Exploring student and demonstrator perspectives of the teaching and learning provided by demonstrators during undergraduate laboratory practical sessions

Victoria Palumbo

Graduate Teaching Assistant, School of Biological Sciences, University of Bristol
Correspondence: vp16176@bristol.ac.uk
Social Media: https://www.linkedin.com/in/vicky-palumbo-541757220/
ORCiD ID: 0000-0001-8744-3856

Victoria Palumbo is a Graduate Teaching Assistant (GTA) in the School of Biological Sciences at the University of Bristol. Her role has included working as a demonstrator in undergraduate practical sessions, invigilating lab-based exams and captioning undergraduate lectures for staff and students. At the start of this year, she graduated from the University of Bristol with a Master's by Research degree in Biology. Her thesis began to look into the role of root exudates in limiting soil erosion as she is motivated by sustainable agriculture and novel techniques in these systems. Moreover, from her past experiences of working as a GTA she aims to improve the teaching and learning experiences of both students and demonstrators in the laboratory setting.

Christopher Cammies

Teaching Associate, School of Biological Sciences, University of Bristol
Correspondence: cc15486@bristol.ac.uk
Social Media: https://www.linkedin.com/in/christopher-cammies-70a1bb36/
ORCiD ID: 0000-0003-3246-9607

Christopher Cammies is a teaching associate based in the School of Biological Sciences at the University of Bristol. He is responsible for

laboratory and practical teaching on the Biology and Zoology BSc programmes and the management and training of GTA demonstrators who are teaching on these programmes. His current research endeavours to determine the role of nematode assemblages in novel and sustainable agricultural systems. In addition, as a qualified science teacher and Fellow of the Higher Education Academy his education research and interventions aim to improve teaching by improving assessment, critical thinking and by enhancing the quality of teaching delivered by GTAs.

Abstract

Graduate teaching assistants (GTAs) such as demonstrators are integral to higher education teaching. However, undergraduate student perceptions on the impact of demonstrators to their teaching and learning is understudied. Similarly, demonstrator perceptions on the quality and value of their teaching also remains largely unexplored. We addressed both students' and demonstrators' perceptions of demonstrator teaching and learning within undergraduate Biology practical sessions at a UK research intensive university. We combine quantitative and qualitative data to explore students' ideas around where their learning and feedback comes from, and the effectiveness of demonstrators during their practical sessions. This was paired with analogous data from demonstrators derived from the same concepts, thereby helping to assess their dynamic. Most students considered demonstrators to be important for teaching and learning in the laboratory setting by delivering high quality pedagogy, creating a positive learning environment and by being their primary source of feedback. Conversely, a small number of students raised issues regarding demonstrator consistency and lack of knowledge when compared with a lecturer. Students largely considered demonstrators to have sufficient knowledge and to be more approachable than lecturers. Demonstrators also recognised their valuable contribution to teaching and learning and largely mirrored the ideas undergraduate students had about effective demonstrators. Many demonstrators believe they need to be allocated more paid time to fully prepare for teaching and maximise their potential. Finally, we reflect on lessons learnt from both students and demonstrators regarding how demonstrators can improve their teaching and how universities can support this.

Keywords: Feedback, GTA, Higher Education, Learning Environments

Introduction

Graduate Teaching Assistants (GTAs) are postgraduate students who are enrolled in either Master's or PhD programmes and teach students on a part-time basis. In recent years, universities across the UK have relied on GTAs to help educate the increasing number of students attending university (Beaton *et al.*, 2013). GTAs are important in relieving teaching pressure from staff, as well as supporting students with their learning (Ramos, 2001). Furthermore, when compared with other staff members, GTAs are usually in more direct contact with undergraduate students and can be influential in

enhancing a student's learning experience (Huffmyer & Lemus, 2019).

The role of a GTA can be varied; for example, GTAs are asked to lead seminars, mentor students, demonstrate in laboratories and mark assessments. In STEM (science, technology, engineering, and mathematics) subjects a student's experience in the laboratory positively impacts their interest in the degree they are studying (Benjamin, 2002; Jaeger, 2008). Thus, as GTAs are a vital source of teaching in practical sessions, it is likely that their relationships with undergraduates have an important and sometimes unmentioned part to play in their academic success. However, due to their own research commitments, teaching part-time can feel stressful and unmanageable for GTAs (Park, 2002; Rao *et al.*, 2021). This feeling of stress is not aided by their complicated status within universities, as they are neither full-time students nor permanent staff (Compton & Tran, 2017). GTAs have less time for their own studies and are not valued as legitimate teaching staff, thereby occupying a highly demanding niche in the university (Muzaka, 2009).

Previous research has primarily focused on the role of GTAs and their experiences of teaching (Elliott & Marie, 2021; Muzaka, 2009; Park 2002; Park & Ramos, 2002; Ryan, 2014) and have highlighted the need for continual training and better pay to improve GTA confidence and morale (Chiu & Corrigan, 2019; Prieto & Meyers, 1999; Young & Bippus, 2008). Training is crucial to improving GTA teaching ability, which could potentially enhance student learning. A study by Park (2002) lists the positives and negatives of the GTA experience for both the GTAs themselves and for students. Encouragingly, it states that GTAs offer a diverse way of teaching and approachability which in turn benefits the student (Park, 2002). It also states that GTAs gain invaluable teaching experience and the opportunity to develop key skills such as time management and communication – essentially kick-starting their career in academia (McCready & Vecsey, 2013; Park, 2002). On the other hand, a GTA's lack of teaching experience and subject knowledge may hinder student learning and consequently complicate matters (Park, 2002). Muzaka (2009) highlights that most students recognise a GTA's knowledge as being very specific relative to academic staff, which is unhelpful for their learning. Perhaps this is exacerbated by a situation where GTAs often feel overworked and stressed due to insufficient time to simultaneously carry out their own research and prepare for teaching (Park, 2002). GTA confidence and authority are further areas that have been recognised as lacking by students and GTAs themselves, however GTA confidence has been shown to improve significantly with adequate training (Chiu & Corrigan, 2019; Kendall & Schussler, 2012; Muzaka, 2009; Young & Bippus, 2008). Nonetheless, some universities provide little to no training for GTAs. A study by Prieto & Meyers (1999) has reported that 30% of GTAs in their sample received no supervision or training. If this statistic reflects the picture today, improper GTA training could be negatively affecting both the student's learning and the GTA's teaching experience.

Student expectations of GTAs and their role within teaching may also influence the learning and teaching experience of students and GTAs. A study by Ryan (2014) exploring the role of GTAs in sciences surveyed students on what they thought made an effective GTA. The results of this study concluded that three themes – 'knowledge, communication and affective' – were key to being a successful GTA. In essence, students believed that to be an effective GTA a good understanding of

the topic, the ability to explain ideas well and engagement were fundamental. These attributes develop with training, practise and of course time, something that GTAs already struggle to find. Thus, living up to student expectations whilst being new to teaching and in some cases unprepared can make GTAs feel anxious about their teaching role and unappreciated by students (Elliott & Marie, 2021). Anxiety surrounding their role can once again damage GTA confidence and subsequently enthusiasm whilst teaching. Ultimately, this impacts a student's learning experience and their perceptions of GTAs.

The relationship between students and demonstrators inevitably works both ways (i.e., the opinions and actions of students towards GTAs affects GTA performance and vice versa). Studies that provide an insight into the student-GTA dynamic are limited (Golish, 1999; Kendall & Schussler, 2012; Nasser-Abu Alhija & Fresko, 2018; Park, 2002) and instead most studies have thus far focused on the pros and cons of the GTA experience (for example: Elliott & Marie, 2021, Muzaka, 2009; Park & Ramos, 2002; Pezzella, 2014; Ryan, 2014). Thus, the purpose of this research paper is to evaluate both the students' and GTAs' perceptions of the teaching delivered by demonstrators (GTAs) in laboratory practical sessions, using surveys tailored to each party. We aim to address the following questions:

1. What perceptions do both students and demonstrators have about the teaching and learning provided by demonstrators in the laboratory setting and what makes the best demonstrator?
2. What is the student-demonstrator dynamic?
3. What can staff or demonstrators do to improve the teaching and learning experience for students and the overall demonstrator experience?

The research takes place at a research-intensive Russel group university, where demonstrators are paid to support laboratory teaching, run tutorials, and mark student work. Newly appointed demonstrators must complete four hours of paid mandatory general training (which includes some pedagogic theory such as Bloom's taxonomy). Demonstrators are paid to attend preparatory briefings for all practical sessions and marking they are involved in but are not typically paid for any other preparation they do.

Methods

Ethical Approval

Ethical approval for the student and demonstrator specific questionnaires were given on the 26/04/2022 and 06/06/2022 respectively by the Faculty of Life Sciences and Faculty of Science Research Ethics Committee at the University of Bristol.

Survey data collection

To evaluate the student-demonstrator dynamic, we developed two online survey questionnaires. The first was aimed at capturing undergraduate students' perceptions of demonstrators and their performance during laboratory practical sessions. The other was curated for demonstrators and addressed their perceptions of their own teaching and learning experiences. Thus, congruent questions relating to teaching and learning and the student-demonstrator dynamic were asked in both questionnaires in order to compare student and demonstrator perspectives. Data collection took place in the 2021/2022 academic year.

The completion of both the student and demonstrator questionnaires was voluntary and answered by undergraduate students in years

ranging from 1-4 and demonstrators from the School of Biological Sciences. The student-specific survey was completed by 117 individuals (~22 % response rate), whilst the demonstrator-specific survey was completed by 26 individuals (a 27% response rate). Survey questions are listed below in Table 1.

Qualitative analysis

Thematic analyses were used to explore the perceptions, values and ideas held by students and demonstrators regarding the role, ability and importance of GTA demonstrators in teaching and learning during practical sessions.

Thematic analyses of the survey questions were achieved by assigning codes which captured the important ideas in the data, which would then be used to derive the themes. The data was independently coded by the co-authors using an inductive and latent approach focussing on the implicit meaning behind student responses according to the methods used by Braun & Clark (2006, 2012). These codes were then compared in order to validate the key themes. Codes which were uncommon or irrelevant were discounted for the final representations of the data.

Quantitative analysis

All figures were created in RStudio version 3.6.1 (R Core Team, 2019) using the R package, ggplot2 (Wickham, 2016).

Results

Perceptions on the teaching and learning provided by demonstrators in a laboratory setting

There were 117 coded student survey responses and 26 coded demonstrator survey responses used for thematic analysis. The undergraduate and demonstrator surveys were completed by 79 females, 37 males and one non-binary person and 16 females, 9 males and one non-binary person respectively. A visual representation of the themes derived from the combined survey data regarding how both students and demonstrator perceive the teaching and learning provided by demonstrators during laboratory practical sessions can be seen in Fig. 1.

Eight key themes were derived from the thematic analysis for both students and demonstrators regarding the teaching and learning provided by demonstrators. Both datasets derived analogous themes though framed from slightly different perspectives. As the eight themes were commensurate the descriptions of the themes will be given in congruous pairs below:

Theme pair 1: *Demonstrators are the interactive and engaging teachers that encourage learning/ We provide inspiration, motivation and discussion that help keep students engaged in their learning*

Undergraduate responses within this theme described how demonstrators engaged and interacted with them in a positive light. This included discussions of topics covered and new interesting facts taught, and often described how the interactions kept them engaged and focussed. A representative comment was:

"They help [you] stay present during the practical, being asked a question can sometimes catch you off guard but it's useful to make sure you're staying on task. Being monitored aids any self-directed learning, its less likely I am going to get distracted."

The demonstrator responses reflected student responses, as many saw part of their role as "keeping students engaged", but also to inspire and motivate them. Over 25% of student respondents and 70% of demonstrators made comment relating to this theme.

Table 1: Questions asked in both the student and demonstrator online survey questionnaires. Options to questions are indicated in brackets and questions that required a free text response are marked with an asterisk (*).

Questionnaire type	Survey questions
Student	What gender do you identify as? (Female, Male, Non-binary, Prefer not to say)
	If your gender was not listed in the question above (Q1), how do you self-describe?*
	What degree programme are you studying?*
	What year of your degree programme are you in?*
	In the laboratory, where does most of your learning come from? Please rank from most (1) to least (5) by dragging and dropping the boxes below or using the arrows. (Demonstrators, Lecturer/Professor, Lead demonstrator, Lecture content, Self-directed)
	Please justify your rankings in the question above (Q5).*
	In the laboratory, from whom are you most likely to ask for help? Please rank from most (1) to least (5) by dragging and dropping the boxes below or using the arrows. (Demonstrators, Lecturer/Professor, Other students, Lead demonstrator, I prefer not to ask for help).
	Please justify your rankings in the question above (Q7).*
	In the laboratory, where does most of your feedback come from? Please rank from most (1) to least (5) by dragging and dropping the boxes below or using the arrows. (Demonstrators, Lecturer/Professor, Other students, Lead demonstrator, I have not received feedback).
	Please justify your rankings in the question above (Q9). Include comments on the type (e.g. verbal/written) and quality of feedback. This can also include feedback received after a laboratory practical.*
	In the laboratory, how important are demonstrators to your teaching and learning experience? (Extremely important, Somewhat important, Neither important nor unimportant, Somewhat unimportant, Extremely unimportant).
	Please explain the reasoning for your answer in the question above (Q11). Feel free to include examples of how demonstrators have enhanced and/or hindered your learning.*
	What characteristics does a good demonstrator have? How might these characteristics impact your learning experience?*
	How often do you think demonstrators have sufficient knowledge to support your learning in laboratory practicals? (Always, Often, Sometimes, Rarely, Never)
	Please provide an explanation for your answer above (Q14). Include example(s) if you can. *
	Is there anything demonstrators could do differently to better improve your learning?*
	Do you consider demonstrators to be role models? (Yes, Somewhat, No, I am not sure).
	Has talking to a demonstrator made you think about doing a Master's or PhD? (Yes, Somewhat, No, I am not sure).
Demonstrator	What gender do you identify as? (Female, Male, Non-binary, Prefer not to say)
	If you gender was not listed in the question above, how do you self-describe?*
	Which school(s) do you demonstrate in? (e.g. Biological Sciences)*
	Approximately how many times have you demonstrated in an undergraduate laboratory practical? (0, 1-4, 5-10, 11-15, 16+)
	What role do you believe a demonstrator plays in a student's learning experience? Feel free to include examples of how you or others have enhanced and/or hindered student learning.*
	What characteristics do you believe are important for a good demonstrator? How might these characteristics impact a student's learning experience?*
	In the laboratory, how important are demonstrators to student learning? (Extremely important, Somewhat important, Neither important nor unimportant, Somewhat unimportant, Extremely unimportant).
	Please explain your answer to the question above (Q7).*
	In laboratory practicals, how confident do you feel working as a demonstrator? (Extremely confident, Somewhat confident, Neither confident nor unconfident, Somewhat unconfident, Not at all confident).
	Please explain your answer to the question above (Q9).*
	In the laboratory, how frequently are you able to answer questions asked by students? (Always, Often, Sometimes, Rarely, Never).
	Please elaborate on your answer to the question above (Q11). Feel free to include examples.*
	As a demonstrator, what training and/or courses have you attended?*
	Are you aware of training and/or courses available to you?*
	Would demonstrators benefit from extra-training? If so, what type of training would be beneficial to demonstrators?*
	In the laboratory, how frequently is your teaching appreciated by students? (Always, Often, Sometimes, Rarely, Never).
	Please elaborate on your answer to the question above (Q16). Feel free to include examples.*
	Do you receive feedback from students and/or staff on how to improve your teaching in the laboratory? (Yes, No)
	Please expand on what type of feedback you have received and whether you would you like to receive more (please include what feedback would benefit you most).*
	Would you like to receive feedback from staff and/or students? Please state what type of feedback you would benefit from the most.*
	Do you give feedback to students? If so, please expand on what type. Feel free to include examples.*
	Do you think there is anything that demonstrators could do differently to better improve student learning?*
	Do you consider yourself a role model to undergraduate students? (Yes, No, I am not sure).
	In the laboratory, how much do you enjoy working as a demonstrator? (Extremely enjoy, Somewhat enjoy, Neither enjoy or do not enjoy, Somewhat do not enjoy, Extremely do not enjoy).
	Please elaborate on your answer to the question above (Q24). Feel free to include examples.*
	Do you personally benefit from demonstrating? If so, how?*
	How could your demonstrator experience be improved?*

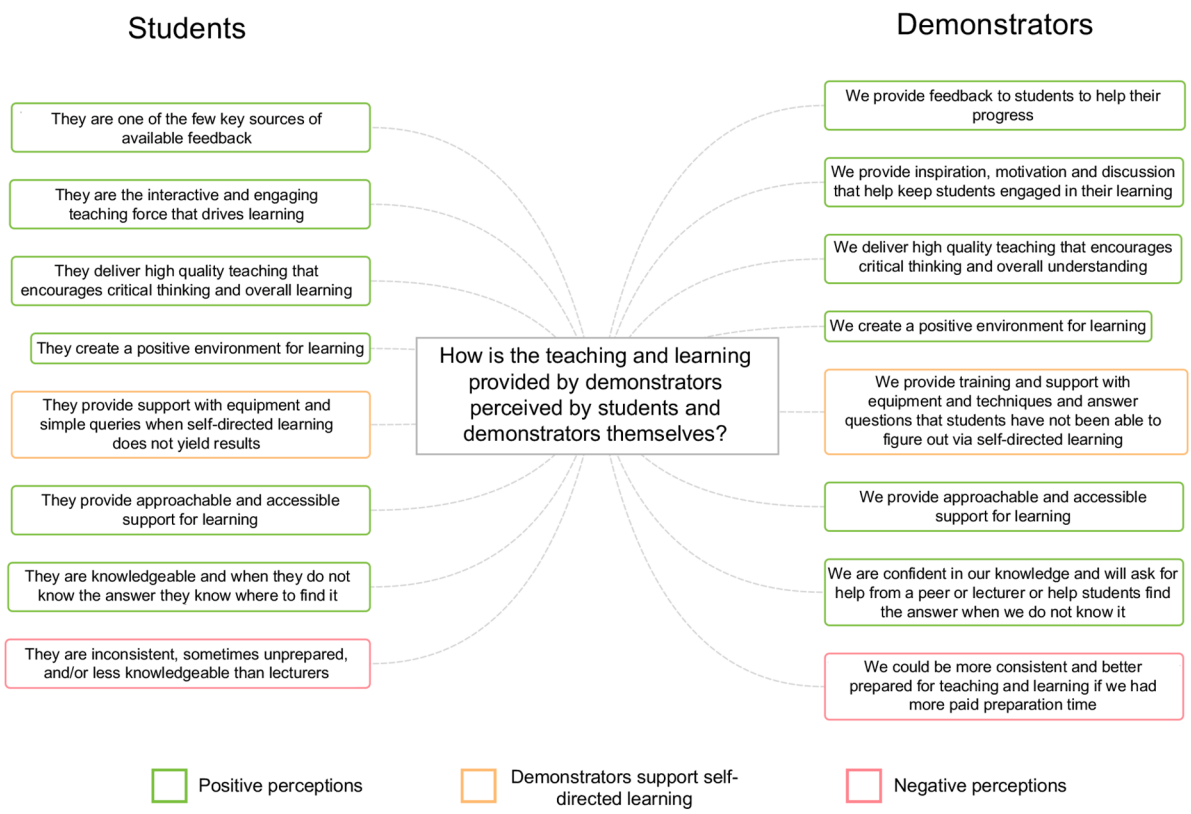

Figure 1: Thematic Analysis of combined survey data to ascertain how students (left) and demonstrators (right) perceive the teaching and learning provided by demonstrators in the laboratory setting.

Theme pair 2: *Demonstrators are inconsistent, sometimes unprepared and/or less knowledgeable than lecturers/ We could be more consistent, prepared and better for teaching and learning if we had more paid preparation time*

Of the 117 student respondents, 15 undergraduates felt that demonstrators sometimes lacked consistency or preparedness. Some respondents were completely unsatisfied with all demonstrators, whereas most were complementary but cited issues with consistency between the quality of individual demonstrators and their preparedness. Other student responses indicated a preference to have the lecturer deal with their enquiries due to their perceived superior knowledge and teaching quality.

Demonstrator responses in this theme also acknowledged that they were sometimes unprepared, with some comments attributing this to a lack of sufficient paid preparation time for their teaching.

Theme pair 3: *Demonstrators provide approachable, accessible, support for learning/ We provide approachable, accessible support for learning*

Responses in this theme tended to highlight demonstrator accessibility and how much more approachable they were relative to lecturers. Often responses explicitly emphasised how unapproachable the lecturer was or how they perceived the lecturer to be too busy for their questions, for example:

"Demonstrators are the least intimidating [to ask for help] and I'm not worried about asking them a stupid question"

"They [demonstrators] are more available and approachable than the lecturers, [and] often better at

explaining things. They are needed because there is no way the lecturer could answer all the questions people have in practicals."

Students also felt that they could confidently double-check their work with demonstrators due to their accessibility and approachability. Demonstrator responses mirrored these ideas, also recognising themselves as more approachable, relatable, and less intimidating. This was a frequently mentioned theme, as 61% of student respondents and 88% of demonstrators attributed comments to it.

Theme pair 4: *Demonstrators deliver high quality teaching that encourages critical thinking and overall learning/ We deliver high quality teaching that encourages critical thing and overall understanding*

Student responses attributed to this theme talked explicitly about the quality of teaching or the impact demonstrator teaching had on their learning. This included responses praising the quality of explanations from demonstrators and how that enhanced their knowledge and understanding or describing how demonstrators had encouraged them to think critically. Many responses also described how demonstrators guided students towards answers and how this had been beneficial to their learning. Some examples include:

"If you were stuck on something, they [the demonstrators] wouldn't just give you the answer, they would unravel it slowly letting you actively search for the solution yourself. I felt this was a very effective way of handling it and is of great benefit to the Lab learning experience."

"[Demonstrators] circulate and often ask additional questions promoting critical thinking"

Demonstrator responses in this theme mirrored those made by students and often mentioned the importance of guiding and not telling, giving good explanations, developing critical thinking and challenging students. A higher proportion of student respondents (28%) than demonstrators (23%) outlined the delivery of high-quality teaching and consequent learning.

Theme Pair 5: *Demonstrators are one of the few key sources of feedback/ We provide feedback to students help their progress*

Of student respondents, 55% made comments contributing to this theme, describing demonstrators as a source of feedback (predominantly verbal) and often as the only source of 1:1 feedback they received regarding their performance in laboratories. It is noteworthy, though not a component of this theme, that many students felt that they did not receive feedback on their laboratory performance or that it was largely generic class feedback.

Demonstrator responses also recognised their role in giving feedback and often listed or described the types of feedback they gave. These included using feedback to guide students to the answer, giving feedback on their use of equipment and giving verbal feedback on the answers in their laboratory workbooks. Many also mentioned giving positive feedback to boost confidence and enhance the learning environment. More demonstrators than students (81% vs 55% respectively) provided comments relating to this theme.

Theme pair 6: *Demonstrators create a positive environment for learning/ We create a positive environment for learning*

Undergraduate responses in this theme expressed the fun and enjoyment that demonstrators brought to the learning experience, and some explicitly mentioned the learning environment.

Other responses focussed on the relaxation and stress reduction they attributed to the demonstrators' presence and the discussions they initiated. Representative quotes include:

"They [demonstrators] are the main people who make the lab environment joyous and living."

"[I] definitely feel like they [demonstrators] don't hinder my learning. Just the fact that you can talk in an informal way to them helps me relax and actually understand content"

"I think they [demonstrators] serve a function outside of simply demonstrating procedures and answering questions. Their presence is important because they encourage a certain social dynamic to develop by encouraging conversations about the work we are doing. Also, they talk to everyone. So, even if a student is working alone, they talk to them and make them feel part of the class."

Demonstrators' responses in this theme echoed the above responses and some demonstrators also elaborated on the value that a positive learning environment created for students. Only one of the 26 demonstrators commented on the potential of demonstrators to create a positive learning environment relative to the 16 student responses for this theme.

Theme pair 7: *Demonstrators provide support with equipment and with simple queries when self-directed learning does not yield results/ We provide training and support with equipment and techniques and answer question when students have not been able to figure them out with self-directed learning*

Responses from students in this theme were predominantly from students who described their learning preferences as self-directed or self-motivated and typically described a demonstrator's value in terms of showing them how to use new equipment or in answering questions and queries when they could not do it themselves. Comments were not typically critical of demonstrators but focused less on the teaching led and/or enhanced by demonstrators and saw them as more of a support resource to supplement their chosen self-directed learning style. Demonstrator responses described their role as a demonstrator in the same manner. They also emphasised the importance of self-directed student learning and that demonstrators should avoid micro-managing or interfering excessively. An equal percentage (27%) of student and demonstrator respondents contributed to this theme pair.

Theme pair 8: *Demonstrators are knowledgeable and when they do not know the answer they know where to find it/ We are confident in our knowledge but will ask for help from a peer or lecturer or help students find the answer when we do not know the answer*

Student responses attributed to this theme (in contrast to theme 2) described a satisfaction with the level of knowledge the demonstrators had and were understanding and content with demonstrators looking up the answer or asking for help from a lecturer when needed.

Demonstrators' responses within this theme expressed a confidence that the knowledge they had was sufficient for their role and that they were happy with seeking help or finding answers collaboratively with students. Some responses actually highlighted how not knowing the answer might be comforting for students and looking up answers together might enhance learning. More than half of respondents from both the demonstrator and students surveys contributed comments towards this theme pair.

What makes an excellent demonstrator?

The same 117 coded student survey responses and 26 coded demonstrator survey responses as described above were used for a second thematic analysis. A visual representation of the themes derived from the combined survey data exploring perceptions regarding optimal demonstrator performance can be seen in Fig. 2.

The themes regarding demonstrator best practice were also commensurate and have therefore been grouped into 6 different theme pairs when described below:

Theme Pair 1: *Demonstrators build relationships, have fun, and start discussions/ We inspire, motivate, start discussion, and add new perspectives*

This theme included student responses that suggested the best demonstrators started discussions around scientific topics, careers, further study, or even friendly small talk. Encompassed in these responses was the idea of relationship building. Responses suggested students found this a fun part of laboratories and that it improved the learning environment.

Demonstrator responses also focused upon relationship building but were more angled towards improving student engagement and motivation. Demonstrators felt that they brought extra knowledge and perspectives as part of these discussions. A higher proportion of demonstrators compared to students (50% vs 21% respectively) identified this theme as a characteristic of the best demonstrators.

Theme Pair 2: *Demonstrators are warm, kind, empathetic, understanding, caring and compassionate/ We are warm, kind, empathetic, understanding, caring and compassionate*

Student responses in this theme described the best demonstrators as those displaying traits that helped support students emotionally during their learning or made the demonstrator an approachable source of help.

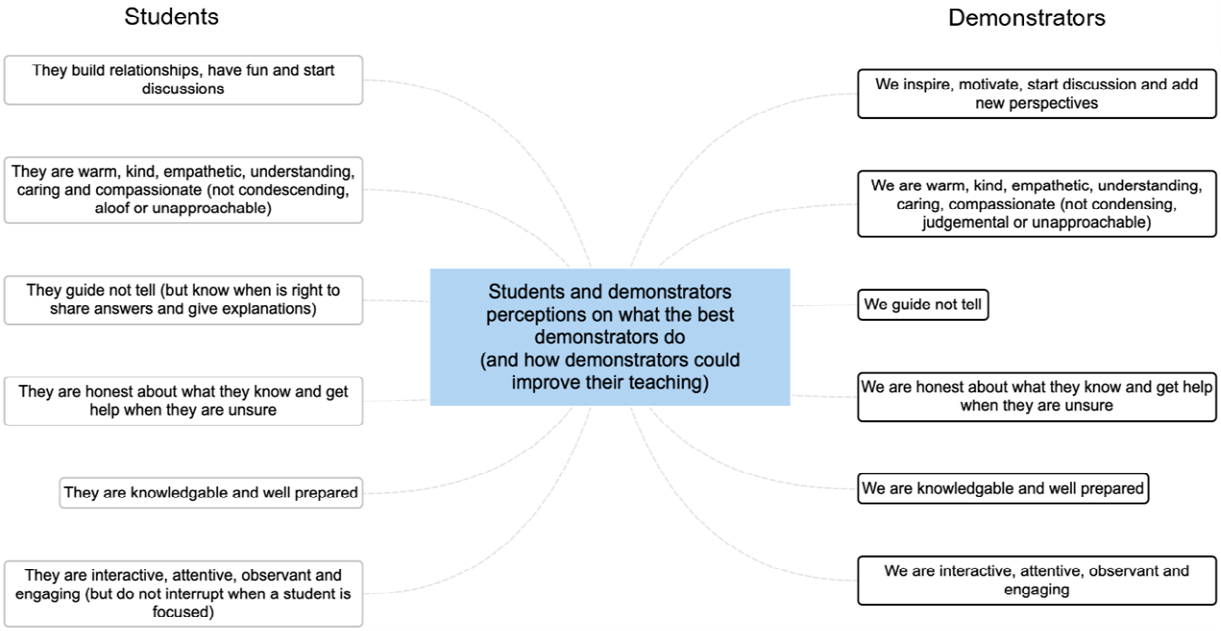

Figure 2: Thematic Analysis of combined survey data representing what students (left) and demonstrators (right) perceive the best demonstrators to do and how other demonstrators could improve.

These responses often chastised demonstrators who were aloof, unapproachable, or condescending and said that this made them hard or undesirable to approach for help. An illustrative quote is shown below:

"Being friendly, honest on their understanding of the subject. Not judgemental. Patient. Being friendly, and patient helped me to be relax in the lab and ask for help whenever I need which helped me a lot to understand the content."

Demonstrator responses in this theme also described the importance of these traits in improving the learning environment and allowing students to comfortably ask for help. Student and demonstrator responses in this theme were equally common with 76% of both cohorts valuing these character traits.

Theme Pair 3: *Demonstrators guide not tell / We guide not tell*

Both student and demonstrator responses attributed to this theme described how the best demonstrators guide students to the answer and do not tell them. A student described this as:

"[the best demonstrators don't] just tell you the answer but to try and help you get there yourself, so you understand the reasoning behind the answer better"

There was a key difference between the student and demonstrator responses in that many students mentioned that in addition to the guiding process it was also important in some circumstances to share the actual answer and that failure to do so hindered their learning. Only 12% of student respondents were explicitly attributed to this theme compared with 31% of demonstrators.

Theme Pair 4: *Demonstrators are honest when they do not know the answer and get help when they are unsure/ We are honest about what we know and get help when we are unsure*

The theme pair title was almost verbatim for the responses that students and demonstrators gave regarding the best demonstrators. In addition to many instances describing this as a behaviour of the best demonstrators, a number of student responses highlighted the frustration they felt when demonstrator did not do this and described a lack of honesty as a hinderance to their learning. The majority of demonstrators (81%) explicitly mentioned this honesty compared with 4% of students.

Theme Pair 5: *Demonstrators are knowledgeable and well prepared/ We are knowledgeable and well prepared*

Respondents from both the demonstrator and student survey data highlighted that the best demonstrators were well prepared and knowledgeable. Student responses also highlighted the inverse, criticising poorly prepared demonstrators who were not familiar with the basics of the session. Demonstrators typically did not focus on these negative aspects, though some demonstrator comments highlighted that they only selected to work in sessions where they already had good knowledge. More demonstrators than student respondents (81% vs 50% respectively) stated that the best demonstrators were knowledgeable and well prepared.

Theme Pair 6: *Demonstrators are interactive, attentive, observant and engaging/ We are interactive, attentive, observant, and engaging*

Student responses in this theme described the best demonstrators as those who checked in on learning and paid attention to who was struggling and needed support. Demonstrators mentioned that some students would not ask for help unless they engaged with them. Some responses indicated however that excessive interactions or those whilst students were in deep focus were described as harmful to learning.

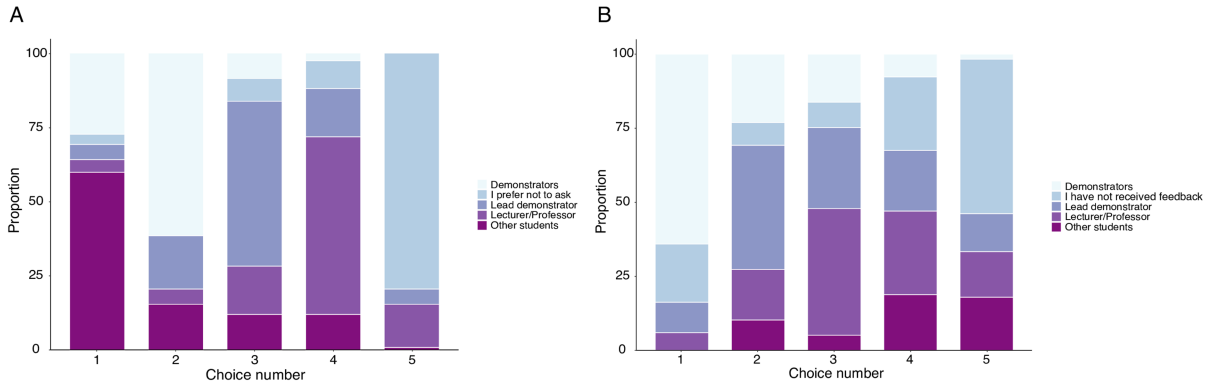

Figure 3: Stacked bar charts illustrating who students are most likely to ask for help (A) and who they receive the most feedback from (B) in laboratory practical sessions.

A and B were both ranked questions in the student questionnaire, meaning that students could assign ranks to their answers, i.e., choice number 1 was their first choice and choice number 5 was their last.

Table 2: A summary of student's responses explaining their preferences regarding help and feedback during laboratory practical sessions.

	Peers	Demonstrator	Lecturer
Why students DO ask for help and/or feedback	Fun, easy and helpful learning method which is easily accessible.	More accessible and approachable than lecturers. They provide high quality explanations and teaching. Feedback is more personalised.	Feedback and answers are often more specific and of a higher quality due to lecturers' depth of knowledge.
Why students DO NOT ask for help and/or feedback	Asking peers can be tough if a student feels socially isolated. Peers can be unreliable or unknowledgeable compared with a lecturer or demonstrator.	Inconsistency in quality, accessibility and depth of knowledge. Less knowledgeable than a lecturer.	Lecturers can be intimidating, unapproachable or perceived to be busy. Feedback can also be lacking and/or too general.

Demonstrator responses were similar but largely neglected the negative aspects of "too much interactivity" and/or disrupting flow and focus. Demonstrators did mention that they would like more strategies for starting higher quality interactions and for spotting students who need help. Over half of the demonstrator respondents (65%) saw these as traits of the best demonstrators whereas only a third of students mentioned these traits.

Where do students ask for help and who do they perceive their laboratory feedback comes from?

The proportion of responses attributed to different individuals with regards to whom students ask for help in the laboratory, and from whom they perceive most of their laboratory feedback to come from is shown in Figure 3.

Students' first choice when seeking help was to ask their peers (60%) followed by

demonstrators (27%). The second choice of help was predominantly the demonstrators (62%). The least popular option (5th choice) was predominantly 'I prefer not to ask' (79%) followed by lecturer (15%).

Students perceived demonstrators to be their primary source of laboratory feedback (64%) with the second most selected option for their first choice being 'I have not received feedback' (20%). The lead demonstrator was most often selected as the second-place option (42%) with other options comparable in frequency. The lecturer was most often selected as a third-place option (43%). Justifications for student choices are summarised in Table 2.

Demonstrator knowledge, importance, and influence

Students and demonstrators were asked to rank the importance of demonstrators to practical sessions and whether they had sufficient knowledge for the role. Their responses can be seen in Figure 4.

Survey questions also explored whether demonstrators were role models and whether their teaching was appreciated.

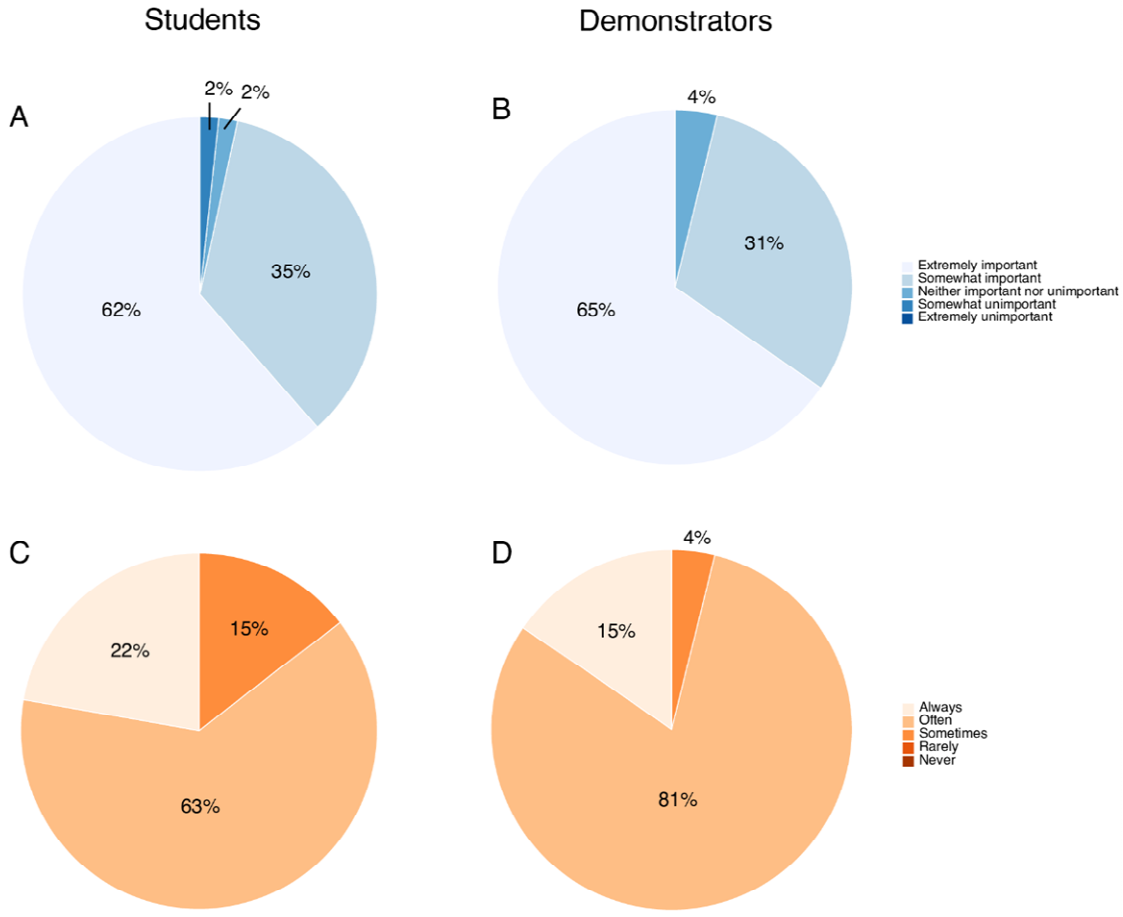

Figure 4: An assessment of demonstrator performance in practical sessions/Students and demonstrators assess the importance and knowledge of demonstrators (in teaching and learning).

Pie charts A and B visualise student and demonstrator responses to the question 'How important are demonstrators to teaching and learning?', whilst C and D visualise responses to the question 'How often do you think demonstrators have sufficient knowledge to support teaching and learning?'.

Most demonstrators (73%) believed that their teaching is "often appreciated", with a further 4% "always appreciated" and some (23%) feeling that their teaching is only "sometimes" appreciated. The majority of students considered demonstrators to be some form of role model (Yes 35%, somewhat 53%), with the remaining disagreeing (8%) or uncertain (4%).

On the other hand, 46% of demonstrators considered themselves to be role models, whilst 8% did not and 46% were unsure. Furthermore, conversing with demonstrators has made 73% of students think (strongly or somewhat) about embarking upon a Master's degree or PhD.

Discussion

Students and demonstrators are largely aligned in their perceptions regarding the teaching and learning provided by demonstrators in the laboratory setting. Similar to findings by Muzaka (2009) and Park (2002), our research showed that students and demonstrators recognised demonstrators to be an engaging and approachable teaching force. We also found that students perceived demonstrators to be supportive and builders of important relationships with students, helping to create a positive learning environment. Demonstrators were also recognised as predominantly good quality educators who help build knowledge and develop critical thinking. However, both parties agreed that sometimes demonstrators are underprepared and their quality inconsistent. Underprepared demonstrators could therefore be hindering student learning and undermining faith in the demonstrator team with poor explanations or incorrect advice. A possible solution, suggested by demonstrators in this study, would be to provide more sufficiently paid preparation time prior to teaching. It is understandable why some demonstrators, who are already busy with their own research, feel begrudged to prepare sufficiently when they are perhaps unfairly remunerated. Students and demonstrators further agree that the best demonstrators are personable (rather than condescending or unapproachable), honest, knowledgeable, well prepared, observant, and able to initiate discussions. They also believe that demonstrators should help guide students rather than provide answers immediately. However, students have highlighted that demonstrators should share answers with good explanations if a student is unable to be guided to the solution, and that failure to do so can damage the student-demonstrator dynamic. Students further highlighted that demonstrators should know when to ask questions and when not to interrupt e.g., when a student is focused. However, from my past experience of working as a GTA I sympathise, as it is sometimes difficult to know when a student needs help, especially if they are shy. Thus, the introduction of a traffic light system could be beneficial in ensuring students get the level of interactivity they want from demonstrators. However, this does run the risk that some students may choose to avoid interactivity completely and in turn miss out on key learning experiences.

We can describe the student-demonstrator dynamic as one that sits somewhere between student-peer and student-lecturer, as students consider demonstrators to be high quality educators and role models, but also as relatable individuals who are more approachable and accessible than lecturers. In the laboratory, demonstrators are the most recognised source of feedback and are students' second choice when asking for help (after their peers). Demonstrators thereby play an important role in

student learning as they put students at ease, are more knowledgeable than student peers and provide a key source of feedback. In the UK higher education sector where feedback is often poorly scored in the National Student Survey (Williams *et al*., 2008), this opportunity to impact student learning should be shared more widely with all staff. However, what we do not know is the quality of demonstrator feedback and so perhaps more should be done to train, support and measure the feedback given to students. Demonstrators also stated that they would benefit from strategies for identifying students that need help and for initiating better quality discussion. Thus, training in these areas should be included in their training programmes. This could be more generic training regarding student body language, or session specific training which points out specific signs in students' experimental set up or workbooks as indicators of a student who has not grasped the concepts fully. Moreover, conversations between students and demonstrators appear to inspire students to consider post-graduate study; this supports similar findings by Park (2002). With many students considering demonstrators to be role models, it is perhaps unsurprising that they would want to explore these topics with them. However, despite positive student perceptions, demonstrators themselves do not always feel appreciated by students. Thus, to boost demonstrator morale and maintain a positive learning environment it would be beneficial for students to regularly vocalise their appreciation. To further ensure demonstrators feel more valued, students should have the option to consistently leave positive (or negative) feedback for an individual(s).

Concluding remarks

This research provides a blueprint for the pedagogic and personal skills required for excellence as a practical demonstrator. Students recognise demonstrators to be approachable, relatable and talented educators who provide feedback and create a positive learning environment but would like more consistency in demonstrator performance. Demonstrators do not always feel appreciated by students, or fully prepared for teaching and suggest that they would benefit from more paid preparation time and training to perform to their potential. Universities should do more to recognise and maximise demonstrator potential and improve their teaching experience by ensuring that demonstrators feel valued and providing suitable access to training in the areas of feedback, identifying which students need help (and when) and relationship building.

Acknowledgements

Thank you to Sheila Amici Dargan for her support and guidance.

Funding

Funding was provided by the School of Biological Sciences, University of Bristol.

References

Beaton, F., Bradley, S. and Cope, S., 2013. Supporting GTAs Who Teach: Foreword: Supporting Graduate Teaching Assistants: structures and practices. Practice and Evidence of Scholarship in Learning and Teaching in Higher Education, 8(2), pp.83-92.

Benjamin, E., 2002. How over-reliance on contingent appointments diminishes faculty involvement in student learning.(Analysis). Peer Review, 5(1), pp.4-11.

Braun, V. and Clarke, V., 2006. Using thematic analysis in psychology. Qualitative research in psychology, 3(2), pp.77-101.

Braun, V. and Clarke, V., 2012. Thematic Analysis. In APA Handbook of Research Methods in Psychology, edited by H. Cooper., Vol. 2: Research Designs, pp.57–71. Washington, DC: APA books.

Chiu, P.H.P. and Corrigan, P., 2019. A study of graduate teaching assistants' self-efficacy in teaching: Fits and starts in the first triennium of teaching. Cogent Education, 6(1), p.1579964.

Compton, M. and Tran, D., 2017. Liminal space or in limbo? Post Graduate Researchers and their personal pie charts of identity. Compass: Journal of Learning and Teaching, 10(3).

Elliott, M.I., and Marie, J., 2021. Advancing student-staff partnership through the unique position of GTAs. Postgraduate Pedagogies, 1(1), pp.71-90.

Golish, T.D., 1999. Students' use of compliance gaining strategies with graduate teaching assistants: Examining the other end of the power spectrum. Communication Quarterly, 47(1), pp.12-32.

Huffmyer, A.S. and Lemus, U.D., 2019. Graduate TA teaching behaviours impact student achievement in a research-based undergraduate science course. Journal of College Science Teaching, 48(3), pp.56-65.

Jaeger, A.J., 2008. Contingent Faculty and Student Outcomes. Academe, 94(6), pp.42-43.

Kendall, K.D. and Schussler, E.E., 2012. Does instructor type matter? Undergraduate student perception of graduate teaching assistants and professors. CBE—Life Sciences Education, 11(2), pp.187-199.

McCready, R. and Vecsey, S., 2013. Supporting the Postgraduate Demonstrator: Embedding development opportunities into the day job. Practice and Evidence of the Scholarship of Teaching and Learning in Higher Education, pp.104-111.

Muzaka, V., 2009. The niche of graduate teaching assistants (GTAs): Perceptions and reflections. Teaching in Higher Education, 14(1), pp.1-12.

Nasser-Abu Alhija, F. and Fresko, B., 2018. Graduate teaching assistants: how well do their students think they do?. Assessment & Evaluation in Higher Education, 43(6), pp.943-954.

Park, C. and Ramos, M., 2002. The donkey in the department? Insights into the graduate teaching assistant (GTA) experience in the UK. Journal of Graduate Education, 3(2), pp.47-53.

Park, C., 2002. Neither fish nor fowl? The perceived benefits and problems of using graduate teaching assistants (GTAs) to teach undergraduate students. Higher Education Review, 35(1), pp.50-62.

Pezzella, A., 2014. There is more to a GTA than meets the eye. Health and Social Care Education, 3(1), pp.51-53.

Prieto, L.R. and Meyers, S.A., 1999. Effects of training and supervision on the self-efficacy of psychology graduate teaching assistants. Teaching of Psychology, 26(4), pp.264-266.

R Core Team (2019). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. Available at: https://www.R-project.org/. Accessed 15 August 2022.

Ramos, M., 2001. Postgraduate research students as teaching assistants: an exploratory study on directions for TA

practices at Lancaster University. Lancaster University, Lancaster.

Rao, N., Hosein, A. and Raaper, R., 2021. Doctoral students navigating the borderlands of academic teaching in an era of precarity. Teaching in Higher Education, 26(3), pp.454-470.

Ryan, B.J., 2014. Graduate teaching assistants; critical colleagues or casual components in the undergraduate laboratory learning? An exploration of the role of the postgraduate teacher in the sciences. European Journal of Science and Mathematics Education, 2(2), pp.98-105.

Wickham, H., 2016. ggplot2: Elegant graphics for data analysis. Springer-Verlag, New York.

Williams, J., Kane, D., Sagu, S., & Smith, E. 2008. Exploring the national student survey: Assessment and feedback issues. The Higher Education Academy, Centre for Research into Quality.

Young, S.L. and Bippus, A.M., 2008. Assessment of graduate teaching assistant (GTA) training: A case study of a training program and its impact on GTAs. Communication Teacher, 22(4), pp.116-129.

To cite this article: Victoria Palumbo and Christopher Cammies. 2022. Exploring student and demonstrator perspectives of the teaching and learning provided by demonstrators during undergraduate laboratory practical sessions. Journal of PGR Pedagogic Practice, 2, 9-26. Available at: https://doi.org/10.31273/jppp.vol2.2022.1224