

“Schools” in the Future: What has to change, and why

THE 21ST CENTURY LEARNING INITIATIVE

An explanation of why, in the light of recent research on the nature of human learning, the present Western, essentially Anglo, system of schooling is both upside down in terms of its distribution of resources, and inside out in terms of its excessive dependence on school-as-place; on formal as opposed to informal learning, and on the teacher as instructor rather than as facilitator. Once the entire system is redesigned on the basis of constructivist and enquiry-based practice, then student dependence on teacher and school will begin to decrease with age. This will allow a growth in student choice and responsibility so escaping from the present dilemma of squeezing out-dated systems to perform in ways which truly release human potential at hitherto unprecedented levels.

HOW HUMANS LEARN – and consequently how children should be brought up – has concerned the elders of society for longer than records have existed. It is referred to as the nature/nurture issue – how much of what we are is a result of what we have been born with and to what extent is this (or can this be) enhanced by the way we are brought up? That there is no easy answer to this question concerned the Greeks as much as it did our Victoria ancestors, and is as lively an issue today for the proponents of “outcome-based education” as it is for those who argue for teaching children how to think for themselves. Given what we now know from research into how children learn is there an alternative way of doing things and would this benefit children and society alike?

Current thinking about the nurture/nature issue polarises around three beliefs, each of which was articulated at least 2,500 years ago;

I Plato taught that the effectiveness of the human brain was all to do with inheritance – those born to be leaders had gold in their blood, those to be administrators, with silver, while the common man (the vast majority) had only iron. To Plato destiny was fixed at the moment of conception.

II Not so, said the ancient Hebrews, it's all far more dynamic than that, so “do not confine your children to your own learning, for they were born in another time”. Learning – to those ancient seers from the desert – was dependent on taking the wisdom accumulated by your ancestors and (and this was critical to the Jews) adapting it to ever-changing circumstances.

III Half a world away in China, Confucius noted that “man's natures are alike, it is their habits that carry them far apart.” Confucius reminded all those who would listen that “tell a child and he will forget; show him and he will remember; but let him do, and he will understand”. While any observant parent will readily agree with such an observation, some politicians will dismiss this simply as “failed child-centred or progressive dogma”.

In today's world, do these issues have any value? Are they conflicting explanations or can contemporary scientific research show how each actually expresses one aspect of what shapes human learning ... and what might this mean for pupils at Eton College, a comprehensive school, a bush school in Tanzania, or in the school districts of British Columbia?

It was only 150 years ago that Darwin proposed in *The Origin of Species* that all life is a “work in progress” and subject to continuous, long-term adaptations. Only in the last half century (and essentially in the last 25 years) has biomedical technology, linked up with genetics, evolutionary studies, systems thinking and anthropology, to help explain how the human brain has been shaped by the way our ancestors adapted to their environment. It was only in 1962 that Crick and Watson unravelled the double-helix of the DNA molecule, so enabling scientists subsequently to understand how intellectual processes, developed by our ancestors hundreds of thousands of generations before, still shape the structure of the brain of a baby born within the past five minutes.

Equipped with such technologies, cognitive scientists now see the human brain as being like a veritable archaeological paradise with varying mental predispositions, reflecting adaptations made thousands of generations ago, and subsequently laid one upon another like strata in a geological sequence and – and this is the essence of so much recent research – transmitted genetically to subsequent generations. For instance, the neural networks we use for language ride piggy-back on those much older networks earlier developed for vision, meaning that today we find it much easier to think in terms of pictures and stories, rather than abstract theory, while our ability to “read faces” owes more to the development of empathy a million and more years ago, than to the much more recent development of using language to describe features.

Steadily, scientists are coming to appreciate that humans, together with all their likes and dislikes, reflect those deep-seated adaptations made by their early ancestors as they adjusted to ancient environmental problems. These ancient adaptations still shape the way we think and act today, and explain our preferred way of doing things. It is this variety of adaptations that account for the complex twists, turns and convolutions in the grain of our brain.

As of now, cognitive scientists see the brain as having all the texture and resilience of a piece of ancient oak, rather than the uni-dimensional nature of a piece of pre-formed chipboard – you can do almost anything with the oak but only one thing with the chipboard. Our brains are so special just because, in comparison with any other species, they bear the deep imprint of the history of our species and it is that which makes the baby’s brain of today eventually highly adaptable and open to learning. We are enormously empowered by ancestral experience but we consistently under-perform when driven to live in ways that are utterly uncongenial to such inherited traits and predispositions.

From this perspective, most of the schools that today’s children attend were designed when prevailing cultures assumed that children were born to be taught rather than to learn. Which is why, for so many children, the wonder of learning has been replaced by the tedium of trying to remember what they were told by somebody else about something that really didn’t interest them very much in the first place.

So what of the cultural factors that have shaped the way schools currently do things?

Two thousand years ago the Greeks invented the modern school to supplement and regulate young people's innate desire to reason things out for themselves. They defined a school as a place of pleasurable activity where children between the ages of 7-14 spent one-third of their time learning the arts of the grammarian (writing, mathematics and the art of oratory), one-third on drama and music, and one-third on gymnastics. Such a balanced education, the Greek believed passionately, would fit a man for the responsibility of being a citizen in a democracy.

Conquered by the more methodical and mundane Romans, the Latin version of school became something very different. Replacing the philosophic concerns of the Greeks with the need to ensure compliance with laws, the schools of the Roman Empire became preoccupied with rote learning. Describing his time in a school in Rome, circa 325AD, the young man one day to be known as St Augustine wrote in his diary "Oh my God, how I suffered. What torments and humiliations I experienced. I was told that because I was a mere boy, I had to obey my teachers in everything. I was sent to school. I did not understand what I was taught. I was beaten for my ignorance. I never found out what use school was supposed to be."

Because the Romans had little sympathy with Aristotle's humanistic belief that "all men by nature desire knowledge" they treated their children somewhat as they treated their slaves – they frightened them into learning because of the fear of being beaten. That was to become the practice of European schools for more than 1,000 years. Learning was forced into children. School became a place of social control where Shakespeare's "whining schoolboy with his satchel and shining morning face crept like a snail unwillingly to school."

The first book ever written in English about education was "The Scholemaster" by Roger Ascham in 1570, which set the pattern for post-Reformation (i.e. non-church delivered) schooling – e.g. the Boston Latin School of 1643. Ascham argued against the excessive use of fear as a motivation for learning; he encouraged the development of "hard wits" not "quick wits", but then added a most curious third injunction: "more is learned in one hour

of theoretical study than in 20 hours of learning through experience". To the English Protestant teachers it was their responsibility to censor what a child learned for fear, wrote Ascham, that pupils might rush off to Rome and while studying classical literature be corrupted by the sexually-explicit statues and mosaics then being rescued by the archaeologists. In so doing, Ascham set the school-teacher and the classroom apart from the experience of ordinary men who had to adjust their lives to the requirements of everyday experience.

It was only in the mid 16th Century that the word "education" entered the English language. The word is based on the Latin "educare" meaning to "lead out" in the sense of a general leading his troops out from the security of the defended camp on to the problematic field of battle. The Roman armies owed their success to the maintenance perfect discipline and the insistence that every soldier only do what he was ordered to do. Transmitted into the world of education, such a literal definition saw learning as doing what you were told. This narrow definition of education isolated the world of the school from the workaday experience of ordinary people who, through the rigorous development of apprenticeship and learning-on-the-job propelled England into leading the world into the Industrial Revolution on the broad backs and the skilful hands of numerous, reflective, self-aware craftsmen.

Few academics, and certainly no schoolteachers at the time speculated on why it was that some Englishmen from the most obscure backgrounds with little or no formal schooling – like John Harrison who invented the marine chronometer, or Thomas Newcombe who made a steam pump to lift water in 1712, or William Smith the self-taught surveyor who made the world's first geological map in 1795 – achieved more from direct experience than they could from theory.

Attempting to bridge that divide between the classical version of education and the apprenticeship model of learning in 1746 the Earl of Chesterfield wrote to his son "do not imagine that the knowledge which I so much recommend to you, is confined to books, pleasing, useful and necessary as that knowledge is for the knowledge of the world is only to be acquired in the word, and not in a closet. Books alone will never teach it to you; but they will suggest many things to your observation which might otherwise escape you". The Industrial Revolution, while making England phenomenally rich, destroyed that earlier social cohesion that had created the genius of

the applied craftsmen. Eventually a form of elementary schooling was established early in the 19th century as a means of social control of the poor, and the old local town grammar schools were replaced by elite secondary boarding schools available only to those who could afford them.

Then in 1859 the publication of *The Origin of Species* shook Western thinking – science, religion and philosophy – to its roots by arguing that all species, humans included, were simply “works in progress”, prototypes in the process of being refined by experience. The medical profession leapt at such a theory and subsequently used it as the basis for modern medicine so giving humanity a “user guide” to the operation of the body. Darwin was initially nervous about extending his theory to the operation of the human brain, but concluded his book with a challenge to the newly-established subject of psychology by claiming that “this will be based on a new foundation, that of the necessary acquirement of each mental process by gradation (evolution). Light will then be thrown on the origins of man and his history.”

Psychology just did not know how to deal with the principles of evolution. As a formal discipline, psychology had only been established two years earlier as a hybrid of philosophy (a much-respected ancient discipline) and physiology (a new white-coat laboratory-based subject that concentrated on the functioning of animal muscles) – so creating a most uncomfortable partnership. Lacking any technology able to understand, at a molecular level, how the brain might work, psychology turned its back on Darwin, claiming the brain to be the same now as it had been in the past and would be in the future. To psychologists, the brain was simply a mysterious “blank box”, there was nothing in it that had not been put there by external agencies during the individual’s own life.

For just over a hundred years (up to the 1970s when the oldest of today’s teachers were being trained) psychology ignored any suggestion that the brain might be a product of evolutionary processes. While medical science used evolutionary theory to, in practice, double people’s life expectancy, psychology allowed itself to be shaped by the Behaviourists who regarded the brain as simply an input/output system.

The Behaviourists claimed that nothing which could not be studied and measured ever existed. This provided the basis for two theories which have done enormous damage to many generations of

children. The first was the Behaviourists’ belief that they could define the exact nature of every input which, if properly delivered, could produce the perfect child as defined by them in advance. The management of external motivation, and the construction of a closed environment, was the essence of behaviourism – the child’s progress was totally dependent on the brilliance of the teacher, and had absolutely nothing to do with its inheritance or personal experiences. There was one exception, and that was the expectation running very strongly in the 1930s that a way could be found of developing tests that could so assess the natural “quality” of the individual child’s brain that they could predict a child’s innate intelligence as young as the age of 11.

These two ideas were largely contradictory but, lacking the technologies to study the brain objectively and they convinced themselves that the brain was born without any structural preferences to learn in particular ways. Consequently, educational policy makers in England and several other places persuaded themselves in the mid-1940s that psychologists had perfected tests which were of such diagnostic accuracy that they could detect the 25% of children deemed (following the teaching of Plato) to be capable of receiving a classical education; the next 15% fitted for technical skills, while the remainder should go for a limited number of years to a Modern school as a precursor to manual employment.

One further theory has to be understood. The almost total collapse of apprenticeship in the late nineteenth century left young adolescents bereft of any useful work to do. Gilbert S Hall, President of the American Psychological Association, claimed in 1904 that adolescence was a dangerous aberration (something which should not be happening) from which children needed to be protected for their own good – that protection, he argued strongly, should involve keeping adolescents in school for ever longer and giving them so much work to do that this adolescent urge to do their own thing could be bypassed.

In all this lies the origin of today’s Western, especially Anglo, model of schooling; age-related classes assumed to be progressing at a uniform rate; skills and knowledge delivered via subject-specific disciplines; a custodial role for social development confused with a degree of willingness with which a child accepted the ethos of the school; more funds allocated to the education of older pupils leaving the youngest children to be taught in the largest classes;

the increased marginalisation of home and community as an integral component of learning; the retention of teenagers in school to “save” them from the turmoil of adolescence, and the training of teachers being more concerned with the preparation of subject specific instruction than with the development of pedagogic strategies informed by philosophy and the research into the nature of human learning.

This basic model has not changed in more than half a century and largely reflects the thinking of the Behaviourists, and the belief in the unchanging nature of human intelligence. No amount of tinkering around the edges will change this – hence today’s frustrations amongst those who understand the importance of this research and how, without significant structural change, pupils will continue to under-perform.

There is one social, economic imperative to be added. Over the past 30 years the aim of education has progressively shifted away from the creation of the all-round child to satisfying the “new economic imperative of supply-side investment for national prosperity”. A dangerous confusion has entered the public mind: although most people would deny this in terms of their own personal experience, the public have been convinced by the statisticians that the more paper qualifications children can accumulate the better prepared they will be to think for themselves in a world that looks increasingly problematic. Yet the experience of many is that by continuing to over-emphasise the role of the school and outcome-based education, national jurisdictions have allowed themselves to so over-school their young people that they are effectively under-educating them.

Some people, some provinces, some school districts, and even individual schools have known this for some time but find that despite their best attempts to break clear of this they are totally frustrated by the legalistic arrangements of recent years which are aimed at squeezing still further life out of an out-dated, and increasingly dysfunctional, system. The traditional factory model is incompatible with the idea that students are workers, that learning must be active, and that children learn in different ways and at different rates.

That dysfunction has been given scientific objectivity by the findings of recent research:

- The brain is driven by curiosity and the need to make sense of all its many experiences.

- Intelligence is more than just a general capacity to learn; it is shrewdness, cleverness and knowledge all rolled together with emotional intuition, balance and a strong sense of practicality. Essentially it is about cognitive and emotional self-regulation, the ability to apply ‘intelligence’ in a self-reflective and meaningful way.

- The brain is empowered by the experience of its ancestors with “predispositions” opening up like windows of opportunity at those stages of life which evolution has found are the most appropriate to the individual’s development.

- Children’s search for meaning starts very young. It is those children who are already anxious to make sense of issues that matter to them in their own private lives, who come to formal schooling anxious to use whatever it can offer them to help their personal objectives. Not the other way around.

- The adolescent brain is a critical evolutionary adaptation that has built up over thousands of generations, and is essential to our species’ survival. Adolescence forces young people in every generation to think beyond their own self-imposed limitations, and exceed their parent’s aspirations. Adolescence is an opportunity, not a threat.

- The brain works best when it is building on what it already knows; when it is working in complex, situated circumstances, and when it accepts the significance of what it is doing. It is at its best when it is exercised in highly challenging but low-threat environments.

- Given the inherent limitations of schooling it seems essential for a child to have an intellectual life outside school. Thus equipped, the child is in a position to use schooling as a source of learning opportunities without being drawn into short-cut strategies that work well for handling school-based tasks but often lead nowhere in the life-long development of expertise.

- Learning is an immensely complex business, so, to put faith in a highly directive, prescriptive curriculum, is to go “against the grain of the brain”, that it inhibits creativity and enterprise.....the very skills needed in the complex, diverse economy and community for which we need to prepare our children.

COGNITIVE SCIENTISTS, working alongside neurobiologists and anthropologists, have become much interested in the processes that make apprenticeship such a successful model of learning. They advocate a CONSTRUCTIVIST approach to learning, with its progressive deepening of earlier understandings, and the joining together of what had earlier been separate, disconnected ideas. It is through experience mixed with reflection that humans weave their own experiences and knowledge of the world into unique patterns. Constructivists see the role of the teacher as “guide on the side” rather than the conventional “sage on the stage”.

COGNITIVE APPRENTICESHIP takes constructivism a stage further by showing how our brains, over vast periods of time, have become conditioned to learn through a process of (1) Showing – the “teacher” or parent, craftsman or artist captures the imagination of a young learner who becomes sufficiently intrigued to want to know how to do it for itself; (2) Coaching – the “teacher” shows the novice learner how to identify the sub tasks that have first to be completed, each with its own particular form of expertise; (3) Scaffolding – the “teacher” provides sufficient temporary support as learners go beyond what they had earlier thought were the limits of their skills; (4) Fading – the “teacher” has to be as proficient at removing the scaffolding when it is more appropriate to the individual to struggle to stand on his or her feet, as they had been when putting the scaffolding in place; finally (5) Dialogue – through the whole of the apprentice / master relationship the novice learner shares ideas with other learners as they try to describe what they are doing and reflect on the outcome. “Learning is not time-out from productive activity; learning is the very heart of productive activity”.

Within a cognitive apprenticeship both the task, and the process of achieving it, are made highly visible from the beginning. The student understands where they are going and why. Learners have access to expertise in action. They watch each other, get to understand the incremental stages and establish benchmarks against which to measure their progress. These are the processes that are at the heart of apprenticeship. They have evolved over thousands of generations as parents sought the most effective way of helping their children to understand the world. It is what Confucius understood intuitively when he advocated going from “telling” to “showing” to eventually “understanding”.

The definition of success was when the apprentice could demonstrate that Jack was as good as his master, and maybe even better.

Such contemporary research takes us beyond the Roman definition of obeying the rules, to the ultimate aim of modern education as the weaning of the novice of his dependence on someone else. “It is a bad teacher,” the philosopher Nietzsche wrote, “whose pupils remain dependent upon him”. This is best defined in terms of Subsidiarity, another Hebrew concept recorded in Exodus, and now inscribed within the framework of the European Union constitution as meaning: “It is wrong for a superior to hold the right of making decisions which an inferior is already able to make for himself.”

SUBSIDIARITY is not the same as delegation where a pre-designed task is assigned to a junior to carry out on your behalf, largely in the way you defined, and then to be answerable to you for completing it to your satisfaction. Subsidiarity could not be more different. Like parents letting go of their children, or a shipbuilder sending his boat into unknown waters, so Subsidiarity is a relationship of trust, not control. Subsidiarity is the exact opposite of Behaviourism.

The problem we all share, as we try to shape a new model of schooling is that we ourselves were often trained as Behaviourists and are now required to lead a revolution about a very different kind of process.

“The method people naturally employ to acquire knowledge is largely unsupported by traditional classroom practice. The human mind is better equipped to gather information about the world by operating within it than by reading about it, hearing lectures on it, or studying abstract models of it. Nearly everyone would agree that experience is the best teacher, but what many fail to realise is that experience may well be the only teacher.”

Santa Fe Institute 1994

Elements of Change Required: Summary

The weight of this research strongly supports a number of elements that cannot be provided in current systems. Schools and administrators have made many changes, but have largely reached the practical as well as the legislative edge of what we can do alone.

The elements of change can very briefly be described as follows:

1. Individualized learning paths versus pre-programmed paths from which students choose their course of study.
2. A much greater emphasis on experiential and situational learning, especially as students get older.
3. A much greater emphasis on constructivist and inquiry-based practices.
4. A much greater use of community members and organizations in the direct delivery of educational programs, and in the support of apprentice-like learning outside the school.
5. The evolution of the teacher from the role of instructor when children are young to a much more complex and professional role of learning facilitator as students get older.
6. A student-teacher ratio that varies greatly depending on age and learning activity (this is NOT about class size as we know it) – see “comparison of current student/teacher ratios with proposed ratios” as drawn up by Jeff Hopkins, added as an appendix, together with “A Day in the life of a Secondary Student”.
7. A de-emphasis of courses from K to 12 and a move toward ensuring deep learning that matches developmental levels, and is naturally interdisciplinary.
8. Rich assessment and reporting based on competencies rather than courses or disciplines, and that uses language and artefacts rather than scores to show achievement.
9. Post Secondary transition based on the demonstration of competencies rather than marks in pre-requisite courses.
10. A sliding scale of student dependency on teacher and school-as-place that decreases with age, so allowing growth in student choice and responsibility.

Conclusion

Obvious as all this will appear to many, to others the changes are virtually too big to contemplate. “A big challenge, a tall order?” wrote a recent reviewer of *Overschooled but Undereducated* in The Irish Times. “Yes, but this book makes a very convincing argument for the revitalisation of education to save it from trivialising the very young people it claims to be supporting. Education is like a suit, said the proverbial wise tailor, ‘it has to fit’. Schooling is not fitting very well now. The longer we have to wait the more the present system approximates to the emperor’s new clothes.”

It will not be easy to do.

It has to start by ensuring that all those – politicians, legislators, administrators and school and teacher leaders really understand the nature of what is involved – if they are to make the changeover between two very different ways of doing things. There is a paradox... this is so urgent it must not be rushed.

Secondly, it will require a systematic drip-feeding of these ideas into whichever communities in England or British Columbia wish to be involved. This will require an integrated media campaign through press, radio and television.

Thirdly, it will require finding several well-defined pilot areas in which there is the confidence to spearhead these changes on behalf of the rest of the country or province. It cannot be done everywhere all at once.

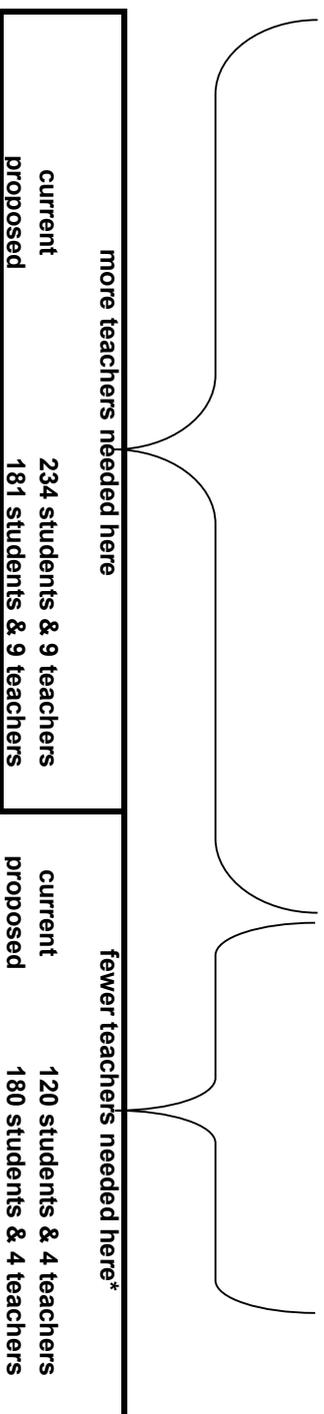
In parallel with two and three above, discussions would have to start with those university education faculties whose support and involvement would be critical if new generations of teachers are to be equipped for their new role, and existing teachers retrained.

The native wisdom of British Columbia recognises that today’s adults have not inherited the land from their parents, but have been loaned it by their children; consequently in the saga of the ages, if a generation fails, the fault lies squarely with the previous generation for not equipping the young well enough for the changes ahead.

This paper has been prepared by the 21st Century Learning Initiative drawing upon the ideas contained within *Overschooled but Undereducated* and additional research from around the world, to be helpful to those in an English city, and in British Columbia, who are seeking to bring about radical change.

Comparison of Current Student:Teacher Ratios with Proposed Ratios

	K	1	2	3	4	5	6	7	8	9	10	11	12	total
CURRENT														
students	22	24	24	24	30	30	30	30	30	30	30	30	30	364
teachers	1	1	1	1	1	1	1	1	1	1	1	1	1	13
PROPOSED														
students	15	18	18	18	20	20	24	24	24	40	40	50	50	361
teachers	1	1	1	1	1	1	1	1	1	1	1	1	1	13



At this point class size becomes meaningless: 40/1 or 50/1 might mean classes to 20 or 25 if only half the classes of the day are taught, or tutorial groups of 10 or 12 if the majority of periods are student directed.

As students learn more about how to be learners and how to operate independently and interdependently with other students, they will be more adept at learning without direct control of that learning by a teacher when they reach "high school." Just as an optimal learning situation would typically involve modelling, scaffolding, fading, and mastery (i.e. cognitive apprenticeship), an optimal K to 12 program would share that same pattern but over the course of 13 years.

Teachers in high school must then play two very different roles: One role as specialist where it is appropriate for the learning to be directed by the teacher. The other role, as facilitator of learning, helping students develop learning plans that might see them doing much of their learning outside the school and with natural tutors, teachers, experts, etc.. and helping them evaluate that learning. Students who need more support could receive it; students who need less support could have less.

(See "a day in the life of a secondary student" for more details)

A Day in the Life of A Secondary Student: Scenario #1

I went to a meeting with my Learning Path Facilitator this morning. We discussed my science project on wind energy and how I would need to find some help with my interest in different propeller types as they relate to migratory bird safety and different wind zones. I remember thinking only two weeks ago before deciding to study this that wind energy was so simple!

My facilitator has found a retired navy aeronautic and marine propeller expert in Bethesda, Maryland. I have an online conference with my facilitator on Tuesday at 9:30 am. Amongst my friends their facilitators include a doctor, an insurance agent, an engineer, a plumber, a lawyer, a shopkeeper, a professional pianist and a professional baseball player. As per my suggestion (after talking at our last co-operative learning seminar) another student will be joining me as she is stuck on a physics problem related to the Bernoulli Effect that this same expert can probably help with. I learned about her question during our weekly small-group check-in where each of us shares our status in our learning paths and any wonderful or frustrating things that are going on at that time.

After meeting with my facilitator, during open lecture hour, I went to the second lecture in a series this month on ethical food production. I will be using my notes from this lecture to support my English 11 essay on ethics in science. There were about 40 students in attendance from grade 9 to 12, half of whom came as an entire class with their Scientific Foundations teacher. There was a number of interesting lectures running today, so it was hard to pick. I can see, though, that some of them will be offered again next week and the week after.

Following the lecture hour, I had writing workshop, where I actually begin working on my essay right away. The teacher was very helpful as I struggled with a proper thesis statement. There were 12 of us in writing workshop at the time, with a few arriving later in the morning and a few leaving shortly afterward. The writing workshop room has the writing performance standards posted for all to see, helping each of us know how to hone our work toward an acceptable standard.

Right now, my cognitive apprenticeship is with a local marine biologist who the Apprenticeship Coordinator and my Learning Path Facilitator recom-

mended after reviewing my “planned experiences” summary in my learning path portfolio. I am really looking forward to the next few weeks working with the biologist as we do water sampling in several local lakes and harbours, do some species counts, and analyze some of our own and other people’s data. This will be a real shift from my last apprenticeship with the boatbuilder. I still have nightmares about calculating the curvature of hull profiles. I now know how to use number of tools that, until my placement, I didn’t even know existed. I still need to update my journal and add the last few photos to my portfolio before my next progress meeting with my learning path facilitator.