Chapter 6 –Conclusions

6.0 Overview

The primary conclusion to be drawn from the work discussed here is that global learning potential has been grossly underestimated. A second layer of conclusions concern the effectiveness of certain methodologies of promoting learning. Finally, a third layer addresses meta-questions of how to think about the design of innovations in education.

I contend that the primary conclusion is supported beyond any reasonable doubt as something that applies across the globe. *The barns that hid indigenous technology also hid latent expertise. This expertise provides a solid foundation upon which to build and leverage other learning. The constructionist use of computational technology on real-world projects provided the means to expose this hidden expertise and leverage it into powerful learning*. Our investigations bear directly only on a small number of sites in just one country and even there looked at a fortuitous sample of "latent expertise." But I contend that it is utterly compelling as an "existence proof." It shows that it is possible in principle to bypass commonly held assumptions about the conditions of learning. Moreover, I will note that some of the observations in Thailand are consistent with those that can be drawn from different but related projects in other countries, notably Costa Rica, and also the United States.

The second layer of conclusions is equally compelling when read in the spirit of providing existence proof: *the observations presented in the body of this thesis confirm that a certain pattern of constructionist learning will at least under some circumstances*

release latent learning potential that is hidden by standard models of education. I cannot make a strong claim that the methods as we put them into operation in Thailand can be directly generalized to provide a solution to the educational problems of the world or even of Thailand. But I maintain that they provide a compelling point of departure for discussion of new approaches to promoting learning.

On the third level, I contend that *the experience as a whole demonstrates beyond any doubt the possibility and necessity of a different and more flexible approach to the design of educational interventions.* Moreover, I maintain that by doing so it introduces a new *conceptual dimension* into educational discourse, which has not in the past included any kind of consideration of the nature of design as a theoretical theme. Recognizing the study of design – the consideration of alternative modes of design -- as a theoretical dimension for education provides a framework for bringing together in a systematic way a number of concepts (such as "breaking mindsets") that were present in an ad hoc form in the initial design of the Lighthouse project and some experiences in other constructionist education projects (e.g. the collaboration between the Media Lab and the Omar Dengo Foundation in Costa Rica). However, while I feel quite secure about the firmness of these conceptual contributions, the *particular details* of design methodology followed in this work is offered in the spirit of a very preliminary exploration. Indeed, some of the conclusions on this level bear on weaknesses in the work in Thailand and lead to suggestions for improvement.

6.1 Hidden Learning Potential

The most salient of all our observations in Thailand is typified by realizing that the mechanical innovations hidden away in the barns of what appeared to be simple villages also hid the latent expertise of the villagers. The list of indigenous technologies developed is incredibly impressive. People learn in informal situations not only to repair these contraptions but also to hack and kludge, to work around, to innovate, to adapt to local situations and needs. The skills needed to do this successfully are significant and are a major subset of the skills desired by educators. Yet, when surveying the educational state of Thai society, rather than being counted as a strength, the rural areas are viewed as backwards, in horrible shape, and perhaps not even savable.

Before we began work in Project Lighthouse, people criticized our plan stating that rural teachers would not be able to learn the technology, let alone teach with it. Perhaps the most important accomplishments in Project Lighthouse were the recognition of the intelligence and expertise of the people and teachers in the rural areas, and the concrete demonstration of how technologically rich, constructionist learning environments could build upon and leverage this experience and expertise

6.2 Alternative Paths to Learning

In these examples, as in Thailand with the engine culture, people learned what they needed in informal settings. The key to where my work goes beyond theirs lies in the generative power of the constructionist use of digital technology. The commentators are impressed that the Brazilian street children learn some elements of mathematics because

it is rooted in their lives and interests. Agreed. And this is how the Thai villagers learn about motorcycles and internal combustion engines. The difference lies in the next steps. Arithmetic is useful for the Brasilians. But it does not open out onto larger areas of knowledge. The internal combustion subculture in Thailand went a little further. In particular it supported the development of a bricoleur attitude and a degree of self-confidence in learning and inventing. But the larger difference came when we introduced digital technology. This technology is learned in a manner that is close to the situated learning recognized by Suchman.

The new feature is that it carried with it many embryonic forms of powerful ideas of science, mathematics and management and serves as a bridge into appropriating these ideas and the areas of knowledge built on them. *The constructionist approach, immersive environments, building technological fluency, and applying this on projects of interest and importance to the participants combine to break through barriers to learning and break mindsets about what is possible and how learning environments must function.*

6.3 Design all the way down

The third level of conclusions bears on the idea that consideration of design has a bigger role than has been given it in thinking about education. How can we assess the degree to which the work in Thailand supports that idea?

(1) First I submit that the idea itself came from this work. Of course it might have come independently. But the fact is that it did not and so the work should get some credit for engineering the idea.

(2) More specifically, I submit that any idea that a pre-designed curriculum could have done what we did is open to the following objections:

- Arguably it would have been impossible for any curriculum design committee to have anticipated these actions
- Even if the usual practice of "covering" all the knowledge to be learned were possible it would require enormous expense and risk drowning the specific knowledge we found so useful in a mass of knowledge that could potentially be useful.
- Even if the actions could have been anticipated in a cost-effective way, doing so would have deprived the local practitioners of the benefits of learning to design their own teaching and learning experiences.
- The best results occurred when there was a close connection among people, or among people with a passion for a particular domain area or way of working, or a connection to the interests and needs of a community, or to take advantage of a particular time. This is inherently unpredictable and the results themselves only emerge when provided the freedom to capitalize upon opportunity. Could the discovery of and connection to the engine culture have emerged otherwise? It certainly had not previous to this work.

(3) Project Lighthouse did overcome a number of obstacles to the idea of Emergent Design, among which were the absence of good local examples of the kind of features that could come about emergently. I conclude this section by discussing a central example: the role in education of mindsets.

What do we mean by mindset? Mitchel Resnick refers to a centralized mindset when he demonstrates how his StarLogo environment can facilitate shifting this mindset to better investigate emergent, decentralized phenomena [Resnick, 1997]. A major portion of the work of Papert deals with changing mindsets both with regard to learners and educators thinking about learning environments [Papert, 1980].

We can think of mindsets as what exists within a paradigm. Rather than being able to objectively reason our way through every situation, we are predisposed to look at data, at causality, and at remedies and activities through the filter of our mindsets. For example, an educational administrator may look at a room full of children busily scurrying around, talking animatedly with each other, having no overall center of attention, working on a variety of things, and have a mindset that this situation is disorderly, confusing, chaotic, out of control, and non-productive. The administrator may want the teacher to clamp down, impose discipline and order, and make everyone sit in their seats. A different type of educator may view the same situation and have a mindset that this is active, engaged, creative, and joyful. This educator may encourage the teacher to keep up the good work.

The difference in reaction and remedy reflects a difference in mindset about learning environments.

How do mindsets change? Kuhn reminds us that one reason why paradigms are important is simply because they are stable and do not easily change. Mindsets do not necessarily change by dint of logic or persuasion. Even when things are not working satisfactorily, the first and often the only inclination is to look within the same paradigm, within the same mindset. However, when enough evidence accumulates that is sufficiently compelling to challenge the existing mindsets, the possibilities for change are open.

The goal of this work was not to provide a blueprint for a new educational system. It was not to produce a reform in its traditional sense. My view is that history has proven this is rather hopeless. Rather, the goal was to change mindsets about the operation and necessities of learning environments. The most important element in order to achieve this was to provide concrete examples that go against the established mindset. If these examples provide an existence proof, particularly working in situations proven most difficult according to existing mindsets, then the evidence is all them more compelling. This work, although accomplished with minimal resources, succeeds in providing such an existence proof. The next steps are to refine and to expand; to experiment more boldly; to believe all human potential; and to work to enable all to achieve their potential.

Robert Pirsig's book Zen and the Art of Motorcycle Maintenance is a novel about different styles of thought [Pirsig, 1974]. Pirsig questions the limits of rational thought and restores privilege to emotion, to aesthetic, to the bricoleur approach. It is not the point here to accept or to reject Pirsig's work or philosophy. However, it bears noting that a philosophical stance no longer accepted by most maintains a vice-like grip on educational thought and practice, and even on most educational reform efforts.[1]

Despite a growing acceptance of new approaches to management and organization, and to change and management of change, the mindsets in educational institutions and of educational reformers remains, for the most part, mired in the paradigms of the past. Reform efforts remain top-down, rigid, and fully planned. To suggest otherwise is deemed unscientific, irresponsible, or incomplete. Curriculum is set as the one best plan. A reform must proposed the new best way and it is up to educators to implement the exact plan or they are at fault or incompetent. The reform plans dictate the best way to implement the changes.

The view here is that there are alternatives. This work does not suggest the new best way. Rather, it strives to illustrate possibilities, to provide examples, to propose alternatives. Rather than accepting planned hierarchical systems as the most privileged model, a more biological model of system, with instantiation, adaptation, and propagation. Current views of complex systems highlight the problems of planned hierarchical systems in dealing with highly complex, dynamic systems. Biological

[1] George Lakoff and Mark Johnson term this the *obectivist* stance and provide a compelling examples of how this type of philosophy permeates our thought.

models are proving more fruitful and resilient. It is time we change our mindsets regarding what learning environments need be, and how we must plan and work to change and improve them.

A sample of failed top-down approaches is addressing the inequities in modern societies. One of the major goals behind Project Lighthouse was to begin to address the widening chasm between rich and poor, both within and among societies. Such deprivation and widening gaps is unconscionable at a time of unprecedented wealth and possibilities. This problem is complex and has many inter-related and hard to detect causes. Even when explicit and oppressive controls are removed, it appears that certain people and groups remain mired in cycles of poverty. How to escape and transform the situation is fraught with difficulties.

The work in Project Lighthouse, while only a very rudimentary beginning, provides hope for the possibilities of change. All areas have a wealth of expertise. We now have better potential to enable people to take control of their own learning, their own environment. We now have an improved potential to learn and to develop in accordance with the wishes and the cultures of local areas. What is required are changing mindsets and the will to try.