A semester-long journal club improves self-perceived critical appraisal skills in undergraduate Sport & Exercise Science students.

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Introduction

The American Association for the Advancement of Science (2011) strongly encourages a shift from traditional instructor-led courses to a student-centred teaching and learning environment where inquiry driven teaching and research-orientated active learning is favoured. Traditional undergraduate courses use didactic textbooks to inform students of what is currently known in the discipline. However, textbooks are usually broad in topic matter, superficial in content and present a false image of the reality of scientific research (Hoskins & Stevens, 2009). Consequently, they present scientific visualisations with little attention paid to the research process and the experimental techniques used to generate the data (Duncan et al., 2011). As such, textbooks may stifle the development of skills that correspond with higher order thinking (levels 4 to 6) in Bloom's taxonomy such as scientific thinking and the development of critical appraisal (Duncan et al., 2011; Krathwohl, 2002). Without these skills, reading and analysing the primary literature may appear too challenging and a point of frustration, stress and anxiety for many undergraduates (Round & Campbell, 2013).

Many contemporary studies in Sport & Exercise Science are becoming more complex in their use of advanced experimental laboratory techniques to generate novel results that are yet to appear in most exercise science textbooks. Therefore, an inquiry-based active learning environment that promotes the guided use of the primary literature may be an effective means of raising Sport & Exercise Science students' awareness, understanding and critical appraisal of (contemporary) research.

Analysis of the primary literature has been incorporated into the curriculum of a variety of undergraduate courses (Phillips, 2009; Round & Campbell, 2013; Segura-Totten & Dalman, 2013; Willard & Brasier, 2014) and some have withheld sections of the articles so that student attention can be focused on understanding and interpreting the methods and data without the distraction of the wider text (Hoskins et al., 2007; Hoskins et al, 2011; Round & Campbell, 2013; Segura-Totten & Dalman, 2013). Such studies have reported significant improvements in students' self-assessed confidence in their ability to read and analyse the primary literature (Hoskins et al., 2011; Round & Campbell, 2013; Segura-Totten & Dalman, 2013), improvements in objective measures of critical thinking (Hoskins et al., 2007; Round & Campbell, 2013) and changes in their epistemological beliefs (Hoskins et al., 2011). However, not all studies have included a control group for comparison (Hoskins et al., 2007; 2011; Phillips, 2009).

Therefore, the purpose of this pilot study was to test the hypothesis that an extra-curricular semester long journal club will improve students' self-perceived critical appraisal skills and module marks within the related disciplines of nutrition and physiology relative to a control group.

Methods

The opportunity to attend an extra-curricular journal club was presented to approximately 350 Level 5 Sport & Exercise Science students during module lectures in September 2015. A total of six students attended the journal club meetings and completed all of the data collection procedures. Six students from the same course cohort that did not attend the journal club acted as control participants. Both groups contained five males and one female. The mean (SD) age for both groups was 20 (1) years and all students were enrolled on the same modules within their degree programme.

The biweekly journal club met for one hour on five occasions during semester one of the 2015-16 academic year (October to December). The journal article for discussion was distributed to students one week before each meeting and guiding questions were provided to facilitate critical appraisal of the research paper (Mazal & Truluck, 2014). The academics determined the topics for the first two meetings and students determined the topics for the final three meetings from which academics selected an article perceived to be novel and challenging. The journal articles selected were based on the following topics: muscle fuel utilisation, diet-induced insulin resistance, hormonal regulation of collagen and muscle protein synthesis and physiological adaptations to endurance exercise. Each meeting was facilitated by the two academics responsible for organising the journal club and the discussions were based on the guiding questions that were distributed to the students one week earlier. Refreshments were provided during the meetings to encourage a relaxed and informal environment for discussion (Bazarian et al., 1999).

Self-perceived ability to critically appraise journal articles was assessed in both groups at the start and end of the semester using eight-point Likert scales (where 0 = “not good at all” and 7 = “excellent”). Journal club participants also completed open-ended format questions to provide qualitative information regarding their reasons for attending the journal club prior to the first session. An evaluation form was provided to journal club members after the final session of the semester to evaluate ratings of enjoyment and interest generated from the meetings using a four-point Likert scale (where 0 = “not at all” and 3 = “very much”). Qualitative feedback about positive and negative aspects of the journal club was also obtained using open-ended questions. This method of data collection was adapted from Phillips (2009).

In order to assess whether participation in the journal club was associated with improved academic performance within the curriculum, the change in module marks achieved between Level 4 and Level 5 for related subjects was evaluated for both the journal club and control groups. Due to the journal club focussing on sport and exercise metabolism, the module marks selected were for the related subjects of physiology and nutrition.

Data was analysed using IBM SPSS statistics version 22 for Windows. Changes in self-perceived critical appraisal skill between the start and end of the semester was compared separately for each group using the Wilcoxon signed-rank test. The change in module grades between Level 4 and 5 was compared between the journal club and control group using an independent t-test. Parametric data are presented as mean (SD) and non-parametric data is presented as median (IQR).

Results

Self-perceived critical appraisal skills significantly improved in the journal club group (JC; Median (IQR); Pre: 4 (1); Post: 5 (1); P = 0.028) but not the control group (Con; Pre: 4 (1); Post: 4 (1); P = 0.684). All journal club participants rated the sessions as being “very interesting” and “very enjoyable”.

Participation in the journal club did not significantly influence the change in module grades between Levels 4 and 5 for nutrition (P = 0.284; Figure 1a) but the change in physiology module grades between Levels 4 and 5 was significantly improved in the journal club attenders compared with the control group (P = 0.014; Figure 1b). Furthermore, grade position improved for five out of six journal club attendees relative to the remainder of their cohort for nutrition and all six attendees improved their grade position for physiology in Level 5 compared with Level 4. Alternatively, only one participant from the control group improved their grade position for nutrition and two control participants improved their grade position for physiology.

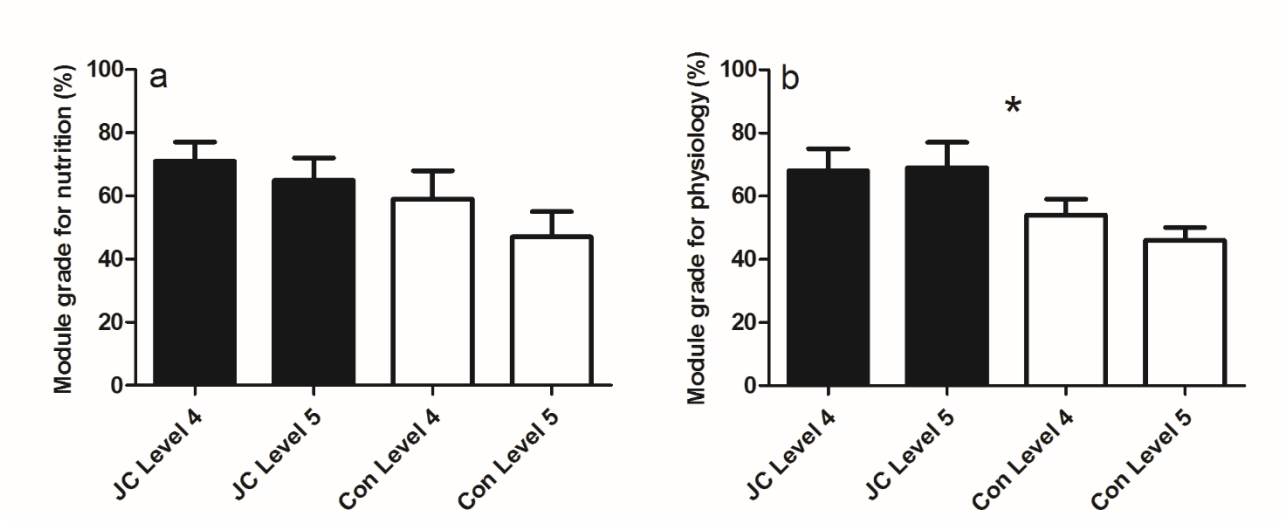

Figure 1. Module grades for nutrition (a) and physiology (b) at Level 4 and 5 for the journal club and control participants. Values are mean (SD). *Significant difference between groups for the change in module grade from Level 4 to Level 5, P < 0.05.

The participants' reasons for attending the journal club were to: improve knowledge and understanding of the subject, improve critical analysis skills, gain a better understanding of how to read journals, and to develop a better understanding of research methods. Qualitative feedback for the journal club is presented in Table 1.

Table 1. Qualitative feedback upon completion of the journal club.

Positive aspects
• Critical analysis and evaluation of data and experiments. • The depth and high level of content was challenging. • Interesting to learn the application of findings for 'real life'. • Increased confidence, knowledge and understanding. • Interpreting articles and discussing ideas between peers with different viewpoints. • Discussing potential future studies based on the findings of current journal articles.
Suggested improvements
• Greater continuation of topics between meetings.

Discussion

The major findings of this pilot study were that students' perceived ability to critically appraise the primary literature was increased after an extra-curricular semester long journal club and that this was associated with maintained or increased academic achievement in related disciplines relative to controls.

The improvement in the journal club students' self-confidence and perceived critical appraisal skills is consistent with previous studies where undergraduate students reported enhanced self-confidence in their ability to read and critically analyse the primary literature (Hoskins et al., 2011; Phillips, 2009; Round & Campbell, 2013; Segura-Totten & Dalman, 2013). This occurred despite the completion of only five biweekly meetings compared with other studies where weekly (Segura-Totten & Dalman, 2013) or twice weekly semester long sessions were conducted (Hoskins et al., 2011; Round & Campbell, 2013). This suggests that favourable changes in student confidence and perceived competence can be achieved in relatively few sessions. The articles selected in the present study exposed students to topic areas at a depth they were previously naïve to, and the guided questions challenged their understanding of contemporary research techniques, promoted a critical view of the data presented and encouraged the students to develop their own interpretation of the research findings. In preparing their answers, students would have entered the higher levels of Bloom's taxonomy (Krathwohl, 2002) which may explain their self-reported gains in confidence, knowledge and understanding. These feelings may also explain why many undergraduate science students no longer find the reading of primary literature a frustrating and stressful exercise after repeated guided analysis of the primary literature (Round & Campbell, 2013).

The higher module grades achieved after journal club attendance is in agreement with studies where improvements in objective measures of critical thinking were reported (Hoskins et al., 2007; Round & Campbell, 2013), but contrasts with Phillips (2009) who reported a disconnect in the relationship between gains in students' perceived critical appraisal skills and assessment marks. The absence of a specific objective measure of students' critical appraisal skills in the present study has meant the extent to which journal club contributed to the improved module marks is uncertain. Nevertheless, it is possible that students may have further developed their metacognitive abilities to help them interpret the module content as a consequence of journal club attendance and that this was beneficial for their academic assessments (Tanner, 2012).

Students found journal club to be "very enjoyable" and "very interesting". They positively rated the opportunity to discuss potential future studies and highlighted their desire for more sequential studies within a given topic. This is in agreement with previous studies where positive gains in student attitudes to and personal engagement with science were improved with guided reading of the primary literature (Hoskins et al., 2007; 2011).

Conclusion

Students' self-perceived ability to critically appraise the primary literature was increased after journal club attendance and this was associated with maintained or increased academic achievement relative to controls. To what extent improvements in self-perceived critical appraisal can explain the improved academic achievement in this study warrants further research with a larger sample size.

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