This Teaching Cycle of the PGCTHE portfolio has been submitted to CADAIR with the permission of the author detailed above. It is to be used as a resource for future PGCTHE candidates and other staff as part of their professional development at Aberystwyth University. It remains the property of the author and Aberystwyth University. If you wish to cite this work then please contact the author. Contact details can be found at http://www.aber.ac.uk/en/directory/.
Teaching Cycle 3
The benefits of research experience for undergraduate students in Sport and Exercise Science.

By Glen Davison

Department of Sport and Exercise Science, Aberystwyth University

Abstract

The integration of research, and the provision research experience, into undergraduate teaching can be very beneficial to undergraduate students. Mentored research for undergraduate students may be beneficial in terms of facilitating greater understanding of a research topic, promoting higher-order learning and development of skills for future employability. The aim of this Teaching Cycle was to secure bursaries for 2 undergraduate students (3rd years) to undertake research experience under my supervision and mentorship and then evaluate the success and benefit, to the students, of these 'placements'. In general, the placements were beneficial: students reported that, after completing the Research Experience placements, they had a greater understanding of a research topic and were encouraged to undertake relevant research-related careers or further study in the field. It was felt (both by the students and the mentor/supervisor) that the research experiences were successful in assisting the students to subsequently secure positions and/or funding for research-related careers or postgraduate study. Furthermore, there were some similar benefits reported by these 2 students compared to a previous student, who had secured a placement in a previous year under the supervision of a 'more experienced researcher and mentor'. In conclusion, it is possible that research experience for undergraduates can help to increase integration of research into their learning experiences and benefit the students, staff and the department.
Introduction

The Boyer Comission on Educating Undergraduates in the Research University (Kenny, 1998) called for more integration of research, and depth of research experience, for undergraduate students. Research experience can be very beneficial to undergraduate students (Randall et al., 2004) and is highly valued within research universities (Garde-Hansen and Calvert, 2007) as it can help to "create an educational environment that benefits undergraduates and simultaneously allows the research-oriented faculty to conduct high-quality research programmes with important scientific and social implications" (Gonzalez, 2001). It is not surprising, therefore, that 'undergraduate research' is increasing and undergraduate presentations at national conferences are becoming more common (Whiteside et al., 2007). Indeed, in Sport and Exercise Science there is an annual national 'student conference' of the national professional body for Sport and Exercise Science(s), the British Association of Sport & Exercise Sciences (BASES), devoted to undergraduate and postgraduate student research presentations (in addition to keynote contributions and workshops from established leaders in the field). The aims of the student conference are: to facilitate communication between students, researchers and applied consultants; provide opportunities for students to present research and share good practice; and facilitate networking and development of employability skills (BASES, 2008). This highlights the value placed on student research by the sector. It is also quite pertinent that this conference will be hosted (for the second time in 5 years) by the Department of Sport and Exercise Science, Aberystwyth University, showing this department's commitment to student research experiences.
Mentored research for undergraduate students may be even more beneficial in terms of facilitating greater understanding of a research topic, and development of skills for future employability (Miller, 2002; Beaty, 2003) and developing higher-order learning in students (Marshall, 2003; Lopatto, 2003; Garde-Hansen and Calvert, 2007). This is also in line with the experiential learning theory of Kolb (1984; 2001), which states that experience is central to the learning process (as discussed in Teaching Cycle 1). The Faculty of Science at Aberystwyth University offers 6 bursaries per year to fund undergraduate students for a placement of research experience in a faculty research group (The Faculty of Science Walter Idris Summer Bursaries, see Appendix 1), which shows the idea that undergraduate research experience is highly valued within research universities (Garde-Hansen and Calvert, 2007) is true in this faculty at Aberystwyth University. The fact that the Department of Sport and Exercise Science funds a further 5 bursaries (with similar aims and requirements to the Faculty Bursaries but for students within this department only, see Appendix 2) also shows the Department’s support and high regard for undergraduate research experience.

Aims and Methods

*Implementation into teaching practice, intended outcomes and methods of evaluation.*

The aim of this Teaching Cycle was to secure bursaries for 2 undergraduate students (3rd years) to undertake research experience under my supervision and mentorship and then evaluate the outcomes. It was also intended to compare the experiences of these 2 students (referred to as STUD-1 and STUD-2, respectively, throughout this report) to those of an other student (referred to as STUD-P) who was awarded a similar
bursary in a previous year (and worked under the supervision of a more experienced 'researcher' and 'supervisor' within this department) and who is currently a PhD student in the department. The intended outcomes were:

1. that the students would gain experience and competence of working as a researcher in Exercise Physiology
2. that the students would report that they have a greater understanding of a research topic
3. that the students would develop skills for future career and professional development (employability/postgraduate opportunities etc.)
4. that the students would report similar 'benefits' to those reported by the previous student (STUD-P).
5. I also intended the research experience (in accordance with the aims of the Bursaries) would encourage these students to consider research careers in the field, and pursue postgraduate study in the area of Exercise Physiology in the future (and that the research experience placements would help them in securing such positions or studentships etc. in the future).

Scisney-Matlock and Matlock (2001) warn that failed mentorship relationships may occur when expectations are unclear from the outset (i.e. both the student's expectations of the mentor/supervisor and vice versa). Therefore, the practice employed in this Teaching Cycle was to establish a good professional relationship, make clear my expectations and discuss the students' expectations. It was also deemed necessary to engage the student in all areas of the research process from literature research and review, to study design, to carrying out the research and
analysing results and preparing the report/manuscript, so as to give them a sense of
ownership and responsibility for the project. This is in accordance with the
suggestions of Whiteside et al. (2007) that when students are given responsibility for a
specific task or project (i.e. rather than being a general Research Assistant/lab hand
for various projects), there is often a greater sense of mastery by the student. It was
also suggested that this increases the likelihood of the project being completed
successfully, in a timely manner (ibid). Lopatto (2003) has also suggested allowing
students to collaborate with researchers, design their own projects and ensure they
participate in all aspects of the project, provides a sense of ownership and also helps
to develop exposure to higher-level scientific thought.

Whiteside et al. (2007) note that some researchers meet individually with their
undergraduate student Research Assistants weekly regarding their performance and
state that this is ideal, although often not possible for researchers in large research-
intensive institutions. However, for the purpose of these projects and research
experience in this Teaching Cycle, this was possible and was carried out at least every
week as I was supervising/mentoring 2 undergraduate Research Assistants on 2
separate projects. In fact the actual contact was much more frequent than this because
of working alongside the students in the laboratory on a daily bases, which allowed
frequent, albeit informal, meetings/discussion to take place. During the formal,
weekly meetings, discussion took place about the students' long-term goals (e.g.
planning for postgraduate or job applications), but the meetings were also a good
opportunity to provide constructive feedback to the Research Assistants, in
accordance with the suggestions of Whiteside et al. (2007).
Results and Discussion

Progress notes on teaching practice

First of all, both students were successful at securing bursaries through the Faculty-wide award (The Faculty of Science Walter Idris Summer Bursary award). Students met with me formally, as mentor/supervisor, weekly and we discussed their progress on the project, their goals and other topics, as discussed above. There was a final meeting after they completed the project in which we discussed their experiences and they were encouraged to reflect on their experiences and learning. They were then asked to produce a report summarising their reflections about the research experience (final report on the Research Experience, see Appendix 4-5). After reading the reports I had one final brief meeting with the students, where I interviewed the students to get more information about some of the comments and reflections in their reports.

Summary of relevant data and feedback on student learning.

Results of report from STUD-P for comparison: STUD-P also provided a final report on his research experience placement (see Appendix 3 for the full report); some of the key points are highlighted below:

Question from report form: "State what you feel have been your main achievements during the tenure of the grant".

Some relevant quotes from the response:

"I feel that the scholarship has enhanced my knowledge and understanding of the research process... I also learned that whilst undertaking research projects it is likely that barriers and obstacles may become evident.... dealing with them in a research context ... I feel that I have also further developed my self-management skills..."
flexibility... will prove useful when I am undertaking my dissertation, PhD and future career”.

**Question from report form: "What are your career plans for the future?".**

Some relevant quotes from the response:

“This scholarship experience has reinforced my desire for a career in academia and research, and as such my career plan is focused upon achieving this aim... Upon completion of my degree I intend to undertake a PhD within exercise physiology... Following this I aim to pursue an academic career in sport and exercise science.”.

**Question from report form: "How do you anticipate this award will affect your future career?".**

Some relevant quotes from the response:

“I anticipate the research undertaken during this award will have a major impact upon my career. There are an ever increasing number of graduates leaving University with excellent degrees and as such competition for postgraduate funding and ultimately employment is fierce... I feel that the knowledge and skills gained and developed during this scholarship will add considerable weight to my application initially for postgraduate positions and then for employment positions.”.

**Report, by the research Experience supervisor/mentor, on the Future Prospects of the student.**

“Based on my observations, STUD-P has a bright future as a research scientist. During this scholarship he has contributed conceptually, technically, and logistically to the project. Conceptually, for example, STUD-P has made useful suggestions about theoretical issues related to the research question. Technically, he has shown initiative and diligence in learning how to operate the equipment used in the project. Also, he has spent considerable time and has offered excellent ideas as we have attempted (to
no avail) to fix the difficulties that arose with the EMG equipment. Logistically, STOO-P has shown an ability to overcome difficulties and adjust to participants' needs to ensure that data has been collected in a timely manner. More generally, STOO-P has good interpersonal skills and a great desire to conduct research, both of which are needed by successful scientists in the sport and exercise science disciplines."

The report from STUD-P demonstrates some important reflections and suggests that the aims for this Teaching Cycle were achieved for this student. They also support the theories/suggestions of Hathaway et al. (2002), that students who participate in an undergraduate research experience are more likely to pursue postgraduate study.

Results of reports from STUD-1 and STUD-2: Feedback and results from meetings and reports with these students were positive (see below). It was also interesting to compare these results to those from a student (STUD-P) that had worked as an undergraduate Research Assistant under the mentorship/supervision of a different member of staff in our department in a previous year. The other member of staff was a much more experienced 'researcher' and 'supervisor' than me so it is interesting to compare the outcomes (see below).

Evaluation

Evaluation of student learning experience in relation to intended outcomes.

Both STUD-1 and STUD-2 showed promise before undertaking the research experience but in informal discussions both indicated that they were not 100% sure on their future plans. Generally, both students appreciated the experience as outlined in their reports (see Appendix 4-5 for full reports). In her report, STUD-1 stated that she
felt involved in, and responsible for, the project (quoting from her report: "... my role was predominantly practical based but initially I was able to have an input into the study design. This highlighted key considerations for scientific research at a more advanced standard, which built on my knowledge from undergraduate level" and the following statement: "During my time of research experience I also had the opportunity to write a short literature review which allowed me to gain a better understanding of the topic and the relevance of the study undertaken"). These comments from the student, in their reflective report, support the suggestion of Whiteside et al. (2007) and Lopatto, (2003) that giving students responsibilities for a specific task or project means they achieve a greater sense of mastery. The comment that the experience enabled the student to "...further develop my research skills. In particular I was able to improve my independent study skills and the ability to use various equipment and data collection techniques" also suggest that intended outcomes 1 and 2 were achieved. This is in accordance with the suggestions that mentored research for undergraduate students may facilitate greater understanding of a research topic, and development of skills for future employability, including higher-order learning (Miller, 2002; Beaty, 2003; Lopatto, 2003; Garde-Hansen and Calvert, 2007). Evaluation of the report and follow-up discussion with the student also show that there is similar perceived benefit, compared to STUD-P's reflective summary and report. In terms of career development, STUD-I went on to achieve an assistantship and a bursary/funding to undertake postgraduate study (MSc), in Exercise Physiology, at Bangor University. I agree with the student's belief (Appendix 4) that the skills and experience gained on this placement helped to secure these awards and enhance her 'employability'. This also supports the idea of Hathaway (2002) that students who participate in undergraduate research experience are more likely to pursue
postgraduate study. Furthermore, I am sure that any application to this department (Sport and Exercise Science, Aberystwyth University) in the future would be very welcome (I would personally relish the opportunity to supervise this individual as a PhD student). Taken together the above findings (from the student's report, my observations of and discussions with the student, i.e. follow-up on the report) suggest that the intended outcomes 1, 2, 3, 4 and 5 have all been achieved.

In her report, STUD-2 stated that "I was actively involved... The knowledge I gained... has undoubtedly helped me as I am now working... been of great benefit and helped me to secure the job as a research associate". This also supports the suggestion of Whiteside et al. (2007) and Lopatto (2003) that giving students responsibilities for a specific task or project allows them to achieve a greater sense of mastery. She also stated that "processes and skills that I learnt whilst carrying out the research will be with me for life and will inevitably continue to help me in my future career... Overall, the experience was of great value to me... I gained a lot of knowledge... giving me more confidence in my abilities and in the career path I want to pursue". These statements suggest that intended outcomes 1 and 3 were achieved and suggest that the programme of research experience was able to provide the student with more direction about their future career plans (i.e. reduce previous uncertainty about future career plans). As for STUD-1, this is also in line with the suggestions that mentored research for undergraduate students facilitates greater understanding of a research topic, and development of skills for future employability, including higher-order learning (Miller, 2002; Beaty, 2003; Lopatto, 2003; Garde-Hansen and Calvert, 2007). Evaluation of the report and follow-up discussion with STUD-2 also show that there is similar perceived benefit, compared to STUD-P’s reflective summary and
report. In terms of career development, STUD-2 went on to secure a position as a Research Associate (9 months fixed term) on a large externally funded research project in Exercise Physiology/Physical Activity and Health, at Herriot-Watt University, Edinburgh. This was followed by a PhD studentship in Exercise Physiology at the University of Kent. Again, in accordance with Hathaway et al. (2002) and intended outcome 5, it seems that the research experience placement contributed to STUD-2 securing these positions.

Overall, the findings of this study support the idea that undergraduate research experience programmes can enhance the educational environment and be beneficial to undergraduates and the research-oriented faculty (Gonzalez, 2001).

Personal reflections

It is possible that projects such as those described in this study/Teaching Cycle could help to increase integration of research, and depth of research experience, for undergraduate students, in accordance with suggestions put forward in the Boyer Commission report (Kenny, 1998). It also supports the views that research experience can be beneficial to undergraduates and is/should be highly valued by universities (Randall et al., 2004; Garde-Hansen and Calvert, 2007) and may contribute to educational environments that are beneficial to undergraduates and research-oriented faculties or departments (Gonzalez, 2001). Furthermore, the results and feedback from STUD-1 and STUD-2, in addition to that from STUD-P, support the ideas of Miller (2002) and Beaty (2003) that undergraduate research experience can facilitate greater understanding, and development of skills for future employability.
Furthermore, these findings support the idea of Hathaway et al. (2002) that students who participate in an undergraduate research experience are more likely to pursue graduate education.

*Future implications for professional development and teaching*

This study supports the continuation of these research experience schemes in the faculty and department and supports the department's decision to provide financial support to allow placements to continue in the future. The fact that the outcomes appear similar (or equally beneficial) between the students that I mentored/supervised and a student supervised in a previous year by a more experienced mentor may also support the view that such schemes are worthwhile to relatively new staff also.

However, as highlighted by Whiteside et al. (2007), if not managed and supported properly, such schemes could be very problematic. For this reason Whiteside et al. (2007) have provided a set of guidelines and suggestions for supervising and mentoring undergraduate Research Assistants at large research universities. However, these recommendations are based on their experiences, and successful undergraduate Research Assistantship programme, at a very large research-intensive American institution, in a Psychology Department. Given that the research environment, and roles of Research Assistants etc, are likely to be quite different in a relatively smaller department, like our own, it will be beneficial for staff in our department to work together (i.e. the Head of Department, Director of Learning and Teaching, and other staff/potential supervisors) in order to construct a set of guidelines, and lay down some general expectations and recommendation for good practice, regarding the supervision/mentoring of undergraduate Research Assistants and research experience. Ideally these guidelines will be more tailored and specific to this university and the
Department of Sport and Exercise Science (compared to the general recommendations of Whiteside et al., 2007) and may assist mentors and students in the future.

Obviously, this model cannot provide research experience opportunities for all undergraduate students but it could support or form the basis of a “research-intensive community” model as proposed by Desai et al. (2008) to increase the number of undergraduates that can be supported, in research experience, per faculty member (and limit the burden on them when mentoring/supervising undergraduate research experience). Application of this model to our department may be worthwhile and beneficial in the future therefore.

References


