The attitudes and experiences of student-tutors to peer tutoring in higher education physics

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Abstract

In the School of Physics and Astronomy at the University of Glasgow a wide variety of teaching and learning methods are employed in undergraduate degree courses. Included in this are a series of peer-led tutorials, known as the 'Peer to Peer' tutorial scheme, in which senior students in the third, fourth or fifth years of their degrees assist students in years one and two, acting as tutors and assisting the less experienced students with issues related to their coursework and student life. This paper discusses the scheme and looks in-depth at the experiences of the tutors that took part, as well as investigating why they volunteered to act as a tutor. Using closed and open survey questions, their attitudes were collected and analysed. Student-tutors reported a positive experience of the tutorials. They had taken part in the scheme to improve their own skills and to assist both younger students and the school. The scheme, whilst not perfect, improved the skills-base of the tutors, as well as boosting their own self-confidence.

Keywords: peer tutoring; physics; skills development.

Introduction

The use of peer-based teaching and tutoring has seen a recent increase across the UK in higher education institutions (Collings et al., 2015). At the University of Glasgow, its use by the School of Physics and Astronomy is a relatively new endeavour, and this was the first truly in-depth analysis of the tutor experience that was carried out. Whilst there is extensive work in the literature relating to the wide range of peer-teaching schemes being employed, there is little looking at the evaluation of such schemes. Collings et al. (2014) identified several, but highlighted that there were still many gaps in this area (see also Nisbet et al. (2014)). This work strives to help fill this gap, focusing specifically on a peer-led scheme that is embedded in a higher education physics school. A mix of quantitative and qualitative data was collected to create the best picture possible.

Defining 'peer tutoring'

Many authors have put forward definitions for 'peer tutoring'. Topping (1996, p.322), for example, suggested the term was best described as 'people from similar social groupings who are not professional teachers helping each other to learn and learning themselves by teaching', whilst Colvin (2007, p.166) describes the process of peer tutoring as one that 'involves those of the same societal group or social standing educating one another when one peer has more expertise or knowledge'. The definition put forth by Boud et al. (2001, p.4), though, best matches the scheme that will be discussed in this paper. They describe a peer learning model involving an 'instrumental strategy in which advanced students, or those in later years, take on a limited instructional role'. Collings et al. (2014) describe a similar scheme, though they use the term 'peer mentor'.

The advantages of peer tutoring for the tutors and students

Many advantages have been identified in the literature for the student-tutors involved in peer-tutoring, including improved cognitive and communication skills (Topping, 1996; Annis, 1983; Benware and Deci, 1984; Carroll, 1996; Watters and Ginns, 1997). Rubin and Hebert (1998) also found student-tutors improved their motivation to study and became more empathetic to their own teachers. In terms of the learning process, Moust and Schmidt (1994) put forward three ways in which student-tutors differ from staff-tutors to the benefit of the students. Firstly, students communicate more freely in the absence of staff.

Secondly, student-tutors think about the material the same way that the students do, which is fundamentally different to the way staff view the material. Thirdly, students benefit more from learning guided by student-tutors because the student-tutors interact in a more direct and personal way with the students, creating a safer and more open learning environment.

'Peer to peer' tutorials

The peer tutoring scheme discussed in this paper is called 'Peer to Peer Tutoring', and runs in the School of Physics and Astronomy at the University of Glasgow. The Peer to Peer scheme was designed to support student learning and revision, alongside other schemes such as traditional, lecturer-led tutorials and small group supervision sessions. Students in their Honours years – i.e. years 3, 4 and 5 of their degrees – act as tutors for students in years 1 and 2. Topping (2015) discusses a wide range of styles of peer tutoring. The scheme used at Glasgow, though, most resembles the Learning Assistants scheme, created initially at the University of Colorado (Otero et al., 2010.), where experienced students are employed within mathematics and STEM subjects. They work closely with less experienced students three times per week through every semester, working closely with course lecturers to reflect on student performance and make adjustments to courses as required. However, the Glasgow scheme was deliberately created to be more of a 'light touch'.

Specifically, the peer to peer tutorials at Glasgow form part of the timetable for the Physics 1 and Physics 2 classes in the School of Physics and Astronomy. They run in the normal lecture slots for these courses. Students participate in four tutorials through the academic year; each student-tutor is involved in around 6-8 tutorials. Student-tutors are paid for two hours' work per tutorial, at minimum wage rates. The rate is set on the assumption that for each one-hour tutorial they take part in, the tutor performs one hour's preparation. The student-tutors are recruited on a voluntary basis, with around 30 recruited each year. Tutorials are designed around set questions that are distributed ahead of each meeting. Student-tutors also receive full worked solutions for the questions. The questions are chosen from each course being studied at the time of the tutorial. One lecture theatre and two classroom-style venues are used for the tutorials. The class is randomly split between each, with a minimum of two or three student-tutors per room. A typical tutorial would have between 50 and 100 students, spread across the three venues.

These tutorials have three main aims. The first is to assist with student learning/revision of physics. Secondly, they aim to help integrate level 1 and 2 students into the School of Physics and Astronomy through communication with Honours level students. It is hoped that this will help improve the School's retention levels. At the University of Glasgow, students do not register on a particular course. Rather, they join a College. Within that College, they then take three subjects in the first year and two in the second year. In theory, they can then go on to major in any one of those subjects. The end result is that a large number of students in level 1 and 2 physics classes have no intention of taking the subject beyond those years. Many authors, including Collings et al. (2014), Crisp (2010) and Jacobi (1991), have identified peer-based schemes as having a beneficial impact on encouraging students to remain with a particular subject. The third and final aim for the scheme is to give Honours level 3/4/5 student-tutors an opportunity to develop/improve their teaching skills and their understanding of the basics of physics. The tutorials were, therefore, designed to be of value to both students and student-tutors.

Methods

The ultimate goal of the research reported here was to explore the experiences of student-tutors in the peer to peer tutorials. Within this broad goal were the following aims:

A. Identify the reasons the student-tutors had volunteered to be a tutor.
B. Identify what the student-tutors thought were the benefits to them in taking part, and explore their attitudes to the scheme, by requiring them to reflect on the tutorials as they took place.
C. Identify possible areas for improvement in the Peer to Peer scheme.

As these experiences and attitudes were investigated, a clear picture of what happened during these tutorials was developed, which it was hoped would highlight whether any changes were needed to create a better educational environment for the student-tutors and the students they were working with. The work here was carried out as an intrinsic case study, as defined by Cousin (2005).

Participants were volunteers from amongst the team of student-tutors. Thirty-two student-tutors recruited, of whom 26 volunteered to take part in the research project. Ultimately, no

more than 23 took part in any one stage of the work. Nine students were female, 17 male, though the tutors were not asked to declare their gender when completing the surveys detailed below. Sixteen students were in the penultimate year of their degree, with the remainder taking part in their final year.

Data was collected by means of online, anonymous surveys, using the Survey Monkey tool (http://www.surveymonkey.com). Three different surveys were developed.

Survey 1

The first survey consisted of three questions and was issued after the first tutorial that the student-tutors had participated in. Question 1 was designed specifically to explore the first aim of the study and as such, asked why the tutors had volunteered for the scheme that year. Questions 2 and 3 were included to explore their attitudes and identify the perceived benefits, and required them to reflect on the specific tutorial that they had just completed.

Question 2 was a four-part Likert (Likert, 1932) scale question, asking participants to respond to the following statements on a five-choice scale from strongly agree through to strongly disagree:

a) Tutoring students in lower levels helps with my understanding of physics.
b) Acting as a tutor makes me feel more confident in my understanding of physics.
c) I get a feeling of satisfaction from tutoring other students.
d) Acting as a tutor makes me feel more a part of the School of Physics and Astronomy.

Question 3 was an open-answer question. Student-tutors were asked to reflect on their experiences in the tutorial, with guidance to aim for ~500 word responses. Such an open question was chosen in order to explore the student-tutors' experiences and attitude in depth, and to avoid pre-empting any views they might have.

Survey 2

The second survey was designed to record student-tutors' ongoing reflections and as such included Questions 2 and 3 as described above, which were administered after each subsequent tutorial.

Survey 3

The final survey was conducted to identify possible areas for improvement. It contained two free-text questions. The first asked participants to reflect on the tutorials as a whole, and the second asked them to put themselves in the position of tutorial organiser and comment on what changes they would make to improve the system.

Ethical approval for the data collection methods was received from the Faculty of Education's ethics board at the University of Glasgow.

Results and discussion

(A) Rationale for acting as a student-tutor

The first question student-tutors were asked to answer, after their first tutorial, was 'Why did you choose to be a peer tutor?'. This was a free-text question, the responses to which were analysed using a general inductive approach (Thomas, 2006). This method, which was also used for the analysis of all free-text questions reported in this paper, involved careful reading of all responses, looking for common categories and themes in the data. Those themes were found to fall within two broader 'super-themes'. Table 1 summarises these results. 23 student-tutors completed this question, generating 50 responses.

Table 1. Reasons for volunteering.

Super-theme	Theme	% of responses
Self-improvement	Improving/developing skills of student-tutor	34
Self-improvement	Improve knowledge of course work	26
Self-improvement	Personal benefit of student-tutor	6
Altruistic intentions	Want to help	18
Altruistic intentions	Enjoy tasks associated with teaching/tutoring	16

The findings suggested that the student-tutors had volunteered either to improve themselves or to help others. Example statements for 'Self-improvement' included 'gaining experience for a future career' and the 'chance to improve my teaching/tutoring abilities'. 'Altruistic' examples included 'I enjoy teaching' and 'Enjoyed being a tutor before'. As such, it would seem that the student-tutors were either thinking about their future, and how to get the best out of their time at university to help that future, or they simply wanted to help their fellow students or the school as a whole, or indeed a mixture of both. Whatever the reason, the student-tutors clearly had a vested interest in making the peer to peer tutorials work.

(B) Student-tutors' reflections on the tutorial experience

After the completion of each tutorial, student-tutors were presented with a series of five-choice Likert style questions, detailed in the Methodology section above. Table 2 summarises the responses. The questions were asked a total of 12 times, once per tutorial. The number of responses to the individual tutorials varied from 12 for some sessions to 4 for others. The average response was 6, and the mode 5. A total of 68 responses were generated through the year to the four questions. Table 2 summarises these responses. Here each numerical entry represents the percentage of the 68 responses that fell within a particular response (strongly agree, agree, etc.).

Table 2. Reflections on tutoring.

Question	SA*	A	N	D	SD
			%		
Tutoring students in lower levels helps with my understanding of physics.	50	44	4	1	0
Acting as a tutor makes me feel more confident in my understanding of physics.	52	46	3	0	0
I get a feeling of satisfaction from tutoring other students.	69	29	1	0	0
Acting as a tutor makes me feel more a part of the School of Physics and Astronomy.	58	36	6	0	0

*SA = Strongly Agree, A = Agree, N = Neutral, D = Disagree, SD = Strongly Disagree

Student-tutors clearly felt that the tutoring was improving their understanding, and their confidence in that understanding. This tied in with one of their goals for taking part. They also found them satisfying and helped to integrate them with the School. The results were very consistent throughout the year.

The next question was free-text:

> In 500 words or less, please describe what happened in this week's tutorial. How happy are you with how things went and why? What would you do differently next time?

500 words was an arbitrary length, chosen to encourage students to write more than a brief summary of what happened. Responses varied from brief, single sentence comments, to longer, more discursive summaries.

Two broad themes were identified in the data: student-tutors' evaluative judgements about the tutorials and their thoughts on their experiences of what happened in the tutorials. Within these themes, individual responses varied widely, and so specific examples are discussed here. The evaluations were often superficial, referred to by Hatton and Smith (1995) as descriptive writing. There were, though, some deeper examples, such as one student who stated that 'I was fairly happy with how things went, because afterwards the students seemed to understand the question better than before'. Hatton and Smith (1995) would classify this as dialogic reflection.

In terms of the student-tutor descriptions of the tutorial experience itself, the responses here provided a detailed look at what actually happened in the tutorials. The views focused on the behaviour of the tutors or the students.

The student-tutors reported that they and their colleagues worked in two ways. Some were proactive and would move amongst the students in their tutorial, actively seeking questions and offering help. Others would wait to be called before going to the students. The general feeling from the student-tutors was that the more proactive approach was better. For instance, one student-tutor stated 'All tutors wandered round the room…good technique rather than just standing at the front. You feel more involved and I think the students feel that too'. Another student-tutor referred to the method of waiting for questions as 'a somewhat less effective method'. One more student-tutor made a comparison between the two methods: 'This week instead of walking around and asking if everything was ok I waited until someone put their hand up. Although this worked, I felt that there wasn't the same number of questions asked'.

In terms of student behaviour, the student-tutors reported that for the most part the students had attempted the set work ahead of time, and that most of them worked steadily through the tutorials. One student-tutor reported that students were more at ease as the year unfolded, whilst another noted a difference in their behaviour depending on the venue of the tutorial: 'I found the students less willing to raise questions in the large lecture theatre'. It would seem, from the student-tutors' point of view, that the nature of these rooms does affect the behaviour of the students.

(C) Areas for improvement in the peer to peer tutorial scheme

In the final online survey, student-tutors were asked to consider the tutorial scheme overall. They were first asked the question 'What could you, as a tutor, have done to improve your tutoring experience?'. They were given a range of options to pick and they could tick as many as they felt applied. They then had to comment on their responses. 12 participated, generating 20 responses. Table 3 summarises the results.

Table 3. What could you as tutor have done to improve your tutoring experience?

	Category	% of responses
I	Spent longer studying the questions and solutions.	45
II	Moved amongst the students more.	25
III	Been more approachable to the students.	20
IV	Tried to help the students understand the underlying content, rather than just give them the answers to their questions.	10

These statements fell into two broad themes: student-tutor preparation before the tutorials (I), and student-tutor performance at the tutorials (II, III, IV). The responses showed an approximately equal frequency for both themes, and many tutors' explanations for how they responded inter-linked the categories. One example is particularly interesting, demonstrating critical reflection of the situation (Hatton and Smith, 1995). They stated that they needed to:

> Spend more time studying the questions AND thinking about how you would explain the answer and underlying physics to someone else. It's not enough to study the question so you know it, you need to know how to explain it.

Other responses drew attention to the fact that the student-tutors grew more comfortable in their role as the year progressed. 'At first it was difficult to know when to ask if a student needed help, but as the year progressed it got somewhat easier'.

It should be noted that this does not automatically mean that the student-tutors were ill-prepared or performed badly at the tutorials. Indeed feedback from the students suggested that they felt the student-tutors were very good for the most part. Rather, the responses

suggest a perceived failure on the student-tutors' part of their own performance. This is indicative of a desire to do well in their role, suggesting they recognise the importance of being a tutor.

The second question in the final survey given to the student-tutors said the following:

> Imagine you have been asked to run the peer to peer tutorials for your year group next session. What changes might you introduce in order to make the peer to peer tutorial experience more helpful so that future students can be helped to understand and apply the ideas of physics?

This was a free text question, resulting in a wide range of responses. These responses – 25 in all – were coded using a general inductive technique and Table 4 lists the common themes found in the responses, together with the percentage of the occurrences of the categories that fell into those themes.

Table 4. Student-tutor improvement themes.

Theme	%
Administration of tutorials	57
Support for tutors	19
Content of tutorials	14
Nothing	10

The most frequent categories in the 'Administration of tutorials' theme were requests to run more tutorials. One student stated they 'would run more of them; I think that the peer-to-peer tutorials are useful, and running them more frequently would be beneficial'. Others wanted the tutorials to use more rooms for them and to improve the student/tutor ratio by recruiting more student-tutors. 'Have more rooms and make the groups smaller, so that the students fell less intimidated to ask questions'.

In terms of 'support for tutors', the student-tutors requested better solutions to the questions ('typed questions and solutions'), and provide copies of the students' lecture notes. They also suggested arranging a pre-tutorial meeting '5-10 mins before the tutorial starts to make sure everyone knows what they are doing'.

'Content of tutorials' referred to the questions being used – tutors requested a broader range of questions, designed in part to focus on key course concepts: 'I would cover Must Know Concepts, so that all students would definitely have a solid grounding'.

In all of these areas, the student-tutors were demonstrating clear, sensible views on what would make the tutorials better – it was clear that they felt the tutorials were valuable to them and the students, and should be retained.

Conclusions

Peer-based approaches to learning take on a wide variety of styles. Consistent with the approach of Otero et al. (2010), where more advanced students teach less experienced colleagues (see also Boud et al., 2010; Collings et al., 2014), peer-led tutorials were introduced to the University of Glasgow's School of Physics and Astronomy. There were three goals for these tutorials: to provide additional revision opportunities for students; to provide greater integration for junior students; and to provide an opportunity for senior students to broaden and improve their skills, both in terms of core theoretical subject knowledge, and broader, transferrable skills. The work here looked at the evaluation of these goals, aiming to help address the lack of published evaluations of such schemes identified by various authors (e.g. Collings et al., 2014; Nisbet et al., 2014). This evaluation was carried out through an attitudinal investigation of the student-tutors' motivations to taking part and their experiences of the tutorials themselves.

Findings suggest that the student-tutors volunteered to participate for their own benefit – they wished to improve their own understanding of coursework and broaden their skills base. This is consistent with previous studies (Benware and Deci, 1984; Carrol, 1996; Galbraith and Winterbottom, 2011; Nisbet et al., 2014; Topping, 1996; Watters and Ginns, 1997). They also acknowledged a wish to help others, both in terms of the students they were tutoring and the School itself, a finding also reported by Galbraith and Winterbottom (2011). Further, it is interesting to note that whilst student-tutors were paid for their efforts, the financial return was not acknowledged as a motivation to participate, which is a finding not generally reported by others (Nisbet et al., 2014). Perhaps this could be due to the relatively low payments offered in this context.

Having participated in the tutorials, student-tutors reported that they had achieved their goals. They felt their skills and self-knowledge had improved which is again consistent with the findings of others (see e.g. Nisbet et al., 2014). More specifically, they acknowledged that their confidence in their abilities had improved (Galbraith and Winterbottom, 2011). They also reported to find the work satisfying (see also Rubin and Hebert, 1998) and felt that the tutorials had helped them feel more a part of the School.

Overall then, from the student-tutors' perspective, the Peer to Peer tutorial scheme appears to have met its objectives. Against the positives, though, the student-tutors did feel that more support for them would have helped improve the tutorial scheme, and in turn would provide more opportunities for them to help the students. In light of this, formal training was introduced for all tutors. Interestingly, Berghmans et al. (2013) and Nisbet et al. (2014) have also recommended that formal training would improve the effectiveness of peer-tutoring schemes. In the present context, the training is in the form of a credit-carrying elective module that forms part of the degree programme, with students no longer receiving payment for their efforts. More tutorials were also scheduled and where possible more rooms were provided to enable smaller group sizes to work with the tutors.

This evaluation has confirmed that the peer to peer tutorials are an effective component of the undergraduate teaching at the School of Physics and Astronomy. Even on a relatively small scale, it would seem that such schemes provide an environment in which students can develop their skills, both academic and transferrable. This is in line with the published literature and shows that such a scheme also works well in a physics environment

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References

Annis, L.F. (1983) 'The processes and effects of peer tutoring', *Human Learning*, 2(1), pp. 39-47.

Benware, C.A. and Deci, E.L. (1984) 'Quality of learning with an active versus passive motivational set', *American Education Research Journal*, 21(4), pp. 755-765.

Berghmans, I., Neckebroeck, F., Dochy, F. and Struyven, K. (2013) 'A typology of approaches to peer tutoring. Unraveling peer tutors' behavioural strategies', *European Journal of Psychology Education*, 28(3), pp. 703-723.

Boud, D., Cohen, R. and Sampson, J. (2001) *Peer learning in higher education*. London: Kogan Page Limited.

Carroll, M. (1996) 'Peer tutoring: can medical students teach biochemistry?', *Biomedical Education*, 24(1), pp. 13-15.

Collings, R., Swanson, V. and Watkins, R. (2014) 'The impact of peer mentoring on levels of student wellbeing, integration and retention: a controlled comparative evaluation of residential students in UK higher education', *The International Journal of Higher Education Research*, 68(6), pp. 927-942.

Collings, R., Swanson, V. and Watkins, R. (2015) 'Peer mentoring during the transition to university: assessing the usage of a formal scheme within the UK', *Studies in Higher Education*, 3 [Online]. Available at: http://dx.doi.org/10.1080/03075079.2015.1007939 (Accessed: 30 November 2015).

Colvin, J.W. (2007) 'Peer tutoring and social dynamics in higher education', *Mentoring & Tutoring*, 15(2), pp. 165-181.

Cousin, G. (2005) 'Case study research', *Journal of Geography in Higher Education*, 29(3), pp. 421-427.

Crisp, G. (2010) 'The impact of peer mentoring on success of community college students', *The Review of Higher Education*, 34(1), pp. 39-60.

Galbraith, J. and Winterbottom, M. (2011) 'Peer-tutoring: what's in it for the tutor?', *Educational Studies*, 37(3), pp. 321-332.

Hatton, N. and Smith, D. (1995) 'Reflecting in teacher education: towards definition and implementation', *Teaching and Teacher Education*, 11(1), pp. 33-49.

Jacobi, M. (1991) 'Mentoring and undergraduate academic success: a literature review', *Review of Educational Research*, 61(4), pp. 505-532.

Likert, R. (1932) 'A technique for the measurement of attitudes', *Archives of Psychology*, 140, pp. 5-53.

Moust, J.H.C. and Schmidt, H.G. (1994) 'Facilitating small-group learning: a comparison of student and staff tutors' behaviour', *Instructional Science*, 22(4), pp. 287-301.

Nisbet, J.T., Haw, M.D. and Fletcher, A.J. (2014) 'The role of tutors in peer led teaching', *Education for Chemical Engineers*, 9(1), pp. 15-19.

Otero, V., Pollock, S. and Finkelstein, N. (2010) 'A physics department's role in preparing physics teachers: the Colorado learning assistant model', *American Journal of Physics*, 78(11), pp. 1218-1224.

Rubin, L. and Hebert, C. (1998) 'Model for active learning', *College Teaching*, 46(1), pp. 26-30.

Thomas, D.R. (2006) 'A general inductive approach for analyzing qualitative evaluation data', *American Journal of Evaluation*, 27(2), pp. 237-246.

Topping, K. (1996) 'The effectiveness of peer tutoring in further and higher education: a typology and review of the literature', *Higher Education*, 32(3), pp. 321-45.

Topping, K. (2015) 'Peer tutoring: old method, new developments', *Journal for the Study of Education and Development*, 38(1), pp.1-29.

Watters, J.L. and Ginns, I.S. (1997) *Peer assisted learning: impact on self-efficacy and achievement*. Paper presented at annual meeting of the American Educational Research Association, 2-28 March, Chicago, IL. Available at: http://eric.ed.gov/ERICWebPortal/recordDetail?accno=ED409324 (Accessed: 22 November 2015).

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