'analytical thinking means taking something apart in order to understand it, systems thinking means putting it into the context of a larger whole' (p.30). The behaviour of the parts is decided by the whole. As such, to understand any object, we need to explore its environment or context at the same time.

Based on systems thinking, 'the world is no more a collection of isolated objects, but is a network of phenomena that are fundamentally interconnected and interdependent' (Capra, 1996, p. 7). A network is a basic form of life. As Capra says, whenever you see life, you see networks. In a network, the change in one single part might elicit dramatic change in the whole system. Also, whenever a part does anything to the web, it so does to itself. The same is said in a Chinese proverb: 'You will get kindness back if you are kind to people'. Systems thinking suggests that to understand a system we need to shift our attention from parts to relations and patterns. And humans need to cooperate with different members in one network, otherwise we ourselves will be destroyed.

Chaos

Thinking that chaos and order are coexisting in all living systems is an application of systems thinking. As Katherine Hayles (1990) writes:

> The fundamental assumption of chaos theory, by contrast [to the Newtonian paradigm] is that the individual unit does not matter. What does matter are recursive symmetries between different levels of the system…The regularities of the system emerge not from knowing about individual units but from understanding correspondence across scales (quoted in Doll, 1993, p. 91)

It is when we view all parts in a system as a whole over time that the order of the system can be seen. In education this implies that 'it is not the individual as an isolated entity which is important but the person within the communal, experiential, and environmental frame' (p. 92). There is an unseen pattern lying in students' operations in a number of different situations. To understand a student, we cannot separate the student from his or her background, history and context. Also, we need to observe the student over time.

In chaos lies not only invisible order but also the seeds of development. Chaos is indispensably needed for a living system to transform: 'In open systems, a great deal of dissipation *must be* developed if transformation is to take place' (Doll, 1993, p.104). In other words, equilibrium must be disturbed or shaken profoundly if chaos is to be reached. According to Stuart Kauffman's (1995) law of complexity, natural selection favours and sustains living systems 'at the edge of chaos'. In chaos are diversity and complexity. They make living systems alive. Both James Lovelock's Daisyworld model and Stuart Kauffman's example of minimum programs show us that diversity brings flexibility. The self-regulation of the Daisyworld 'becomes more and more stable as the model's complexity increases' (Capra, 1996, p. 110). In a minimum program, which is maximally compressed, 'any change in any symbol would be expected to cause catastrophic variation in the behaviour of the algorithm' (Kauffman, 1995, p. 154). These two examples imply that squeezing out redundancy in living systems can make them vulnerable. Living systems must be robust. In

addition, as Capra (1996) says: 'Creativity is the generation of diversity' (p.221). Diversity makes creativity possible.

How can living systems maintain chaos and order at the same time, and also be capable of transforming themselves towards novelty? Self-making and dissipative structures make this possible. According to Capra's (1996) key criteria of living systems, self-making is the pattern of organization in living systems. Living systems' 'order and behaviour are not imposed by the environment but are established by the system itself' (p. 167). By the recursive attribute, a living system affects and thereby makes itself. Whitehead (1929/1967) states in his philosophy of process: '*How* an actual entity *becomes* constitute *what* that actual entity *is*… Its "being" is constituted by its "becoming"' (quoted in Doll, 1993, p.142; emphasis in original). Living systems interact with the environment continually through exchanging energy and matter with it. Through this interaction, natural selection can play a role in the evolution of living systems. But such interaction can only trigger living systems to change. Living systems change by themselves. As you know, you can lead the horse to the river, but you cannot make it drink. Kauffman (1995) says that evolution is 'a marriage of spontaneous order and natural selection' (p. 304). Evolution is affected by natural selection and also self-making. The theory of self-making implies that transformation of students is a spontaneous result of the student's own self-organizations. School environments and teachers *cannot impose change* upon students but they can facilitate students' changes. As such, education should be co-constructed by students and teachers. Also, for transformation to happen, students' autonomy and recursion (the loop back of students' thoughts on their thoughts) are extremely necessary and important.

Dissipative structure is the structure of living systems. According to Ilya Prigogine, by dissipative structure, living systems 'continually maintain themselves in a state far from equilibrium' (quoted in Capra, 1996, p. 181), in which living systems can keep the same overall structures over long periods of time in spite of ongoing interactions with the environment. Because living systems are open to outside environments and have self-making abilities, they will gradually move further from equilibrium. Eventually they will reach a bifurcation point: 'a threshold of stability at which the dissipative structure may either *break down or break through* to one of several new states of order' (p. 191). At this point, the dissipative structure shows 'an extraordinary sensitivity to small fluctuations in its environment. A tiny random fluctuation… can induce the choice of path' (p. 191). This makes new forms of living systems possible. By the recursion and the openness of a living system, how it will change at a bifurcation point 'will depend on the system's history and on various external conditions and can never be predicted' (p. 183). Also, because of repeated feedback loops, minute difference in the dissipative structure will bring amplified difference later. This makes prediction of the pathways impossible, even when there are no bifurcations. In sum, the heart of the theory of dissipative structure is dissipative structures are sources of orderly creation, …[also] they are indeterminate' (Doll, 1993, p. 106).

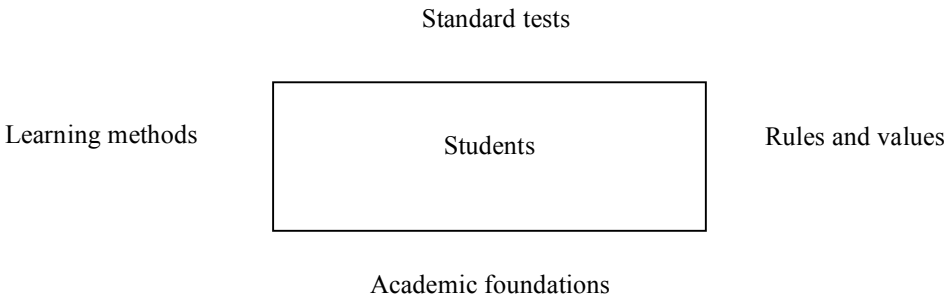
The theory of dissipative structures has very significant implications in changing peoples' worldviews. First, because small differences at the beginning can make huge differences later, we need to pay attention to the subtle differences in students' understandings of knowledge and ways of thinking or doing. Similarly, to assist students' development, we need to help them to change just slightly and gradually. Second, since living systems are unpredictable in the long-term, 'we must give up the pretence of long-term prediction' (Kauffman, 1995, p. 29). There is no absolute, guaranteed future out there waiting for us. As Capra (1997) suggests, we should change community design from one based on visible or existing structures, to one that incorporates present and emerging structures. In the educational context, educators should help to set a learning environment that honors and calls for

creativity and novelty. In sum, chaos theory indicates that diversity (or complexity) is the true status of life. In this seeming chaos lies invisible order and the seed of development.
With the understanding of difference, pattern, chaos, and systems thinking, we can begin to open our minds and change from modernism to postmodernism.

Postmodernism and modernism

Formed from Descartes' and Newton's modern science, and developed quickly through industrialism, modernism has already dominated modern peoples' minds. Modernists view the world as a stable one with objective truths. Science is truth and it can prove truth. Human beings will master all truths of the world one day. Modernism is dualistic. Everything has a diametrical other, like black and white, good and bad, true and false, and so on. People get used to selecting either-or: you can be either normal or abnormal, you cannot be both; you can choose right or wrong, you cannot choose both. In this framework, modern curriculum is like a box (see chart 1).

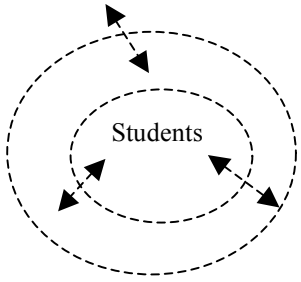
Chart 1: Modern curriculum



In a modern curriculum, students' learning goals and contents are pre-set by others outside the box. Learning methods are limited. 'Abnormal' approaches are not allowed. Rules and values are fixed by others and imposed on students. Students learn objective truth in the classroom, seriously, without heart. Students are limited in this box. They bump up and down, back and forth in it and cannot go outside the boundary. Thus they cannot grow into alternative forms other than boxes. Modern curriculum is a closed system. It is inert. It is time for change.

Postmodernism emerges from the development of human knowledge, especially after the birth of quantum theory and relativity theory. Stable objective truths and dualisms are challenged radically. As a new *pattern* of understanding of the world, postmodernists believe all truth is relative (to the historical situation). As Bateson (1979/2002) asserts, 'there is no objective experience' (p. 28). And 'science probes; it does not prove' (p. 27). Postmodernists view this world as changeable, diverse and connected. Postmodernists prefer *verb* instead of *noun* – everything is moving and changing. They always ask '*what [it] can be*' while modernists ask '*what [it] is*' (Doll, 1993, p. 163). Postmodernists say '*both*' and '*and*'. They ask for alternatives and relationships. Under such a framework, a postmodern curriculum is like many open circles (see chart 2).

Chart 2 Postmodern curriculum



In a postmodernist curriculum, students can move inside and outside freely. Boundary is flexible and movable. Diversity, multiple perspectives and intelligences are celebrated. Students dare and are free to explore alternatives, to inquire, to interpret. Educational goals are not pre-set and external to students, they emerge from the learning process and are called from within the students. Learning is co-constructed by students and teachers. Reflection and conversation are always ongoing. Local community is valued. To summarize: Post-modernist curriculum is a *verb*, a *movement*.

Next, I will introduce you to *a* (not the) postmodernist curriculum advocated by William Doll. Doll (1993) suggests the 4R's of Richness, Recursion, Relations, and Rigor to serve as criteria for a curriculum designed to foster a postmodernist view. In order to extend your mind, I will explain its application in general school education.

Richness

Doll (1993) writes that richness refers to 'a curriculum's depth, to its layers of meaning, to its multiple possibilities or interpretations' (p. 176). Offering to students only differences – multiple materials, selections, possibilities and even means of instructions or learning – is not rich enough. Richness focuses on quality instead of quantity. There are at least two patterns in this richness. First, as Whitehead (1929/1967) argues: 'Do not teach too many subjects… What you do teach, teach thoroughly… Let the main ideas which are introduced to a child's education be few and important' (p. 2). Richness is served for the aims of education – abstraction and a habit of thinking. As such, not only the richness we introduce to students should have patterns, but also it should be co-constructed by teachers and students, according to students' emerging abilities of abstraction in dealing with richness. For example, you are teaching Dongdong the differences between skirts and pants. Instead of telling you more of the differences she perceives between these two kinds of clothing, she tells you that grandpa doesn't wear skirts. You'd better follow her in this direction instead of presenting more clothes to her, because she is beginning to find a relationship between members of a class. Maybe you can ask her a question, such as 'Why doesn't grandpa wear skirts?' to guide her to explore the relationship between humans and clothing – a larger class than that of just types of clothing.

Second, richness needs to have the 'right amount' of indeterminacy, anomaly, inefficiency, chaos, disequilibrium, dissipation, lived experience' (Doll, 1993, p. 176). The questions we bring to students need to be 'real problems' for them. As such, richness is diversity or complexity, in which ambiguity is emphasized; alternatives and patterns are purposefully sought. To advocate diversity, educators can value multiple intelligences; cherish and celebrate individual differences; assess students by focusing on their personal progress instead of having them compete with others, etc. But all of these are less than enough. To make diversity possible, there are at least two more things we need to do.

Firstly, we should keep rules simple and flexible. Complexity can be generated from simple rules. Strict (and often complex) rules are set to make students or teachers follow each step without a subjective 'misunderstanding'. As such, these rules decrease ambiguity (and understanding). No thinking is required – one needs only to follow others' orders. Students educated in such a system may become dependent on these rules to act. Later on, they become unable to think. Therefore, creativity is impossible. From another point of view, strict and complex rules are often detailed in order to produce no waste and make education 'effective'. However, if there is no waste, then there is no redundancy and therefore no flexibility. Both rule systems and students relying on these systems are vulnerable. Thus we need to think about whether we are speeding up towards disaster or development.

Two examples may be useful here to extend an understanding of rule. One is that Japanese elementary teachers usually let new G1 students live in one classroom without any rules for

the first few months of schooling (Lewis, 1995). After a period of chaos, students often spontaneously ask for rules to organize their activities. As such, the classroom rules are local. They are fitted to students' needs and students have high autonomy. This example implies that self-emerging order is possible if educators have a high tolerance of chaos and give students suitable guides towards order. Another example is about a Chinese student who got his bachelor's degree in English and was eager to study computer science at the graduate level. By explaining to the professor he wanted to study with, that he understood the same patterns in English and in computer language, he was admitted into the program and finished it successfully. This example prompts me to think about the admission requirements of graduate programs. I wonder whether we can leave a door open for 'abnormal' students without 'suitable academic' or 'professional' backgrounds. Can we have an item such as 'Others' in the requirements list? For example, in education programs, I believe that as long as people have a passion for teaching *or* learning – the essential attributes that a good teacher must have – they should be included. (In fact, education is about teaching and learning.) At least, we should have ways to let 'strange' people in. Otherwise, by excluding people who are enthusiastic learners, we narrow down our possible creativity.

Secondly, we need to provide supportive environments for students. To be different, to be abnormal, students need to feel safe and supported; thereby they can be adventurous. As such, we need the kind of community advocated by Doll (2003), in which there is both care and critique. Teachers need to provide positive and constructive feedback to students; allow students to have enough time to reflect; never say 'no way' or 'impossible'; give more suggestions instead of judgements, and keep the dialogues going. Teachers also need to pay attention to students' zones of proximal development. Students in school environments, as living systems with dissipative structures, are sensible to teachers' comments and supports. As such, teachers should trigger students only slightly each time. If teachers show too high expectations of students, it might make them nervous and induce low confidence. The worst thing is that these expectations might act as severe perturbations and can effect a living system breakdown instead of a successful transformation.

So, good teachers should be good at play. They need to be changeable and adapt to students according to their differences. On the one hand, they are friendly. They always give you feedback and supports. And when they appear, they are just a little bit better than you in some areas and you can catch up with them. But when you think you have already made it, they will show you that you still can learn from them. On the other hand, they never let you know what their real expectations are in one period. They just guide you to set an appropriate goal within your zone of proximal development. If you succeed, they show you that you have already moved beyond their expectations. If you fail, they show you that they still believe in your ability. As such, they make you always feel confident. Unconsciously, you gradually improve your ability.

To sum up, richness is chaos, but it is the state of life. It is time for romance and play. Richness asks for patterns and diversity. Richness aims at helping students succeed in diverse and creative ways instead of in uniform ways. So, instead of pre-setting goals and directions for Dongdong, co-construct richness with her, so that her own direction can emerge and she can be unique and strong.

Recursion

Recursion refers to the 'human capacity of having thoughts loop back to themselves' (Doll, 1993, p. 177). The differences between one person's thoughts in a different time or between one person's thoughts and another's trigger the person's cognitive system to operate and thereby mental development is possible. Doll writes that 'such looping, thoughts on thoughts, distinguishes human consciousness; it is the way we make meaning… also the way one

produces a sense of self, through reflective interaction with the environment, with others, with a culture' (p. 177). Without recursion, living systems' self-making is impossible and systems will be dead.

Recursion is not simple repetition; it is reflective and its frame is open. It 'aims at developing competence – the ability to organize, combine, inquire, use something heuristically' (p. 178). Thus, to reflect is not just for better repetition of what has happened before, it is for creativity – to be able to do what has never been done before, to figure out patterns and to jump to a higher level of learning. Through reflection, by 'distanc[ing] oneself in some way from what one knows' (Bruner, 1986, quoted in Doll, p.177), we can understand the outside world and ourselves with depth.

'Recursive reflection' lies at the heart of a transformative curriculum (p. 178). As Dewey (1926/1964) says, education without reflection is 'really stupid' (quoted in Doll, 1993, p. 138). Doll points out that 'In a curriculum that honors, values, uses recursion, there is no fixed beginning or ending' (p. 178). In this frame, every assignment or test should be taken as a beginning of new exploration or a new chance to learn. Teachers can encourage students to respond to their comments on assignments, and then teachers can give more comments on students' comments, likewise back and forth, keeping dialogue and reflection going. Reflection takes time. Otherwise, there is no difference between thoughts or the difference is too slight to be perceived. Hence, educators need to rethink the value of silence. Reflection needs others. Through discussion with others, differences between thoughts of different people are revealed. Reflection becomes possible. Dewey, Bruner and Doll suggest that reflection should be private, public and communal. Postmodern classrooms are conferences 'where no one owns the truth and everyone has the right to be understood' (Kundera, 1986/1988, quoted in Doll, 1993, p. 151), where everyone can speak out, where conversations are kept on going and where 'the community of truth [which] advances our knowledge through conflict, not competition' (Palner, 1998, p. 103) can be shared and analyzed.

Recursion requires us to encourage students' reflection on history. The theory of dissipative structures tells us that a dissipative structure's future is related to its history (Capra, 1996). The present of human society is formed by its past. Without reflection on history, transformation of human culture and knowledge is impossible. On an individual level, history often is not useful immediately but it can have amplified influences in a person's mind later. Thus, we should emphasize history in education not omit it just because history appears outdated. History can be shared as stories. People always enjoy listening to stories as long as they can find relations between stories and their own lives. Hence, how to make students see connections between their lives and history stories is one key in teaching history. To do this, we can integrate history with other subjects. For example, when teaching science, we can tell some stories about the scientists and the social contexts, and encourage them to explore the historical influences on the science. Also, we can have students present their personal interpretations of history matters in different forms. No matter how we teach, we should emphasize seeking patterns in history instead of only memorizing and reciting isolated data. We should ask them to think '*Why* things happened' instead of '*What* happened'. By doing this, history can illuminate students' future.

You must still remember that I am the child in our family who has written the most letters of apology to our mum. Mum always asked me to self-reflect whenever I did anything wrong. Now, I have a high reflective ability. Similarly, Japanese kindergarten and elementary education fosters students' reflection abilities by having a reflective meeting at the end of every school day (Lewis, 1995). In the meeting, teachers invite students to discuss the major attainments and issues that happened in that day. This helps Japanese students to form a reflective ability. I believe reflection is also a habit that education can and should cultivate.

Relations

Relations refer to 'those within the curriculum – the matrix or network which gives it richness', and to those outside school, 'a large matrix within which the curriculum is embedded' (Doll, 1993, p. 179). Paying attention to relations, cross-disciplinary education that integrates different subjects in one program should be advocated. But relations in a postmodernist frame are much more than those between materials, contents, and subjects. According to systems thinking, relations include all those in different system levels within an education context. Here are four kinds of relations that educators should consider.

Firstly, we need to take students as a whole, having mental, emotional and biological properties. Instead of thinking of cognition as mental behaviour in the brain, we should take it as 'a phenomenon that expands throughout the organism, operating through an intricate chemical network of peptides that integrates our mental, emotional, and biological activities' (Capra, 1996, p. 285). This implies that we need to provide students with a rich, multisensory learning environment; also we need to have students engaging emotionally in learning activities. Chinese educators used to exclude emotion from schooling because many Chinese people believe that learning is always bitter. But all our thoughts, perceptions and bodily functions are colored by emotions. Without emotional satisfaction, students' motivation decreases and teachers' passion diminishes, too. Education should allow emotion to penetrate: teachers can show their personality and passion; students can enjoy learning. To improve students' enjoyment in classrooms, we need to pay attention to the physical environment of classrooms and the relations between all members in the classroom (including teachers). We can invite students to decorate classrooms, encourage students to bring something they like to share with others, provide rich choices to students or let them have self-selected learning contents or topics, advocate that students communicate with each other and with teachers more often and so on. By doing these, we make learning more flexible to match students' personal needs and interests.

Secondly, we need to encourage students to cooperate and learn from others. People need to realize that 'Independence is a political, not a scientific, term' (Margulis & Sagan, quoted in Capra, 1996, p. 296). Human society always is interdependent, especially when the world is becoming a global village. With the development of the Internet, more and more knowledge is distributed to people within the world. To survive and develop, all people need to respect and cooperate with others. To cultivate cooperative abilities, we can have students learn both from concord and from discordance. Japanese kindergarten teachers usually cut off the number of toys to make discordance occur (Lewis, 1995). They provide conditions to make conflicts happen and thereby students can learn how to deal with them. In contrast, some Chinese parents offer too many toys to their children. By excluding negative experiences, these children are vulnerable when they face unhappy experiences in reality later. So, to help students build strong adaptation and cooperation abilities, we should not purposefully exclude discordance in schools, families, and societies. The 'right amoun*t'* of appropriate negative experiences can help people become robust. Every quarrel and fight can be a valuable opportunity to teach students how to face and solve problems. Also, discussion and debate should be used more often in classrooms.

Thirdly, we need to connect curriculum with the local community and make curriculum 'locally fit'. As Doll (1993) says, a textbook should be seen as 'something to revise, not as something to follow. It is the base from which transformation occurs. Curriculum in a post-modern frame needs to be created (self-organized) by the classroom community, not by textbook authors' (p. 180). For example, when we teach English in Beijing, we can introduce students to the Great Wall. But when we teach English in Tibet, it might be better to introduce students to the Pudala. On the one hand, to combine the key ideas (patterns) in the textbooks with concrete local resources can make teachers, especially those teaching in poor villages, to

'have rice to cook'. On the other hand, it makes learning relevant to students' lives. Students should be encouraged to use what they learn to solve local problems. In addition, to make curriculum locally fit, besides textbooks, we need to reconsider our teaching methods and educational goals. One of my classmates, Joe, said: 'We need 100 successful students, not 100 successful engineers'. Education is to help students succeed in different ways not in a uniform way. We need to make our educational goals more locally achievable. A Chinese teacher, who teaches in a remote village, shares this point. He says: 'We don't need universities here. What we need are colleges where students can learn skills useful for our local community.' In terms of teaching methods, Doll even suggests that teachers burn their guidebooks for teaching in order to be creative. By connecting curriculum with the local context, we make learning useful and meaningful to students.

Fourthly, we need to be aware of the strong interdependent relation between each member in nature. On the one hand, we must realize that nature, with its dissipative structure, 'is unpredictable, sensitive to the surrounding world, influenced by small fluctuations' (Capra, 1996, p. 193). Any change we make to nature may affect the whole system dramatically sooner or later. So, we must watch our steps. On the other hand, nature is much more mysterious than what human beings can imagine. As Capra (1995) writes: 'Technologies like genetic engineering and a global communications network, which we consider to be advanced achievements of our modern civilization, have been used by the planetary web of bacteria for billions of years to regulate life on Earth' (p. 229).

If we annihilate other species in the world because of our ignorance and arrogance, we not only cut off our chances to learn from nature but also we might annihilate ourselves as well. Thus, we must respect and protect nature, and we need to cultivate and support students to do so. We can teach them how to plant, how to recycle; we can set classes in a natural environment and we can have students explore natural pollution problems. No matter how we teach, we need to notice that what we teach should be related to students' lives, so that they can use the knowledge to change the world little by little.

The above relations – with self, with others, with local community, and with nature – are just four examples of many different kinds of relations. The key in Doll's relations is that we not only need to pay attention to visible relations but also invisible ones and indirect ones, in which we need to take time to get feedback and response.

Rigor

Rigor in a postmodernist frame is different from precision. It draws on *interpretation* and *indeterminacy*. As Doll (1993) says, 'in dealing with indeterminacy, one can never be certain one "has it right"… One must continually be exploring, looking for new combinations, interpretations, patterns' (p. 182). On the one hand, since the world is always changing, it is impossible for humans to master all the truths of the world. No truth is absolutely stable. So, people need to *probe* instead of *prove* the truth. By throwing all ideas into various combinations (Whitehead, 1929/1967), by 'playing with concepts' (Dewey, 1933/1971, quoted in Doll, 1993, p. 182), by purposely looking for alternatives and relations, we can approach the truth. On the other hand, as the Santiago Theory of Cognition tells us, 'Cognition… is not a representation of an independently existing world, but rather a continual *bringing forth of a world* through the process of living' (Capra, 1995, p. 267). As such, no objective reality and absolute truth exists any more. Whether inner or outer, there is no pregiven and independent world. Whenever we look at the outside world, we see *a* world, not *the* world. Therefore, multiple interpretations and indeterminacy always exist for one matter. In this case, rigor is very necessary.

Doll (1993) writes: 'In dealing with interpretation rigorously, one needs to be aware all valuations depend on (often hidden) assumptions' (p. 183). Without consciously ferreting out

and knowing these assumptions, we cannot understand others appropriately. Therefore, we cannot keep the conversations with others going. As Nikals Luhmann points out, human society is a self-making network that is connected by communication and processes of communication:

> Social systems use communication as their particular mode of autopoietic reproduction. Their elements are communications that are … produced and reproduced by a network of communications and that cannot exist outside of such a network (quoted in Capra, 1995, p. 212).

Communication is the energy and matter that is desired to flow continually in the dissipative structures of both the whole society and each individual. Without communication, for an individual, cognitive transformation cannot happen; for the whole society, its pattern – a shared system of beliefs, cultures and values – a context of meanings is lost. Human society's knowledge, as a whole, cannot be developed either. In addition, according to Humberto Maturana, 'communication is a coordination of behaviour among living organisms through mutual structural coupling' (in Capra, 1995, p.287). Without communication, cooperation which asks for coordination of behaviour cannot happen. Therefore, we should keep communication going. To do so, we should listen actively with an open heart. We need to talk *with* not *to* people. Make more suggestions than judgments. We need to give time and freedom to let other people speak and flow so that we can see their patterns.

Although rigor in a postmodernist frame is different from precision, it doesn't omit precision. Rigor includes precision and romance. It emphasizes discipline and freedom at the same time. On the one hand, because the world is always changing, the exploration of the world will never end. We need to pursue precision – deeper understanding of the world by doing many tests and inquiries. On the other hand, we are free to use different approaches and means of exploration. We are free to play with the contents and combine ideas in different ways. In this way, learning is like cooking. We always can make new dishes by changing the ways of combining the same materials. With this freedom to play, if we make our dishes edible – make success achievable for students – precision and discipline can be fun.

As Doll (1993) writes, 'creativity occurs by the interaction of chaos and order, between unfettered imagination and disciplined skill' (p. 88). Rigor makes creativity possible. Moreover, since nobody owns the truth, rigor suggests that we respect others (including all creatures in the world), to be in awe of nature and to let others be free. Being an adult educated in a modern curriculum, you might have already forgotten how to play and how to listen with an open heart – so try to let Dongdong guide you. Let her teach you how we can play and listen.

Up till now, I have explained Doll's 4R's separately. But, Doll's 4R's are not separate parts. They integrate as *a whole*. If we use these 4R's as four new rules to measure our curriculum, then we totally lose Doll's points. Doll's perspective on curriculum is not a model but only one version of an interpretation. In Doll's classes, he always reminds us that this or that is just only one way, there are many other ways and we need to find them. He never wants to lead us into another model when we leave one model. What we need to learn from these 4R's is the pattern, which emerges when we look at them as a whole. Next, I will present the pattern I see in these 4R's.

I believe any postmodern curriculum should facilitate three fundamental changes in people's minds. The first one is the perception of ambiguity. People must understand that ambiguity is the natural state of life and precision is artificial. Like science, it is just a limited window of the world and it never can be objective. It cannot prove, only probe. Also, since nature is unpredictable and is co-evolved with human beings, it is impossible for humans to master all knowledge of nature and control the whole world. Science is not almighty. We

need to help students get used to ambiguity and indeterminacy instead of only strict precision and determinacy. In order to do so, we might teach non-linear mathematics and philosophy in students' younger ages – for example, while they are in high school; while teaching science, we could emphasize the assumptions underlying theories and encourage students to challenge them. We can provide more open questions and have more discussions and debates in classrooms; or to use Dr. Doll's way, we can have them challenge each other by using self-designed problems. In a word, the ways to introduce ambiguity are infinite; the pattern inside them is to encourage students to look for alternatives. For young children, arts, especially Chinese painting, can be a good way to invite them to celebrate ambiguity.

The second change is that we need to view this world as a *web* instead of only *layers*. A hierarchical scheme is a 'human projection' (Capra, 1996, p. 35). In nature, there is no hierarchy (Capra, 1996). Viewing the world as layers, we look for the top one, the fittest. We compete. Also, if the layers are not direct neighbours, they cannot communicate with each other. Viewing the world as a web, we look at everyone in the world as an equal member. Everyone can communicate with each other. This will help students to realize that a human being is only a member of the world instead of a master of it. We need to cooperate with other members in the world with respect instead of oppression and exploitation. To help students to form a web-view, teachers can present contents in the form of webs instead of layers or hierarchical structures and have students sort them out in layers by themselves. We can have students sit in circles instead of in rows more often; always have leadership rotate in groups; student-led discussions and conferences can be held on a regular basis to share community knowledge.

The third change is the understanding of play. Like the mice in the psychology experiments, we are in a play. All concepts and objects are brought forth through our cognitive play. 'Existential human suffering arises, in the Buddhist view, when we cling to fixed forms and categories created by the mind instead of accepting the impermanent and transitory nature of all things' (Capra, 1996, p. 294). By realizing this – by jumping to learning III – we should *play* with this play – play with categories, play with concepts. Moreover, play is a natural need of life. All lives tend to create novelty. And play is a behaviour that pushes boundaries, an attempt to run away from order. This gives organisms the possibility to transform to a new order, to create novelty. Hence, *to play is to live*.

One way to play is to change metaphors. History has shown us that it can induce tremendous changes in humans' worldviews. For example, by comparing the world with a machine, we think in a modern way – humans are the masters of the world. In contrast, by comparing the world to a living system, we think in postmodern way – humans exist interdependently with the whole world. Hence, changing metaphors, playing with concepts, can liberate people's imaginations from invisible boundaries, thereby we can be creative. As such, we Chinese need to rethink our metaphors about teachers and students. We used to compare teachers to candles or gardeners and compare students to sponges or flowers. These metaphors confine people's imaginations about curriculum in a modernist way. To foster a postmodernist curriculum, we must first change these metaphors.

To play, we need to make science funny and friendly. I have attended a chemistry professor's show at the University of Victoria. In the performance, he presented chemistry reactions as magic shows. He even demonstrated the Belousov-Zhabatinski reaction, one of Prigogine's favorite examples of a far-from-equilibrium situation. The professor also mentioned that it was his teacher who showed him chemistry as magic that made him become interested in chemistry. From this we see that educators can integrate science with arts and make science funny and interesting. Also, can our teachers tell students some jokes or stories about the scientists when they are teaching science? I will say, why not? Chinese too often make scientists as perfect apotheoses instead of true human beings. As such, they are not

approachable because they are far away from students' lives and students will lack motivation to learn from them. If my teacher told me that Pascal developed the theory of probability because he was interested in gambling, probability would be more interesting for me because the scientific, the serious and boring theory becomes lively and friendly.

In sum, if people can have these three changes in their minds – if we can get used to ambiguity, webbing, and play – not only can we have a curriculum that facilitates creativity and wisdom, we can also have dreams and spirits again and we can talk with rocks.

Now, my dear sister, I really want to tell you how personally meaningful it is to learn from Dr. Doll's courses. Firstly, in dealing with people, I used to be confused about how I should treat them, because I was very much concerned with how they would treat me in return. Now, I understand that whatever I do to others, I do to the web and as such I do to myself. As Naess recognizes, 'Care flows naturally if the "self" is widened and deepened so that protection of free Nature is felt and conceived as protection of ourselves' (quoted in Capra, 1996, p. 12). Similarly, the category of 'self' can be extended to the whole human web. As Doll says, when he is counseling others, he is counseling himself. So, I no longer need to be concerned too much about people's feedback to me. By caring for others, I care for myself.

Secondly, I used to think of myself as a person without strict boundaries and principles. I easily change my opinions and I often change myself in order to cooperate with others. I dislike precision and I talk too much. I used to dislike myself a lot because of these characteristics. Thinking of myself as a person without a strong mind and beliefs and being dissatisfied with the fast changing world, I went to Tibet to pursue a strong spiritual power, something that could be trusted, believed in and could support me forever, but I could not find it. Now, I find that I can be comfortable with change, ambiguity, and indeterminacy and I am comfortable with who I am – I can be good at play. What I need to remember is that I should leave my heart open all the time: to make more suggestions instead of judgments; to keep being aware of people's assumptions behind their words and behaviour and to keep on inquiring; to believe there are more alternatives existing.

Thirdly, I used to be very frustrated with social reality because I didn't think a single person could change this society. Now, by understanding dissipative structures and the web of life, I begin to understand that everyone is making the world change, no matter if it is voluntary or not. Each person's words and behaviours will have amplified influence in the world. And also, it is wise that we make change a little bit each time instead of asking for rapid transformation. As Doll says, we need to push the boundary slightly and gradually. Yes, I can change the world and I am changing the world. My dreams will come true.

You have asked me 'What do people live for?' This is the question I have asked myself for so many years. Now, I think I find a good answer: We don't live for one life-long commitment; we live for different goals in different periods in our lives. I am not suggesting that we can always linger in the romance stage and that we don't need concentration and goals. We must have goals and persist in them over time; otherwise we will accomplish nothing. What I am arguing against is the idea that we must select *a* life-long goal, like a career, a study major and so on, otherwise we cannot set off. This task is so serious that we don't dare to try. We are scared that we might not survive if we select a wrong direction. But, this task is impossible to finish, because we are asking ourselves to *decide the* direction rather than to *select a* direction.

Looking for one life-long goal is a modernist way of thinking. People are scared of change; they desire a stable and life-long thing to trust, to let them feel safe. However, with the development of science and technology, 10 years in this era can be equal to 50 years in the 1800s. So, contemporary people may live lives many times longer than the people in older times did. The world changes so fast, how can we pre-set a goal for an unpredictable future?

As such, selecting one short-term (like 10 or 20 years) goal and working hard on it is much better than to keep struggling with selection. Leaving life open to different possibilities is what postmodernism teaches me. You feel concerned that you will lose your style? Fear the chaos that you might need to face? Don't worry. There is a pattern in the chaos of your life. Bateson is a 'mess'. He was a biologist, anthropologist, pathologist, and epistemologist. But, he is great and unique. His style or pattern is invisible until the end of his life: he always seeks a higher abstraction of the whole world. Understand and worship chaos, no matter how you change, you will live with your own pattern, I believe.

One of my friends said that philosophy is to put nonsense together and make you feel reasonable. I should say the key is who puts it together – who makes the pattern appear? Well, I think that's enough for now. I am looking forward to your reply soon.

Lixin

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