Black Hole Pedagogy: the violence in e-learning

Post Primary Teachers Association Conference:
Charting the Future
Wellington 20 April 2004

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Abstract

The National Observatory of New Zealand, The Carter Observatory, worked with the New Zealand Qualifications Authority to develop assessment standards for astronomy. Courses for these standards are taught online by the Observatory in a teaching platform designed specifically for the purpose. This paper considers the pedagogy applied in the development of the distance education materials and course delivery. This theory of pedagogy is called the black hole theory because once a student enters the system they are trapped and pulled towards inevitable success. The paper discusses several positive features of this system, along with the inherent violence within the system.

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Introduction

In this paper, I consider the goals of the Carter Observatory regarding secondary schooling, how the Carter proceeded to develop a curriculum, the pedagogy developed, and the concept of off-site specialist teachers. If argues that this pedagogy, called *Black Hole Pedagogy*, should be further developed and evaluated. There are serious ethical questions raised about the violence of this e-learning technology.

If you want to change things in the senior secondary school, you must work with the assessment system. In New Zealand, assessment controls curriculum and credentialing controls assessment. When students fall outside of the credentialing/assessment system, perhaps ending up in activity centres or other alternative arrangements, we often strive to bring them back into the mainstream. Such actions demonstrate our values and the strength of the formal system. If you want something taught in secondary schools, you must make it valuable – today that means you must associate it with credits.

For decades, the School Certificate Examination efficiently advanced both curriculum and the training of teachers. The School Certificate Examination Board was in many ways more powerful than the Minister of Education. Its meetings could be political, ideological, and sometimes excessively technical. The work of teachers at Lopdell House at Titirangi and then on the North Shore, and Stella Maris at Seatoun, provided the analysis needed for curriculum change – all in the name of School Certificate and associated syllabus documents. However, notice also that the same effort provided the teacher education and training.

The standards based system we have today puts more power into the hands of teachers in individual schools than ever before. Teachers can pick-and-choose what areas of curriculum will be taught. Standards inevitably leave curriculum gaps and teachers decide how to make their presentations coherent. Teachers continue to lead national curriculum change through their work on standards. The power of New Zealand teachers in curriculum will endure because there is no other group of sufficient numbers all that interested.

A teacher perceptions study showed that the introduction of the standards based system had an effect on teachers. “The impact of the Curriculum Framework had brought real changes in the quantity of assessment and teachers' practice. ...the themes include obvious change in practice and amount of assessment, greater individualization, greater specificity, and the use of school-wide procedures which were not a feature of many schools before the new curriculum” (Mansell, 1999) . The New Zealand Council for Educational Research recorded the effect of changes on secondary schools including those that came from a new approach to administration and those that were the result of changes in assessment (Wylie & Mitchell, 1992).

The Observatory's goal

The *Carter Observatory Act 1937* established the National Observatory of New Zealand to advance astronomy throughout New Zealand. The Board is appointed by the Minister of Research, Science and Technology. The Carter has about 12 staff members and apart from teaching primary and secondary school students provides a "visitor experience" in Wellington. Two years ago the Board of the Observatory undertook a major review of its progress and the needs of New Zealand and decided to focus on secondary schooling. The Board stated its values in its business plan:

> "The Board of the Carter Observatory believes:

- Astronomy is a superb vehicle to promote science & technology
- Understanding astronomy contributes to a students' personal development
- Maori astronomy and the astronomy of Pacific peoples should be taught
- Astronomy strengthens science education in general
- Distance education techniques are suitable ideal for the teaching of astronomy because it is visual and a rapidly changing subject
- A distance education course makes astronomy available to students around the world
- A distance education course widens student choice, provides timetable flexibility, and has minimal transaction costs
- Teaching New Zealand students helps us to fulfil the Carter Observatory's statutory responsibility
- Being a specialized distance education provider would be consistent with Carter's statutory responsibility as New Zealand's National Observatory" (The Carter Observatory, 2003).

The Board was also mindful of the fact that as New Zealand's National Observatory its responsibilities went beyond Wellington. Accordingly, the Board resolved:

- "The Observatory will provide education and learning experiences in astronomy for the public, for students and for amateur astronomers that are both authoritative and stimulating; and which excite the young to seek further involvement with science and technology.
- The Observatory will be a specialist 'outside' provider of astronomy courses for secondary school students, to assess student achievement and have students gain credit for this learning on the New Zealand Qualifications Framework.
- The Observatory shall have regard to The Treaty of Waitangi and the interests and needs of Maori people in all its business and in the allocation of resources to Distance Education.
- The Observatory shall have regard to the needs of Pacific Island students in New Zealand and overseas.
- The Observatory would make available on the internet courses on 'southern sky' astronomy, Maori Astronomy and Pacific Island astronomy" (The Carter Observatory, 2003).

The Board saw the policy above as being consistent with Government. "We believe our work in distance education contributes to the following strategies set by Government:

- Raise participation rates and achievement for underachieving students.

- Give students access to a wider range of options.
- Better provide for Maori and Pacific Island students.
- Take full advantage of information technology.
- Ease in-school resource constraints.
- Advance the goal of a strong research, science and technology workforce.
- Advance the skills of self-directed life-long learning. (The Carter Observatory, 2003).

How to promote science and technology

The summary from the above deliberations is that the Carter decided to get into the business of science and technology promotion. To promote science and technology we had to attract secondary school students and give them success in their own terms. Accordingly, our practical task was to associate astronomy with credits. With minor exceptions, there were no unit or achievement standards in astronomy. Consequently, we had to work with the New Zealand Qualifications Authority to create the currency of secondary school education. It is remarkable that we could walk in off the street and within a year have established 3 new standards and 12 credits. Their willingness to develop the system reflects well on the New Zealand Qualifications Authority and demonstrates useful feature of the unit standard system.

We did have the advantage of being New Zealand's national astronomical observatory and hence we had links to Government (on the politics of curriculum see for example Roberts, 1997) . Also, our aims were consistent with the stated principles of the Government for curriculum which includes "provides for flexibility, enabling schools and teachers to design programmes which are appropriate to the learning needs of their students" (New Zealand Ministry of Education, 1993).

Technology and purpose

Once we made the decision to get into the business of science promotion, our focus was on pedagogy. We would use technology, but only as it could be used towards our specific goal. We deliberately tried to remember the telling conclusion that came from Massey "The key point is that many ICT initiatives are based on unexamined assumptions" (Codd et al., 2002).

More specifically, we were most concerned about motivation and attention – and these things in terms of providing rewards. A supporting concept was that of efficiency – meaning that the students' time on-task had to be maximised and they had to achieve the greatest level of reward possible for their efforts. We can make the same point in a negative way. We were conscious of the need to reject any thought that the fact that we could build a technology was a reason to build it – the students' needs had to come first.

The Massey University researchers made a similar but more general point after a review of 97 major international projects related to future focussed research on teaching and learning: "A recurring feature of the projects reviewed is the uncritical acceptance of ICT as a social and technological phenomenon. Indeed, as an educational innovation ICT is characterized by a high level of technological determinism. There is a tendency throughout the projects to treat ICT as an external force that is driving the future direction of school and the learning society. This implicitly obscures social processes and serves to naturalize technological change by imply its inevitability ..." (Codd et al., 2002).

Black hole pedagogy

Pedagogy is about method and method depends on aims. So, what are our aims? We built our aims on the needs of a specific group of students and our understanding of their characteristics. They are the average and below students academically, who are unlikely to study science further or to find careers in science. We see these students as the strugglers in schools, perhaps easily distracted from their work, and often with an enormous need to achieve. We see them in schools bombarded with images and movement, distracted easily by this movement, and distracted by their friends, and we see that they struggle to get the attention they need from teachers and parents.

We rejected all the broader notions of educational aims to focus just on what we saw as the needs of the students identified. Richard Peters' notion that education was about initiation into intellectual disciplines and Paulo Freire's aim of consciousness raising did not assist us because they are too broad, general, and remote (Freire, 1970, 1973; R. S. Peters, 1970) . We needed aims that derived from the problem we identified. We also needed to have an aim that was consistent with our available resources. Accordingly, our pedagogy would:

- Focus students on their own self-interest.
- Show students the relevance of the learning to their self-interest.
- Hold students attention - cut out distractions.
- Integrate assessment with learning to the point that the student is not aware that they are being assessed.
- Give students personal attention.
- Promptly and fully reward the student's efforts.

We called this approach to teaching "black hole pedagogy": once a student enters to a certain point in the system they cannot escape – they cannot see outside of the system, they are drawn into the system, helplessly propelled onwards, until there is an inevitable conclusion. The conclusion is success for the student and their release from the system. This is not pedagogy for the whole of secondary schooling. It is a very specific, narrow, teaching method. It contrasts with several common doctrines. Some of the contrasts are:

- How it relates to the values for secondary schooling writ large.
- Concern for cultural needs.
- The doctrine of student choice and "open learning".
- The doctrine about student-student interactions in distance education.

Values in secondary schooling

Some may say our pedagogy contrasts with the Post Primary Teachers' Association values for secondary schooling. As the Curriculum Review Group said in 1969: "this statement of major aims consists of a short list of human qualities which education should be concerned to promote at all times. The highest value is placed on: the urge to enquire; concern for others; the desire for self-respect" (New Zealand Post-Primary Teachers' Association, 1969).

The urge to enquire

We take a very limited view of "the urge to enquire". Certainly, the course content (astronomy and space) is fascinating and presented we hope in an interesting way. But, we do

not in the Level 1 courses take students into areas where they must be creative and experience the joy of enquiry. In other words, we have been very cautious in the use of extension exercises. We hope students will go on to enquire, but that is a goal for a latter day. In our Level 2 course "Cosmology" a totally different approach is being taken and the "urge to enquire" is an extant course objective.

A private world

In our system, we seek to create for the student a "world apart". That is, a private domain in which they can exist without reference to home or school. We compare this to the feeling of being "lost" in an escapist novel – it takes you away from the clutter of your life. Our system has to be comforting and comfortable. The student must feel no pressure to perform. We give them a year to complete a unit standard that is officially 40 hours of learning.

Motivation comes from the student's own self-interest. External motivation comes from the desire for credits, and internal motivation from the opportunity to escape from the world and the rewards of communicating with the system and the teacher. Accordingly, our system does not relate well to the PPTA value of "concern for others". Our system is "anti-social". There is a narrow concern for the self.

Cultural difference

We considered several times how to address the need to include diverse cultural values/perspectives in both the unit standards and our courses. Zepke and Leach (2002) summarise such concerns in their thinking about how appropriate distance education techniques are for Maori students. They drew the strong conclusion that distance educators are bewitched by the potential of computer-mediated distance learning and yet computer-based instruction is not always the best option for Maori. There were two extreme models to address cultural concerns that we debated and both approaches had strong advocates: set out different cultural perspectives throughout the unit standards and the courses, or, provide separate unit standards and courses for Maori and Pacific astronomy.

Perhaps they are wrong thinking (it is foolish to think you can avoid culture), perhaps deluded, but science and technology do aspire to be "international". Astronomy books for students from around the world are very similar. The advice we had from Maori was to accept this and not attempt to artificially add a Maori dimension to a basic astronomy course. Accordingly, this has been our approach, although the site aesthetics will be distinctly "New Zealand". Work is proceeding on Level 1 standards for Maori astronomy and the astronomy of traditional Pacific navigation.

Open education

In general, we reject student choice once the student has begun the course. Open education is about maximising student choice and distance education is very much associated with such pedagogics (Distance Education Association of New Zealand, 1998; Distance Education Association of New Zealand., 2000; Hornblow, 1998) . We want students to focus on the course content, which means we do not want them distracted with decisions that are not about the content itself, and we want them to follow the logic that the course follows in its presentation.

To help students to focus on the course content we seek to:

- Make our site graphically spectacular (this is easy to achieve when your subject is astronomy).
- Make the reading age about 9 years.
- Structure the course logically.
- Make each segment of learning very small and distinct (a "screen-full" .
- Require very frequent responses from the student.
- Make it easy for the student to respond.

Some support for our approach comes from Alfred North Whitehead. He described the rhythmic claims of freedom and discipline, by which he meant that there were times when students had to learn content in a determined way before they were able to exercise their creativity (freedom) (Whitehead, 1950) .

Student-to-student interaction

Consistent with this intention we see a student's interaction with other students as being a distraction. Accordingly, we reject discussion forums and internet chat facilities. Students may like to communicate with other students, but they are far more likely to learn about astronomy from a teacher.

Compare this with a conclusion about distance education - "Students who socialise with their peers, and have a sense of being part of the educational institution are less likely to drop out and are more likely to maintain high levels of motivation" (Lockett, 2000) . Surveys, and the experience of tutors, confirm that the lack of social contact is often cited as a reason why students drop out of distance education courses (Lockett, 2000) . Hornblow attributes success in course completions to flexible learning and assessment "facilitated through a process of pre-entry counselling, learner profiling, consideration of learning and assessment options, assessment …" (Hornblow, 1998) . The literature of distance education largely relates to tertiary education and I have not been able to locate useful studies about secondary school students.

Teaching styles and student progress

We know that there is great complexity in the interactions between teachers, learners, and schools structures. Some of this complexity was revealed in Bennett's empirical study of student progress (Bennett, 1976). We thought about a framework for understanding the role of computers in learning. Given the students described above it was natural we should consider the work of Crook who stressed the need to consider the various types of collaboration between students, teachers and computers (Crook, 1996) . We have yet to decide if our system does work well for the students we identified, and would very much like to collect data on the characteristics of the students who do well in this form of learning.

Teaching in our system

Our intention to maximise the personal attention given to students has considerable consequences and we have only just begun to address the practicalities. The challenge regarding the interaction between the student and the teacher is to improve on the situation in New Zealand secondary school classrooms. Research tells us that teachers in classrooms talk

a great deal. Flanders empirical study, for example, concluded that 70% of the time a student is in a classroom someone is talking. Of that 70%, the teacher talks for about 70% of the time (Flanders, 1970). Studies vary but most people agree, “teachers talk a great deal”. Students vary greatly in the amount of talking that they do in classrooms. Much of the talking in classrooms will not be about the course content, but that does not mean that it is unproductive or wasteful. However, there is an argument that says most students in classrooms do not have much of an opportunity to interact with the teacher in a manner that advances their learning.

If a course is to be delivered on the internet, the interaction between the student and the teacher will be degraded from that in the ideal face-to-face situation. Dimensions to be considered include the ease of communication (speaking as opposed to writing, say), the availability of context, and the rapidity of the exchange.

Independent but not autonomous learners

There is a sense in which our learners may be independent. So far as the online system is concerned they can determine when they work (although internet connected students in classrooms may be draftees). They certainly can determine the pace at which they work within the system. They can choose whether to answer questions or to doze. However, they are not autonomous in the sense that they can make decisions about their own learning. The course is deliberately structured to begin with very simple questions and to proceed from the simple to the complex. Students are not able to miss steps. Students cannot avoid specific experiences such as seeing particular graphics or answering certain questions.

Independent Learning and Teaching is an educational system in which the learner is autonomous, and separated from his teacher by space and time, so that communication is by print, electronic, or other non-human medium” (Gibson, 2003). However when Moore develops his concept of independent study he considers four key ideas: “(1) independent study is concerned with both learning and teaching; (2) independent study is concerned with the capacity of learners to be self-directing; (3) independent study systems are both internal and external to educational establishments; and (4) whether internal or external, independent study systems learners and teachers carry out their tasks separately from one another” (Moore, 1973).

The theorist whose views most accord with our own is Gibson. He is concerned with learning styles and teaching styles. He supports diverse practices and recognises the diversity of students (C. Gibson, 1990; Gibson, 2001; Gibson & King, 1997) . “Direct instruction, drill-and-practice, and lecture are all appropriate strategies to consider when introducing some skills or concepts, to build awareness or to reinforce habits or a set of defined actions when time is limited or when particular learners are involved” (Gibson, 2001).

National implications

“With regard to the implementation of the curriculum (New Zealand's standards based secondary schooling system) there is no doubt that the impact has been huge in its implications for teachers' work. It has steered their workload, programmes, planning, assessment and professional development” (Mansell, 1999). “Historically computers have been oversold and underused in schools” (Codd et al., 2002). These two uncontroversial quotations should be kept in mind as we consider the opportunities suggested by the Carter's work. My experience in educational development projects has taught me that it is best to

demonstrate new things rather than explain them (M. Peters, Marshall, & Shaw, 1986; Shaw, 1983; Shaw & Burns, 1999; Shaw & Ohia, 1988). This means you need small-scale evolutionary projects that provide opportunities to solve problems. At present we are just beginning the Carter project. Not all the problems have been identified. However, it is already possible to see some of the wider implications. There are two features of our work that might have national implications: first, the idea that the assessment of a standard can be done on the internet; second, that specialist offsite teachers can support teachers in classrooms throughout the country.

Efficient assessment

Between internal assessment and external assessment there are a range of possibilities. In New Zealand, schools have assessed in regions, in clusters, in groups, and in informal configurations. Now, with the internet, new mechanisms of assessment can be easily developed for individual teachers and groups of teachers.

One strength of the standards system is that there is a relatively specific definition of what must be assessed and this lends itself to, indeed requires, formularised assessment (notwithstanding the protestations of the Qualifications Authority). We should capitalise on this strength. It is very inefficient to have individual teachers throughout the country working on assessments for standards.

A feature of the Carter's system is the level of automation in the processing of student assessments. Teachers see the students work and make judgements about it. When they see the work they also see on the screen the assessment criteria and precedents. In this way they are assisted in making accurate judgements. The teachers interact with the students regarding each assessment exercise. But, once the decision is made that a particular standard has been reached, with the click of a mouse the machine takes over and proceeds right up to the registration of the credits with NZQA.

Hence, the teacher is concerned only with professional judgements and student support. All the administration is automated. Again, this capitalises on a strength of New Zealand's elements/standards system. There are many examples of internet based assessment systems working well. Microsoft and Sun have both developed the model to train people in the use of their products and their awards are sought after by students and employers.

The main argument against this concept is that desirability of integrating assessment and learning. It is probably the same argument that supports internal assessment against examinations.

Specialist off-site teachers

Teachers learn from other teachers. This is the traditional system of teacher in-service training in New Zealand. The Carter, because it want to strengthen astronomy in schools throughout New Zealand seeks to work with science teachers. For years we have provided teacher in-service courses but they have not addressed the shortage of physics teachers and they have not made astronomy a core part of a science degree. Everyone agrees astronomy is exciting and important as anything in the curriculum but the situation regarding teachers will not change in the foreseeable future.

Accordingly, we seek to work with our colleagues throughout New Zealand, and to provide the course materials, teach their students and handle assessments and reporting. Inevitably, teachers in schools will learn more about the subject as we proceed. They will learn from our materials, from their students, and from their interactions with our specialist teachers.

Conclusion: positives and violence

Our project has raised for us two issues for the future: what is the efficacy of the pedagogic model, and, what might New Zealand gain from the use of off-site specialist secondary school teachers. Both these need to be the subject of formal evaluation. Our claim is that Black Hole Pedagogy will advance the learning of a significant number of secondary school students, and that these are students who struggle within schools. It is a bold claim and we have yet to collect data to support this hypothesis. However, an investigation is a manageable project that could chart a way ahead. Perhaps not just in relation to astronomy, but importantly for other subjects. Our teaching system offers a means to extend student subject choice throughout the country with students working in either school time or their own time.

The notion of off-site specialist teachers has potential. Science teachers have been very supportive of our work in astronomy and see it as being an appendage to their own work. Even in its current form we can see how our system could assist the country as we seek to address the shortage of physics teachers and the workload of teachers. Again, it is possible that there are opportunities in other disciplines. Although we use the term “specialist”, in fact the support the student receives at level 1 is largely pastoral care. It is about motivation through reward. We would like to know more about the potential of such a system to provide pastoral care to students whose contact with teachers or parents is insufficient. For these reasons we have talked to Massey University about an independent evaluation and a little charting.

Finally, there is a serious word of caution needed. The system operated – designed to generate student success – closes-off the options of students. It traps the student in a system that holds their attention and gives them no escape but by way of the linear pathway entrenched by the designers. This renders violence upon the student. Forms of failure are no longer possible and this is a curtailment of the normal freedoms which we associate with learning. In short, the system is inherently violent.

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Annex

The internet facilities established by the Carter Observatory

www.carterobservatoy.net

Carter Observatory Distance Education Website

Teaches and assesses astronomy unit standards.

www.carterobservatory.org

Back up for www.carterobservatory.net

Unit standards

Level 1 Our Solar System (4 credits)

Level 1 The Milky Way and other Galaxies (4 credits)

Level 1 Space (4 credits)

Level 1 Traditional Pacific Navigation (in production)

Level 1 Maori Astronomy (in production)

Level 2 Cosmology (Level 2) (in production)

There is a schedule of Level 2 and 3 standards to be developed and a plan for a Level 4 National Diploma in Astronomy. A National Certificate in Astronomy for secondary school students is also being considered.