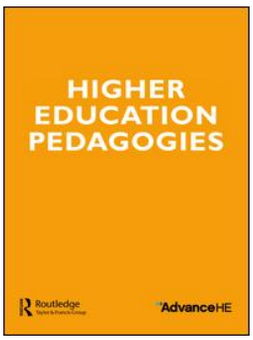

Higher Education Pedagogies

Routledge
Taylor & Francis Group

ISSN: (Print) 2375-2696 (Online) Journal homepage: http://www.tandfonline.com/loi/rhep20

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To cite this article: Caroline Douglas, James Yearsley, Graham W. Scott & Katharine E. Hubbard (2018) The Student Thesis Conference as a model for authentic and inclusive student research dissemination, Higher Education Pedagogies, 3:1, 331-353, DOI: 10.1080/23752696.2018.1478675

To link to this article: https://doi.org/10.1080/23752696.2018.1478675

HIGHER EDUCATION PEDAGOGIES
2018, VOL. 3, NO. 1, 331–353
https://doi.org/10.1080/23752696.2018.1478675

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The Student Thesis Conference as a model for authentic and inclusive student research dissemination

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ABSTRACT

Engaging in a final year project is required in most undergraduate degree programmes. However, the student research experience often differs from the academic experience due to a lack of opportunities for research dissemination. We present the Student Thesis Conference as an innovative research dissemination model used in Sports Science degrees at the University of Hull. The 500 delegate conference is embedded throughout the programme; first year students attend as delegates, second years present their dissertation proposals as posters and final year students give oral presentations of their research findings. We determine that the conference engages students of all abilities, and students see the conference primarily in terms of improving communication skills. We show that the conference increases student confidence in presentation skills, demonstrating the impact of communication to larger audiences. The conference is an inclusive and authentic model of undergraduate research dissemination, and could be widely adopted throughout the sector.

ARTICLE HISTORY
Received 10 January 2017
Revised 15 January 2018
Accepted 15 May 2018

KEYWORDS
Undergraduate research; inquiry-based learning; research dissemination; undergraduate conference; communication; capstone experiences

Introduction

Most undergraduates in the UK undertake a research project as part of their degree programme, allowing the development of essential skills including project management, written communication and development of self-regulated learning, as well as the disciplinary skills required to address the research question (Boyer, 1998; Healey, 2005; Healey & Jenkins, 2009; Hunter, Laursen, & Seymour, 2007; Russell et al., 2007; Seymour, Hunter, Laursen, & DeAntoni, 2004). Despite the recognition that undergraduate research is a beneficial activity, the model of research engagement for students often differs from that of the professional researcher. Undergraduate projects are often of a short duration, with limited opportunities to refine or adapt research questions along the way, although some structured undergraduate research experiences require students to refine their research questions and methods part-way through projects (e.g.

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Supplemental data for this article can be accessed here.

Rowland, Lawrie, Behrendorff, & Gillam, 2012). The typical undergraduate experience also differs markedly from that of discipline-based research in that students are presented with relatively limited opportunities for research dissemination (Healey & Jenkins, 2009; Spronken-Smith et al., 2013). The Boyer Commission report stated that '*Dissemination of results is an essential and integral part of the research process, which means that training in research cannot be considered complete without training in effective communication*' (Boyer Commission, 1998). The importance of presentation skills goes beyond preparing students for research as employers have repeatedly highlighted a relative lack of 'soft skills' including communication, adaptability and personal resilience amongst graduates (Confederation of British Industries and Universities UK, 2009; Wakeham, 2016). Here we present an extended case study of how authentic undergraduate research dissemination is embedded into curricula through the Student Thesis Conference (STC) used in Sport, Health and Exercise Science (SHES) degree programmes at the University of Hull (UK), providing a model of undergraduate research that better mirrors the professional research experience.

The need for authentic dissemination opportunities for undergraduate researchers has been highlighted by several authors (Healey & Jenkins, 2009; Spronken-Smith et al., 2013; Walkington, 2012). This may occur either through undergraduate research journals (Luck & Park, 2012; Walkington, 2012) or conference-like settings (Hill & Walkington, 2016; Kneale, Edwards-Jones, Walkington, & Hill, 2016; Spronken-Smith et al., 2013). Undergraduate conference or conference-like events have been proposed as a mechanism to solve the dissemination problem. Many institutions run small-scale events such as poster sessions that occur within the programme; however, these do not typically recreate the professional conference experience. Some of these 'conference-like' events do require different year groups to interact with each other to provide feedback and feedforward opportunities (e.g. in the psychology department at St Mary's University College, described in Healy and Jenkins 2009), but do not typically involve postgraduate researchers or the entire academic staff so remain somewhat isolated from the research activities of the department. An alternative approach to undergraduate research dissemination is the 'elite' conference model, where high-performing undergraduates are invited to submit work to a local-level conference (e.g. the University of Queensland's Advanced Study programme in Science, described in Blanchfield et al. 2007), or a national cross-institutional event (e.g. the British Conference of Undergraduate Research [BCUR], evaluated in Hill & Walkington, 2016; Kneale et al., 2016). The elite model is usually a beyond-curriculum experience targeted towards students who intend to go on to postgraduate research. Elite 1-day symposium models for the dissemination of student research exist within Sport Science, most notably the British Association of Sport and Exercise Sciences Annual Student Conference. Delegates at this event are predominantly postgraduate; however, undergraduate participation is encouraged through two dedicated awards for poster and free communication presentations. Yet typical of the elite model awareness of relevant societies and conferences at the undergraduate level is dependent on staff affiliations and their promotion of opportunities. The elite model also often excludes those who intend to seek employment (rather than postgraduate study) after graduation, which represents 67.6% of UK Sports Science graduates (Higher Education Careers Services

Unit, 2015), as well as lower ability students who may not be directed towards the opportunity by academic staff.

In the UK, student research projects are typically written up as an extended dissertation which is only read by the student's supervisor and potentially one or two other academics. Many degree programmes include an oral or poster presentation of final year projects, which typically occur towards the end of the degree programme to a fairly small group of peers or academics. However, both of these strategies are small in scale and do not reflect the relatively public forms of dissemination that researchers typically use. Undergraduates also receive few opportunities to hear about research done by others and are therefore usually excluded from research communities. As such, there has been relatively little research into student experiences of conference participation, and the potential benefits such opportunities may bring. Undergraduate students attending BCUR developed key graduate attributes such as communication skills, self-authorship and a development of professional understanding (Hill & Walkington, 2016; Kneale et al., 2016). A survey of undergraduates presenting their work at a national meeting of the American Chemical Society identified that the primary motivation for doing so was to present their work, which was followed by having fun and to list the activity on their CV (Mabrouk, 2009). Almost all students in that survey considered the experience of presenting at conference to be either 'life changing or positive'. However, the delegates surveyed were all high-achieving students participating in an 'elite' conference experience, 51% of whom attended the conference to meet prospective postgraduate research supervisors (Mabrouk, 2009). It is unknown whether similar benefits of attending a conference would be obtained by lower performing students or those who do not intend to establish a research career.

Here we present and evaluate an alternative model of undergraduate research dissemination through an extended case study of STC, used within Sports Science at the University of Hull, UK. STC is embedded into the curriculum of all programmes in the subject area, so is inclusive of all undergraduates not just an elite group of high-performing students. In contrast to most in-course dissemination opportunities, STC is a large-scale event with ~500 delegates including undergraduates of all years, postgraduate researchers and academics, as well as external exhibitors. STC is therefore a more 'public' format for undergraduate research dissemination, and more authentically replicates how professional research is communicated. The conference is also embedded across years, meaning that students build their communication skills iteratively throughout the programme, rather than being a one-off event. Students can also see what is expected of them in future years, reflect on their experiences of attending the conference in previous years and engage with peers from different year groups. STC is therefore a 'capstone' experience for students on these degree programmes with respect to both research-led learning and communication skills. The event therefore provides an opportunity to determine if it is possible for student conferences to achieve both high pedagogic impact and inclusivity. We also wanted to determine if benefits to students can be maintained when the conference is also used as a formal assessment mechanism, in contrast to the extracurricular nature of 'elite' conference models previously described. Through a mixed-methods approach, we address the following lines of inquiry:

(1) What activities do students choose to engage in within the conference environment?
(2) Do students of all abilities engage in the conference?
(3) What factors shape student perceptions of the conference?
(4) What are student perceptions of the value of conferences?
(5) Does participation in the conference increase student self-confidence and perception of their communication skills?

In this study, we firstly describe the design of the conference, including the format and associated assessment strategy to provide context to the reader. We then describe the development of a mixed-methods approach to exploring the student experience of the event. We present results of our analysis alongside discussion, and then consider implications of our findings for practice.

Design of STC

Concept and learning context

STC was created to target engagement with final year research projects and to improve the student experience of feedback. SHES degree programmes include a Research Methods strand with modules at each level to develop skills in experimental design and empirical analysis. This culminates with the submission of an 8000-word thesis in the final year, where students have the option to complete 'data collection' (which include empirical studies, questionnaire or interview projects and autoethnographic studies) or 'literature review' projects. Unfortunately, Research Methods is a topic that students perceive as '*dull, difficult and distressing*' (Haslem & McGarty, 2014) which can cause a lack of engagement (Keenan & Fontaine, 2012; Kilburn, Nind, & Wiles, 2014). STC was introduced to encourage early engagement with final year research projects and to build student confidence through providing opportunities for oral presentations. The inaugural 2010 STC was supported by a grant from the University of Hull Innovations in Student Learning Scheme.

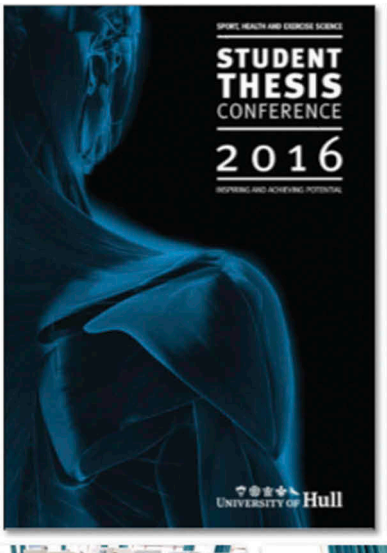
Format

STC is an annual 1-day symposium held in the University of Hull conference facilities to replicate a typical academic conference environment. The event is held part way through the academic year, usually in mid-March. To underline the sense that STC is a prestigious occasion and distinguished from the ordinary student timetable, no departmental teaching is scheduled on this day. Students are expected to wear smart dress and create their presentations on a standardised STC template. There is a printed book of abstracts and formal programme of events (see Figure 1(a,b)). STC also has a dedicated logo and tagline '*Inspiring and achieving potential*' depicted on banner stands and posters to heighten the feel of a professional event. Approximately 500 delegates are in attendance each year, composed of SHES undergraduates, postgraduates, staff and invited guests. Numerous industry exhibitors who recruit from the sport science cohort are also present to inform students about current and future job opportunities. To

A

Time	Session		Notes
08.15 – 09.00	Registration and Breakfast		
09.00 – 09.30	**Opening Address** **Opening Keynote Speaker**		Keynote speaker = Department Alumnus (Graduated 2012 from SCP).
09.45 – 10.25	**Oral Presentations I**		8 parallel sessions of 10 minute talks by 3rd year students.
10.25 – 10.45	Refreshments		
10.45 – 11.15	**Oral Presentations I** (continued)		
11.20 – 12.20	**Poster presentations I** Invited Exhibitors	**Invited speaker seminars:** - Invited Speaker 1: Get into teaching - Invited Speaker 2: Working as a Sport Scientist at a professional club	Poster presentations by 2nd year students. Invited speakers 1 = University of Hull staff Invited speakers 2 = Alumni (Graduated 2012, SES + SCP)
12.25 – 13.10	Lunch		
13.15 – 13.55	**Oral Presentations II**		8 parallel sessions of 10 minute talks by 3rd year students.
13.55 – 14.05	Break		
14.05 – 14.35	**Oral Presentations II** (continued)		
14.35 – 15.40	**Poster presentations I** Invited Exhibitors	**Invited speaker seminars:** - Invited Speaker 3: From BSc to PhD - Invited Speaker 4: From Personal Trainer to PhD	Poster presentations by 2nd year students. Invited Speaker 3 = Alumnus (Graduated 2011, SR) Invited Speaker 4 = Alumnus (Graduated 2010, SCP)
15.45 – 16.20	**Closing Ceremony** **Closing Keynote Speaker** **Head of Department closing address**		Keynote speaker = Alumnus (Graduated 2012, SES). Students receive talk and poster marks between Closing Keynote talk and the Closing Address, Prizes awarded by Head of Department

B



C

Figure 1. STC replicates an authentic conference environment.

(a) Annotated summary of the conference programme. (b) Cover and a page from the 115-page Abstract handbook, which each delegate is given a copy of. Each final year student has a page in the handbook detailing their Abstract alongside a photograph of themselves. (c) Photographs from the day, illustrating the conference environment, a second year student presenting their poster and invited exhibitors from the Armed Forces. Image credits: Mike Park, University of Hull.

enhance students' awareness of the programme and to generate an advance 'buzz' for the invited speakers, STC also has a permanent dedicated website (www.hull.ac.uk/stc) with speaker profiles and past and present conference information. The site provides support with presentation advice through weekly blogs by postgraduate students, previous award winners and the SHES Student Success Advisor. Student interaction with STC is reinforced through the use of social media presence on Twitter and a #STC twitter feed. The hashtag builds student engagement through conference photo sharing and live tweeting of events in the lead-up and on the day itself. To mirror academic conference procedures and to provide transferable employment skills, students are responsible for individually submitting their abstracts and slides in specified formats via the website on set deadlines.

Typically at an academic conference, keynote speakers are leading authorities in the field. However, keynote speakers at STC are drawn exclusively from SHES alumni. Former students who have developed successful careers in sport science and postgraduate research are invited to share their experiences and inspire the current cohort. This forges a direct link between skills developed as an undergraduate and real-world practice. Furthermore, the presence of invited speakers and employer exhibitors permits panel discussions with networking opportunities. Future networking is enabled through the STC handbook which contains a photograph of each student alongside their abstract (see Figure 1(b)). This provides highly distinctive evidence of undergraduate achievement that can be utilised as a PDF attachment in online job applications or to a LinkedIn/social media profile. SHES postgraduate students play a key role in STC by acting as chair in the oral sessions and attending poster presentations to offer formative feedback.

Assessment strategy

STC is a vehicle to assess progressive skill development over the course of the 3-year degree programme. Assessment is embedded within the Research Methods strand, where students are challenged with a novel but related assessment every year that escalates in difficulty. Students in the first year of study attend the conference as delegates and write a summatively assessed reflective blog in which they critique several presentations in areas of their personal interest. During their second year, students begin to work with a research project supervisor who will guide them through the dissertation project into their final year. As second year students they develop a research question that they present at STC as an assessed defended poster. During their third and final year, students deliver individual 6-min PowerPoint presentations on the dissertation research they have completed, followed by 4 min of questions from two members of academic staff (assessors) and other delegates. Through the conference environment both staff, postgraduates and peers can provide immediate formative feedback, but more pertinently student also receive vital feedforward. A categorical marking system enables speedy and consistent assessment, meaning that summative marks can be returned to all second and third year students following the Closing Address. Prizes are awarded for outstanding oral and poster presentations in each programme. To highlight the work of students who may not have scored the highest academic grades, Recognition Awards are given to individuals nominated for excellent

oral communication, original ideas or graphical design. STC is scheduled prior to the Easter vacation to enable third year students to absorb both formative and summative evaluations, and adapt their written thesis prior (approximately four teaching weeks) to final submission. Similarly, the timing of the event means that second year students can act on the feedback received at the conference to adapt their project proposals and ethics applications prior to submission at the start of the third year.

Methods

Prior to the study, we obtained approval for the research from the Sport, Health and Exercise Science Ethics Committee (application no. 1516173). Participants consisted of students from the three BSc degree programmes available in SHES; Sport and Exercise Science (SES), Sport Coaching and Performance (SCP) and Sport Rehabilitation (SR) including first, second and final (third) year students.

To capture student views of the conference we adopted a mixed-methods approach, consisting of questionnaires, on-the-day short interviews and longer structured interviews after the conference. A pre-conference student briefing to outline conference protocols and clarify the programme was held 2 days prior to STC. During this session, the first phase (pre) questionnaires were given to second and third year students. On the day itself students completed the second phase (mid) questionnaires just before the closing address while waiting for their marks. A final (post) questionnaire was completed 2 months after the conference. Students were identified by their student number to allow tracking of individual participants through the study, but were not identified by name. A copy of the mid-questionnaire is available in supplemental materials; the pre- and post-conference questionnaires followed the same format with the exception of the questions relating to activities on the day, and grammatical phrasing was altered to reflect the timing of the questionnaires being completed.

We received 184, 103 and 240 responses to the pre-, mid- and post-conference questionnaires, respectively, giving a total of 527 completed questionnaires (Table 1). As first year students attended as delegates and were not required to attend either a pre-conference briefing or the closing ceremony, first year data is only available for the post-conference questionnaire. Response rates for second and third year students were 72%, 46% and 86% for the three questionnaires, respectively. The sample had a similar

Table 1. Response rates for the three questionnaires.

	Questionnaire			
	Pre	Mid	Post	Trackable across all three questionnaires
First/foundation year	21	1	63	0
Second year	65	43	88	36
Third year	79	48	89	35
Unknown/prefer not to say	19	11	0	0
Total	184	103	240	71
Response rate (all years, n = 400) (%)	46	26	60	18
Response rate (second + third years only, n = 200) (%)	72	46	89	36

Pre-conference questionnaires were completed 2–3 days before the conference, mid-conference on the afternoon of the conference before the closing address and post-conference 2 months after the conference. Questionnaires included student identification numbers, allowing 71 individuals to be tracked across all three questionnaires, which were then removed during data analysis to preserve anonymity.

gender balance to the cohort (64% male:36% female, compared with 68%:32%). The balance of programmes in the sample was biased slightly in favour of Sports Rehabilitation students (28% Sport and Exercise Science:28% Sports Coaching and Performance:44% Sports Rehabilitation compared with 41%:31%:28%); however this was not statistically significant (chi-square = 5.352, d.f. = 2, $P = 0.069$). The bias mainly comes from the first year students sampled in the post questionnaire; when only second and third year students are considered the balance is more representative (31% Sport and Exercise Science:33% Sports Coaching and Performance:35% Sports Rehabilitation; chi-square = 1.842, d.f. = 2, $P = 0.398$).

There were 71 individuals who could be tracked across the three questionnaires, 36 of whom were second years and 35 were third years (Table 1). This sample had a similar demographic breakdown to the cohort, with a gender ratio of 65% male:35% female and a programme ratio of 28% Sport and Exercise Science:37% Sports Coaching and Performance:35% Sports Rehabilitation (chi-square = 3.21, d.f. = 2, $P = 0.201$; Supplemental Table 1). The trackable students had significantly higher mean marks awarded on the day than the non-trackable students (trackable = 74.98 ± 12.98, $n = 67$; non-trackable = 70.01 ± 12.01, $n = 86$; $t = 2.406$, d.f. = 151, $P = 0.017^{*}$), therefore high-achieving students are over-represented in this data set and this should be taken into account when interpreting results.

Due to the ordinal nature of the data, all data analyses were performed using non-parametric statistics. Initial tests for difference were conducted using Kruskal–Wallis or Mann–Whitney tests as appropriate, with significance defined at $\alpha = 0.05$ or $\alpha = 0.01$. Where Kruskal–Wallis tests indicated statistical significance Mann–Whitney post-hoc tests were used to identify groups responding significantly differently. To reduce type I errors, Bonferroni corrections were applied where multiple post-hoc tests or multiple demographic comparisons were conducted within the same data set. In this case significance was defined at $\alpha_{adj} = 0.05/n$ or $\alpha_{adj} = 0.01/n$ where n = the number of tests performed.

To allow comparisons between different groups, we used the engagement data to calculate an 'engagement score' for each student. Ten students gave text rather than numerical responses to some questions (e.g. 'Lots'); however, a single numerical answer to each question was required to calculate the engagement score. We therefore made assumptions about levels of engagement based on the data. For example, a student who said they looked at 'all' posters was assumed to have looked at 30, as this was the maximum estimate given by other students. Compulsory activities (such as attending the keynote speaker) were awarded one point, while optional activities (e.g. a careers talk) were awarded two points. This was justified on the basis that all compulsory activities had attendance of over 80%, while all non-compulsory activities were attended by fewer than 50% of students (Table 2). Attending each student talk was worth two points, while looking at and discussing a poster were each awarded one point. For example, a student who submitted their slides online, attended a pre-conference briefing, four talks, the keynote speaker, one invited speaker careers talk and looked at three posters would be given an engagement score of 16. The distribution of engagement scores was normal when either excluding or including assumptions (excluding assumptions Shapiro–Wilk 0.98, $P = 0.11$, $n = 93$; including assumptions Shapiro–Wilk = 0.98, $P = 0.06$, $n = 103$), and there was no significant difference between the two distributions

Table 2. Student-reported engagement in the conference.

Activity	Participants attending (%)	Median number attended	Points awarded for calculation of engagement score
Pre-conference activities			
Attended pre-conference briefing	97		1
Used website to submit presentation	98		1
Looked at other sections of website	42		2
Conference day activities			
Third year student talks		5	2 per talk
Second year posters looked at		6	1 per poster
Second year posters discussed with the presenter		3	1 per poster
Opening keynote speaker	93		1
Closing keynote speaker	84		1
Talked to exhibitors	46		2
Posted on social media	38		2
Invited speaker 3: from BSc to PhD	13		2
Invited speaker 2: working as a sport scientist at a professional club	12		2
Invited speaker 4: from personal trainer to PhD	11		2
Invited speaker 1: get into teaching	6		2

Data from the mid-conference questionnaire, responses for second and third (final) year students (

($T = 0.51$, $P = 0.611$; Figure 2(a)), therefore we considered the 'with assumptions' data set valid for further analysis.

Forty-one students participated in short semi-structured interviews on the day of the conference, which were conducted by two different interviewers. Some students were interviewed alone, others in groups of two or three, resulting in a total of 32 interviews. Students were identified by student number to allow tracking back to the questionnaire responses. The interview group contained 20 male and 21 female students, so female students were over-represented compared to the cohort. There were 10 Sport and Exercise Science students, 8 Sports Coaching and Performance and 17 Sports Rehabilitation students interviewed, as well as 6 students who did not state their programme. Sports Rehabilitation students are therefore over-represented in the interview sample. Four longer structured interviews were also conducted 2 months after the conference; with interview subjects comprising one third year female Sports Coaching and Performance, one female second year Sport and Exercise Science, one male third year Sports Rehabilitation and one female third year Sport and Exercise Science student. Both sets of interviews were semi-structured, with the following broad lines of questioning:

(1) What conference activities did you participate in?
(2) What were you expecting to get out of the conference, and were those expectations met?
(3) What is the purpose of a conference?
(4) What types of feedback did you get at the conference?
(5) What emotions did you experience during the conference?

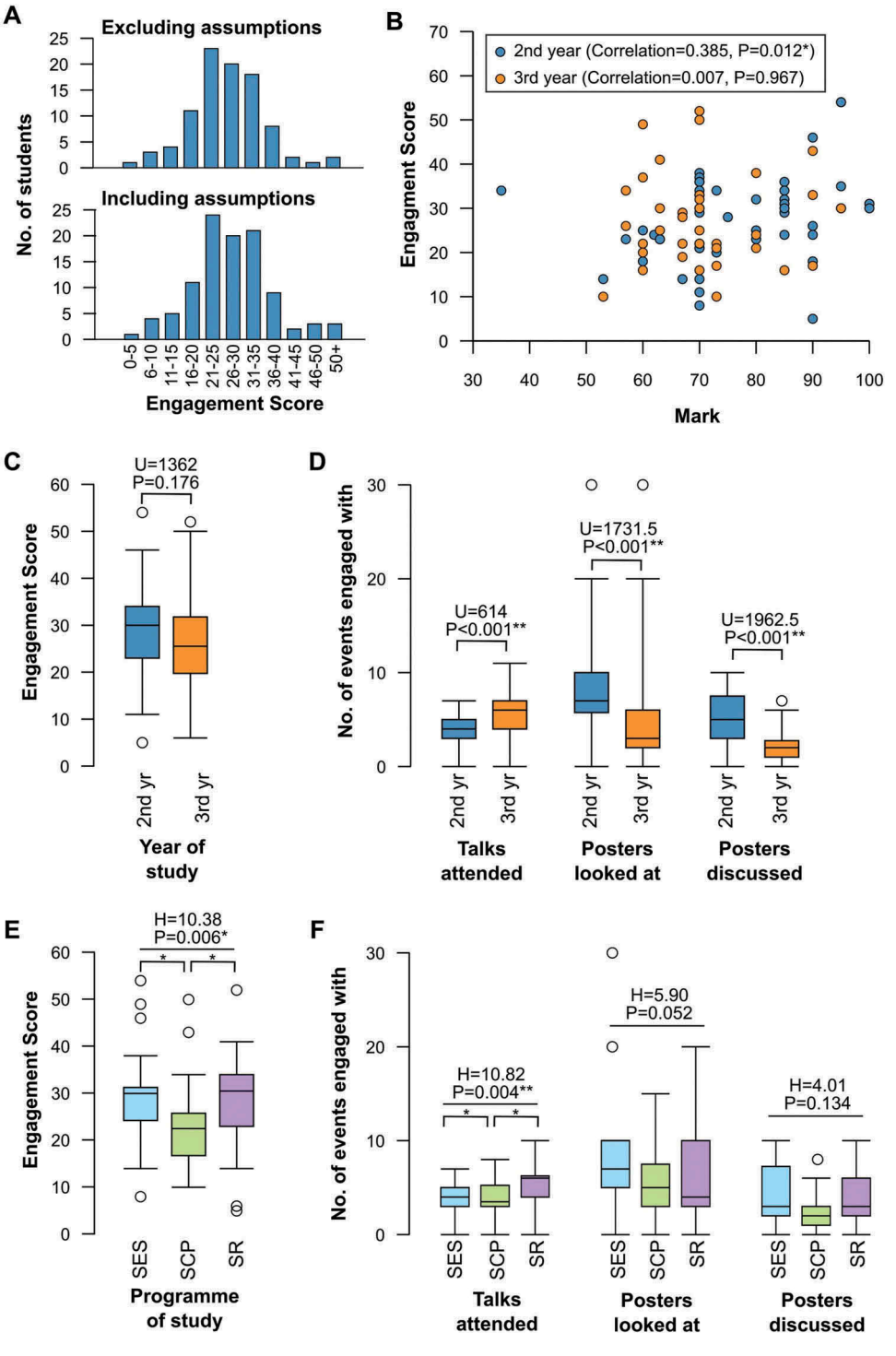


Figure 2. Student engagement in the conference as a function of year and degree programme.

(a) Engagement scores for the whole cohort, both excluding and including assumptions (see description in text). (b) Relationship between mark awarded on the day for posters or talks and engagement scores for second years (Pearson correlation = 0.385, $P = 0.012$, $n = 42$) and third (final) years (correlation = 0.007, $P = 0.967$, $n = 41$). (c) Engagement scores for the two year groups. (d) Engagement with talks and posters by the two year groups. For (c) and (d) square brackets represent Mann–Whitney tests for differences between year groups. (e) Engagement scores for second and third year students on the three programmes (SES = Sports and Exercise Science, SCP = Sports Coaching and Performance, SR = Sports Rehabilitation). (f) Engagement with talks and posters by the three programmes. For (e) and (f), lines and quoted P values represent Kruskal–Wallis test for differences between the three programmes, square brackets and asterisks represent Mann–Whitney post-hoc tests for differences between pairs of programmes (P values not displayed for clarity). For initial tests for differences * represents significance at $\alpha_{adj} = 0.05/2$; ** at $\alpha_{adj} = 0.01/2$; for post-hoc tests * represents significance at $\alpha_{adj} = 0.05/3$; ** at $\alpha_{adj} = 0.01/3$.

Results and discussion

Here we present results of the questionnaires and semi-structured interviews, exploring (i) how students of different abilities engage in the conference, (ii) the impact of discipline identity on perceptions of the conference, (iii) student perceptions of the purposes of conferences and (iv) the impact of the conference on student confidence and perception of their communication skills.

Students of all abilities engage in multiple activities at the conference

The conference provides students with a wide range of activities to participate in, most of which are optional (Figure 1). To determine how students engaged with the conference, the mid-conference questionnaire asked students which events they attended, and how many student talks or posters they had attended (Table 2). As only second and third years completed the mid-conference questionnaire, we are unable to determine patterns of engagement for first or foundation year students. For second and third year students, the highest level of reported engagement was for using the website to submit presentation slides (98%), while the lowest level was for the careers talk 'Get into teaching' (6%). Also, 93% of students attended the keynote talk, and 46% spoke to exhibitors. Median attendance was five talks and six posters, and 87% of students reporting discussing a poster with the student presenter (Table 2).

To allow systematic comparisons of engagement we determined engagement scores for each student based on the activities attended; mean engagement score was 27.4, with a median score of 28 (Figure 2(a)). We hypothesised that there would be a relationship between the engagement score and the marks that students received on the day. For third year students there was no relationship (Pearson correlation = 0.007, $P = 0.967$, $n = 41$), while for second years there was a weak positive relationship (correlation = 0.385, $P = 0.012$*, $n = 42$; Figure 2(b)). This suggests that the conference engages students of all abilities, in contrast to the assumptions embedded in elite models of conferences. There was no difference between the engagement scores of the second and third year students (Mann–Whitney $U = 1362$, $P = 0.176$; Figure 3(c)). However, the type of activity engaged in did differ across the year groups. Third year students attended more talks than second years ($U = 614$, $P < 0.001$**), while second years looked at and discussed more posters with the presenter (looking at posters $U = 1731.5$, $P < 0.001$**; discussing posters $U = 1962.5$, $P < 0.001$**; Figure 2(d)). Students therefore primarily engaged in the activity relevant to their year group. Comments in interviews

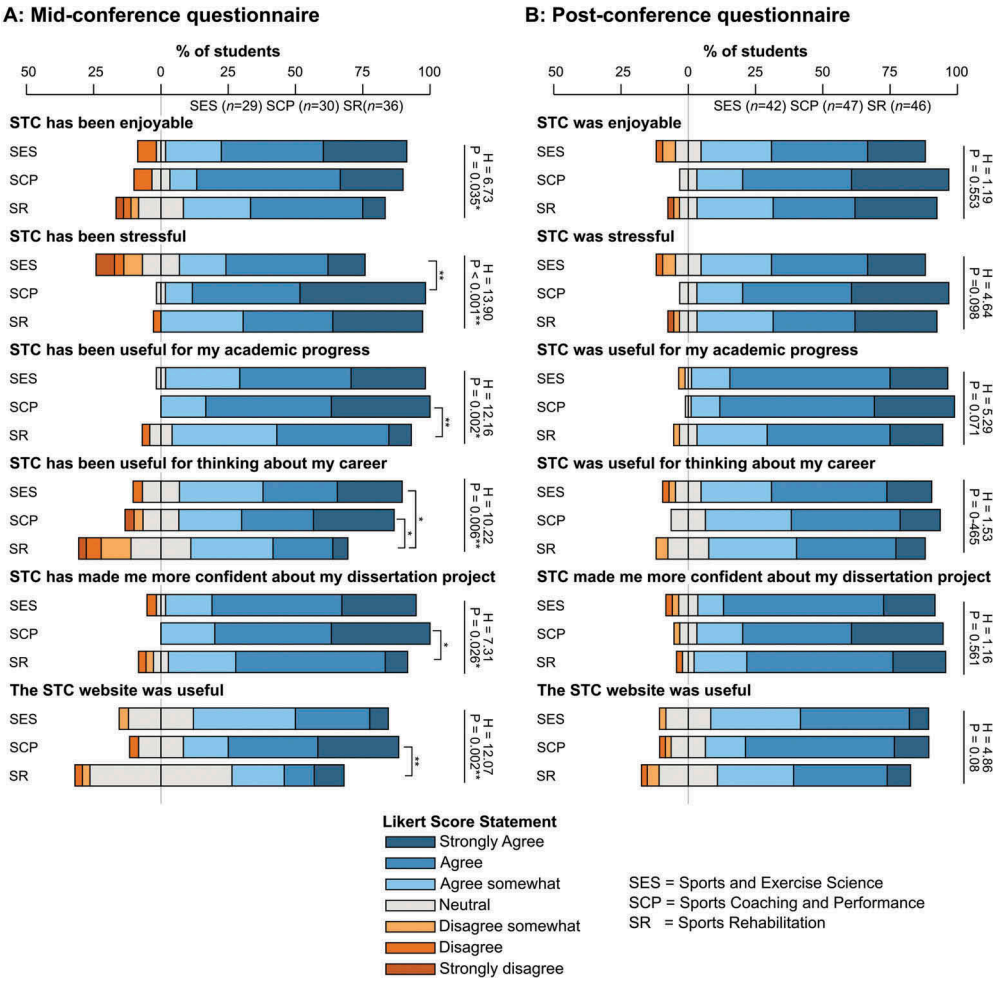


Figure 3. Perceptions of the student thesis conference by second and third year students on different degree programmes.

Likert scale data obtained from (a) the mid-conference questionnaire and (b) the post-conference questionnaire. SES = Sports and Exercise Science, SCP = Sports Coaching and Performance, SR = Sports Rehabilitation. Lines and quoted *P* values represent Kruskal–Wallis test for differences between the three programmes, square brackets and asterisks represent Mann–Whitney post-hoc tests for differences between pairs of programmes. For initial tests of difference * represents significance at $\alpha = 0.05$; ** at $\alpha = 0.01$; for post-hoc tests * represents significance at $\alpha_{adj} = 0.05/n$; ** at $\alpha_{adj} = 0.01/n$, where n is the number of comparisons performed.

suggested this was to see what their peers were doing, which for some students had the added benefits of settling their nerves:

> I've seen a few of the systematic reviews which I found interesting because I've been doing an experimental study so it was good to see what it's like on the other side. (Third year male)

> Going round the posters this morning) actually made me feel better. Because it was quite loud and quite a good atmosphere … it didn't look like a presentation, it looked more like a chat and that's quite good. (Second year female)

There was also interaction between the year groups, with second years attending third year talks, and third years discussing posters with the second years (Figure 2(d)). Several students described being able to attend events across year groups as having clear benefits in terms of managing expectations for future years. Interestingly, some third year students described giving feedback to second years on the basis of their own experiences, so spontaneously taking on a mentoring role.

> We went round four different presentations done by people, and then after the break we went around we went around the posters room asking questions and stuff. Trying to get ideas for like potential stuff that we could do in the next year …. Its given me an idea of what to expect. (First year male)

> When I was watching the 3rd years I was looking at what to and what not to do. So having seen two, I've now got a clear idea now of how it could go wrong and how it could go really well. (Second year female)

> From last year presenting your presentations I think you kinda know what the days about. Like you've already done it twice really …. I went through somebody's poster presentation with them. It's nice to give them a few tips almost as if I was their supervisor …. 'cause I'd done it all before. (Third year male)

The importance of a social dimension to learning has been described for students attending 'elite' conferences, with students learning through both formal academic session and more informal social exchanges (Gumbhir, 2014; Kneale et al., 2016). The emergence of similar networks at STC indicates programme-level conferences can facilitate the development of learning communities in an inclusive way. For most students, social interactions form a major part of their learning environment, with peers providing motivation, clarification, information gathering and directly supporting learning (Orsmond, Merry, & Callaghan, 2013). At STC students support each other as friends, but also contribute to a learning community where they discuss ideas and provide peer feedback on work, despite there being no formal requirement for peer assessment. Spontaneous development of learning communities between students in different year groups at STC is a distinctive feature of the conference as most undergraduate programmes do not provide formal opportunities for exchange of ideas between students in different years of study.

Student perceptions of the conference are shaped by discipline identity

To determine what students thought of the conference, we asked students to what extent they agreed with a series of statements in a 7-point Likert scale (Table 3). Eighty-six per cent of students on the post-conference questionnaire agreed with the statement '*STC was enjoyable*', while only 5% disagreed with the statement (n = 237). Despite having attended the conference in previous years, there was a significant increase in the level of agreement with the statement '*STC was enjoyable*' for the trackable second and third year students across the three questionnaires (Friedman chi-square 34.421, d. f. = 2, $P < 0.001$**), with the level of agreement increasing with each subsequent questionnaire. Ninety-one per cent of students agreed with the statement '*STC has been useful for my academic progress*', while 81% agreed with both '*STC has been useful for thinking about my career*' and '*STC has made me more confident about my*

Table 3. Student perceptions of STC before, during and after the event.

	% of students agreeing with the statement								
	All students			Second and third year students only			Trackable students only		
	Pre	Mid	Post	Pre	Mid	Post	Pre	Mid	Post
STC will be/has been enjoyable (%)	72	84	86	71	83	91	67	82	90
STC will be/has been stressful (%)	84	89	68	91	89	89	90	88	91
STC will be/has been useful for my academic progress (%)	91	94	91	90	95	95	90	96	94
STC will be/has been useful for thinking about my career (%)	85	72	81	83	74	84	81	77	85
STC will make me/has made me more confident about my dissertation project (%)	93	94	81	92	95	91	94	94	93
The STC website was useful (%)	69	64	66	71	64	78	67	63	79
Total number of responses	177	98	237	145	95	135	67	67	67

% agreement calculated from those who answered any of 'strongly agree', 'agree' or 'agree somewhat'.

dissertation project'. Also, 89% of second and third year students agreed with the statement '*STC was stressful*' compared with only 68% for all students, reflecting the fact that first year students were only attending as delegates (Table 3).

Given that STC is a department-wide event, we were interested to see if there were different responses to the conference by students on different degree programmes. Sport Rehabilitation (Sports Rehabilitation) and Sport and Exercise Science (Sport and Exercise Science) students reported significantly higher levels of engagement with the conference than Sport Coaching and Performance (Sports Coaching and Performance) students (median engagement scores Sport and Exercise Science = 30, Sports Coaching and Performance = 23, Sports Rehabilitation = 30; Kruskal–Wallis $H = 10.01$, $P = 0.006^{**}$, Figure 2e). Sports Rehabilitation students attended significantly more student talks than Sport and Exercise Science or Sports Coaching and Performance students ($H = 10.83$, $P = 0.004^{**}$, Figure 2(f)), but no significant differences were observed when it came to engagement with poster presentations. This difference in engagement between programmes is partially supported through attendance counts of student talks through the day, with Sports Rehabilitation talks having a median attendance count of 24 compared to 12 for Sport and Exercise Science and 10 for Sports Coaching and Performance (data not shown).

There were also differences in the way that students on the different programmes perceived the conference on the day. Sport and Exercise Science students were less likely to agree with the statement '*STC2016 has been stressful*' than students on the other two programmes (Figure 3(a)). Sports Rehabilitation students had less positive perceptions of the conference than students on other programmes, with significantly lower levels of agreement for five out of the six evaluation statements on the mid-conference questionnaire (see Figure 3(a) for statistics). However, on the post-conference questionnaire there were no significant differences in the attitudes towards the conference between the three degree programmes (Figure 3(b)), suggesting that all students saw the value of the conference on reflection.

A slight paradox is therefore present in the mid-conference questionnaire data, in that Sports Rehabilitation students seemed to have less positive attitudes towards the conference on the day than those on other programmes, despite being most highly

engaged in the conference itself (Figure 2(e,f)). We considered three alternative explanations for this discrepancy:

(1) Sports Rehabilitation is a more applied discipline (e.g. 25% of teaching staff for Sports Rehabilitation have a doctorate compared with 100% for Sport and Exercise Science and 82% for Sports Coaching and Performance), so the research-focused nature of the event was less relevant to students on this programme.
(2) Sports Rehabilitation students have a distinct identity from other students and feel that the conference is biased towards other disciplines.
(3) As Sports Rehabilitation students attended more events than those on other programmes, these students experienced more 'conference fatigue', resulting in a less positive perception of the event.

To consider the first explanation, we considered the type of projects undertaken by students on the different programmes. Fifty-seven per cent of Sports Rehabilitation students undertook systematic literature review projects compared with 30% and 15% of students for Sport and Exercise Science and Sports Coaching and Performance, respectively. Data collection projects might be seen as more appropriate for the conference environment, and therefore project type may affect perceptions of the conference. We therefore analysed the survey as a function of project type, with students being classified into either 'data collection' (which included empirical studies, questionnaire or interview projects and autoethnographic studies) or 'literature review' projects. There was no difference in the engagement scores between students on different types of projects (Mann–Whitney $U = 57.3$, $P = 0.416$). No significant difference in perception of the conference as a function of project type was observed for either the mid- or post-conference questionnaires. On the post-conference questionnaire there was no significant difference for this question ($U = 2427$, $P = 0.114$), suggesting students on both types of projects got equivalent benefits from the conference in the long term. This indicates that project type does not explain the distinct responses of Sports Rehabilitation students.

An alternative explanation for the apparent paradox lies with the fact that the Sports Rehabilitation students attended significantly more talks than students on the other programmes (Figure 2(f)). It may be that Sports Rehabilitation students were less selective in the way they engaged with the conference and either felt more obliged to attend everything or were providing more peer support to other students on that programme. We therefore compared the responses to the statements 'STC has been enjoyable' and 'STC has been stressful' as a function of engagement category and found no statistically significant difference once Bonferroni corrections had been applied ('enjoyable' $H = 4.84$, d.f. = 2, $P = 0.08$; 'stressful' $H = 6.14$, d.f. = 2, $P = 0.04$), so concluded that conference fatigue was not a major explanation of the disciplinary differences.

We finally considered the possibility that issues of programme identity and perceived bias in the programme design were the primary contributor to the less positive perceptions of Sports Rehabilitation students. In interviews both on the day and after the conference, several Sports Rehabilitation students highlighted the fact that the

keynote speakers were not from a rehabilitation background (referred to as 'Rehab' within the department):

> [Student A] The problem is with us because we're Rehab [the keynote talk] is not quite relevant for the careers we're going into. They're talking about sports analysts and stuff. (Second year, Sports Rehabilitation)

> [Student B] Yeah. I found myself thinking that. I mean the guy has done really well for himself, it was interesting to hear what he'd done, but it's not what I want to do at all. (Second year, Sports Rehabilitation)

> One thing that's noticed a lot is particularly kind of the external professionals that come in and do a talk – there's never really anything Rehab specific. Whether that's because students that have gone on to work within clinical practice or whatever don't necessarily want to come back or anything but I think …. Sometimes it's difficult to relate to the professional talks because they're not really that Rehab specific. (Third year, Sports Rehabilitation)

The keynote speakers at the previous two conferences had also been from non-rehabilitation backgrounds, which may have set up a perception that the conference was less relevant for Sports Rehabilitation students. Sports Rehabilitation students are required to undertake 400 h of clinical placement to get contact with professionals elsewhere in their programme; however, the lack of rehabilitation-based keynote speakers at the conference itself appeared to affect their overall perception of the event. There was however a Sports Rehabilitation alumni guest seminar speaker at the event who was employed in the design department of a famous football boot company because of her rehabilitation expertise, and there were also exhibitors present offering Sports Rehabilitation-specific career advice and employment pathways. This perhaps indicates that alternative strategies may be needed to help students better recognise discipline-relevant engagement opportunities at the conference. We therefore concluded that the perceived bias of disciplines in the conference programme was the primary factor influencing the less positive responses of Sports Rehabilitation students. Programme identity acting as a potential barrier to engagement contrasts with the experience of students at elite conferences, where students saw benefits to being exposed to other disciplines (Kneale et al., 2016).

Students perceive the conference primarily as an opportunity to develop presentation skills

To explore what students thought the purpose of a conference is, we asked students to rate their level of agreement with 11 statements about conferences on a 7-point Likert scale (strongly disagree = 1 through to strongly agree = 7). Across the 527 completed questionnaires and 11 statements (total of 5797 responses), 4883 responses were in agreement with the statement (86%; Figure 4). Across all students, the strongest level of agreement was with the statement '*The purpose of a conference is to improve your presentation skills*' (mean Likert score ± standard deviation = 5.99 ± 1.04, n = 237), and the weakest level of agreement was with the statement '*The purpose of a conference is to have time away from the usual work environment*' (4.33 ± 1.47, n = 237). For second year students '*to get feedback on your work*' had the second highest level of agreement,

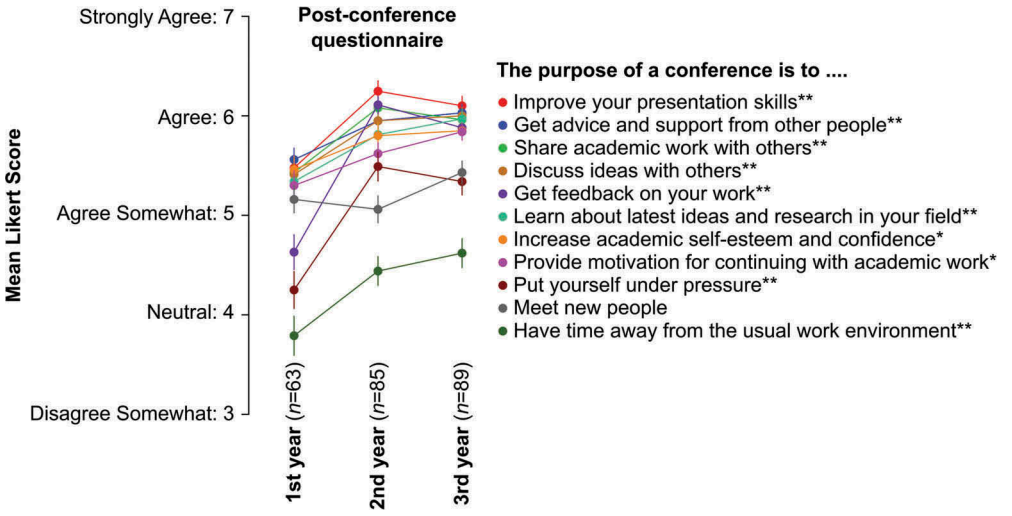


Figure 4. Student perceptions of the value of conferences change through the degree programme.

Data obtained from the post-conference questionnaire, displayed as the mean Likert score ± standard error of the mean Likert score (7-point scale, points 1 and 2 not shown for clarity). ** indicates significance at α = 0.01, * indicates significance at α = 0.05 (Kruskal–Wallis test for differences between year groups).

whereas for third year students it was '*get advice and support from other people*' (Figure 4). Student comments reflected the emphasis on communication skills, particularly in relation to employability, but also demonstrated that both second and third year students saw the conference as an opportunity to shape the future direction of their dissertation projects. This is consistent with studies of 'elite' conference models, where development of public speaking skills was seen as a major benefit of conference attendance (Hill & Walkington, 2016; Kneale et al., 2016). Many students described STC as a mechanism to present to a larger audience than they would otherwise encounter in their degree programme, and students could see the future benefits gained through giving presentations to a larger audience:

> It's an essential skill to be able to present in front of a large audience and this conference gives you that opportunity to do so, whether it's a poster or your 3rd year presentation. (Second year male)

> [Student A] I think (the point of today) to get you used to presenting. For us, it's to prepare us to do the presentation next year. For the 3rd years it's interview practice for the real world and all that kind of stuff really. Confidence building more than anything. (Second year male)

> [Student B] It's more preparation and get you used to being able to talk in front of people. It's good, it's good practice I think. A lot of people come through – you talk to a lot of people about your ideas. (Second year female)

> [Student A] Yeah exactly. So it helps you to get a dissertation idea now. It makes you actually think about what you're going to and actually do a bit of research into it cos you have a purpose for it.

For 7 of the 12 statements in the post-questionnaire, first year students were significantly less likely to agree than second or third years, suggesting that just attending rather than presenting resulted in a different perception of the conference environment (Figure 4). Third year students were significantly more likely to agree with the statement '*The purpose of a conference is to provide motivation for continuing with your academic work*' than either first or second year students ($H = 8.88$, d.f. = 2, $P = 0.012$*; Mann–Whitney post-hoc test first vs. third years $U = 2041.5$, $P = 0.009$**). All years had significantly different levels of agreement with the statement '*The purpose of a conference is to get feedback on your work*' ($H = 17.62$, d.f. = 2, $P < 0.001$**), with second years having the strongest level of agreement. When responses to the three questionnaires were compared for the 'trackable' students, there were no significant differences in the level of agreement with the statements between the pre-, mid- and post-conference questionnaires, with the exception of second year students for the statement '*The purpose of a conference is to increase academic self-esteem and confidence*' ($H = 6.17$, d.f. = 2, $P = 0.046$*), where they had strongest levels of agreement on the post-conference questionnaire. This suggests that student perception of the role of conferences does not change significantly as a result of attending one. However, we were only able to obtain trackable data for second and third year students who had attended STC at least once before; it is likely that different results would be obtained for students attending their first conference. The fact that students primarily see the conference as being about developing presentation skills may contribute to the high reported stress levels of second and third year students (Figure 3).

Student confidence and communication skills are increased by presenting at the conference

While students could see the value of the conference for developing communication skills, we wanted to determine the impact of the conference on student confidence. Across the 3-year groups and three questionnaires, there were significant increases in the number of students agreeing with the statements 'I feel confident about giving presentations', 'I feel confident discussing my work with people I know well' and '*I feel confident about discussing my work with people I don't know well*' (Figure 5). For two of these questions the biggest changes in responses were associated with attending the conference in the second year of study. Before attending the conference, only 44% of second year students agreed with the statement '*I feel confident about giving presentations*', which increased to 70% after attending the conference ($U = 1089.0$, $P = 0.005$**). A similar increase was seen for the statement '*I feel confident about discussing my work with people I don't know well*', where only 55% of second year students agreed with this before the conference, and 83% agreed after attending the conference ($U = 991.5$, $P < 0.01$**). This increase was not seen for final (third) year students, who had high levels of agreements with these statements before the conference as well as afterwards. While there was a significant increase in the proportion of students agreeing with the statement '*I feel confident about discussing my work with people I know well*' across the year groups and questionnaires, there was no significant difference as a result of attending STC. This indicates the main value of the conference is in facilitating communication between students and an unfamiliar audience, which in this case primarily consists of PhD students and postdoctoral researchers in the

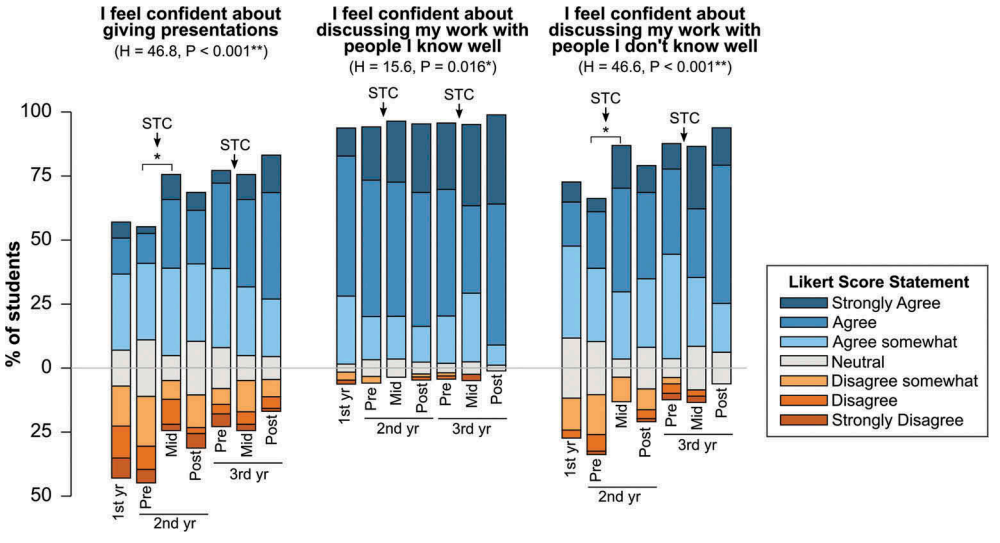


Figure 5. Students' perceptions of their confidence and communication skills as a result of attending the conference.

Data obtained from the pre-, mid- and post-conference questionnaires for second and final (third) years, and from the post-conference questionnaire for first years. Square brackets represent Mann–Whitney tests for differences between year groups. For initial tests of difference * represents significance at $\alpha = 0.05$; ** at $\alpha = 0.01$; for post-hoc tests * represents significance at $\alpha_{adj} = 0.05/n$; ** at $\alpha_{adj} = 0.01/n$, where n is the number of comparisons performed.

department, as well as students on different degree programmes. Several students described the impact that having a large audience had on their approach to presenting, both in terms of anxiety and in ensuring that they were appropriately prepared:

> We do presentations on our course but it's different when you're stood there up in front of a room full of people. I didn't know how I was going to react to that room full of people. I didn't know whether I'd just be stood there just like 'I don't know how to speak any more'. (Third year male)

> There must have been about 15 or 20 people that came up before [my academic assessor]. Obviously the poster session is an hour long – he came up to me in about the last 15 or 20 minutes, which allowed me to get all the nerves out the way and speak to people about various random questions first. (Second year male)

> I made sure I did a bit or reading and made I sure I fully knew the area what I was talking about – obviously I've got a doctor in the subject [assessing me]. You've got to know what you're talking about. I made sure I fully understood everything …. why I was doing [my research] and what I hoped to achieve from it. (Second year male)

STC is an inclusive high-impact pedagogy for the dissemination of undergraduate research

High-impact pedagogies have been described as '*encouraging approaches to learning and teaching that support students in cultivating deep understandings of what it is to think and learn within a discipline, the ability to self-monitor their own learning and to be sensitive to their own individual needs and the requirements of the context. High-impact*

practices by definition need to be accessible to all students, and attuned to an understanding of individual differences; they should be inclusive' (Evans, Mujis, & Tomlinson, 2015). We consider embedded STCs such as this one to represent high-impact pedagogy as they are inclusive of all learners, support students in understanding the requirement of their disciplines and allow students to see the development in their learning across years. The timing of this conference also allows feedforward from the conference into the remainder of the undergraduate research experience, allowing students to use the event to address their individual needs. While the use of presentations and research projects in undergraduate programmes is common and has clear pedagogical benefit (Healy and Jenkins, 2009; Spronken-Smith et al., 2013), we provide evidence that a large-scale event embedded into undergraduate programmes that allows multiple research dissemination opportunities can have a significant impact on the confidence and communication skills of students. There was little correlation between the academic achievement of students and their engagement with the conference, therefore the conference successfully engages students of all abilities.

The difference in impacts between in-class presentations and events like STC may primarily be a function of scale itself. Spronken-Smith et al. propose a framework for dissemination of undergraduate research based on both the level of student autonomy required and the level of exposure or 'public-ness' involved. STC represents an intermediate level of dissemination on the Spronken-Smith dissemination framework, with research being communicated at a department level and requiring both teacher- and student-directed components. It has been argued that undergraduate-only conferences reinforce exclusion from the broader academic and research community (Gumbhir, 2014), and that many of the advantages of attending conferences come from when student work is removed from formal assessment requirements (Gumbhir, 2014; Kneale et al., 2016). However, our experience suggests that conferences linked to programme assessment can also have considerable benefit for students. The inclusion of three different degree programmes at this event may effectively make the event more public as students are given the opportunity to present to other students that they would not usually discuss work with.

Practical challenges of running the conference

On a practical basis, there are challenges with establishing and running dissemination events on this scale, while maintaining a personalised experience for the individual student presenter. The conference requires significant administrative support to run, including in the processing of individual student abstracts for the conference handbook and running registration desks on the day. Administrative support for the production of publicity materials and the conference website is also required to create an authentic conference environment. Staff engagement is also essential; all academic staff in Sports Science are timetabled for the entire conference day, and postgraduate students also attend and contribute to the assessment of presentations. This high level of staff input is required as oral presentations are second marked, meaning 16 assessors are required for the eight parallel sessions at any given point in the day. Marks are returned to students at the end of the day to encourage attendance at the entire event, meaning there is considerable administrative support required to process marks during the final closing ceremony. To facilitate this, a standardised easy-to-use rubric is used for all presentations and posters. The

conference also requires appropriate co-located rooms with presentation facilities to enable parallel sessions, as well as appropriate spaces for poster sessions and refreshment breaks. As STC is a core part of compulsory modules, the costs of venue hire, refreshments and publicity materials are accounted for in the programme budget for the subject group. While these may be seen as easy targets for cost-cutting in the face of financial pressures, we strongly believe that allocating resource to create an authentic conference environment significantly increases student engagement with the event, and consequently enhances the pedagogical impact of the activities on offer.

Conclusions and implications for practice

STC is a large-scale and high-profile event within SHES at the University of Hull, which integrates the teaching of research methods, communication skills, professional identity and employability in an inclusive manner. Student opinions of the conference are overwhelmingly positive and highlight the role that the conference plays in developing key skills, consistent with the way students experience elite conferences (Hill & Walkington, 2016; Kneale et al., 2016; Mabrouk, 2009). STC replicates the professional conference environment, thereby providing an authentic learning experience, but remains a safe educational space for students to get feedback on their work and discuss their ideas. One third year student commenting 2 months after the event captured this sense of the conference being a valuable exercise for all students:

> Even people that …. didn't take their degree as serious – when it came to conference day everyone put the effort in and everyone was bothered about doing well and presenting and it was quite nice to see. It just showed how important it was to everyone else. (Third year male)

The strong positive response towards the conference is therefore similar to that reported by studies of students attending national or international conferences (Hill & Walkington, 2016; Kneale et al., 2016; Mabrouk, 2009), despite the fact that STC is compulsory. On the basis of our experiences and the results presented above, we make the following recommendations for practice:

(1) Dissemination opportunities should be inclusive of all learners, not just high-achieving students intending to pursue a research career.
(2) Multiple points of dissemination should be built into the undergraduate research process to allow feedforward into projects, allowing students to adjust their research questions on the basis of feedback obtained at dissemination events. The timing of dissemination opportunities relative to summative assessment deadlines should therefore be carefully considered during programme design.
(3) Appropriate aspects of research projects (e.g. project proposals, relevant ethics applications) should be embedded prior to the final year to encourage early formation of relationships between students and their research supervisors.
(4) Bringing students from different degree programmes together to disseminate their research has considerable value, but the design of dissemination events needs to give equal balance to all disciplines, otherwise the impact of the event may be devalued.

(5) Conferences should be embedded into programmes, to include tasks that allow differentiated outcomes for students in all years, therefore allowing purposeful participation of all rather than students attending as passive observers.
(6) Student conferences are appropriate for multiple research styles including literature-based projects, so should be considered as a dissemination tool for all disciplines.
(7) While large-scale conferences require administrative support, creating an authentic conference environment promotes engagement, increases pedagogical impact and raises aspirations of all students.

Further research is required to fully describe the pedagogical benefits and student experience of the event; in particular, investigation of affective domain responses to the event is required, and perceptions of the usefulness of the event by recent graduates need to be explored in full. However, our results indicate that inclusive approaches to undergraduate research dissemination should be adopted more widely so that all students can benefit from the conference experience.

Acknowledgments

We thank Dr James Gilbert (University of Hull) for advice on statistical analysis of data and the anonymous reviewers for their positive suggestions for improvements to the manuscript.

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