# Helping students to climb the mountain: A study to inform the development of a resource to improve the learning of statistics in psychology

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*Students often struggle with learning about statistics, which encompass a large proportion of a psychology degree. This pilot study explored how first- and final-year students reflected on their experiences of being taught this topic, in order to identify needs that could be addressed in a project to improve their learning.*

*First-year students reported that they initially found their module challenging but that it became easier towards the end. Third-year students recognised the importance of the topic but were not confident in their abilities. Most students reported anxiety about statistics. Although students were positive about practical classes, many felt that they could not easily remember the materials. The findings suggested three areas of focus to improve student learning. Firstly, diverse needs and levels of ability should be catered for. Secondly, students need help to go beyond surface learning and button clicking. Finally, low levels of engagement should be addressed.*

*This work has informed a project to develop an online resource to address the above identified needs to enhance teaching of this important topic.*

**Keywords:** *psychology; statistics; research methods; research-based learning; course engagement.*

## Introduction

### *Background*

PSYCHOLOGY DEGREES in the UK are overseen by the British Psychological Society (BPS) and research methods comprise 25 per cent of the content. There is often a mismatch between student expectations about psychology and the amount of statistics that they are required to learn (Ruggeri et al., 2008). Evidence suggests that some students face difficulties, and sometimes even anxiety, about this aspect of their studies (Onwuegbuzie, 2004). This anxiety is detrimental to the student experience and often results in lower attainment on statistics modules (Onwuegbuzie & Wilson, 2003). Moreover, other evidence suggests that those who teach this topic perceive high levels of student disengagement in statistics modules in psychology across the UK (Davies & Jackson, 2014). Thus, those involved in teaching this topic may face a 'double challenge'; to reduce anxiety and enhance engagement in lectures and seminars.

At Oxford Brookes University, in common with other UK institutions, there are lectures and practical seminars on research methods and statistics in the first and second year of a Psychology undergraduate degree. Lectures follow the traditional format of PowerPoint presentations, whereas in practical seminars, students learn how to collect data, work on a computer to use the Statistical Package for the Social Sciences (SPSS), and to learn to write lab reports. In the third year, students complete an independent dissertation and are expected to apply their learning from previous parts of their degree programme. An important feature of our degree programme is that it is modular, allowing students some flexibility in their studies.

Although we often receive positive feedback in module evaluations in methods modules, we have noted that in recent years, high levels of anxiety and low levels of confidence are demonstrated by our students when reflecting on our teaching. Consequently, as a team, the authors sought to explore the student experience of learning about statistics in psychology at our own institution in order to provide information that would help us to develop further measures to support our students.

There is a wealth of existing research that explores the teaching of statistics in psychology (Chew & Dillon, 2014; Field, 2014), which suggest methods by which it can be improved. For example, some studies have proposed using humour to convey challenging topics (Lomax & Moosavi, 2002). Other authors have suggested using a mix of strategies including ensuring lectures are interactive and including real life examples (Neumann, Hood & Neumann, 2008). What is clear from the literature is that there is as yet, no widely agreed 'ideal' way in which to teach this topic. It is also evident from our student feedback and our own reflections that our classes are made up of students of differing statistical knowledge and engagement. Our starting point in this exploratory project was to select students in the first and third years of study. First-year students were of interest as they are at the start of their journey into learning about statistics at university level; third-year students were of interest as they are putting their knowledge into practice to complete a dissertation.

***First-year students***

There is considerable evidence of a 'skill gap' between A-levels and university in a variety of disciplines, and the problems that it can cause to students' performance at university (Ballinger, 2003; Gallager-Brett & Canning, 2011; Tate & Swords, 2013). For example, in a study by Tate and Swords (2013) geography students identified that they were missing practical, cognitive and critical thinking skills that impeded their progress at university level. In a recent review, Kitching and Hulme (2013) discussed issues about transition from secondary education to university specifically related to psychology. They concluded that there is indeed a considerable gap between pre-university education and psychology at university, and that the students are not prepared well enough for university study. A report by the Higher Education Academy (HEA) (Field, 2014) concluded that statistics anxiety and lack of confidence in statistics are key factors that inhibit students' achievement and potential. Moreover, the HEA report claims that around a fifth of all students are at risk of being left behind in terms of statistical knowledge (Field, 2014). If psychology students were given help to bridge this gap, then frustration regarding statistics may be reduced and academic performance enhanced.

***Third-year students***

At the other end of the scale, the culmination of a psychology degree is the completion of an independent empirical project in the final year of undergraduate study, conducted under the supervision of a single member of staff. This requires students to put into practice what they have learnt in their research methods and statistics modules in the first and second year of study. Understanding students' experiences of applying what they have previously been taught offers an opportunity for us to explore ways to enhance our teaching of this topic across the degree programme and to attempt to reduce the anxiety that often accompanies these modules.

The aim of the current study was to understand the student experience of learning statistics in psychology in years one and three. Specifically we sought to: (1) explore first year students' experiences of their methods module; (2) explore third year students' experiences of completing a dissertation; and (3) use those experiences to identify the needs to be addressed in a project to enhance the teaching of this topic.

## Method

### *Participants and procedure*

All first-year psychology students registered for a required Research Methods module (*N*=140) were invited to take part in two anonymous surveys via email at two time points in time. Seventy-six (54 per cent; 10 males, 66 females) first-year psychology students took part in a survey at the beginning of the module and 22 (16 per cent) took part in a second survey at the end of the module (four males and 18 females).

All third-year students (*N*=87) registered for the project module were invited to take part in two different anonymous surveys at two points in time. Thirty third-year psychology students (34 per cent; four males, 26 females) took part in a survey prior to a 'refresher' class to help them analyse their data and 20 (23 per cent; four males, 16 females) took part after submitting their dissertation

### *Measures*

The first- and third-year students completed different surveys in order to capture information relevant to their current experience of studying. The surveys were developed by the authors drawing on insights from the literature and module feedback. The surveys consisted of questions relating to: (1) anxiety and confidence about statistics; and (2) questions about the students' statistical knowledge. The two surveys were administered to each year group of students. For first-year students this was at the start and end of an introductory statistics module in order to explore changes in views about learning statistics over time. For the third-year students this was before they began analysing their dissertation data, prior to a SPSS refresher class, and once the dissertation had been submitted in order to explore their views prior to and then upon completion of this important piece of work. Each survey took approximately 10 to 15 minutes to complete and was administered online using Qualtrics software.

### *First-year students*

In the two surveys directed at first-year students, they were asked about their transition from pre-tertiary to undergraduate level study, confidence levels, anxiety and experiences within the module. There were a number of rating scale questions, for example 'How anxious do you feel about studying statistics in this semester?'; these were rated from 1 (lowest level of anxiety) to 7 (highest level of anxiety). There were also three open questions asking for further comment on experiences of learning about this topic and the module.

### *Third-year students*

Before the SPSS refresher class, third-year students were asked about their experiences of learning SPSS and statistics and their feelings about preparing for the upcoming dissertation. After submission, they were asked about their experience of completing the dissertation and for overall reflections on studying research methods during the degree. There was a number of rating scale questions, for example, 'I feel confident about using SPSS for analysing my dissertation data' rated from 1 (scales from 1 (strongly disagree) to 7 (strongly agree). There were three open questions asking for further comment on experiences of learning about this topic.

The study received ethical approval from Oxford Brookes University Ethics Committee (project registration number 140798). Numerical questions were entered into SPSS and analysed using descriptive statistics. The open answer questions were grouped into codes guided by the principles of thematic analysis (Braun & Clarke, 2006) in order to search for themes relating to the experience of learning statistics.

## Results

### *First-year students*

Table 1 shows the results from the two questionnaires for the rating questions. There is very little evidence to suggest, at least from the quantitative data, that the module

decreased their anxiety ($U$=724.5, $N$=97, p=.376) for learning statistics. However, their confidence was significantly higher for *t*-tests ($U$=522.5, $N$=97, $p$=.008), correlations ($U$=421, $N$=97, $p$<.001) and approaching significance for chi-squared tests ($U$=565, $N$=95, $p$=.052) compared with their initial confidence about studying statistics. This is in agreement with the qualitative results, whereby students said that although they were less confident at the beginning, things improved towards the end of the module. Regarding the question of how previous learning had equipped them for this module, the average response was in the middle of the scale with very high variability, reflecting the large differences in the background of the students. Students seemed to consider the 'practicals' more useful than the lectures ($T$=4, $N$=15, $p$=.001).

In the questionnaire administered at the beginning of the module, students were asked if they had been taught statistics before; 33 (44 per cent) replied that they had, and listed the statistical tests they could remember. Most of them mentioned having experience with non-parametric tests such as the Wilcoxon's well as the chi-squared test; two students mentioned that there were familiar only with descriptive statistics. Furthermore, two of the students had done A-levels maths, which may have had an impact on their confidence/ability with statistics. Two students stated that they could not remember if they did any statistics, while two students stated that they did learn statistics but they could not remember which specific tests. These responses illustrate the variability of the background of the students regarding statistical knowledge, with more

**Table 1: Response to survey questions by first-year students studying a research methods modules.**
*(All Likert scales 1–7, except where specified.)*

| **Feedback at First Seminar ($N$=76)** | **Median** | **Interquartile Range (IQR)** |
|---|---|---|
| How confident do you feel about studying statistics this semester? | 4 | 3–5 |
| How anxious do you feel about studying statistics in this semester? | 4 | 3–5 |
| Confident about navigating through different windows in SPSS | 5 | 4–6 |
| Confident about opening and saving files in SPSS | 6 | 4–7 |
| Pace of this session (1=too slow, 10=too fast) | 5 | 5–6 |
| **Feedback at Last Seminar ($N$=22)** | **Median** | **IQR** |
| To what extent do you feel statistics you learned prior this degree equipped you for the current module? | 4 | 2–5 |
| Confidence with *t*-tests | 5 | 4–6 |
| Confidence with correlations | 5 | 4–6 |
| Confidence with Chi square | 5 | 4–6 |
| Usefulness of the module | 6 | 5–7 |
| Overall difficulty of the module | 5 | 3. 75–5 |
| Anxiety regarding the module | 4 | 3–5 |
| Number of lectures attended (10 in total) | 9 | 8–10 |
| Number of practicals attended (10 in total) | 10 | 9–10 |
| Usefulness of practicals | 7 | 6–7 |
| Usefulness of lectures | 5 | 4–6 |

**Note:** First-year students were only asked about *t*-tests, correlations and chi square as they were not taught about other tests.

than half of our sample having not done any statistics at all in the past, which could be a benefit.

There were three open questions in the surveys completed by first year students: only a small number of the students completed these. Responses fell into three categories: *'positive'*, *'negative'* and *'negative turned positive'*.

Positive comments were received about using the SPSS software, which was found to be, *'Intuitive and easy to use all long'*. Students were also positive about the level of support available – *'I feel that the staff are approachable if I have a query or don't understand - thank you'*.

Negative comments were around the difficulty of the module and the pace of classes. For some students, the practical classes were too slow but for others they were far too fast – *'The practicals took too long considering the simplicity of the content'*.

There was also some evidence in the student comments that the experience of learning about statistics was negative to begin with but positive by the end of the module – *'Started off hard but once I got it, it became fun'*; *'I was unmotivated in the beginning as I thought it was going to be much harder than it seem to be. I went from being terrified of stats to actually find it amusing now'*.

Students were asked what they would like us to do to improve their experience of learning about research methods and statistics. Twelve students gave suggestions. Six students suggested an introductory text to SPSS, in the form of a step-by-step guide. Students mentioned that it would have been helpful to have access to such a resource before the module begun so that they were able to prepare for it in their own time. However, one student felt that they did okay at the module and that their mathematical background was sufficient and that an introduction to SPSS beforehand would have been overwhelming. This contrast again illustrates the variability in the students' background and preferences. Another student suggested that dummy data to practice with would be useful, while another student suggested that having SPSS software at home from the beginning would have given them the chance to practice at home beforehand (although they are able to access SPSS to use at home via the library). Finally, another student stated that a brief overview explaining key ideas would have been very useful at the beginning of the module.

***Third-year students***

Table 2 shows student ratings of agreement to statements about their learning experiences. This table shows a high level of anxiety or worry (Median=6) together with a low level of confidence (Median=2) about the upcoming dissertation analysis. However, it does show that students were confident in asking for help with this (Median=5.5). The level of agreement to the statement about enjoying learning statistics was in the middle of the scale (Median=4.5). There was again a high level of variability in response as indicated by the interquartile range for all questions. .

Ratings of agreement to statements in Table 2 show that practical classes were rated slightly higher on enjoyment ($T$=8.5, $N$=9, $p$=.093) and lower on being avoided ($T$=0, $N$=5, $p$=.034) than lectures. Enjoyment of lectures, time spent on statistics and worry before degree were both rated in the middle of the scale, worry was rated higher during it. There was a low level of agreement to the statement about the content of the degree and an above the middle of the scale rating to using statistics in a job post-degree. There was a lot of variability in the responses, other than to the statement about avoiding practical classes.

There was a greater response to open questions from the third-year students, than was seen in the first-year responses. The written comments made in response to open questions supported the variability in the range of the rating questions. The responses of students prior to the refresher class were coded as positive (10 comments), negative (26 comments), neutral (12 comments) and remembering (14 comments).

**Table 2: Response to survey questions by third-year dissertation.**
*(All Likert scales 1–7.)*

| **Survey before a statistics refresher class (*N*=30)** | **Median** | **Interquartile Range (IQR)** |
|---|---|---|
| I feel anxious or worried about having to use statistics in my dissertation | 6 | 4–7 |
| I have enjoyed learning about statistics during my degree | 4. 5 | 3–6 |
| I feel confident about using SPSS for analysing my dissertation data | 2 | 1–4 |
| I feel confident in asking for help with my dissertation statistics if I need it | 5. 5 | 4–6 |
| **Survey following the dissertation (*N*=20)** | **Median** | **IQR** |
| I expected my degree to have less statistics that I was taught | 3 | 2–4 |
| I found lectures on statistics to be enjoyable | 4 | 3–5 |
| I avoided lectures about statistics | 2 | 1–3 |
| I found practical classes to be enjoyable | 5 | 3–6 |
| I avoided practical classes about statistics | 1 | 1–2 |
| I wish there was more time spent learning statistics | 4 | 3–7 |
| I can see myself using statistics in future career | 5 | 1–6 |
| I felt anxious or worried about learning statistics before my degree | 4 | 3–6 |
| I felt anxious or worried about learning statistics during my degree | 6 | 2–6 |

Positive comments came from students who reported feeling confident in their ability to apply what they had learnt to their dissertation – *'I like the fact that my dissertation is like pulling everything together I have learnt over the past two-and-a-half years into one big project that is completely my own work'*. Students were also positive about the teaching team's support available to them in the face of the challenging work ahead – *'There's no need to say that the stats team is brilliant. Thus I am not worried at all regarding the pretty steep statistics mountain in front of me'*.

Negative comments were related to a low level of confidence. Students reported feeling worried about their abilities, for example, when selecting the appropriate statistical test – *'I feel very bad about SPSS, I often get the results section wrong in lab reports. I don't know what tests to use for what and reporting them is difficult for me'*. For other students this was because they concerned about making mistakes – *'I'm terrified that I'll do something wrong'*.

Some of the comments were coded as neutral because the students discussed general thoughts and feelings about their dissertations or, for example, they felt that having a revision session would be helpful but were not overly negative or positive – *'I did not have much issues using SPSS during the past two years, but now I feel that my knowledge might need to be refreshed in all areas as it will help with my dissertation'*.

However, many comments indicated that students had forgotten about the statistics they had learned during their degree, so that they felt that they had an issue with remembering what they had to do – *'I will be honest and say that I will not be able to remember much of what I have learnt from previous years'*. This was reflected in comments that indicated students were really hopeful that the refresher class would help them – *'I feel (I hope) that once we have this refresher session that my knowledge about SPSS will come flooding back to me however, having not used the software for what feels like a very long time, I am in a slight panic as to how to use it for my project.'*

Following the submission of the dissertation responses were coded as *positive* (8 comments), *negative* (22 comments), *anxiety* (6 comments) and *suggestions* (19 comments).

Positive experiences about completing the dissertation related to improving confidence, the quality of the seminars and the support received by demonstrators who taught them – *'Fun examples in the seminars were great, the demonstrators were really helpful'*.

The negative comments centred around three main sub-themes areas. The first were comments related to the quality of the teaching in lectures – *'Lectures were poor, too quick and really complex'*. Secondly, a number of comments referred to the teaching within the seminars, suggesting that students had just learned to click the buttons in SPSS – *'I felt like I was just clicking buttons on the screen rather doing statistical analyses, I could not understand why'*; *'It seems like all we learnt was what order to press buttons on SPSS'*. Thirdly, the refresher session was not perceived to be useful because of the time that it was held in the year and didn't cover materials as much detail as the students wanted – *'The session was rushed and everyone's issues were individual, it was hard to ask for help'*.

A number of the comments indicated the anxiety felt during the process of completing the dissertation – *'I think everyone was really worried about the SPSS part of the dissertation'*.

Students were invited to make suggestions for improvements to the programme. These included adding more statistics lectures to the final year, being taught to do statistical tests by hand, to less specific suggestions of – *'Better online resources, more helpful lecture slides, better lecture times, less repetition in lectures'*.

We also asked the third-year students what advice they would give to new first-year students. The overwhelming response was to suggest they attended all lectures and seminars – *'Go to all the lectures and seminars, it will only get harder if you start skipping them'*; *'Go to lectures AND practicals, then you'll be fine!'*. This demonstrates that students do realise the importance of statistics class attendance to their success in the degree programme. However, there is some recognition that students may have pre-conceived ideas about this topic which may have adverse effects on learning and attendance – *'Don't panic! People go in with the wrong attitude. Stats isn't that bad if you approach it properly'*.

## Discussion

The aim of this study was to explore the experiences of first- and final-year dissertation students with regard to learning about statistics. The findings are discussed in light of the three questions:

*1. How do first-year students reflect on their experience of learning about statistics in Psychology before and after completing a first-year module in statistics?*

The quantitative questions showed that first-year psychology students are not very anxious and are fairly confident about statistics, although there was high degree of variability in the ratings. The qualitative questions revealed that several students found statistics very difficult at the beginning but became more confident, or found it easier with it towards the end of the module. On the other hand, a small group of students continued to find statistics very challenging even at the end of the module, whilst others did not experience any difficulties with statistics at any point. This variability in knowledge, skills and confidence we observed is in sync with the findings of the HEA report (Field, 2014) and provides a challenge to address within classes. It is also important to note that only half of the students had been taught statistics before university. Being given materials before the module could help them prepare for it; for example, an introduction to SPSS and step-by-step guides, as well as an overview of the module.

The results suggest that the transition from secondary education to first year of university in psychology students learning statistics could be improved. A fair amount of students experience a high level of anxi-

ety, especially at the beginning of the module. This finding concurs with results from previous studies (Ballinger, 2003; Gallager-Brett & Canning, 2011; Kitching & Hulme, 2013; Tate & Swords, 2013). On the other hand, there were students who found the module easy and felt they did not benefit from it (possibly those with prior experience of learning statistics). It appears that the way statistics is taught in the first year of university does not fully address the needs of a considerable amount of students and additional resources are needed to address this gap.

*2. How do third-year students reflect on their experience of learning about and statistics in Psychology during and after completing their dissertation?*
Unsurprisingly, students rated their confidence with tests and functions that they had learned in the first year higher than those they had learned in subsequent years. However, it does indicate that there is a need for further practice of the more complex tests and functions, such as ANOVA, regression and factor analysis, which students at Oxford Brookes are more likely to use in their dissertation than correlations or *t*-tests. Before completing the dissertation, students reported a high level of anxiety, as well as low confidence in remembering which test to use, also supporting the need for further practice. Post-dissertation, the findings also pointed towards high levels of anxiety about learning statistics although it was promising to see that students had enjoyed the seminar classes and indicated that they did not avoid these classes.

The open-ended questions further highlighted the students' experiences of learning statistics. It appeared that before the refresher class, students had forgotten much of what they had been taught during the degree programme and had feelings of anxiety. Negative comments revealed that these students had probably felt this way throughout the degree. On the other hand, it was positive to see comments about how the dissertation pulled everything together. This is something that could perhaps be highlighted more from the outset. Following the dissertation, student revealed their feelings about teaching across the programme. Lectures were typically viewed in a less positive light than seminar classes, possibly due to the interactive nature of the seminars. The findings also indicated that students felt that some of the teaching involved 'spoon feeding', that is, just clicking along in SPSS without fully understanding what was happening. It was encouraging that students were able to reflect on the benefits of the classes they had attended, demonstrated by their advice about attendance to first years.

*3. How can we use the student experiences to draw up a list of needs to be addressed in a project to enhance the teaching of this topic?*
It is interesting that whilst both first- and third-year students appeared to have a negative perception about statistics at the start of the module or degree, this changed to a more positive attitude by the end. This finding illustrates the need to counter the preconceived notion that statistics is something to be feared and/or avoided. Indeed, the third-year students revealed that their advice to newer students was that attendance in both lectures and seminars was important. In order to increase attendance and reduce some of the negativity, our findings suggest areas where we can focus to enhance the teaching of statistics.

Firstly, the variation in our students' knowledge indicates we need to address individual student needs, providing extra support for those who are struggling, while allowing those who feel more confident to continue to develop without feeling bored. There is a call for personalisation of learning (Banyard, 2010) which is difficult to provide with the ever-increasing student numbers, but, is important in addressing the needs of individual learners. Online resources appear to be an important tool to promote personalisation of learning. For example, there is evidence that when online resources take into account cognitive and learning styles,

then students learn more effectively compared to a control group that was taught in a more conventional way (Yang, Hwang & Yang, 2013). Given that traditional university mass education typically adopts a narrow range of learning and cognitive styles, it is no surprise that there is such variability in students' opinions and academic performance. An online resource to accompany formal teaching that takes into account personal cognitive, learning styles and knowledge level could be a step in the right direction to address the individual needs of different students. This has the advantage of allowing students to work at their own pace, without feeling pressure to keep up, or frustration if things are going too fast.

Secondly, there is a need to address the surface learning apparent in our students, so that they can apply their skills and understand more than just which buttons to click; deeper learning needs to be encouraged. Comments about 'button clicking' suggest that students may be taking a 'surface approach' to their learning (Fry, Ketteridge & Marshall, 2009). Anxious students may not engage beyond surface learning, especially if their underlying level of confidence with mathematics is low. However, the comments we received in the survey indicated that these students may be feeling disempowered once their reach the dissertation. We need to explore ways of encouraging a deeper approach to statistics learning as this may reduce student anxiety around this topic, for example, by highlighting that learning statistics is a journey towards the final dissertation from the outset. Although this is something that we currently do in seminars, it is possibly quite an abstract concept for those who have just started university.

Thirdly, we need to ensure that students can see the purpose of learning about statistics from the start of their degree programme and to keep them engaged in the topic. In terms of engagement, Banyard (2010) argues that teaching of psychology should become more exciting and students should be allowed to explore interesting and 'relevant-to-them' psychological concepts, rather than just learning analysis techniques and 'impeccable trivia'. This may lead to a greater ability to apply what is learned to topics that are of interest to students, as well as prepare them for the workplace. Also, studying tends to focus on assessment; we 'teach to test' instead of helping our students become independent and creative thinkers. Other studies have shown that using a more informal and conversational style (Ginns & Fraser, 2010) and using humour while teaching (Garner, 2006) improves students' learning. In a similar vein, Rahman and Zeglin (2014) provided some preliminary evidence that using comic books can enhance teaching of abnormal psychology. Additional, fun materials to aid the students' learning could be beneficial to those who are struggling. Furthermore, computer games can be used to help students practice with statistics in a more enjoyable way (Morris, 2013). It seems possible that students will be engaged and interested if given the opportunity to create the materials and mentoring other students, rather than just be passive receivers of education.

There are two additional challenges to be faced as revealed in our findings. Firstly, how to help students adapt to university study; and secondly, how to ensure they retain the information learned during the three-year degree programme in order to apply it during their dissertation. The research discussed in the introduction to this paper and our findings show that there is a challenge to be addressed in bridging gap between pre-tertiary education and university. Kitching and Hulme (2013) indicate that A-level psychology should encourage more critical thinking and problem solving, rather than learning by rote. They also suggest that induction procedures should become more effective to make sure students are given a good introduction to university study. Also, study and writing skills training could be included in the first year of a degree. Banyard (2008) suggests making it compulsory for students to do A-level psychology if they wish to study psychology at

university, to make sure that there is less variability in level of knowledge between students but this change is unlikely to happen in the near future. Finally, an HEA report (2014), suggests using diagnostic tests for new students, along with follow-up actions to make sure that the students are progressing well (Field, 2014). An online resource that includes diagnostic tests as well as materials for students to practice before they start university could also bridge the gap to an extent. Prospective students could be given access to these resources to study over the summer, before they start their first year at university. In order to build such a resource, it will be important to work with students and applicants to the university so that it meets their needs and does not appear overwhelming or off-putting.

Furthermore, we need to ensure that students retain the knowledge they acquired in their first and second years of university so that they can apply it when they work on their own project in the third year. There is, therefore, a need to integrate the statistics teaching across our programme. One way of achieving this is to develop an overarching resource that could allow the whole programme to be more 'constructively aligned' towards the dissertation (Biggs, 1996). This may also enable the fostering of a 'research community', which allows students to see their learning of statistics in light of its contribution to their development as independent researchers. A feature of this community could be to get undergraduates even more involved in staff research as has been successful at other institutions (Roberts et al., 2010). Without our modular system, a research community could be built online, and involve the creation of a 'one stop shop' for statistics rather than have different tests attached to specific modules or years. Coupled with increased opportunity to partner with staff in research, this may enable students to see the importance of what they are learning for their future dissertation projects. This method could additionally enable interaction between students in different years, and as demonstrated in the advice comments above, it might be beneficial for first-year students to hear. Peer-assisted learning has been tried successfully in psychology with third-years assigned specifically to first-years as learning mentors (Stone, Meade & Watling, 2012). Kitching and Hulme (2013) also propose peer assisted learning as a method of improving transitions.

***Limitations***

The survey questions posed to the first- and third-year students were not the same and this limits comparisons between the two year groups, although direct comparisons were not the focus of this study. A greater proportion of the first year students completed the questionnaires compared to the third years. Equally we are not able to identify if the same students completed the surveys at both time points in order to see if their levels of confidence or anxiety had changed. This was a small study in one setting and so the findings must be interpreted with caution. The sample size post-dissertation was particularly small, reflecting that students may have left or were less motivated to engage with something that would not directly be of benefit to them. Moreover, it is likely that those who felt most strongly were more likely to respond. Although it is important to take these limitations into account, these responses are important in telling us about student experiences of learning about statistics and research methods within our degree programme and can help us to make improvements in our teaching.

## Conclusions

Although there is a wealth of existing research into statistics anxiety, there is still a need to identify the means by which educators can improve the learning of this important topic. While this is a small study in one setting, this work has identified a number of needs that should be addressed in the development of a project to improve the teaching of statistics in psychology in our institution.

The important needs are: (1) to address the needs of students with different levels of ability and knowledge; (2) to help students achieve more than a surface understanding of data analysis; and (3) to increase engagement and interest.

We used the findings of this study to inform an application for Oxford Brookes University Team Teaching Fellowship Project, and were successful in receiving funding for our project through a competitive bidding process. Future work will now be undertaken to address the identified needs through the creation of an open online resource that incorporates additional materials that link them together to demonstrate their application as research skills. Our overall aim for this resource is to create a research community, which fosters vertical collaboration and support between students.

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