

The perceptions of students in Initial Teacher Education regarding Logo and its use in primary schools

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Anecdotal evidence in 2009 suggested that Initial Teacher Education students in Bachelor of Education (BEd) mathematics classes appeared to have mostly negative perceptions of Logo, which constituted part of the second year course and was a recurrent theme in workshops. The aim of this research was to find out whether this was actually so and if it was, what students disliked about Logo and why they questioned its use in primary school mathematics teaching. The research also aimed to improve future course design. Student and staff views were collected through questionnaires and interview. Return rates for student questionnaires and numbers participating in discussion were small, but confirmed the negative perceptions of Logo in most regards. However, students indicated that several suggested changes to the course might be beneficial and these were implemented in the 2010 course. A similar questionnaire surveyed the views of this cohort of students at the end of the course, and found that perceptions of Logo were broadly similar to those of the 2009 cohort.

Keywords: Initial Teacher Education, Logo, primary mathematics.

Background

In January 2009, I unexpectedly found myself moving from teaching in a primary classroom, to teaching mathematics to student primary teachers on Initial Teacher Education (ITE) courses at university, both undergraduates on a 4-year Bachelor of Education (BEd) course and postgraduates on a 1-year Professional Graduate Diploma in Education course. Mathematics is taught during the first 3 years of the Bachelor of Education course. The broad division of the course is to cover mainly aspects of number teaching in Year 1, most of the rest of the primary mathematics curriculum in Year 2, and devote Year 3 to a couple of curricular areas, but mostly to more theoretical issues and reflection on research.

On both courses, I found to my surprise that learning how to use Logo was an integral part of the course content; on the 2nd year BEd course it occupied part of a lecture and a 2 hour computer lab session. This compared to the topic of fractions and decimals, for example, which received a 2 hour taught and 2 hour student led workshop. I say to my surprise, because although I had learned how to use Logo twice in my previous 30 years' primary school teaching, I had never used it in the classroom with children and had never known any one who had. I thought it was an interesting program, I had used the programmable robot Roamer and had investigated Roamer World software which enabled the Roamer to be programmed through the computer using a version of Logo, but time and space constraints, coupled with a shortage of computers, had always militated against exploring Logo's potential in the classroom.

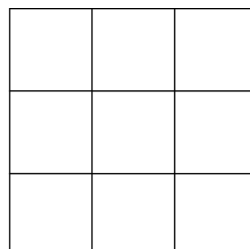
ITE courses are taught by a mixture of full-time university staff, sessional teaching staff and teachers from local schools. I was interested to find out whether

those with recent and current teaching experience used or had used Logo, and was unanimously told they had not. I spent a couple of hours re-familiarising myself with the language and procedures for using Logo, thinking about it this time with an adult learner in mind and also looking for how it could be presented for use in the classroom. I began to see it more as a problem solving activity, with scope for challenge and investigation.

The first week of the 2nd year course arrived with an introductory lecture covering practicalities as well as mathematical content. This part of the lecture included a discussion about visualisation, an introduction to the Logo program and interactivity with the students on how to draw a square and a triangle using Logo. The square followed expectation nicely and the students found it quite straightforward: FD 100 RT 90 FD 100 RT 90 FD 100 RT 90 FD 100 RT 90¹. Not so the triangle! The first student tried, unsurprisingly, FD 100 RT 60 three times and was taken aback when this did not produce a neat triangle. After a couple of other unsuccessful offers of instructions, the lecturer took 3 students out to the front and got them to walk through what was happening with the turtle on screen. Arms extended, and looking somewhat akin to Daleks, they marched across the front of the class, demonstrating that the angle of turn was always measured to right or left of the line pointing straight ahead. In the discussion which followed it was obvious that this aspect of giving commands in Logo was less than intuitive for many.

A 2 hour independent study session in the computer labs followed later that week. The computers had a freeware version of Logo installed and students were expected to work through a booklet which began with very basic commands and shapes and progressed to quite complex pictures and diagrams to replicate, introducing more specialised parts of Logo language such as procedures and parameters along the way.

In some sessions, tutors started the students off and when they were sure that they had understood what they were doing, left them to study independently, working through the booklet at their own pace. In others, the tutors remained for the whole of the session and discovered that problems arose later on when more complex shapes or procedures didn't work as students had expected and they found difficulty in resolving the problems. Occasionally this seemed to happen as a fault in the program, as the tutor could find nothing that they had done wrong, and the easiest solution was to write a new procedure with a different name. Frustration built up when students were unable to visualise how to construct certain shapes such as the one below. Having used procedures with the repeat command to construct similar shapes with rotational symmetry, it was difficult to visualise how to draw the apparent 9 squares. A new way of seeing was needed.



¹ FD 100: go forward 100 units; RT 90: turn right 90 degrees.

Reasons for Research

During the 2 sessions which I spent in the computer lab, it became apparent to me that some students were quite enthusiastic about what they were doing, whilst others were struggling so much with the programming of the shapes that it was doubtful if they were seeing beyond the tasks to how Logo could be used in teaching mathematics. At the other end of the spectrum, some students arrived early for the workshop and rapidly worked their way through most of the booklet tasks and began to experiment a bit on their own. A few of the more proficient computer users found shortcuts which were not always of benefit to them. The long record of instructions in the command box makes it easier to see where a mistake has been made; being too smart in reusing commands led them into difficulties here. As I worked with the students in challenging them to think through the problems for themselves, I became more excited about Logo's potential in the classroom. I sensed, however, that the students were mostly not at that stage.

The following 5 weeks of the course involved a rotation of classes which covered 5 topics in a 2 hour tutor led workshop and also a 2 hour student led workshop on the same topic. For the student led workshop, teams of students worked on a topic-related task to present to the rest of the class. This might involve exploring part of the topic in more depth, or finding and demonstrating some resources for its teaching or ways of incorporating ICT. In both the workshops on (a) Symmetry and (b) Shape, Position and Movement, groups of students were given tasks which involved using Logo. My workshop topic was Problem-solving and I referred to Logo as a way of using ICT in problem-solving and asked for students' reactions. I was keen to hear how students saw the potential for Logo as a problem-solving environment. I was disappointed by their responses for the most part. Most of them were negative. Students saw it as boring, difficult, old-fashioned and complicated. Only one or two seemed to be positive about it.

It became evident to some of the other tutors who were new to the course, that students had mostly negative attitudes to Logo. To investigate whether we were correct about this, I decided to research students' views through use of an e-mailed questionnaire and interviews with selected students.

Students' responses through questionnaires and interview

The course is packed into a short period of 6 weeks at the end of semester 2, just before the spring vacation and assessment period. Probably because of the timing of the research, which was unavoidable, the response to both questionnaires and interviews was extremely disappointing. Out of a potential 138 students, 20 questionnaires were returned and only 1 student, out of the 25 invited, came to be interviewed. There are different ways to look at the lack of response to the questionnaire and interview:

- Students were just too busy at this time of year to complete the questionnaire or attend an interview.
- The subject didn't attract them enough to want to reply.
- A certain number will always reply to questionnaires and some will never reply; similarly for interviews.
- They were put off by the questionnaire itself.
- They would have replied to a paper copy in their hand – the communication method was faulty.

However, the responses were detailed enough to give us an idea of student perceptions.

What did they think about the way they were taught?

The lecture: $\frac{3}{4}$ of the students thought the lecture gave a clear introduction to Logo while $\frac{1}{4}$ disagreed. The student who was interviewed had a clear memory of several students being asked to move around the front of the room to create shapes and turn through different angles, but had no clear picture of Logo itself through it.

The computer workshops: More than half thought the computer workshop was a good way of learning to use Logo, while $\frac{1}{3}$ disagreed. A few commented that smaller groups would have been better because learning was challenging, tutor input was limited and many people required support.

The booklet: They were split almost evenly over whether the booklet was easy to work with; however more disagreed that the booklet tasks were interesting, with 4 strongly disagreeing and only 1 strongly agreeing. One commented on it being tedious. One liked working through the booklet at their own pace, with support from peers and tutor when needed.

Learning tasks: Just over half the respondents had used Logo in one or more of their weekly tasks, so there was a greater response from this section of students. They had had more experience than just the lecture and workshop. Some felt that they had been over-exposed to Logo. However, the student who was interviewed felt they had not had sufficient knowledge to use Logo as well as they could have for the tasks. 2 students commented that they had done more work independently because they had the task to present.

What might have improved their learning?

Nearly $\frac{3}{4}$ agreed that they would have liked some reading about Logo; just over $\frac{1}{4}$ disagreed. Almost all thought it would be useful to see children working with it. One thought that playing with the program first would have been an advantage, while a couple thought using the Beebots and Roamers first would have helped.

What did the students think of Logo itself?

Several thought it was a good support for teaching shape, position and movement or for linking this topic to ICT. A few liked its interactivity and its ease of use, while a few mentioned the possibility of differentiation or progression in levels of difficulty. One thought that its lack of gimmicks was an advantage: "Although it isn't all singing, all dancing like many programs, it does exactly what is required. Sometimes the simpler the better."

This was very much a minority view, as several expressed their dislike of the program or that they found it unattractive. Several also thought that it was boring, dated, unappealing or dull, either for themselves or for children. Some thought it tedious, repetitive or time-consuming and that its novelty wore off quickly.

What was their view of children's perception of it?

More than half thought children would not enjoy using Logo. Some students thought Logo was fun or useful to begin with but children would get bored after a short time. Several commented that they thought children would find it too difficult or unappealing, but a few thought their opinion might change once they saw children

using it. A few said there were other suitable resources which were more appealing, including one who preferred Roamer.

Would they use it in their teaching?

Most students felt confident about teaching shape, position and movement and $\frac{3}{4}$ thought that Logo would be good for teaching the topic.

There were no definite responses to how likely the students were to use Logo in the classroom themselves. 11/20 (just over half) said they 'probably will', while 7/20 (approx 1/3) said they 'probably will not'. 2 said it depended on the resources that would be available in their future schools.

Tutors' responses to questionnaires and discussion

Only one of the 5 maths tutors had used Logo in the classroom, for supporting teaching about angles, bearings and polygons. She had used it at several stages.

Tutors liked the open-ended nature of Logo and that it helped children's understanding of shape, position and movement. What they didn't like reflected some of the students' comments. It wasn't visually attractive and its simplicity could be unappealing. There were also conventions to learn in using it. When asked how they thought our students would use Logo in the future, all were doubtful that they would use it at all.

Changes to the course for 2010

As a result of this research we introduced three changes to this year's course.

- We decided to show progression from using children's own body movements, to use of Beebots and Roamers, and then to use of Logo more clearly by teaching this in one workshop, rather than spreading it over several topics where we had hoped students would make the link themselves. We also, for other reasons, didn't have the lecture.
- We identified a couple of articles which would give students a flavour of how Logo had been used with children in a creative and stimulating way, and asked them to read these prior to the workshop. Many interesting articles were unsuitable because they needed an understanding of Logo which the students would not have.
- We asked the students to engage in a design challenge requiring them to work creatively and individually with Logo during the few days following the computer session.

The readings were chosen, firstly, to introduce Logo and to demonstrate, from research, some positive benefits from its use (Clements and Meredith 1992), and, secondly, to give a practical example of its use in school (Mihich 1993). As they were on the Logo Foundation website, students who were interested would have a starting point for further information.

We had a last minute change of several tutors imposed on us, but one of them had used Logo in her school in England and was keen to teach the Logo workshop. The design challenge of creating a maze was one that she had previously used successfully with primary children.

At the end of the course I surveyed the students with a similar questionnaire and interview. This time students were handed a paper copy for voluntary completion.

The return rate was slightly better this year in that we had 53¹ questionnaire returns from 161 students and 1 interview from the 12 invited. However, the open-ended written responses were not as thoughtful this year.

Students' responses through questionnaires and interview

The first surprise was that about 1/4 (13) of the students, all under 30, said they had used Logo as a pupil and 4 had seen it used in their teaching placement schools. Did this make a difference to their other responses? No, their responses were in line with the rest of the returns.

There was still a disappointing number, just under 1/4, (13) who said they did not have a clear understanding of what Logo is. We need to work on that more. Also disappointing was the fact that only 1/2 the students found the readings helpful and less than 1/2 found the design challenge a valuable activity.

Responses to most other statements were similar to last year, with one noticeable exception. Whereas last year a majority of students thought children would not enjoy Logo, this year a majority (37/53) thought that they would enjoy it.

When asked how likely they were to use it in the classroom, there was a greater variety of response this year: 2 said they definitely will use it; 4 definitely will not; 18 probably will and 29 probably will not. However, more are unlikely to use it than are likely to use it. (31:20). Given that it is another 2 years before they are in their own classroom, the chances are probably slim that they will instigate its use, unless they are in a school already using it.

What difference have we made to students' perceptions of Logo?

What we haven't explored is whether giving students experience of a more colourful commercial version of the program, would make a difference to their perceptions. Time hasn't been available to give students experience of both (although one is installed on computers to which students have free access), and I think the feeling from lecturers has been that the more structured versions may obscure the mathematics involved.

Where do we go from here?

The course structure for 2010 - 2011 will change because of overall changes to the Bachelor of Education programme, resulting from the introduction of the new Curriculum for Excellence in Scotland. The structure of 2nd year mathematics courses will change from being all workshops, to half lectures, half workshops, meaning there is real pressure on workshop time.

Questions we have to consider are:

- Should we devote a whole workshop to a subject which students see little point in, when other topics are also struggling for time?
- Do we continue with Logo for all students, and if so, can we do it in a way that doesn't turn most of them off it before they have had time to fully appreciate it? Are we actually doing a disservice to Logo by squeezing it into such a small space that students cannot explore its possibilities?
- Should Logo be part of a lecture for students to follow up if interested, as we have to do in the Postgraduate one year teaching programme?

¹ 13 questionnaires were returned after the presentation at BCME7. Their responses have been included here. The opinions expressed are in line with the previous 40.

- Or is Logo a product of its time, a program which may now engage some people but only a few?

In 'Logo mathematics in the classroom', Hoyles and Sutherland (1989, 1) wrote,

Computers are part of our everyday life – at home, in the work-place and in schools. Stories of the enthusiasm generated by computer use in our classrooms abound. The interactive environment and the colourful graphics make computer-based learning exciting and different.

How much more are computers part of children's lives now? With huge advances in technology, and the power and speed of today's computer hardware and software, today's children would view these computers of the 1980s as antiquated. They are used to powerful word-processing and graphics packages, which were unthinkable in the 1980s. How can Logo compare with these?

One student wrote, "It seems that teaching using Logo must be preceded by teaching Logo itself. It's an extra layer of complexity to confuse children. Perhaps its active nature is not so unique any more." Another commented, "Got my son to do it. He could do it, enjoyed it but couldn't tell me what he was learning! Where is the benefit?" In a climate of learning intentions and success criteria for every lesson, is there space for something as free and investigative as Logo?

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