Technology and the Celebration of Work as Developed in Waldorf Education

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[Editor's comment: This article was first published in the *Waldorf Journal Project #19,* April 2012. David Mitchell, the late co-director of the Research Institute, was both prescient in anticipating the challenges that technology would increasingly present and articulate in describing the countermeasures that Waldorf education offers.]

We live today in an exciting, fast moving, and astonishing world! Rockets have lifted men and women across 230,400 miles of emptiness to explore the desolate, crater-pocked landscape of the moon. Machines have been designed that allow us an unprecedented ease of living. Time is like a snowflake in our hand: It disappears while we are deciding what to do with it. Our work week is shorter than ever before in history, and we find ourselves with large amounts of leisure time. This allows us more time to confront ourselves! It also presents us with interesting problems! How do we fill this time? What is the relationship between our thinking and our will life? Can we use our thinking creatively? Are we self-stimulating and able to continually educate ourselves? In this article I would like to explore the relationship between creative thinking and the ability to "do" work within the realms of technology and education.

Today's students need to be made aware of the importance of cultivating different thinking styles at a time when mankind's left brain activity is promised a rest. Neurocomputers, designed to imitate the structure and functioning of the human brain, are being developed to take over everything mundane and repetitive. Already we have computers that can speak, follow voice instructions, manipulate immense lists of facts, make music, and perform robotic tasks—all more error-free than humans.

At the same time we are exposed to telecommunications that connect us almost instantaneously with events as they unfold around the globe. Time and space have become compressed, human potential has been expanded, and the world meets us in our living room! We are both informed and comforted. My house has a heating system that is controlled by a miniature computer thermostat. I program it and, as the advertisement contends, I won't have to worry about being too hot or too cold ever again! We owe this all to technology.

We in the West are witnesses to the fact that, in a single generation, technology has changed our way of life. Yet, how many of us really understand this technology? More importantly, what is our responsibility as educators to bring technology in the correct way into our curriculum? How are we encouraging inventiveness and fostering a love for work in our students?

No one can deny that life has become easier on the physical plane as a result of technological innovation. Some regard technology as the universal benefactor, the distributor of science's bounty, successful in almost every undertaking to which it has turned its hand. However, a shadow side exists, which has become more and more apparent in recent years. The byproducts of technology have spread pollution on such a scale that scientists warn of an impending danger to all life on earth. It is a paradox that the more time we have for ourselves, the more mechanized our civilization, the more hectic and stress-filled our lives have become, as well. We find that we need the extra hours we save each work week merely

to rejuvenate ourselves physically and mentally. How does education help us to deal with this?

A task of education must be to aim technology in the direction of the long-term well-being of humanity. To do this one must develop a curriculum to discuss the above questions, recognize one's motivations, and be able to exercise moral judgment.

During recent years there has been much soul searching with regard to the aims and direction of modern education. The ancient Greek civilization knew its educational aims. The foundation for all learning was wonder—otherwise there could be no impulse to explore. In the early years of a child's education, poetry, music, and movement were developed so that in more mature years there would be an understanding for mathematics and philosophy. To guide the social life, the religious leaders gave moral instruction through the great dramas written by Euripides, Aeschylus, and Sophocles.

In the 17th century when the modern scientific outlook was born, education took a new direction. Descartes gave the Western world *defined thinking*. He said that "consciousness is attributed exclusively to the brain and nervous system."

In the 20th century, educator and philosopher Rudolf Steiner said that if a person reflects upon the powers of his mind or soul, he will soon discover that he has the capacity of expressing himself in three different soul worlds—thinking, feeling, and willing. We can experience many different kinds of thinking, from pure logical thought to the rich, imaginative pictures of new ideas. The realm of feeling can be experienced as cultural appreciation or as spiritual experience of ecstasy or devotion. The will life exists from instinctive impulses to conscious, deliberate acts. An educational task is to lead the will from the control of the feeling into the control of the thinking.

All education starts with the teacher's inspiring interest in the feeling life of the students. It then goes on to the activity of the limbs, and, lastly, the thinking is stirred. Thinking is objective, conscious, analytical. Feelings are subjective, personal, colorful, and less conscious. The life of the will is very subjective, individual, and the most unconscious. Wisdom is acquired by a process of reflection made possible by a short pause in will activity. Waldorf education strives to educate and harmonize these three realms, but it is in the realms of thinking and willing that we find the seeds of technology. It is man's thinking and inventiveness that has brought about technological innovation. Curiosity, playfulness, and imagination are qualities that should be encouraged in education if we wish to perpetuate technological growth.

> The process of technological innovation depends on intellectual spirit—on the willingness to face change, to take risks. It requires creativity, analytical skill, and an independence of mind.
>
> – Frank Newman

Schools Need to Help Cultivate a Love for Work

At the beginning of this century, most students came from a rural, working environment. Their father was a farmer or a laborer. The purpose of going to school was to learn to think. At home they were occupied by activities which exercised their will and made them feel useful. They learned to "do" things out of necessity.

Today, most students come from an urban setting and their parents leave home to go to 'work.' The activity of the parents' work is invisible to the child, and the direct results are not always experienced or appreciated by the family. Life and work have become abstractly separated.

At the same time the media is omnipresent and fills us chockablock full with information. Today, a type of pseudo-thinking is learned outside of school. We are fed lots of information, but information is not education. Information

does not properly exercise the will, nor is it satisfying for the soul!

The heads of many youth are filled with trivia; they have lost contact with real work. This task of learning about "work" has been passed over to the school. Today's students need to be taught to use their capacities, to apply their thinking in such a manner that they are able to do something with it. They are desperately in need of developing practical skills and building up their self-confidence and independence.

Waldorf Education

Thought activity is cultivated through an approach to the subject by which the phenomena are studied and evaluated before conclusions and theories are drawn. This process leaves the student free to develop and exercise the capacity for judgment and discrimination. Work in algebra, Euclidean geometry, and bookbinding strengthens the logical thinking, while projective geometry and experiencing the history of mankind stimulate imaginative pictorial thinking.

How the teacher phrases the questions that put the student's mind into activity is all important. He or she must train the student to look at situations from various points of view and become able to use synthetic and analytic approaches to problems.

Thinking is not, however, the only part of an individual to consider in education. Adolescents often arrive at their high school asking the following questions: What really matters? What is the point of it all? Who am I? To deal with these questions, the teacher must penetrate beneath the surface of the subject. The students must be stirred—their enthusiasm must be kindled. They must care for what they are doing and desire to do their best at it. Waldorf education strives to educate the feeling life as well as the thinking. The tools they use are drama, painting, cultural activities, music, sculpture, art, and the time the teacher gives to the students to express themselves.

Once the student has been connected to the subject through his feeling for it and awakened in his thought life, then the knowledge can flow into his will, into his active deeds. A Chinese proverb states the following:

When I hear, I forget.
When I see, I remember.
When I do, I understand.

In Waldorf education the education of the will is an equally important part of the threefold approach to education. In the academic area, the students are asked to write their own main lesson books and create their own projects. In the practical realm, we offer courses in house building, stone carving, pottery, blacksmithing, and other crafts.

Idealism is kept alive by the curriculum where all the subjects are centered around the human being. In the main lessons on art history, literature, poetry, music, and architecture, the evolution of mankind is traced from ancient times through the Medieval and the Renaissance up to the Modem Age. A life philosophy is evolved in which science, art, and religion are not artificially separated; the qualitative as well as the quantitative is cultivated. When the students study the computer, they should also be able to learn something about themselves!

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Steiner identified two great obstacles that face adolescents, and he offered suggestions as to how a curriculum could be formulated to assist the youth in meeting them. The first is "sexual lust," which can be met in them by keeping them busy with meaningful tasks, by encouraging them to strive for beauty, and by keeping their

hands busy with such Waldorf school subjects as handwork, jewelry making, blacksmithing, stone sculpture, woodcarving, and joinery.

The second danger is the "lust for power." To keep them from falling victim to this, the teachers must inspire the teenagers' thinking. They must bring great ideas to them and moral thoughts. They must keep the intellect moving and help them develop altruism. They have the task of helping the students come out of their self-centeredness and of guiding them to help others through service-motivated activities, such as cleaning trash from a road, clearing a forest path, helping at a home for the elderly, or working on a farm.

To be absorbed in creative activity is the real fun of life. This process creates rather than depletes energy. One can feel relaxed, in control, at peace, and in harmony.

The puberty experience is one of death—the child dies, the adolescent is born. One of the most powerful agents in overcoming these death forces is to allow the children to model and carve, to transform material enlivened by the forming power of their own human spirit. In carving and modeling the children can find an excellent outlet for their creative energies. It is difficult, if not impossible, to be absorbed in pursuing a meaningful goal and to be depressed at the same time.

The crafts program of the Waldorf school is an example of how this takes place. Both arts and crafts work as a preliminary stage of technical education and are considered indispensable if the pupils are to engage with social competence in the work processes of a technical culture.

The Case for Crafts

Mythology is full of stories connecting weaving and knot-tying with wisdom. A few examples are the puzzle of the Gordian knot, which Alexander the Great solved, and the thread trailed out by Theseus in the Labyrinth on Crete, with its mysterious thousand paths. The string and cleverness allowed Theseus to defeat the Minotaur. Athena, called the Inspirer of all Arts and Crafts, was born out of the head of Zeus and ruled over the world of thoughts. It is the crafts that teach the students to meet and overcome problems. They become engaged in an activity that on the one hand focuses them, and on the other hand can lead them through the eye of the needle whereby they become transformed by the process.

Practical activity builds confidence in the students. The students need to experience that work is wonderful, that work can be a joy. Confidence is the key to academic success. By engaging in practical tasks the students "learn how to learn." The more interests and skills we can develop in our students, the more fully they will participate in life.

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There are stages for each activity. First the student must think or imagine the task, then he must prepare, research, and experiment. This is followed by a very important incubation period during which the idea is allowed to rest so that new directions may emerge. Finally the task is begun, completed, and reflected upon. Lastly, any modifications that need to be made are done. These stages exercise both the thinking and the will life.

Examples from the Waldorf Curriculum

Education of the human being is meant to be a lifelong learning process, especially in the vocational field, rather than a cumulative addition of pre-determined knowledge and skills. When we take the ability to learn and combine it with self-confidence and optimism, we have the capacity for lifelong learning. How admired are

those individuals who are able to learn something new up to the day of their death!

In the classroom we recognize three groups of students. There are those who make things happen. Then there are those who watch things happen, and finally there are those who wonder what happened! Those students who are strengthened in their will activity are usually the ones who make things happen. They are confident in themselves and not overly concerned about making a mistake. We must teach our students how to adapt the mistakes they make, rather than start over again. The students must not be overly concerned with making mistakes because fear of mistakes will cripple their progress. The only way to avoid mistakes is to avoid action. This is not something we want to encourage. What we want is courage and confidence, and this has been observed in students who have mastered practical activities.

The teacher's proper attention to detail in practical skills during the elementary school years can metamorphose into intellectual dexterity in the teenage years. In the early years in a Waldorf school, work is developed as an outgrowth of play. In these primary years the teacher sets the foundation for the high school. The student should leave the middle school with a craving to know, an insatiable curiosity about everything that goes on around him, such that he can convert this curiosity and craving for knowledge into still further knowledge.

In grades 7 and 8, the students work with wood, metal, stone, and fabric. The woodworking includes carving convex and concave objects such as bowls and spoons, each of which has been designed with functionality in mind. They also meet stone carving, in a material such as soapstone which they craft into animals of their own design. Careful observation is developed as the children chisel, rasp, and sand toward completion. In craft work the key to development is learning to be patient. Students are asked to remember that the chick arrives by hatching the egg, not by breaking it open with a hammer.

Woodworking is taught from grades 4–12 and demands the perception of the unique characteristics of each piece of wood as the different quality, texture, color, and density are examined. Measuring, cutting dovetails, and fitting joints merges with carving, rasping, and sawing wood. In carving a piece of twisted elm, one learns to find form hidden within the grain and thus allow it to emerge out of the wood. Each wood requires a different blade or gouge stroke. Each wood reveals to the carver its fast or slow growth, its moisture or dryness, calling for varying degrees of accuracy and finish techniques.

Copper work in grades 7–9 initiates the pupils into working with metal. In woodworking the students have a close connection with the source of the material they are fashioning—the tree. However, copper is a product of a technical process that is most likely unknown to them. Transforming a flat piece of sheet copper into a vessel, by series after series of carefully-aimed hammer blows while shifting it spirally across the form, must be a slow, flowing process or else the material will become too thin. The soft, red glow of the copper may warm them but they can immediately feel its hardness and rigidity. The noise of the hammer striking it in a hardwood mold is sharp and assaults the ears; the odor of the hot, annealing metal irritates the nose. The senses are fully engaged.

Their first task is to smooth the edges with a file; then it is textured with light hammer strokes spiraling out from the center on a hard steel form. Only through rhythmical beating does it soften and conform to the craftsman's intended shape. Then after continuous pounding it becomes hard and brittle and needs to be softened again by fining, followed by quenching in water, whereby it abruptly changes color. Then the hammering continues until a small bowl is created.

Finally it is buffed and polished to a high luster. The technique is repeated in more complicated ways in the upper grades for jars and vases and ladles. The students learn that rhythm

saves strength. Ten days of hammering is needed to make a vase. For twenty hours each stroke must be identical to the one before it in order to produce a beautiful form. Stamina is developed. Working with copper develops a feeling for form and space as well as rhythmical mobility.

In the pottery shop the students dig their hands into a tub of moist, brown clay. It is cool, heavy, and malleable. Slowly they exert pressure from the outside and it is turned into a sphere. They press their thumbs into one side and press a hole in it and turn it so that the walls are proportional. A vessel has appeared—and this was a lot easier than with copper! The selection of glazes and firing techniques is an exploration of chemistry. There is a lot of room for trial and error, for experimentation.

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Blacksmithing in grades 8–12 develops character as well as manual skill. Respect for the power of red-hot metal comes quickly to the aspiring blacksmith, and there is no time for timidity because the metal has to be worked with spontaneity and focus. Life today is also fast-paced and demands immediacy. The worker must use his strength energetically, even explosively! There is no room for hesitation, because once the metal cools, it loses its plasticity. The time is very short. The look on a student's face when she transforms a ¾"-square stock into a multiple twist pattern with relative ease is a sight to behold. Confidence is developed. The forge trains powers of decision. The blacksmith learns the fundamentals of the craft: keeping the forge fire burning, not allowing an oxidizing flame, handling the tools in a proper fashion, and developing an understanding for the laws of metallurgy.

In a Waldorf high school you may also find other practical courses such as house building, carving, spinning, dying, bookbinding, sewing with both treadle and electric machines, locksmithing, papermaking, shoemaking, surveying, soap making, automobile mechanics, batik, calligraphy, stained glass making, stone carving, furniture making, pottery, and jewelry making. All students participate in various phases of these courses, and as they progress through the school, some may focus on one craft to develop an expertise in it.

In the high school everything that man himself has created through nature and the recognition of its laws should be penetrated with comprehension. Technology has issued from such comprehension. Steiner said that each man who uses a streetcar should know technically what happens so that he really understands how motion is accomplished. He said, "We are living in the midst of a world produced by man, formed by human thoughts, which we use, and which we don't understand. This fact—that we understand nothing of something which is formed by man, of something which is basically the result of human thoughts—has great significance for the entire sphere in which the human soul and spirit lives."

Academics and Technology

Academic classes in Waldorf schools also pay attention to technology from grades 8–12. For example, in the 9th grade history class, the students study the Industrial Revolution. Through vivid pictures they learn from their teacher of life in the mines, of child labor in dark, crowded English factories, of oppression and suffering. They learn of agricultural invention and the promise of a better life. The study of the Industrial Revolution brings young people to confront the issues of their times. Concerns for the underprivileged, the question of power and authority, and the overwhelming domination of economic values over society are issues that today's Waldorf high schools have to address.

The physics classes in the Waldorf schools are dedicated to giving the students an

understanding of the telephone and the steam engines in grade 9; weaving, spinning, turbines, the internal combustion engine, the electric motor, and technical mechanics in grade 10; electricity, magnetism, and atomic energy in grade 11; optics, photometry, and chemical technology in grade 12.

Computer Science

When we think of the word "technology," the word "computer" is often the next word that comes to mind. The following course description is for readers of this article who consider themselves avid technophiles. It illustrates how an 11th or 12th grader might find a computer course in a Waldorf school.

One course that I was instrumental in designing back in the 1980s, when computers were beginning to enter the home life with the advent of the PC, had three fundamental components. The first was to identify the myths and realities about computers. What is it that they do and what do they not do? The next steps were to discuss linear thinking and flow charting —the students could learn how to think like a von Neumann computer! Then flow charting moved into programming and the concept of a procedural language. Artificial Intelligence would be discussed, and the students would write and apply a simple program. The sociological implications of computers would also be debated.

In the second section on computers, the students would investigate programming and the nature of computer languages. Students would write and debug a number of small basic programs. They would work through flow charts for making chocolate-chip cookies and for starting a car. They would also be called upon to imagine themselves as bankers and write a program to develop interest rates and percentages on borrowed money. This section involved the history of the computer including the biographies and work of Pascal, Babbage, and Lovelace. Programming concepts would be addressed and a program for a simple well-known game like Tic-Tac-Toe would be written and debugged by the students. Machine and assembly language would then be introduced as would fourth-generation languages. The students would then be given many exercises to practice programming and finally to learn how to recognize and overcome computer addiction.

The third component of the introductory course involved looking at the inner structure of a microcomputer and the way in which machine languages work. Students would review Boolean algebra, de Morgan's Law, and the binary number system. Using wiring boards (called breadboards), chips, switches, and wire, they would build a one-bit adder, an R-S flipflop using only NAND gates, and four bit J-K shift registers. They would take on the study of logical propositions and logical manipulation as a new kind of mathematics. Then they would take breadboards and build simple and complex circuits. This would give the students a practical experience in building their own computer.

These three sections would be interspersed with trips to a silicon-chip factory, a company using industrial robots, a corporation such as a national motel chain that sets all its reservations by computer, or a large store that controls its inventory and sales through the computer.

Thinking Fructified by Practical Activity

Recent neurological research has confirmed that mobility and dexterity in the fine-motor muscles, especially in the hand, stimulate cellular development in the brain, and so strengthen the physical instrument of thinking. Many forms of thinking (analytical, synthetic, teleological, causal, etc.) need to be learned in today's complex society. It is our task as teachers to apply these various thinking techniques relative to the subject matter we are teaching.

> The principal good of education is to create men who are capable of doing new things, not simply of repeating what other generations have done. – Jean Piaget

In cognitive development Waldorf schools aim to develop the training of judgment and discretion. The capacity for conceptual thought lies on a higher level of cognitive development. The process of abstraction can be exercised by having students analyze their own work. The method of examining why a piece of copper became too thin in a particular area or why a joint of a compound dovetail didn't fit lends itself to such mental evaluation. Self-observation, self-evaluation, and the capacity to take on responsibility are characteristics of personal growth.

Skill learned in the crafts becomes the development of practical consciousness. This practical consciousness has its genesis in an increased power of observation. The training of the power of perception is extended in the upper grades to precise observation.

Handwork causes chemical crystallization in the body. Physical activity breaks it up and brings about a sort of rebirth or surge of energy. Hence, there ought to be a conscious rhythm of intellectual and practical activities throughout the school day so that the students can maximize their learning potential.

Extracurricular Trips and Projects

Waldorf schools find it positive to incorporate trips into the curriculum. A week is set aside at many Waldorf schools during which time each high school class has exposure to a different activity. The 9th grade spends a week working on a farm. They learn about the economy of the farm, working with animals, and the sale of byproducts, and they participate in all the practical work. They develop an appreciation for the rhythms necessary for working such long days.

The 10th grade spends a week working on forestry projects, clearing a mountain trail, building lean-to's, or surveying large land areas. They learn to identify trees and appreciate the diversity of wetlands.

The 11th grade may go to a factory and join the work of an assembly line for a week. In the evening there will be talks by the company president about the goals, by the treasurer about the bookkeeping practices, by a labor union leader about the working conditions, and by shop stewards about production levels.

The 12th grade will take on a task of social significance such as insulating the homes of inner-city slum residents, or a project on behalf of the local city with regard to homeless shelters, old-age homes, retirement homes, etc.

In addition to these projects, class-related trips based on technology are planned for every class so that they can connect what is happening in the classroom with activities that are happening in their immediate community.

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Conclusion

The task of the teacher today is not to structure the minds of the students, but rather to enable them to grow to new dimensions that may even exceed our own understanding. In such a manner can the teacher of the present serve the future. Teaching must become a continual learning process for the teacher as well as for the student.

Educators can learn a lesson from industry. The 3M Company went from producing sandpaper to roofing shingles, to Scotch tape, to magnetic tape, to photocopying, and then to reflective signs. All of these products require a common skill: how to apply a closely-controlled layer of material to a flexible base. The creative thinking that evolved new products at 3M can be stimulated by a proper relationship between thinking and will activities in high school.

> Living is learning. When we are most alive, using most fully our energies, senses and capacities, we are learning the most.
>
> – John Holt

Self-esteem is central to the whole problem of security in our modern world. Self-esteem is also necessary to secure any type of success in any endeavor. No one is capable of reaching beyond the limits of self-imposed boundaries.

Practical subjects, artistic lessons, and activities involving the hand can no longer be seen merely as supportive and enlivening factors of the curriculum. Rather they are absolutely necessary in the education of a youth facing a complex and changing world.

By the time a student graduates from high school, he or she should have made a connection with the main technologies of our age—from the computer to an internal combustion engine and what happens when we flip a switch and the lights go on. It is necessary to understand these things in order to feel at home in the world. Otherwise we are not able to live in full consciousness. The ability to do, to be productive and well-rounded, produces the very independence we want in our students.

No individual will be able to retain his independence in our contemporary working world unless an emancipatory education has endowed him with the practical capacity to do so. An education is emancipatory only when it enables young people to expand and stabilize their individual personalities before they confront the conditions prevailing in a civilization dominated by technology. Education must train students to participate responsibly and creatively. We must see the technical and social changes of our time as a stage in the development of humanity.

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