Reflecting on an Adventure-Based Data Communications Assignment: The 'Cryptic Quest'

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Abstract

This paper details the development and implementation of an adventure game based assignment exploring the use of ciphers as part of a final year undergraduate data communications course. Students were presented with a document that contained a narrative to help them along the journey to the solution, one section of which required decipherment of a key instruction. The author reflects on the (pre-internet) development, student reactions and the difficulties that may be faced in the use of this type of assignment and upon his perception of the potential impact of changes in educational environments upon the use of 'non standard' themes for assignment work. The paper also considers some of the opportunities afforded by the Web for the development of contemporary assignments based upon the approach outlined here.

Keywords: education, adventure game, data communications, discovery learning, programmed learning

Introduction

This reflective paper was triggered by a conversation with a colleague who currently teaches data communications and networks. The discussion ranged across innovative ways to help students learn what they can perceive as a fairly dry, technical and potentially boring part of the subject area. The author described an assignment he had developed some years ago (around 1987) and some time after the conversation he realised that he had meant to reflect upon and document the design and development work but had never managed to find the time. Even though the paper is based upon work that was carried out almost twenty years ago it is felt that the issues relating to the design and management of 'adventure style' assignments are still valid. This paper is built upon the records of that assignment and around a re-visitation of the literature that originally informed its development. The advent of the Internet raises both opportunities and challenges for the development of a modern incarnation of this assignment.

The paper starts by outlining the broad educational influences that informed the author and then outlines the issues that informed the development of the assignment described later in the paper. This is followed by an explanation of the full 'story' ('The Cryptic Quest') that formed the theme for the assignment. It then presents some student comments and leads into a reflection on the use of such learn-

ing vehicles in general and also identifies opportunities afforded by the Web for the development of a contemporary version of the assignment. The paper closes with some personal views of the potential difficulty of using this type of approach in the prevailing educational environment.

The Assignment: Educational Context and Drivers

The assignment described in this paper was developed at a UK university for use with a group of fifty, full-time final year BA (Honours) Business Information System undergraduate students who were studying a Data Communications Networking course.

Much of the material covered in the course was relatively easy to present in the form of lectures and seminars. The lectures were often interactive with, for example, students being brought physically into play to explore the International Standards Organisation (ISO) communication layers. In this session a number of 'volunteers' came to the front of the lecture theatre and collaboratively transformed a given piece of data in accordance with the ISO protocols as the data travelled along the 'human network'. This type of activity alerted students to my non-standard approach and prepared them for what they initially considered to be a 'weird' assignment.

The topic of encryption had previously proved to be somewhat difficult to cover in an interesting and engaging way. Although it was a relatively minor aspect of the overall syllabus it clearly intrigued many students but was typically perceived as being rather complex, dry and mathematical. This perception was aggravated by the topic forming only a small section of a broader subject area that was presented in a traditional lecture format. The author felt that a useful way to learn about this topic would be to provide the students with an opportunity to work individually with an assignment exploring a practical application of codes and ciphers. Although the focus of the activity was to help the students gain an understanding of encryption, an equally important aim was to help them to develop or enhance their individual problem solving skills in a reasonably authentic exercise.

The motivation for the learning approach adopted was largely influenced by the work of Bruner (1960), who suggested that gaining an understanding of the basic ideas of a field involves more than simply memorising general principles and should lead to the development of "an attitude toward learning and inquiry, toward guessing and hunches, toward the possibility of solving problems on one's own ... For if we do nothing else we should somehow give to children a respect for their own powers of thinking, for their power to generate good questions, to come up with interesting informed guesses ... to make ... study more rational, more amenable to the use of mind in the large rather than memorizing." Even though Bruner refers specifically to children rather than adults it was felt that it would be useful to help students re-discover some of their creativity that appeared to have been lost when they moved from earlier education into university study. This issue had been evidenced when a fairly complex packing problem (spheres in cylinders) had been used as a problem solving exercise with a group of computing students on another course. Although they could see that jam jars, marbles and water would offer an excellent way to simulate the problem they were initially extremely reluctant to countenance such 'child-like' investigations.

It is important that a learning environment is created where students felt that they can be creative and try out what may appear to non-standard approaches to problem solving. Combs (1976) considers that an important part of creating effective learning situations is to ensure that learners feel safe and accepted and that they appreciate both the risks and rewards of exploring new knowledge and understanding. In practice this means working closely with students and responding to their questions, however trivial the student may feel it may be, with positive and supportive responses. The responses to questions should be framed in such a way that they encourage the stu-

dent to recognise new lines of inquiry that will help them solve the problem for themselves. The other thinking that informed the development of the assignment discussed here was largely informed by Programmed Learning (PL) and Discovery Leaning (DL) literature and by the authors' exposure to adult education theory and practice. The ideas taken from these areas were then framed within games-related literature, particularly fantasy role-playing games (Holmes, 1981) and recreational mathematical games (Gardner, 1982). Gardner was particularly interesting because he had included a challenge to the readers of his Mathematical Games column in the Scientific American (Gardner, 1977) offering a $100 prize to anyone who could break an encrypted message using the RSA cryptosystem.

Programmed Learning and Discovery Learning

Thomas, Davies, Openshaw and Bird (1963, p12) identify PL as a combination of methods where learning material is reduced to a series of small, logically related sequences that is then taught by question and answer rather than the more traditional expositional approach. It differs from more conventional teaching in the sense that it is predominantly student-centric, with the student accepting a high level of responsibility for their own learning. The design of the learning material is such that the student operates within a controlled environment, works at their individual rate and must take responsibility for their own learning, forming their own opinions and making their own judgments. PL is designed to be self-pacing with each student working at a speed commensurate with their own ability. (Shirley-Smith, 1986, p41). Thomas et al (1963, p3) note that the teacher should have a low level of intervention in the learning process and should act mainly as a catalyst or facilitator who provides an interesting environment in which the student can learn in a structured way.

Discovery Learning (DL) also takes student-centricity and minimal focus on memorization as its underpinning themes. Belbin (1969) indicates that its success relies upon the ability of the training designer to carefully think out the progression of problems that the trainee is required to solve. As with PL the teaching role is facilitative with low levels of intervention. Students raising questions have these reflected back to them in such a way that they are prompted to carry out further investigation to arrive at their own conclusion. Thus DL differs slightly with PL in the sense that PL more strongly assumes that there is a 'correct' path through the learning and that deviations to secondary paths may be "probably more difficult to traverse" (Davies et al, p6). DL is rather less prescriptive in the learning path, with Belbin emphasizing that students learn by finding out the principles and relationships for themselves.

The PL and DL themes of student-centricity, self-pacing and low level of teacher intervention were used as the key guided the design of the assignment considered in this paper.

Education, Games and Dungeon Masters

At the time when this assignment was developed there was limited reference in educational materials to the use of games in adult education except for the developing area of computer-based approaches. O'Shea and Self (1983, p103), discussing the role of computers in education, offer a brief but attractive description of a computer game as 'a computer-based activity which leads its participants to leap joyfully (from the Indo-European 'ghem', to leap joyfully).' Gilligan (1975, p33) argued that the use of computer-based management games overcame the problems of straightforward lectures to help senior ICL salesmen obtain a better 'feel' for practical problems. Godfrey and Sterling (1982, p54) suggest that if rules are kept hidden it is possible to produce games that encourage inductive thinking. Beard (1976, p173) noted that although the use of a game or simulation does not fully reflect the 'real' world "It almost invariably heightens interest, increases motivation, and may promote reading and study of related subjects." Rogers (1977) reported that "Most groups of adults who have

tried discovery learning seem to find it genuinely exciting and enjoyable." but went on to note that "A teacher in adult education wishing to adopt the method for a wider area would immediately come up against difficulties of time and money. Some discovery-type apparatus could be assembled quickly enough, but it is likely that providing something for each student for every lesson would cost more than many institutes could afford." Rogers and Groombridge (1976, p58) identified value in the use of "games, case-studies and simulations for exploring complex problems with no neat solutions", but went on to note that the only educational setting that made consistent use of such approaches "is the privileged, colossally expensive and mostly private management education sector". This suggested that the development of an adventure-based assignment would be extremely time consuming.

Markle (1964, p10), referring to computer-based representations of Programmed Learning, comments that a key aim of the process is to generate an 'active response' to either particular events in the whole process or to the process as a whole. However, he appears to see the response as quite limited when he notes that "An active response is not necessarily a small response to a small bit of information … At the end of an art appreciation program, you might send the student out to spend an afternoon in the local art museum preparing a report on what he saw and felt (This hasn't been done to my knowledge. But I would still call this a response – a very active foot-weary one!)" The intention was that the Cryptic Quest would require students to physically visit several parts of the institution, including the student bar, the computer center and the library, in pursuit of their goal.

Despite these indications that the development of an educational game would be costly in terms of development time and would mean moving into constructivist educational territory it was still felt that it was a worthwhile endeavor in the light of the potential interest in encryption that students had expressed.

Valuable insights were also gained from the broader games literature consulted. Holmes (1981) noted that the 'Dungeon Master' (DM) must "balance the difficulty of his campaign against the abilities of his players characters. Balancing the difficulty of the dungeon to the players is a delicate act for the Dungeon Master, who must avoid the extremes of 'too easy' and 'too difficult'. Rather than offer detailed suggestions for dealing with this difficulty he simply commented that each DM solves this problem in his own special style and must be 'inventive, imaginative and scrupulously fair'.

Holmes also identified the problem that had been of some concern to the author. He commented that "A common DM problem is that, having decided how to deal with some situation during the game, he or she (or one of the players) finds contradictory instructions in the rules." Some initial thinking about the complexity of the assignment problem suggested that it would be difficult to be sure that the story would be coherent, engaging and that all clues would be solvable within the assignment time scale. However, it was still felt that the risk of the whole process failing was worth taking given that the students would not be at risk. In the event that part of the assignment proved to be too complex or convoluted more clues could be given to help the students find their way to the goal.

The Development Process

Consideration was originally given to the idea of building a hyper-text based adventure game using available MSDOS shareware packages (HyperShell and Black Magic) that the author was using for a Technical Authoring Masters. However, further consideration accompanied by some experimentation

suggested that the use of a software-based approach could run the risk of being too structured and predictable and this conflicted with the author's wish to provide students with freedom to utilise creative approaches. What began to emerge was an approach based upon the principles of PL and DL but without being structured as a primarily computer-based activity.

The development criteria for the assignment began to emerge as:

- It should be fun, challenging, complex and interesting, having a specific target outcome that could be reached by a semi-structured process that offered room for the exercise of creativity.
- It must be as student-driven as possible with minimum intervention from the member of staff.
- It must be located firmly within the context of data communications.
- It should be an individual assignment (students had strongly expressed the view that they were involved in far too much group work in the whole program).
- It must be achievable within the available time period. This required that sufficient information be made available, but without compromising the need for students to solve problems for themselves.
- It must track and record the development process so that students would have a document that would allow them to reflect on the learning process.

One immediate problem emerged from this list, namely the need for an individual piece of work. The task of designing a complex game that included ciphers with individual outcomes for each of the fifty students initially appeared to be a major problem. Although the basic idea of developing a process that led to a target word or phrase seemed to be moderately straightforward, the trick appeared to be to find a way to include a mechanism that would allow each student to achieve a unique outcome within a common process framework. In practice a compromise was achieved where the material presented to the students *suggested* that the outcome would be unique to each student but in practice there was a common solution. The rationale here was that although students would realise that here was a common outcome this would occur very late in the process. Students were required to keep a 'journal' to document their processes and they were required to include ideas that had been tested and abandoned as well as successful steps. They were required to hand in copies of journal material each week

The approach taken to implying that the work would be unique to each student was to make use of a mathematical trick part way into the solution path. This required students to first convert each letter of their surname into ASCII code (eg A=65 decimal, B=66 and so on), add the numbers together and then follow a mathematical process that almost always generated a outcome of 9 - *almost* always, as I later discovered when the assignment was in operation, because the first step of the process can sometimes generate a palindromic number (eg 121, 202 etc). In this event subsequent steps in the manipulation would provide an outcome of zero rather than the intended 9. When individual students reported that they felt this zero outcome could be a problem they were asked to use a nickname, or add in their middle name and this usually fixed the problem. In practice this 'Dungeon Master' device worked well and most students did assume that the outcome would be unique to them. Iit did not emerge as common knowledge until very late in the assignment that the same target word would be obtained by all students. There was some evidence of a small number of students finding out what the word was very late in the assignment and attempting to reverse-engineer through the solution path, but the requirement for a weekly journal quickly revealed this tactic. Many students refused to reveal the word to those students they considered to be laggards and a number of students still felt that their outcome would be unique even at the close of the assignment.

Having solved this core design problem the idea appeared to be viable and work on the main body of the assignment began. The assignment was labelled 'The Cryptic Quest' and the selected target word was 'Knowledge'. The development process was iterative, progressing from the initial intent to identification of a target word, identification of the possible location of the target word, then working both backwards and forwards through the problem to identify data for the clues. As each piece of relevant data was identified it was wrapped in the text of the Quest at the appropriate point. From vague idea to final product occupied around two months of wandering round the physical university site, deciding on the target word, producing the narrative to support the assignment and planting words and phrases in various computer labs. The narrative took the form of prose (rhyming all the way through began to occupy too much time and was abandoned!) and was framed in a dungeons and dragons type of storyline.

The Assignment: Final Version

The assignment was issued in week three of a 12-week semester. Students were advised that they were seeking a single word as the main outcome of the assignment and that successful identification of that target word would earn them a reward of 1 mark. The remaining 99 marks were available for explaining HOW that word had been located. The explanation was to be demonstrated through the use of a reflective journal with copies of development work handed in each week. Students were advised that this should be a true and accurate record of their work and should therefore include any efforts that did NOT lead them directly to a solution. In practice this journal approach proved to be useful to students as it kept a record of approaches that may have failed for one part of the work but could prove to be useful 'triggers' for later parts of the problem.

The assignment issued to the students was as follows (lines have been numbered here for explanatory reasons):

The Cryptic Quest

1. *Behind the founts of pleasure or pain*
2. *In the cave where companions gather*
3. *There find you some words revealed*
4. *But their message part concealed*
5. *To divine their meaning, imbibe your fill*
6. *Then gather your knapsack to hold all the clues*
7. *And follow the trail to the magic key*
8. *That in the end your goal will be true*
9. *Into Bruce's Kingdom take your venture*
10. *To seek the help of the one-eyed legend*
11. *Use intuition to summon his name*
12. *And heed his words to aid in your quest*
13. *In another cavern, just to the West*
14. *Seek hidden help lying beneath the root*
15. *And from its heart seize the expression*
16. *That is not a stare but almost a gape*

17. *Then onwards to the Castle not quite rounded*
18. *That shelters a treasure most vital*
19. *Cross the open space and down the lane*
20. *Passing the lodge that leads to a copse*

21. *And so to the realm of stone and of paper*
22. *That contains the container containing the key*

23. *Your final clue is your final name*
24. *But summed in the mystic sevenbit way*
25. *Take the result and blend with the potion*
26. *Twisting the key and reflecting the notion*

NOTE: The above four lines were enciphered in the student copy using the Vigenère approach outlined later in the paper. For example the first line (using CYCLOPS as the key) appeared as:

AMWCT XFCJE WITZU WZIGX KLCWB PEG

27. *The treasure you find is but yet a greater key*
28. *Use it well in greater adventures ahead of thee*

Lines 1 to 4 led the students to the bar in the students union. On the wall behind the bar, printed in gothic script of a yellowed and charred piece of card was:

There is magic in the air
And dragons to be fought
A sword and shield provide defence
But the key to mans' true power is
xxxxxxxxx

The number of x's is the same as the number of letters in the word being sought (Knowledge)

Lines 5 to 8 contain one piece of important data and one piece of misinformation. The misinformation was the word 'knapsack' which was a red herring. Students thought that this referred to a specific approach that they had come across in another subject that also included some security material. The other lecturer had been primed to make a strong point of suggesting that this was a useful topic to become familiar with. This allowed him to be sure that students would learn this topic for his course! The important words are 'magic key', suggesting that they will need a key at some stage for the deciphering process.

Lines 9 to 12 referred to the main computer centre (managed by Bruce of course). 'Intuition' indicated that they needed to be in the lab that supported a software package called Intuitive Solution. Students used this software on another course in the program. A file named Cyclops was accessible from this software, Cyclops being the 'one eyed legend'. The Cyclops file was enciphered using a simple 3-letter shift Caesar code and when decoded provided the following text:

Take all of the characters and express them as the fingers of the hands
Tally the values to make the sum
Observe the number and reflect the result
From the larger take the smaller
Tally the result for number new
Tally on until but one is true

This text relates to lines 23 and 24 and is the section where the students convert their names into their 'unique' numeric value. The 'secret of seven' refers to the seven-bit ASCII code. Here 'express them as the fingers of the hands' implies decimal and 'reflect' suggests both 'think about' and number reversal. The full process should always lead to the number 9.

The four personal computer labs in the computer centre were referred to as North, South, East and West and lines 13 to 16 refer to the West lab. Here the student needed to enter DOS, go to the root directory and then identify any directories that appeared significant (eg GRAIL) and work through other subdirectories until they located one named as TREE (reference to 'root'). In that directory was a short text file named READ.ME that contained two numbers, one a Dewey-decimal-style library reference, the other being a 3 digit number (the 'expression'). The Dewey-decimal number had been multiplied by nine. (Nine being the number generated by the mathematical manipulation of the numeric value generated from their name). The text '*…is not a stare but almost a gape'* is a crossword style anagram where gape can be read as page, indicating that the number is a page number.

Lines 17 to 22 took the students on a scenic tour of the university site, across the car parks and tennis courts, and past the building known as the Polygon (*castle not quite rounded*) then down an entry road, passing the gatekeepers lodge and finally onto the large open space with a central island of trees. This was commonly called the 'fishbowl' where students stake out territory using beer can markers, towels etc and go through display routines to attract a mate on those warm summer days. Opposite to the fishbowl was the library - *the realm of stone and of paper that contains the container containing the key.*

Lines 23 to 26 were enciphered using a modern version of the Vigenère cipher (in Kahn, 1973, pp 98-100). This polyalphabetic substitution cipher was developed by Blaise de Vigenère in 1586 and uses a keyword that must be known to both communicating parties plus a *tableau* in which each row corresponds to a Caesar cipher. In the table the first row has a shift of 0, the second has a shift of 1 and so on. The keyword used for this exercise was Cyclops. This is a relatively obscure approach that does not lend itself to simple frequency analysis solution, but the Kahn book was in the library and a number of a number of hints (including a dreadful fake French accent in one of the lectures) was provided to the students.

This is the most complex and error-prone part of the assignment, requiring that the text be deciphered using the keyword and *tableau*. The ciphered text did contain some errors and upon decipherment appeared to be gibberish in some places, suggesting to some students that they were on the wrong track. However 'context dependency' (covered in the lecture/seminar programme) rescued the day and they were still able to construct a meaningful text. The author would like to claim that this was a neat little trick for throwing searchers off the track, but in fact it was totally unplanned and a result of trying to carry out the ciphering too late at night!

Lines 27 and 28 were used to close the narrative.

Successful navigation of the clues provided students with Cyclops, the number 9 derived from the application of a process to their name, a dubious looking Dewey-decimal style number, and a page number. Dividing the Dewey-decimal number by nine allowed identification of a dictionary in the reference section of the library, the page number led to words beginning with 'K' and the first word on the page was 'Knowledge'.

Reflections

Student Comments

The work produced by the students by the end of the semester was of impressive quality in the main, with five students being awarded marks of 100 within a total student group of fifty.

Typical student comments included:

- *Very difficult, in fact it seemed impossible at times, but once you 'saw the light' it was great fun.*

- *Great to have an assignment that was fun for a change!*
- *You fooled me – I was sure we would each end up with a different word. Neat trick*
- *I asked the resident 'spook' at an embassy party I was at if he could help and he said he had never seen that type of code before.*

The students found some aspects of the assignment to be very difficult but generally enjoyed the challenges and a number commented that this was the 'first time we have ever really had to think'. As noted earlier the novelty of the task led to very high levels of engagement, often to the detriment of other subjects. New versions of the assignment were used in the following two years, again with a great deal of success but a re-structure of the program led to this course being absorbed into another part of the program that the author was not involved with.

Educational Issues

One problem in the design of exercises such as this is that the solution is in the developer's head and clues are constructed in that context. There is a danger that more and more convoluted clues are developed with the danger that they can only be understood once the solution is known. It would be possible to insert keywords into the game to allow the reverse engineering of previous sections to help students deal with the rather more tortuous or obscure clues that may be developed. Even so, the developer must be prepared to be flexible and offer significant hints to those students who are not familiar with Greek literature, crosswords, palindromic numbers and so on.

Several colleagues commented that assignments for courses that they taught were arriving late or, extensions were being requested because students were so absorbed by the data communications problem that they were neglecting other subjects. If one member of staff takes innovative approaches to support learning there is a risk that other courses will feel obliged to follow suit, demanding extra development and management time in a world where time is an increasingly scarce resource. Thomas et al (1963, p39), discussing Programmed Learning, suggest that "When preparing a scheme of work apropos the writing of a programme, teachers must bear in mind the interdependency of their subject on others and, as far as is possible, should try to 'dovetail' their work with that being done in other subjects" They comment that appropriate techniques could be used to help students to recognize the interdependence and interrelationships between subject areas and so help to remove the impression that individual subjects exist in their own right. This would have been an excellent aspiration but the development time required would have been even more extensive and would have demanded even more risk and complexity in the management of the process.

Although the focus of this particular game was a specific part of data communications, these games have obvious applications in such areas as project management, systems analysis, human communications and a wide range of other subject areas. The relatively slow and investigative nature of the type of game outlined in this paper may see to be at odds with the faster 'shoot-em-up' genre, but Game Research (2005) comments that 'Adventure games belong in the more thoughtful end of the spectrum. They demand logical thinking and great persistence from the player. Often their loose structures can be compared with a movie that stops at intervals demanding the solution of task or riddles in order for the narrative to progress. But many players seem to find the slow uncovering of adventure game stories appealing.' It would be interesting to structure an entire collection of courses within such a framework, with individual subject areas working around a central theme. This may allow students to make stronger connections between the various subject areas that comprise an entire educational offering.

There is extensive Problem Based Learning (PBL) literature that more broadly encompasses the type of activity discussed in this paper but retains the overall flavour of engagement with the subject, discovery and student-centricity. What PBL has in common with PL and DL is that it deals with messy and complex problems that require student-driven inquiry, information gathering, some trial and error and reflection. Where PBL appears to differ from the PL and DL approach is that it has no single or 'right' solution. Interestingly PBL appears to be currently very much in vogue but Clark (1999) comments that although the concept of DL has appeared several times as part of educational philosophy but has never received overwhelming acceptance.

This type of learning activity may not appeal to every teacher. The approach requires a genuine handing over of the learning to the learner and willingness to deal with unexpected events along the way. There is a potential need to openly admit that part of the process has not been fully thought-through or that a vital piece of data or process is missing. Rogers (1977) recognises this issue when she comments that "A teacher who works on discovery lines and who starts from where the student is will blame himself if students fail; many teachers in conventionally run classes start from where they think the students ought to be and blame them if this is a standard they seem unable to reach." She further comments that a teacher who likes to feel in complete personal control of everything in their classroom may reject discovery methods. Similarly, there will always be some students who want to be told rather than discovery ideas or relationships for themselves.

Contemporary Versions of Quest

The assignment was developed in a pre-internet era and the most significant feature of a modern implementation of the Quest would be extensive use of the web. It is now easy to locate materials relating to, for example a 'quick Google' for Vigenère provides a plethora of explanations (see, for example, http://www.trincoll.edu/depts/cpsc/cryptography/vigenere.html). The benefit of such web-based material is that it provides links to more cryptographic materials for students whose interest may have been triggered. The downside is that the material is so easy to access that a modern version of the Quest would probably have to suggest a reference to a less obvious set of materials (perhaps using the Gronsfield variation of the Vigenère technique) and would require a somewhat more devious (and time-consuming) approach to the design.

At the time the design of the Quest was undertaken the available 'games' literature was somewhat limited but clearly there is a wealth of material now available in the current world of game design. Cavallari, Hedberg and Harper (1992) offer a useful review of adventure games in education. They comment that adventure games are given a variety of names and are categorised according to a variety of criteria including 'Text adventures' and 'graphic adventures'. They note that Balajthy (1986) refers to 'interactive text games, participatory novels, simulations, interactive fiction, fantasy games, strategy games or mystery games'. Quest would probably fit under the 'text adventure' or 'participatory novel' headings even though it was not delivered via computer screen. It was essentially linear, requiring that sub-problems mainly be solved in a sequential fashion (although some reverse thinking could be used), whereas a modern equivalent could use extensive branching approaches. One problem that arises when the possibilities, and complexities, of easily accessible technology are used to replace a simple text based approach is that the time required for development rises dramatically. The Quest developed over a matter of three months even though it is a relatively simple object. The demands for development time for a more complex structure, given that it may be advisable only be used once every few years to avoid plagiarism, as was the Quest, may be impossible to meet in the demanding educational environment that currently prevails. Perhaps what is needed is a team of educators to develop a series of learning ob-

jects that could be easily modified and re-configured to extend the usable lifetime of the product in line with the idea of 'learning objects'.

Modern games related learning activities could be built around the WebQuest work of Dodge. Dodge developed and named the concept while teaching a class for preservice teachers in the spring of 1995. He wanted to give his student teachers a format for online lessons that would make the best use of student time while fostering higher-level thinking skills. His comments echo many of those discussed above including the need to find sufficient time for the design and the benefits of working with students as a 'coach' rather than the main source of information.

Other approaches could be built around 'geocaching'. Kidd (2005) outlines the ways that Geocachers bury 'treasure' in a hidden location and upload the GPS coordinates to a website like www.geocaching.com. The treasure may be a log book, further clues, or gifts. When a cache is found, the prize is taken by the seeker, who in turn leaves another gift for a fellow cacher. This moves from the individual approach in Quest to a more collaborative student learning possibility. Incorporation of GoogleEarth co-ordinates could produce a global game that could be used as the basis for exploration of subjects such as geography, politics and so on.

Concluding Reflections

Does the author still develop assignments and learning processes of the types described above? Not to the same extent has to be the honest answer. He currently uses Audience Response Systems, authentic learning exercises, juggling, debates and role-play and strongly believes in deep learning and constructivism - but the level of personal risk taking has been massively reduced. The prevailing educational environment seems to be moving towards a more prescriptive approach where course information books are legal documents and assignments are fully detailed. The author would be very reluctant to even consider the use of a Quest style assignment today. Many students want only the minimum amount of contact time with the university and clearly not everyone enjoys puzzle-based work. Charles and Lester (1982, p9), discussing the teaching of problem solving, observe that "Some people love to work on puzzle problems, whereas many people find them unbearably frustrating and don't like them at all. For people who don't like them, puzzle problems aren't really problems at all because the first and third conditions of our definition of a problem aren't satisfied – that is, the individual does *not* want to find a solution nor does he or she make an effort to find one."

Clear learning outcomes and marking schemes are increasingly demanded, but may also very difficult to produce for creative or process based assignments. Beard (1976, p45) identified this problem and notes that the definition of objectives for 'open-ended' activities is difficult and may stop once the main course objectives have been outlined. She reports that even at this minimal level of objectives definition some teachers of arts subjects indicate that it is impossible, or possibly misleading, to clearly define some of their aims. True discovery based learning implies that the learner will gain insights that were beyond those envisioned by the course designer and may have more intrinsic value to the learner than the 'official' aims. The Quest assignment led to five students being given marks of 100%. This was the first, and only, time that the author has awarded such a mark and, given the somewhat loose and intuitive nature of the 'marking scheme', the examination board was viewed with some trepidation. The response of the external moderators was, however, very supportive and they had no problem appreciating the value of the activity and the worthiness of the high scoring students.

For the learning facilitator the very real risk is that innovative, open ended, ambiguous or seriously challenging approaches often carry risk with them and may lead to negative or even hostile course evaluation by the 'customers' with potential cancellation of the course or, at least, a need to mount a strong defence of the approach used. Even if the risks are taken, the time required to develop different

approaches, as indicated earlier, is considerable and time for such activities becomes limited in the contemporary educational environment. However, if time can be made available to develop these types of approach they are valuable learning devices and can also provide some light relief in a busy educators' world, as the following closing stories indicate.

An interesting measure of the impact of the course in terms of student engagement with the problem can be taken from the comments of a student who stopped the author as he was heading for a meal in the refectory and said, in a somewhat accusatory voice, "You are David Banks, aren't you?" I acknowledged that this was the case and the student then commented, at length, on how complex and difficult the assignment was, how much time was required and how it interfered with their social life. Given that I did not recognise her face, I gently pointed out that if they turned up for sessions it might not be so hard as I gave plenty of clues in the lectures and seminars. She replied "Oh, I'm not on your course – but I share a flat with someone who is and they talk about nothing else!"

A flexible approach to marking is required for this type of assignment. One student was awarded 99 marks for his work that demonstrated excellent problem solving and process discussion but eventually arrived at the conclusion that the target word was 'GRIT'. His rationale for this conclusion was as he reached the end of the physical journey round the site he found a large yellow bin with the word 'GRIT' embossed on its side, containing a mixture of salt and coarse sand used for dealing with snow and ice in the car park during winter. This bin was located outside the "realm of stone and of paper" (ie the library) and, as he quite reasonably commented, "You need grit to finish this kind of assignment"!

Designing, implementing and participating in assignments such as the Quest are potentially great fun, for staff and students, but the intensity of design and operation equally demands knowledge and grit on the part of all parties – staff, partners, colleagues, students and even innocent bystanders.

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Biography

David A Banks is a lecturer in Information Systems in the School of Computer and Information Science at the University of South Australia. He worked for a large UK telecommunications company for the first sixteen years of his career, dealing with data, television and video-conferencing systems. During this time he was also a part-time student counsellor with the Open University, taught a variety of adult education classes and produced a series of radio programmes for BBC local radio. Upon gaining a Diploma in Adult Education and a Master of Philosophy from the University of Leeds in the UK he moved into higher education. Subjects taught included computer systems architecture, project management, data communications, database design, and introductory programming. He was seconded to New Zealand in 1993/4 as a Visiting Research Fellow and moved to Australia in 1998 to take up his current post. His research interests include IS education, IS development methodologies and Audience Response Systems. His current teaching includes information systems development methodologies and collaborative information systems.