MicroWorlds and Learning in Teacher Education

ABSTRACT

The introduction of an open-ended MicroWorlds based assignment in a pre-service teaching degree produced interesting results. Students engaged with the task at very high levels and produced work of high quality; so much so that marking trends were reversed.

This paper explores the design and implementation of the task and how for many students it allowed them the opportunity to shine. Students who performed poorly in written assignments achieved excellent marks and reported high levels of engagement and satisfaction. There was also an improvement in marks of students from non-English speaking backgrounds.

The paper details the experiences of particular students and relates their experiences to issues of assessment models in multimedia and the establishment of constructivist learning environments using IT. Some students experienced considerable difficulty and frustration with this task; their experience is also discussed within the context of these issues.

The projects themselves are analysed, along with interviews and observations in an attempt to illustrate the success (and failure for some) of this experience. The individual approaches to the task and the processes used in the creation of projects are also investigated.

The paper also refers to the development of literacies, multimodality and to the continued development of effective (and affective) learning environments.

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BIOGRAPHY

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BACKGROUND

Second year Bachelor of Education (Primary) and Bachelor of Early Childhood Education students at the University of Melbourne undertake a one-year compulsory subject in IT in Education. The subject introduces a range of software applications to students and encourages them to develop ideas about effective integration of IT into their teaching and appropriate use of IT to support and enhance learning. The subject is presented in the form of a weekly lecture (also available online) to the whole cohort and weekly workshops. The workshop series is designed to provide students with practical experience in a range of programs and to introduce them to a range of possible classroom uses for the technology. Whilst there is a desire to develop student skills, the focus is on effective use of IT in the primary classroom and in Early Childhood education. Assessment for the subject takes the form of four major assignments and a series of small workshop tasks. In the past, the major assignments have consisted of three written tasks and the production of a web site. During 2004 the decision was made to alter the assessment tasks to include a multimedia project using MicroWorlds. This resulted in a balance of written and practical assessment tasks. The assessment component for 2004 consisted of an 800-word review of literature relating to an aspect of the use of IT in Early Childhood or primary school education, an 800-word evaluation of software for educational use (including ideas for implementation), the MicroWorlds project, and a six-page website that could be used in an educational context.

Despite many students being under the age of twenty-five, there is an overall lack of confidence on computer use. This paper presents some of the findings of the small research project that was established to investigate student responses and attitudes to the MicroWorlds assignment. A key factor in the creation of the assignment task was the principle of establishing constructivist learning environments; a part of the investigation into the student responses is the analysis of those responses to gauge how well the environment we created worked.

A team of three staff members delivers the subject to some 230 students. Course content, delivery, assessment and educational philosophy are discussed and decided upon by all three members of the team.

Description of the project

The project was prompted by the student response to the assignment. We noticed high levels of engagement and we were receiving more than the usual numbers of requests for assistance, guidance and advice. During class time we noticed that the projects were becoming larger and more complex than we had anticipated. This was confirmed when projects were submitted for marking. We found a remarkable level of complexity and creativity. In order to investigate these experiences and to find out about the learning and the teaching, I identified ten projects to

investigate and sought permission to interview the authors about their projects and the way they worked. Of the ten, two were unavailable for interview. Participants were selected from students who had been in my workshop groups throughout the year.

Given the small scope of this project, I could only work with a small number of participants. Through my normal teaching interaction I was aware of those who struggled with this project and those who felt very positive about it – regardless of their final grade. I am well acquainted with the achievements and difficulties of many of the students; accordingly I identified a number of prospective participants based on the following criteria:

- They produced work that resulted in a significantly higher or lower grade than the first two assignments

- They have indicated a particular level of dissatisfaction or satisfaction with the assignment

- They produced particularly complex pieces

THE ASSIGNMENT

The subject, IT and Children's Learning, strives to introduce and model constructivist learning environments for the integration of computers into the primary classroom. We decided to introduce MicroWorlds to the students through a series of practical workshops, underpinned with a lecture series, culminating in the production of a MicroWorlds project as the third major assessment piece in the subject. We made some important decisions about the task that were based on our own constructivist understandings:

- The task was open ended (A four-page book or game that could be used in an educational setting)

- "Instruction" was limited

- Collaboration was encouraged (page requirement doubled for joint projects)

- In-class support was maximised

- An audience was established

- Imagination, creativity and fun were encouraged

Here is what we asked of the students

Using MicroWorlds Pro and working on your own or with one partner, you are to create a book or a game project that is suitable for use in an educational context. For one person a satisfactory book will have at least four (4) pages with

automatic or manual links to move from one page to another. If you are working as a pair your project should have at least eight (8) pages.

Your project will use at least the four major components of multimedia listed below:

- *Colour*

- *Shapes or images*

- *Moving or still*

- *Generated by a person, camera, computer*

- *Text and text boxes*

- *Sound.*

Remember to acknowledge any images, shapes or sound files you include in your project that are not part of MicroWorlds.

The project should start automatically when opened, and must include the necessary code for all animations used rather than relying on automatic animation. Not every shape or image has to be animated.

Students were supported throughout the project by a series of three lectures that introduced the program and basic programming ideas, provided a theoretical framework of constructionism with examples of classroom practice, and discussed multimodal learning and the place of multimedia in the classroom.

The lecture series commenced with an introduction to MicroWorlds based on using audience members as volunteer 'turtles' to be programmed. The second lecture presented and discussed examples of children's work in MicroWorlds. The third lecture was a presentation of research by John Vincent. His work in the area of multimodality and transmediation with primary school children using MicroWorlds (Vincent, 2003) provided students with the opportunity to see children's finished projects in a context of literacy development and with a clear explanation of theoretical understandings.

The workshop sequence was designed to avoid 'teaching'. The first session was an introduction to basic commands and some free drawing activities – draw a streetscape or write your name. The second introduced the drawing tools and the idea of simple animation and linking of pages. The third, fourth and fifth sessions were used to demonstrate features (always in the context of a working project) or in one-to-one problem solving and discussion.

Student Responses

It is not possible to present detailed analysis of all participants at this time. The following case studies present analysis of some projects and the experiences of participants. Reference is also made to other projects but without detailed analysis.

ANNE

Whilst the assignment was for many a deeply rewarding task, there were some for whom it was very difficult and frustrating. Through my interaction with students in class and out of it, I was able to identify one such student. Anne is a very capable and hard working student came to see me in tears about her inability to successfully complete the task. She received first class honours for her first two written assignments. She said of the MicroWorlds assignment that it was "the most frustrating thing I've done since I've been at Uni." She did not plan her project, although she always plans her written work carefully. She said; "I had nothing to base … I'd never done anything like it before so I had nothing to base my methods on so I just had the biggest mental 'wall' up about MicroWorlds"

WEI WEN AND TRAN

Of particular interest was the way this project provided opportunities for students from non-English speaking backgrounds. The University caters for large numbers of international students; typically, many of these students struggle with the demands of formal academic writing. Asian students, in particular, are amongst those who usually do poorly in the literature review task. I attempted to interview a number of these students after I noticed significant improvements in their results; unfortunately only two responded. Tran and Wei Wen worked together to produce an extremely complex and visually rich presentation of a traditional Vietnamese story: Cuoi and The Magic Tree. Interestingly, they used large amounts of text to underpin the story, not feeling they could rely on the moving pictures alone. I had to intervene to stop the two doing more as they had already committed much more time and effort than was expected and I was concerned that their other work might suffer. They expressed some disappointment that they weren't able to include sounds and music. They also "planned to have the verbal reading of the story" but ran out of time.

For these two the text was important at the start; it was the story, although when looking at the finished project, the text plays a secondary role. Tran said that they "wrote the lines and then we planned the pictures, the drawings. Which line belongs to which page – all on paper first". They did it that way as a compromise in their collaboration. Wei Wen, a student with stronger English skills than Tran, approaches written tasks by making notes and then writing. Tran likes to "read first, then make plan and then write." Wei Wen spent more time initially experimenting with MicroWorlds and developed her skills quicker than Tran. Accordingly, they commenced the project with Wei Wen doing the programming and Tran doing the drawings. Before long they both took up both roles and worked independently, while still cooperating.

Programming

Neither student had any experience in programming. Their response to the task was to plan everything they wanted to happen on a page and then write a program that addressed every turtle and every action in turn. This created very long procedures that were extremely fragile. An over use of the everyone: clickon command ended up causing them problems. The following is one procedure. There were procedures of this length on every one of the twelve action pages:

```
to tree
everyone-
but[t17][clickon]
tto [t12]
infront
tto [t7]
infront
tto [t14]
ht
tto [t6]
ht
tto [t4]
infront
tto [t3]
infront
setpos [111 82]
setsh 113
tto [t2]
setpos [-372 -2]
repeat 11
[setsh 1
setsize 40 fd 5
wait 1
setsh 2 setsize
40 fd 5 wait 1
setsh 4 setsize
40 fd 5 wait 1
setsh 3 setsize
40 fd 5 wait
1]
setsh 126
setsize 110
fd 0 wait 5
setsh 127
setsize 110
fd 0 wait 5
setsh 128
setsize 110
fd 0 wait 5
tto [t3]
setsh 114 fd 0
wait 5
tto [t2]
repeat 2
[setsh 126
setsize 110
fd 0 wait 5
setsh 127
setsize 110
fd 0 wait 5
setsh 128
setsize 110
fd 0 wait 5
setsh 126
setsize 110
fd 0 wait 10]
tto [t3]
setsh 114
tto [t2]
setsh 126
setsize 110
fd 0 wait 1
tto [t6]
st
setpos [371 -
20]
repeat 7
[setsh 38
setsize 40
fd 5 wait 1
setsh 39
setsize 40
fd 5 wait 1]
tto [t3]
setsh 120 fd 0
wait 1
tto [t6]
setsh 40 fd 0
wait 5
setsh 41 fd 0
wait 5
wait 10
tto [t14]
st
setpos [-370 -
118]
repeat 2
[setsh 106
setsize 40
fd 0 wait 5
setsh 116
setsize 40
fd 0 wait 5
lion
setsh 116
setsize 40
fd 0 wait 5
setsh 116
setsize 40
fd 0 wait 5]
wait 20
tto [t14]
ht
tto [t6]
ht
tto [t4]
infront
tto [t3]
infront
setpos [111 82]
setsh 113
tto [t2]
setpos [-372 -2]
hidetree1
everyone [clickoff]
wait 5
end
```

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Not all students adopted this approach, and this is an extreme example, but it was an approach that worked for them and it was, according to Wei Wen, "step by step – easy to see which turtle is which."

They faced many difficulties throughout the task but were so intent on successful completion that these obstacles became sources of great pleasure when they were surmounted. They both found it frustrating at times, especially early on, but worked through the frustrations.

Learning Process

Tran felt that she could have been better supported she needed "extra help – maybe one or two classes in a week for students who need extra help." She needs "to take time to learn more things what I'm doing." When asked about what skills she would have liked to be taught, she didn't really know. Yet she expressed real pleasure at the finished project. For her, working with a partner who had better developed skills than her, helped the process and allowed her to learn from and with her partner. She said that while they were working on their project they were not thinking about marks and that "they wanted something to be proud of."

Tran enjoyed "doing the backgrounds doing … making the characters move and turns and all that," while Wei Wen found it most "rewarding when I managed to do the thing that I want like from this angle to that angle I managed to work that out. "Yeah that kind of stuff I enjoyed that the most when I got what I want." Figure 1 shows some of the shapes they created in order to make the tiger turn around: this is one of the characters to which Wei Wen is referring above.
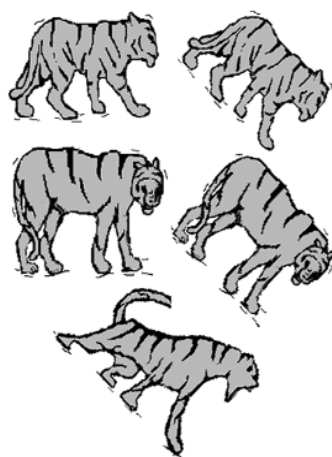

Figure 1 Tiger Shapes

Despite Tran stating that she needed more help, when asked about this assignment in comparison to the literature review task, she stated that it was better because it "doesn't require that much English" and in the literature review she "didn't know what was expected." When I responded that she didn't know what was expected in this assignment, she said, (quite

cheerfully) "I figured it out."

Initially Wei Wen agreed with Tran about more skills teaching, but towards the end of her interview she made this observation:

> "Thinking about how you just teach the general stuff and then we need to explore ourself. Now that I think about it it's a really good idea to do that, like it makes us explore the whole program instead of just getting the information from you lecturers – no don't teach the skills, let the students explore themselves. I find that it's more rewarding if you, um, if you can figure out the things for yourself."

I believe that this represents her understanding of, and acceptance of, the teaching process that we had deliberately adopted.

JEN AND LISA

This was another successful collaboration from two students who had not previously worked together. The pair had a plan from the very beginning and decided that they would use the planets as their theme. They had seen a book about a French boy who visits the planets and decided to follow that idea and produce a story about an Australian girl, Pipi, who travels to the planets. They wrote up everything before they started; "we decided which planets we were going to go to – looked to see interesting features … and we decided on the characters that we were going to have on each page, which had something to do with their planets." They sketched out their characters on paper before they even started in MicroWorlds. They ended up using mostly their own drawings supplemented by MicroWorlds shapes. By working this way they had everything they needed before they started creating their project; MicroWorlds then became the presentation vehicle, but they had to work out how to make it work.

Programming

Neither student had any programming experience. They knew what they wanted to occur; they just didn't know how to make it happen. "It took you ages to work out how to make Pipi come out of the rocket, have conversations, walk back. We took something like about six weeks to do two pages and then we nailed the last four pages in like the last three days." This last comment interested me so I asked them to expand, I said, "What, you knew what you were doing?" To which they replied:

> "No we understood what we were doing from the start, it was just understanding the technological terms, like the terms you had to use to get things done. Like we were being logical about it but sometimes it just wasn't happening. And … we start to have … well the format for the procedures for each page started to be very similar. We worked out how to get things done. We worked out that you needed a hide turtle, show turtle, write three different procedures and then put those procedures into their own procedure."

They had identified a pattern in their programming, or at least a style in their programming, and worked out how to duplicate that process. What is of most interest to me is that they felt they understood what they were doing from the start; they just didn't understand the technical terms.

The following procedures show how Jen and Lisa have duplicated programming styles. They are still using basic commands and have not written any super procedures but they

DISCUSSION

Images and text

The use of images to convey meaning is apparent in all of the projects, of course it is, MicroWorlds operates at an image level. Many of the students also relied on the presentation of text to convey meaning as well. What interests me in this case is that the role text played in the projects lessened as each project

```
to robot                  to M&M2                  to PP2
setpos [65, -43]          setpos [194 -2.5]        setpos [-268 -31]
repeat 10                 seth 0                   seth 180
[fd 10 wait 2]            ht                       st
launch [ma]               wait 10                  wait 30
wait 250                  st                       fd 50 wait 7
repeat 10                 repeat 5                 lt 90
[back 10 wait 2]          [fd 100 wait 2           fd 200 wait 7
end                       bk 100 wait 2]           lt 40
                          wait 155                 fd 130 wait 1
                          rt 90                    launch [ju]
to PP1                    repeat 17                wait 145
setpos [255 -94]          [fd 10 wait 1]           rt 40
wait 250                  ht                       repeat 33
repeat 40                 end                      [fd 10 wait 1]
[fd 10 wait 1]                                     ht
end                                                end
```

have produced a much simpler solution to their programming needs than Wei Wen and Tran.

Learning Process

Jen and Lisa were in agreement about skills teaching. They felt that it would really be a waste of time to try to tell people how to do a whole lot of procedures. They agreed with our approach and said:

> "The skills stuff's hard though, cause if you start sitting there teaching it people are like logging in and doing their emails and stuff and like everyone sort of … there'll be a couple that will pay attention but you'll teach it and five seconds later the people that weren't listening will say to you 'how do you do this?' Sometimes it's better just to have one on one – when you come across a problem …"

> "I think that was kind of good in a way as well cause it gives people much more opportunity to go as hard or as complex or as simple as they liked. It's too hard as well to take it all in at once, with you up there going 'this is how you do this, this is how you do that' and you don't actually have a fiddle with it, you're not going to take it in and you're not going to remember it."

By the time they were finished they were very happy with their project, although they acknowledged that it still didn't look very professional. Unfortunately, neither of them felt confident enough to consider using MicroWorlds in their teaching.

developed. Further investigation may be able to spread more light on this. Only one project did not rely on text. In that project text was used, but had nothing to do with the 'story'. Figure 2 is a screen shot from James and Laura's project, they have used text, not to inform or direct, but to amuse; the text is supposed to represent an advert. Each page used text in the same way; each advert was relevant to the page content.
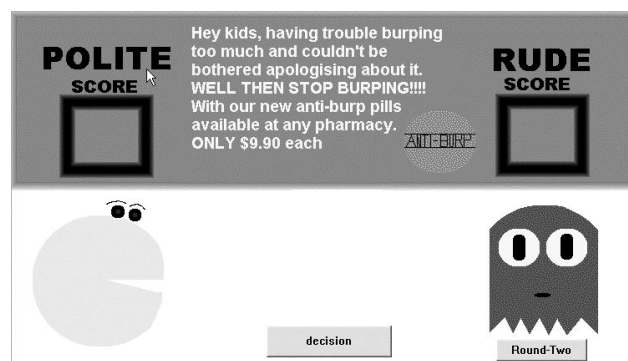

Figure 2 Text as an amusement

It was in this project, too, that sound was used differently to other projects. Sound was integral, all the instructions were spoken, as were the results.

Even though there were similarities in approaches to programming and in the use of text and images to convey meaning, out of approximately 230 projects there was no duplication of content. Every student produced something entirely of their own.

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SIGNIFICANCE

The engagement with this assignment task from the majority of students was unprecedented. Students became engaged to a degree that they were committing amounts of time to the task disproportionate to the value of marks awarded for the assignment. The message we were receiving was that they were more interested in the task than the mark. When the projects were marked, the hard work was justified and a reversal of scores between the first and the third assignment attested to that. The University applies the following grading scale: H1 (1st class honours) is awarded to work in the range of 80 – 100%, H2A in the range of 75 – 79%, H2B in the range of 70 – 74%, H3 in the range of 65 – 69%, P in the range of 50 – 64%, and N for marks below 50%. Table 1 presents the marks for the first three assignments: the literature review marks were 4% H1 and 44% P; MicroWorlds assignment marks were 47% H1 and 13% P. This in itself is worthy of investigation.
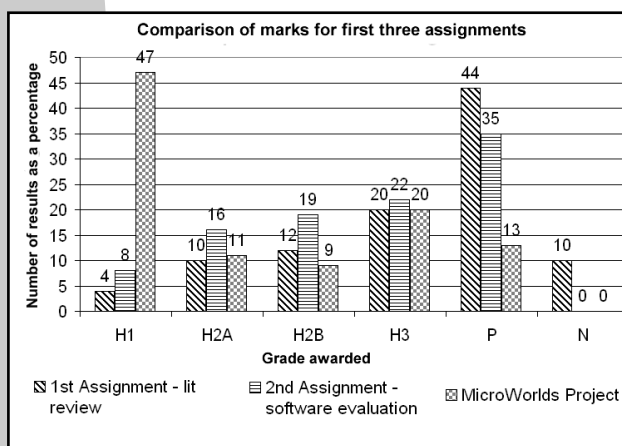

Comparison of marks for first three assignments

Number of results as a percentage / Grade awarded

1st Assignment - lit review | 2nd Assignment - software evaluation | MicroWorlds Project

Table 1

TEACHING AND LEARNING

From a teaching and learning perspective the MicroWorlds project was a success. We applied constructivist theories and were rewarded by a student population that was engaged and challenged - and learning. The level of engagement with this task suggests a level of intrinsic motivation not seen in the other assignment tasks. A constructivist environment relies on student-centeredness (Pederson and Williams 2004); I argue that the design and implementation of this task assisted that intrinsic motivation. Here was an assignment task that was all about what they wanted to do. This was not the case for all students as demonstrated by Anne's responses. Yet overwhelmingly, students enjoyed and engaged with the project. For some it could be argued that they were approaching a state of what Csikszentmihalyi (1996) refers to as "flow." It is possible to identify a number of his "nine elements of enjoyment" including the distortion of sense of time and the sense

that "the activity is an end in itself" (p.113). Participants clearly expressed the view that they were not spending time on the assignment in order to get good marks; they did it because they were enjoying what they were doing. Even in the assessment of the task we strove to assess not only the product but also the process and the learning in context. These are difficult things to assess but this approach fits with ideas of authentic assessment (Cormak, 1997) and his notion that assessment is not a just measure of learning "rather it constitutes learning, in that it specifies what will 'count' as learning." We were using the assignment in an attempt to assist learning about MicroWorlds and, more importantly, learning about learning and teaching.

CONCLUSION

This was a small project and a larger one was conducted in 2005, and will be reported soon. The results of this study were used to inform the implementation of the same project this year. It will be of interest to see if this was an aberration or whether it was a representation of what can happen when powerful software is used in rich learning environments, and when students (even at tertiary level) are carefully supported, yet set free to explore, create and make their own meaning. Papert (1993) is "convinced that the best learning takes place when the learner takes charge" (p.25) I believe that this is an example of that best learning. Perhaps the final words belong to Laura: "when you go through the 8 pages that we did, it's pretty impressive like, that we did it."

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