

Developing a teaching community of introductory programming tutors

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Research has shown that the major learning vehicle for students in introductory programming subjects is the tutorial. As programming is a compulsory part of all computing degrees, these tutorials are critical to students, but are often staffed by postgraduate or even undergraduate students with no prior teaching experience or training. By default, most tutors model teaching style on a former teacher whom they felt was effective. However, this is not always appropriate, as their experience may have been in a different country, or in a different era when less was known about teaching and learning, or with different kinds of students. A teaching community approach has been introduced into our first year programming subjects. Tutors are initially given a three-day intensive training course which introduces them to educational theory in relation to introductory programming, and gives them a model of a good tutorial class, with opportunities to practise techniques and discuss issues. Weekly meetings throughout the semester reinforce the training program and encourage tutors to share ownership of the subjects, to contribute suggestions for ways of teaching particular concepts, and to reflect upon and discuss their teaching experiences. This paper examines the responses of tutors to this teaching community approach.

Introduction

Small group tutorial classes, held in computer laboratories or classrooms, are crucial to the successful progress of programming students 0. Typically, these classes are staffed by tutors who have had little or no teaching experience and view this work as a one-off experience. Staff in the School of Computer Science and Software Engineering, in collaboration with the Education Faculty, have developed a teaching community approach to the introductory programming subjects 0. This approach involves reflective practice groups supported by introductory workshops. We begin with an intensive three-day tutor training course held just before the beginning of semester 0 and aimed specifically at teaching introductory programming, and follow it up with weekly meetings where teaching experiences and ideas are discussed. This paper reports on a group of tutors who have experienced this teaching community approach on the Caulfield campus of Monash University, and explores how their ideas and views of teaching and student learning changed during the course of a semester of teaching.

Course background

The School of Computer Science and Software Engineering teaches introductory computer programming to students in the Bachelor of Computing, Bachelor of Information Management and Systems and associated double degrees at the Caulfield campus of Monash University. In the first year of these degrees, students study two semesters of programming. There are currently about 400 students in each of these subjects each year.

This paper is based on data collected in 1998, when the programming language used was C++. Students were taught the basics of procedural and object-oriented programming. Program design and testing were introduced and a strong emphasis was placed on a software engineering approach. Each week, students attended two hours of lectures, a two-hour tutorial class held in a computer laboratory and a one hour discussion class

held in a classroom. The laboratory and discussion classes had a maximum of 16 students, and the timetable was organised so that the same group of students were together with the same tutor for both classes.

The lectures were taken by a staff member who had many years of teaching experience. On the Caulfield campus, this person is also the subject leader responsible for subject management, including designing and developing teaching materials and hiring and coordinating the tutorial staff. The laboratory and discussion classes are taken by tutors with a wide range of teaching backgrounds and expertise. Some are highly experienced permanent teaching staff (including always the subject leader), but most tutors are hired on a sessional basis and are predominantly postgraduate, Honours level or final year undergraduate students with little or no teaching experience. This is a typical practice in many other tertiary institutions. To many of these sessional staff, tutoring is a convenient way of earning money while they are studying. They view it as a short-term prospect, and most have no long term teaching aims.

The student population is diverse. Students entering the course have different educational backgrounds, ranging from local secondary school to articulation from other tertiary institutions, to mature age entry students who have been in full time employment for many years. The lack of a computing prerequisite and a minimal mathematics prerequisite results in a student population with a wide range of abilities. Many of the students do not speak English as their first language. Most are studying full time and attend day classes; however, about 10% of students are part-time and usually attend evening classes.

The tutor training program

During 1996 and 1997 many changes were made to the content and structure of the introductory programming subjects. These changes were made based on the recommendations resulting from a research project which investigated the teaching and learning of introductory programming within the Faculty of Information Technology. The Education Faculty members of the research team observed that teaching introductory programming presented many challenges. Students see programming as different from other subjects they have studied. Programming is an extremely cumulative subject, as each new topic introduced requires an understanding of all previous concepts. Many students lack motivation to learn programming. They do not intend to seek careers as programmers or work in jobs that require programming skills and therefore do not see that learning programming could be of any advantage to them in the future. One of the findings of the research project was that the small class tutorials were the major learning vehicle of the students. This is supported by. However, the tutors who teach these classes are the least experienced of the teaching staff. A teaching community approach was devised jointly by Education faculty staff in collaboration with the introductory programming teachers.

The tutor training program was presented jointly by the Education and Computing members of the project team in 1996, in separate programs on the Caulfield and Clayton campuses of Monash University. In 1997, they again presented the program on the Caulfield campus but, at Clayton, a revised program was presented by a teaching staff member responsible for the organisation and management of the tutorial staff there. At this stage the two programs developed separate focuses reflecting the different cultures of the two campuses. In 1998, due to budget constraints, funding was no longer

available for Education Faculty involvement. The two programs were then consolidated and the combined program has since been managed and presented by staff within the School of Computer Science and Software Engineering alone. It is now held just before the start of each semester, combining tutors from both campuses into a single group.

The tutor training program was designed specifically for tutors of introductory programming students. It is 12 hours in duration, held in six sessions over 3 days. The aim of the program is to foster and improve the teaching skills of tutors of introductory programming students by:

- developing an awareness of good and bad teaching practices
- providing a forum for the sharing of teaching ideas
- developing an understanding of how students learn, what conditions are necessary for learning and what are the possible barriers to learning
- encouraging them to reflect on their experiences of teaching and learning
- developing a sense of shared ownership of the subjects with the lecturers and the students
- making them aware of particular subject requirements

A minimum of 12 participants is required to establish good class dynamics and also to make the training program viable.

The sessions model the classroom behaviour required of tutors, and are very interactive. The tutors are encouraged to offer their ideas and opinions. A variety of small group activities, e.g. role plays, are used to encourage the quieter ones to participate. The sessions also demonstrate a range of different activities that tutors can use in their own teaching situations. The aim is to build a secure and trusted environment where everyone feels comfortable in participating.

Tutors are given a booklet which outlines the training program and provides background information on learning and ideas on teaching strategies. It also has a checklist which tutors can refer to when preparing for their classes. This resource becomes a useful reference for tutors after the training program.

The training course is open to any members of the School who wish to attend. Although the course was designed for new tutors, a number of experienced staff members have attended the course. Sessional tutors are paid to attend, and the subject leaders for the introductory programming subjects at Caulfield require their tutors to have done the course.

Weekly meetings

The tutor training program sets the scene for the teaching community. The training program is completed before the beginning of semester and therefore before the new tutors have had any actual teaching experience. The reality of teaching, with the unexpected situations that arise, is often quite different from what tutors anticipated. In order to effect real change in behaviour, it is essential to provide ongoing encouragement and support for new tutors during the semester. All teaching staff involved in the introductory programming subjects meet weekly during semester. These meetings provide a forum for the exchange of experiences, and reinforcement of lessons learned during the training course. Tutors discuss teaching techniques that were tried in the

previous week, both successful and unsuccessful. The meetings have a noncompetitive, non-threatening atmosphere where everyone, including new tutors, can feel comfortable about contributing. The subject leader introduces the "Big Ideas" to be covered in the following week, and tutors discuss how best to get these concepts across to the students in the lectures, discussion classes and laboratory sessions. This produces a collaborative feel to the subject, instead of tutors feeling that the subject leader owns the subject and they just do what they are told.

The first year the teaching community approach was used (in 1997), a member of the Education faculty attended all meetings and provided a voice of authority on educational issues. His role was also to question assumptions that he felt were being made, e.g. on the precise meaning of a programming term such as "abstract data type". Many very interesting arguments ensued as tutors realised that they did not share a common understanding of such terms, and gradually came to an agreed position. There was a high level of enthusiasm in the meetings.

In 1998, Education faculty staff no longer attended meetings, and the subject leader found it difficult to engender the same willingness among all the tutors to accept some responsibility for the subject. Many of the tutors had taken part in the animated discussions in the meetings the previous year, and were not interested in rehashing the issues that were now settled in their minds (although not in the minds of the new tutors). The subject lecturer did not have the same credibility on educational issues as the Education staff, and the meetings tended to spend more time on administration and less on discussion of educational issues. It was still a teaching community, and most tutors were actively involved and willing to help with producing assessment tasks, etc., but some chose to be passive in meetings and to revert to easier, less interactive ways of running their classes than were advocated in the tutor training program. The subject was using the same programming language and the same format as in the previous year, and this was felt to be successful, so there was little interest in discussing it.

It is noticeable that, in 1999, now that we have changed our programming language to Java and are using a new environment (BlueJ, 0 to teach it, the level of enthusiasm in tutor meetings is again very high, and the discussions are once again on the topic of how best to teach the concepts.

Training and support: an evaluation

The new teaching community approach was evaluated in the first semester of 1998. Pre- and post-training surveys showed that the participants and the organisers deemed it a success 0. However, it was recognised that it is necessary to monitor the tutors during the semester to establish the true value of the teaching community approach.

A group of six new tutors who completed the training program prior to first semester 1998 were surveyed before the beginning of semester (at the end of the training program) (see Table 1), in mid-semester and at the end of semester (see Table 2). For comparison, another group of six tutors who had at least two semesters of tutoring experience, and four of whom had completed the training program previously, were also surveyed in mid-semester and at the end of semester (see Table 3). Responses are shown on a Likert scale: 5 = strongly agree, 4 = agree, 3 neither agree nor disagree, 2 = disagree, 1 = strongly disagree. An example of a question in table 1 is: "I understand my role as a tutor".

In particular we were interested in their perceptions of their teaching effectiveness, how they were coping and whether they felt they were given enough support. The tutors were also observed during the weekly tutors' meetings. The surveys and meetings offered insights into tutors' concerns and confidence and reflections on their teaching and students' learning. They also provided valuable feedback for the lecturer on how the subject was progressing, and offered ideas for future improvement of the subject.

Post-training program survey

The tutors were very positive about the training program. They found it an enjoyable experience and aimed at the right level. They all considered that it was useful or very useful. They all felt upon completing the training that they understood their roles as tutors and knew how to prepare for classes. Five of the six new tutors expressed confidence about carrying out their role as tutors, however, two tutors were unsure about whether they were well prepared for their positions as tutors and one of these tutors also indicated concerns about confidence.

Prior to training, the tutors had expressed various concerns about their role as tutors. They were worried about standing in front of a class not being able to answer questions, making mistakes, not meeting student expectations and not being good at the job. After the training program however, all but one of the tutors felt these initial concerns had been addressed.

It was apparent from the surveys that during the training the students had developed a good understanding of the important attributes of a good teacher. They realised that they can influence students' attitudes to learning. They became more aware of the role they can play in motivating students and had developed many ideas about how they could do this.

The training program had prepared the new tutors well. Now we were interested to see how they followed through with these ideas in practice.

Table 1: Post training survey of new tutors

Tutor	Confident?	Understand role as tutor?	Well prepared?
1	5	5	4
2	4	5	4
3	4	4	4
4	4	4	4
5	4	4	3
6	3	4	3

Mid-semester survey

The mid-semester survey of tutors occurred just after the students had completed their first practical assignment and class test. At this stage the new tutors had had eight weeks of teaching experience.

The new tutors, in hindsight, now had different views of the training program. Four were now more enthusiastic about its usefulness with comments such as, "I couldn't have tutored with any confidence without it" and "it gave me an insight into how people learn and how to tutor effectively". They felt the training program gave them useful ideas and prepared them well. The remaining two tutors however were less enthusiastic. One felt that he had not learnt much new information in the training program because of past study of educational theory, and the other tutor indicated that, in spite of what he had learned and was applying from the training program, the students still did not want to work.

The new tutors had about the same level of confidence at this stage as they did at the end of the training program. Four of the new tutors were very definite that their teaching was improving; however, two were unsure. They had by now assessed their students' first assignments and class tests and this probably had an impact on their views of their own performances. They all expressed various levels of dissatisfaction and disappointment with their students' learning. The experienced tutors at this stage were, not surprisingly, more confident. Although most were also unhappy with their students' learning, their prior tutoring experience probably prepared them not to have high expectations.

The new tutors had more concerns about their work as tutors at this stage than the experienced tutors. These concerns were different from those expressed at the beginning of the training program and reflected an understandable lack of confidence in tasks that were unfamiliar to them. Some were finding assessment difficult and were daunted by the prospect of having to fail students. One tutor had the useful suggestion of including practice in assessment as part of the tutor training program. Time management and balancing students' needs during class was another issue. Some tutors were finding it impossible to give the individual attention they felt was necessary to assist some students. The new tutors all gave examples of teaching situations they had found difficult, e.g. "students who did not attend class regularly", "students who did not work in class or would not contribute in class". In contrast, half of the experienced teachers could not think of any difficult situations.

At the weekly meetings tutors are encouraged to express any concerns or comments they have about what is happening in their classes. Everyone is encouraged to contribute in these meetings, with the more experienced staff often purposefully holding back to let the new tutors have their say. The emphasis is on sharing, listening and informing rather than judging and instructing. Some tutors were very vocal in these meetings, but at least two of the new tutors did not contribute at all, unless requested.

The new tutors all felt these meetings were useful but for varying reasons. The tutors who were more inclined to speak in the meetings felt that they were useful for reasons such as "problems and concerns are being discussed" and "they allow the opportunity to bounce ideas around". These responses suggested the value they saw in the discussion and the contributions people were making. The quieter tutors felt that the

meetings were useful for reasons such as “it allows problems to be pointed out” and “we are kept up-to-date with the materials”. These responses indicated their tendency to be passive recipients of information, and their lack of understanding of the teaching community approach and what was expected of them. However, regardless of their level of participation the meetings provided a valuable support for all these tutors. One of the new tutors, who in surveys had expressed the least confidence and did not contribute much during the meetings, commented that he found these meetings “enjoyable and a very useful support”.

The experienced tutors also felt the weekly meetings were useful, but for different reasons. They commented that the meetings were valuable for feedback, subject administration, management and planning. They did not mention the benefits of sharing of problems and ideas, probably because they did not have the same need to discuss these as the new tutors did. It was necessary at times to encourage these tutors to contribute at the meetings and share their experiences. Sometimes they are not inclined to participate because they feel that what they have to say is self-evident or too trivial to be of interest, or that they have said it all before. They quickly forget what it is like to be a novice, and it is hard for them to remember that the current novices need to hear their stories.

Table 2: Mid semester surveys of new and experienced tutors
(N = new, E = experienced)

Tutor	Type	Confident?	Concerns?	Teaching Improving?
1	N	5	4	5
2	N	4	4	4
3	N	5	2	3
4	N	4	3	4
5	N	4	3	5
6	N	3	3	3
7	E	5	1	5
8	E	5	2	5
9	E	5	3	3
10	E	5	1	2
11	E	5	1	2
12	E	4	1	3

End of semester survey

The end of semester survey of tutors occurred after teaching had finished, when the students had completed all their class tests and tutors were in the midst of assessing the students for their second practical assignment. At this stage the new tutors had had thirteen weeks of teaching experience.

The new tutors now all felt confident about tutoring, and one tutor felt very confident. They had, by now, assessed 40% - 60% of their students’ work. In contrast to mid-semester, half the tutors were now satisfied or very satisfied with their students’ learning. From comments made they seemed to have developed a more realistic view of what they could expect from their students. In the weekly meetings they were able to discuss their

students' performances, but it was always stressed that classes vary, sometimes considerably. They were encouraged to understand that it is unlikely, with a class of 16 students, that all will pass the subject. They were also reassured that comparisons of student results were never used as a measure of tutor performance.

The experienced tutors, by comparison, all felt very confident. Most were satisfied with their students' learning. As in mid-semester, their expectations of the students did not seem as high as the new tutors' expectations.

The new tutors were all satisfied or very satisfied with the support they had received during the semester. They were all happy with the weekly meetings and by the end of semester most were contributing more as they gained confidence. One tutor, however, who didn't participate in the discussions at the meetings, commented that "they were sometimes boring".

Table 3: End of semester surveys of new and experienced tutors

Tutor	Type	Confident?	Satisfied with support?	Satisfied with own performance?
1	N	5	5	5
2	N	4	4	4
3	N	4	5	5
4	N	4	4	4
5	N	4	5	5
6	N	4	4	4
7	E	5	5	5
8	E	5	5	5
9	E	5	4	5
10	E	5	5	5
11	E	5	5	5
12	E	5	4	4

The tutors are paid on an hourly basis for classes, meetings and help desk sessions and a number of additional hours per week to allow for preparation and marking. All the tutors expressed satisfaction with this arrangement. The experienced tutors claimed they spent, on average, two hours per week on preparation and marking. However, the new tutors were spending, on average, three hours per week. The new tutors were more inclined than the experienced tutors to volunteer for extra work such as giving extra consultation time and checking test and exam papers (this may have been because the experienced tutors felt they had made their contributions in earlier years). One student ran an extra unpaid revision class during the mid-semester break. This is encouraged because it shows the tutor's commitment to teaching and concern for his/her students. However, there is always a danger that the extra time spent will impact on his/her own studies. All the new tutors did extra work on a voluntary basis. However, only one tutor felt that his own study was affected by time spent on tutoring commitments, and this tutor actually had a heavy workload tutoring in three subjects.

The new tutors were all satisfied or very satisfied with their own performances as tutors.

Conclusion

The teaching community approach to the introductory programming subject was evaluated. Tutors felt that the initial training course and the subsequent weekly staff meetings were of benefit, and their confidence in their teaching ability rose as the semester progressed and as their expectations of student performance became more realistic. The level of tutor involvement in meetings and their commitment to shared ownership of the subject dropped during the second year's delivery of a particular format of the subject, but has risen again this year when there is a challenge to teach a new programming paradigm and language, using a new environment.

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