The Journal Club: A Pedagogy for Postgraduate Research and Education.

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Abstract.

Developing deep approaches to learning can enhance students' engagement with academic material and result in improved analytical and conceptual thinking skills. A deep approach to learning occurs when students engage meaningfully with key concepts to gain meaningful knowledge and skills. Understanding how students learn can provide a firm basis for the most effective means of teaching and assessment. Consistent with calls for improvements to the pedagogy for higher research degrees, this study introduces changes to the learning environment for postgraduate research students in an interdisciplinary journal club and reports on the observed effects of the changes. We consider postgraduate students' views and experiences of learning in an interdisciplinary journal club and the outcomes of the new taught component introduced.

Pre-to-post intervention data were analysed to determine students' self-assessed knowledge regarding study design and interpretation. In addition, the revised Study Process Questionnaire (R-SPQ-2F) was used to assess changes in students' deep and surface approaches to learning across the course of the intervention. Qualitative descriptive text data were also analysed using observations from the journal club and appraisals of research papers.

The findings point to greater awareness of knowledge gaps, actual research knowledge, an increase in deep approach and a decrease in surface approach to learning for some students. It is concluded that the journal club provides an authentic learning environment suitable for postgraduate students from different disciplines to collaborate, co-operate and generate new ideas.

Keywords: Approaches to learning; Journal club; Pedagogy for higher research; Postgraduate research students.

1. Introduction.

Enabling active learning, whereby students are not passive recipients of knowledge but actively engage in their learning journey, leads to deeper learning and is increasingly important in higher education (Drumm, Rae & Ward, 2019). The present study explores the use of the journal club (JC) as an active learning pedagogy to develop postgraduate research students' critical thinking skills and understanding of research, as well as their confidence in presenting and communicating research evidence.

The JC may be defined as an educational meeting in which a group of individuals meet to discuss published articles, providing a forum for a collective engagement with key pieces of literature (Kleinpell, 2002). The effectiveness of the JC as a pedagogical strategy to promote critical thinking has long been recognised in the medical field, proving highly effective in enabling trainee doctors to critically appraise literature and integrate evidence-based medical practice (Linzer 1987). More recently, journal clubs have emerged in nursing and other allied health professions (Fleenor, Sharma, Hirschmann & Swarts, 2018). Lizarondo, Grimmer-Somer, Kumar and Crockett (2012) also explored the impact of the JC on the knowledge, attitude, and evidence uptake of different allied health professionals. They found that only physiotherapists improved in all outcomes; speech therapists and occupational therapists increased their knowledge but not attitude and evidence uptake; while social workers and dieticians showed positive changes in knowledge and evidence uptake but not attitude. It was concluded that the JC may be used as a single intervention to facilitate evidence uptake for some allied health disciplines but may require additional strategies to influence practice behaviour in other practitioners. Moore, Fawley-King, Stone and Accomazzo (2013) also report on the implementation of the JC for master and doctoral level social work students in the University of Washington. Their findings suggest that the JC can augment the traditional research curriculum for social work students by encouraging them to read and evaluate research and apply it to their practice.

As the prevalence of journal clubs increases, it is important to understand their value to postgraduate pedagogy within the social sciences and educational institutions. The present study explores the impact of a taught component on '*research design and interpretation*' to a postgraduate JC for social gerontology research students.

2. Aims and Objectives of Study.

The overarching aim of this study is to contribute to knowledge regarding the pedagogy involved in building research methods competencies for postgraduate students. The objectives are:

- To explore students' subjective and objective knowledge regarding study design and interpretation.
- To implement changes to the JC learning environment in the form of a short taught component and a template for student appraisals and discussions.
- To explore students' experiences and perceptions of the JC as a vehicle for knowledge and skills development.

3. Literature Review.

Calls for changes to the model for higher research pedagogy seek to disrupt the characteristically hierarchical nature of the master apprenticeship model towards more collaborative and transparent approaches. Within the social and behavioural sciences, it has been speculated that research training is one source of the problems (Borders, Wester, Fickling & Adamson, 2015; Wester, Borders, Boud & Horton, 2013). Henson, Hull and Williams (2010) point to deficiencies in doctoral students' methodological reporting, identify misconceptions and inaccuracies and an over-reliance on traditional methods. An argument is made that a learning environment which is supportive of research methods and design is not consistently available to many applied education researchers. While the unique and one-to-one nature of student-supervisor relationships makes it difficult to investigate the extent of these deficiencies (Haksever & Manisali, 2000), a review of doctoral-level psychology programmes found they required introductory quantitative methods only (Borders et al., 2015). The range of approaches taught for qualitative research was also found to focus largely on historical methods, such as grounded theory and phenomenology rather than newer approaches, such as consensual qualitative research and discourse analysis. Moreover, a review of the literature on dissertation study at the postgraduate level concluded that students often have weaknesses in their abilities to be analytical and critical (Vos, 2013). From the student's perspective, this points to the anxiety often faced by students in researching and writing the dissertation due to the large number of skills required, as well as the need to keep motivated and self-regulate their progress. From the supervisor's perspective, providing the appropriate level of support while allowing the

student to work independently can prove difficult. To compound matters, in many institutions, supervisors are under pressure towards the timely completion of the thesis and urgency can easily over-ride the development of a researcher with a full set of academic competencies (Carter & Kumar, 2017).

How students process and manage information has been shown to determine approaches to learning and affect the quality of learning outcomes (Duff, Boyle and Dunleavy, 2004; Haggis, 2003; Teoh, Abdullah, Roslan & Daud, 2014). Based on qualitative interviews with students, Marton and Säljö (1976) and Marton, Beaty and Dall'Alba (1993) describe six ways in which students conceptualize learning, including increasing knowledge, memorization, factual information for subsequent use, construction of meaning, a process to understand reality, and developing as a person. These give rise to two learning approaches; '*surface learning*' and '*deep learning*.' With surface learning, the student relies heavily on quantitative information, memorizing facts and concepts (Marton & Säljö, 1976). In contrast, with deep learning, students seek to understand the meaning of information and so the focus is on abstraction, understanding reality and developing as a person (ibid). The surface approach to learning has been linked to poor quality processes and outcomes for students, while the deep approach can produce high quality processes and outcomes (Teoh et al., 2014).

Biggs (1987) and colleagues (Biggs & Tang, 2007) expanded the concepts of deep and surface approaches to learning, drawing attention to contributing factors, such as students' tendency to focus on isolated facts which is associated with a surface approach to learning, leading to negative feelings about the learning task, including anxiety, cynicism and boredom (ibid). In contrast, students using a deep approach are intrinsically motivated to learn. They intentionally choose strategies to handle the learning task for the purposes of '*achieving*' academic qualifications or as a means to gain the highest grades. Thus for Biggs, a deep learning approach is associated with an interest in the content of the task and in achieving the highest possible outcomes, so that the student engages deeply with the learning material, connects the parts to each other, builds new ideas from previous knowledge and applies key concepts to personal practice (Biggs 1993).

3.1 A Constructivist Approach to Postgraduate Learning.

Constructivism is an approach to teaching and learning which holds that cognition (or understanding) is the result of how information is conceived. This approach holds that learners

construct or build their own understanding of new information based on previously understood concepts (El Asmar & Mady, 2013). In the context of the present study, set in a social gerontology research centre, this is a key issue as students come from a range of different disciplines, principally healthcare, social care and software development. Some work on projects focused on health; for example, a survey to explore the health of carers, while others focus on technology projects, such as the design of a mindfulness app for older adults. The members of the JC, therefore, bring knowledge acquired in diverse undergraduate degrees and are equipped with discipline-specific information and skills. This makes an interdisciplinary constructivist approach particularly appropriate for the present study, as it gives students the freedom to construct and generate their own understanding based on previously acquired knowledge (ibid).

3.2 Constructive Alignment.

Constructive alignment is concerned with making the intended learning outcomes clear to students and aligning them with the teaching and assessment strategies (Biggs, 1999). In practice, this means being clear about what students are expected to learn, using appropriate methods to encourage them to behave in ways that are likely to achieve the desired outcomes and using an appropriate form of assessment to determine if the desired outcomes have been achieved. Perkins (1999) shows that while most constructivist classrooms feature active, social and creative learning, different kinds of knowledge invite a range of constructivist responses. He argues for an iterative approach to problem-solving, describing this as '*pragmatic constructivism'*, which he argues is a toolbox for the problems of learning. He also identifies '*inert knowledge*' which: '*sits in the mind's attic unpacked except when specifically called for by a quiz or a direct prompt but otherwise gathering dust*' (p.8).

While students commonly learn ideas about society and self over the course of their education, they often make no connections to current events. Perkins also argues one effective strategy is to engage learners in active problem-solving with knowledge that makes connections to their world. Small group collaborations, such as the JC, is a characteristic of problem-based learning (PBL) that is receiving increased consideration in the literature (Dahiya & Dahiya, 2015). In the present study, a small group of students from different disciplines are given information (i.e. the taught component), engage in reviews of selected journal papers (i.e. individual appraisal), and subsequently provide their interpretation, discovery, and critique (i.e. group discussion). For this reason, students submit individual appraisals in advance of group meetings. This is

intended to promote a deep approach to learning, with students encouraged to prepare questions they wish to consider in novel ways (Biggs & Tang, 2007).

Given that the present study involves postgraduate research students, formal assessment is not appropriate. However, in formal education, there exist ample opportunities for collecting evidence of students' understanding (Ruiz-Primo, 2011): for example, informal formative assessment can elucidate students' thinking patterns, allowing these to be considered and shaped as part of constructive learning (ibid). In the present study, a combination of observations (e.g. evidence of higher order thinking), student appraisal of papers and questionnaire data are used to assess learning from pre-to-post introduction of changes to the JC environment.

Support has also grown for the use of more authentic means of assessing students' skills in recent years. Boud (2010) argues that the emphasis needs to be on the processes of acquisition of knowledge and skills, showing how learners can develop their capabilities and those of others. He argues that such an orientation can have profound implications for the way assessment in higher education is conducted, both in initial and continuing professional education.

3.3 Critical Thinking.

Educators have long been mindful of the significance of critical thinking skills for student learning. Dewey (1993) described critical thinking as '*reflective thinking'*…[the] active, persistent, and careful consideration of a belief or supposed form of knowledge in light of the grounds which support it and the further conclusions to which it tends' (p.99-116). Dewey's definition draws attention to the role of learners in participating actively in their own thinking process, by means of reflection, elaboration and interpretation of conclusions and outcomes (Xu, 2011).

The concept of critical thinking and associated skills are essential components of the classification levels in Bloom's taxonomy of learning domains, which provides a basis for classifying learning outcomes and objectives in academic education and beyond (Bloom, Engelhart, Furst, Hill, & Krathwohl, 1956). Comprising three overlapping domains (the cognitive, psychomotor, and affective), this taxonomy provides a means to express a range of intellectual skills and abilities and to organize thinking skills into six levels (Pickard, 2007). From the most basic level of thinking to levels that are more complex, the six levels were identified as:

knowledge, comprehension, application, analysis, synthesis, and evaluation. It was shown that most teaching tends to focus on the transmission of facts and on recalling information (i.e. the lowest level), as opposed to meaningful personal development and this remains a central challenge for educators today.

3.4 Scaffolding of Learning.

Wood, Bruner and Ross (1976) used the metaphor of instructional supports, or '*scaffolds*', to describe assistance given by teachers to support student learning. They describe the ways in which a teacher may help a student with a concept or a task they were initially unable to grasp independently, offering assistance with those skills that are beyond the student's capability. In a similar way, the present study uses the taught component on research design and pre-devised template for an appraisal of papers as scaffolds to elicit contextual, conceptual and procedural knowledge to improve students' skills. The taught component (delivered just prior to the student presentation of the review paper) and the group discussion (based on the same appraisal template) is designed to support deep learning by allowing students to progress sequentially, building on or affirming existing knowledge, and consolidating this over the course of the intervention. The teaching goal is to engage students in discussions on shared tasks, to stimulate deep learning and the promotion of critical thinking strategies and processes (Chin & Osborne, 2008).

4. Methodology.

This study used a mixed methods approach to address a void in the literature on postgraduate student learning, i.e. the JC method. A questionnaire was used to determine students' self-perceived knowledge of research; actual knowledge; approaches to learning; dissemination activities; use of the JC; and confidence in research, prior to the introduction of changes to the JC. Data were augmented by students' appraisals of review papers completed prior to meetings and by supervisor observations of the JC. This type of methodological triangulation, with data drawn from multiple sources, has been seen to broaden insight into the different issues underlying the phenomena being studied (Bekhet & Zauszniewski, 2012).

4.1 Participants.

Postgraduate doctoral students n=7 enrolled in a social gerontology research centre in Dundalk Institute of Technology were invited to take part in this research. The students were at different stages in their doctoral studies, largely in the second or third year, and from different academic disciplines, including healthcare, social care and software development. All were working on projects related to ageing and later life.

4.2 The Intervention.

The intervention comprised four bi-weekly structured meetings of the JC, each lasting for two hours. Meetings commenced with an informal lecture on research design, followed by a 15-minute student presentation of the paper for review and concluded with the group appraisal of the paper. Students submitted their individual appraisals of the paper prior to the meeting using the template provided. Students also completed a pre- and post-intervention questionnaire, described below.

4.3 Data Collection.

4.3.1 Quantitative.

A self-rated knowledge measure (Lentscher & Batig, 2017) comprised six statements of research knowledge (e.g. '*I understand and can describe commonly used study designs such as descriptive studies, randomized controlled trials, cohort studies, and cross-sectional studies*'). Students rated each statement using a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree). For analytical purposes, given the small sample, these 5 response categories were collapsed into three. Interpretation of scores followed that of Lentscher and Batig (2017), with a total score of ≥80% agreement interpreted as a positive self-assessment of research knowledge.

Table 1 describes questions which measured students' actual research knowledge. Scores were calculated by combining correct responses to the below-mentioned nine knowledge questions on: qualitative research design, quantitative research design, recognizing key research design traits, social desirability, trustworthiness in qualitative research, measures of variability, independent variable, statements on quantitative research, and grounded theory. A score of one was given for each correct response. No negative marking was given for no responses, or '*don't know*' responses. Maximum possible score for the knowledge questions

were 5+4+3+1+4+3+1+3+1=25. A score of ≥18 was interpreted as demonstrating a good level of research knowledge.

Table 1: Questions 2-10, assessing objective knowledge.

Q2 Qualitative research design	Students were asked to list five approaches to qualitative research design.
Q3 Quantitative research design	Students were asked to list four quantitative data collection methods.
Q4 Recognizing key research design attributes	Students were presented with five research statements and asked to select all those that were true.
Q5Understanding social desirability	Students were presented with four research statements and asked to select one to explain the affect of social desirability bias.
Q6Trustworthiness in qualitative research	Students were asked to list four ways in which trustworthiness can be upheld in qualitative research.
Q7 Measures of variability	Students were asked to list the three most common measures of variability.
Q8 Recognizing the role of the independent variable	Students were presented with four variables and asked which one described the name of the variable presumed to cause a change in another variable.
Q9 Statements on quantitative research	Students were presented with four statements about quantitative research and asked to select all true statements.
Q10 Grounded theory	Students were presented with three definitions and asked which one described grounded theory.

Students' approaches to learning were explored using The Revised Two-Factor Study Process Questionnaire (R-SPQ-2F), a 20-item questionnaire that categorizes student approaches to learning as either surface or deep (Biggs, Kember & Leung, 2001). The R-SPQ-2F has been used extensively and studied internationally (Biggs et al. 2001; Zakariya, Bjørkestøl, Nilsen, Goodchild & Lorås, 2019; Xie, 2014). It has acceptable Cronbach alpha values for scale reliability and confirmatory factor analysis indicate a good fit to the two-factor structure (Vergara-Harnández & Simacas-Pallares, 2019).

Five questions sought to explore students' use of the JC and perceptions of its value. This included; dissemination activities at conferences and within the JC; frequency of JC attendance; perceptions of impact on research skills; and confidence in doing research.

4.3.2 Qualitative.

To support qualitative data collection and analysis, Bloom's Revised Taxonomy was used to develop higher order questions for use in JC meetings. In Bloom's Revised Taxonomy, verbs are used to reflect the dynamic nature of teacher and student actions: remembering, understanding, applying, analyzing, evaluating and creating. Table 2 presents the list of

questions the researcher designed based on Bloom's categorizations. Starting at the bottom, '*remembering' questions provide the basis for progression of research design skills: for example, 'list characteristics of study type'*. Moving up in complexity, an example of an understanding question is: '*explain independent and dependent variables'*; an applying question is: '*how well did the study design address causation?*' An analyzing question is: '*what is the most important result of the paper?*' An evaluating is: '*how convincing are the arguments in the paper?*' And finally, a creating question is: '*what would you do differently?*'

Table 2: Applying Bloom's taxonomy to support discussions in a Journal club.

Cognitive levels of thinking	Useful verbs to use when setting questions	Sample questions that promote thinking at these levels
Remembering	Tell List Describe State Name	How would you describe the study? (e.g. list characteristics of study type) What type of study is it? Describe the study population (e.g. carers of people with dementia) What was the purpose of the study? Is the research qualitative or quantitative? What is the question this study was designed to answer?
Understanding	Interpret Outline Distinguish Explain Compare Describe	Explain **independent and dependent variables (e.g. i**n a study assessing relationship between informal care and psychological distress, informal care is independent variable because it is assumed it predicts psychological distress).
Applying	Illustrate Show Use Construct Examine Classify Complete Solve	**How well did the study design address causation? (i.e.** identify correlations or associations between variables) Was the argument novel? (e.g. evidence of an exhaustive literature search; different methodology used to answer similar question from previous studies). Were opposing arguments fully considered? What evidence is brought to support the argument (conclusion)? Was the evidence convincing, novel, insightful?
Analyzing	Examine Compare Contrast Distinguish Categorize Explain	**What are the study's results?** What is the most important result of the discussed paper? What is the most interesting aspect of the paper? How was this paper similar to previous papers

		discussed? What was the underlying theme of the results? What do you see as other possible outcomes?
Evaluating	Judge Decide Justify Verify Argue Recommend Assess Rate Determine	How convincing are the arguments in the paper? (evaluate quality of data and arguments, list strengths and weaknesses of arguments). **What limitations do the authors note?** Was there a statistically significant relationship between dependent and independent variables (e.g. consider P-values and the effect size e.g. presented as regression coefficients, odds ratios, population attributable portions). Do you think there are any problems with the design? (e.g. selection bias e.g. differences in the intervention, or unblinded investigator) To what extent does the study demonstrate validity?
Creating	Create Plan Predict Design Imagine Propose	Would you do anything differently? Could you improve the paper? What use could you make of this research? Could you replicate this research?

A priori codes for cognitive levels of thinking relevant to Bloom's taxonomy were also used to identify qualitative information in student appraisals of review papers and in supervisor observation notes. Informed consent was obtained from study subjects, prior to their participation in the research. Ethical approval for the study was provided by the researchers' institution.

4.4 Results.

Data analysis and graphical representation was carried out MS Excel 2013 software.

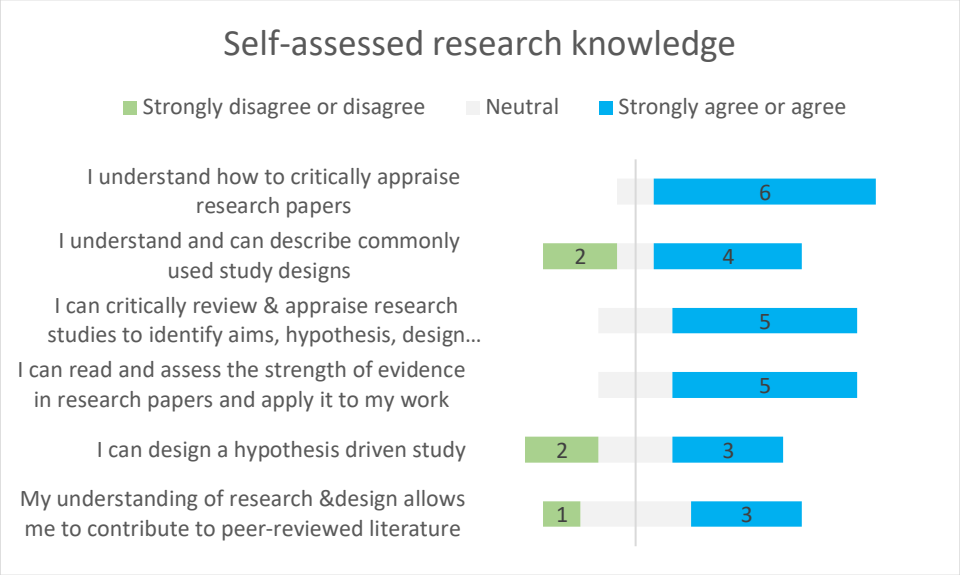
4.4.1 Quantitative data analysis.

Self-assessed research knowledge.

Prior to the intervention, most students (n=6) believed they had a good knowledge of certain aspects of research, with 6 strongly agreeing or agreeing with the statement, '*I understand how to critically appraise research papers*'. As Figure 1 suggest, they were somewhat less positive in their knowledge of study design, with just three students strongly agreeing or agreeing with

statement five: '*I can design a hypothesis driven study*' and a further two strongly disagreeing or disagreeing with this. Similarly, just three students strongly agreed or agreed with statement six: '*My understanding of research and design allows me to contribute to peer-reviewed literature*'.

Figure 1: Self-assessed research knowledge, pre-intervention, all students (n=7).



To compare how students assessed their research knowledge after the intervention, only those for whom full data were available were included in the pre-to-post analyses (n=3). The results point to a slight improvement in assessment of knowledge of study design, as well as awareness of gaps in knowledge (Table 3). Student 1 moved up from strongly disagree/disagree to agree/strongly agree on the statement: '*I understand and can describe commonly used study designs*'. Student 1 moved down from neutral to strongly disagree/disagree on the statement: '*My understanding of research and design allows me to contribute to peer-reviewed literature*', and student 3 moved up from neutral to agree/strongly agree on the same statement, suggesting greater awareness of knowledge gaps.

Table 3: Self assessed research knowledge, pre-to-post intervention (n=3).

	Pre			Post		
I understand how to critically appraise research papers						
Student	**Strongly disagree/ disagree**	**Neutral**	**Agree/ strongly agree**	**Strongly disagree/ disagree**	**Neutral**	**Agree/ strongly agree**
1						
2						
3						
I understand and can describe commonly used study designs						
1						
2						
3						
I can critically review/appraise studies to identify aims/ hypothesis/ design / biases						
1						
2						
3						
I can read/assess the strength of evidence in research papers and apply it to my work						
1						
2						
3						
I can design a hypothesis driven study						
1						
2						
3						
My understanding of research &design allows me to contribute to peer-reviewed literature						
1						
2						
3						

Table 4. Objective research knowledge.

	Pre-training	**Post-training**
Student	**Raw score out of 25**	**Raw score out of 25**
1	21	22
2	22	24
3	12	n/a
4	14	n/a
5	19	n/a
6	15	18
7	18	n/a
Mean	**17.3 (SD 3.7; SEM 1.4)**	**21.3 (SD 3.1; SEM 1.8)**

Questions designed to measure students' actual research knowledge were scored out of a possible 25, with a score of ≥18 considered a good level of knowledge. Prior to the intervention, raw scores for students ranged from 12 to 22, with a mean score of 17.3. Table 4 shows post-training raw scores were 21.3, with the raw scores increasing for all three students for whom full data were available.

Approaches to learning.

Table 5 presents analysis for responses to the R-SPQ-2F (Biggs et al., 2001) pre-to-post intervention. This shows that students have higher scores on deep approach to learning compared to surface approach, suggesting that students preferred to employ a deep approach in their learning for research and design. This is not surprising given that the participants are postgraduate students and thus likely to be highly motivated to learn. Nonetheless, the results do show increases for deep approach to learning for the three completing students, pointing to the potential importance of the changes which the intervention made to the learning environment.

Table 5: Distribution of learning approaches, pre-to-post intervention.

ID	Pre-intervention		Post-intervention	
	Deep	Surface	Deep	Surface
Student 1	27.00	16.00	28.00	17.00
Student 2	40.00	13.00	43.00	14.00
Student 3	31.00	20.00	n/a	n/a
Student 4	34.00	20.00	n/a	n/a
Student 5	32.00	22.00	n/a	n/a
Student 6	39.00	17.00	43.00	16.00
Student 7	30.00	21.00	n/a	n/a

Table 6 shows pre-to-post intervention mean score for participating students. Pre-intervention mean score for the 7 participating students was 33.28 (SD = 4.75), for deep approach, with a mean score of 18.42 (SD = 3.20) for surface approach. Post-intervention, deep approach mean score for the three completing students was 38.0 (SD =8.66), with a mean score of 15.66 (SD =1.52) for surface approach.

Table 6: Distribution of learning approach, all students (n=7).

	Pre-intervention mean score (*SD*)	Post-intervention mean score (SD)
Scale	N=7	N=3
Deep Approach	33.28 (*SD* = 4.75)	38.0 (*SD* =8.66)
Surface Approach	18.42 (*SD* = 3.20)	15.66 (*SD* =1.52)

In line with previous research (Hulreski, Syatriana, and Ardiana 2020), the two learning approaches were calculated further by classifying the scores as follows: 10-19 as low score, 20-29 as moderate score, 30-39 as high score, 40-50 as very high score (Table 7).

Table 7: Cross tabulation of deep and surface approach to learning.

		Deep Approach Score									
		Pre-intervention					Post-intervention				
Surface Approach		10-19 low	20-29 moderate	30-39 high	40-50 very high	Total	10-19 low	20-29 moderate	30-39 high	40-50 very high	Total
	10-19 (low)										
	20-29 (moderate)		1			1		1			1
	30-39 (high)			5		5					
	40-50 (very high)				1	1				2	2
	Total students					7					3

As Tables 5 and 6 suggest, all seven students adopted both deep approach and surface approaches to learning. As shown in Table 7, 5 students received high scores (30-39) and one student received a very high score (40-50) in deep approach after filling the items on the R-SPQ-2F prior to the intervention. 5 students gained high scores (33.2) on deep approach, four of whom had moderate scores (20.7) on surface approach. The accumulation of scores drawn from Table 5 shows that students 3, 4, 5, 6 and 7 had high scores (31, 34, 32, 36, 30 =32.6 mean score) on deep approach.

Table 8 presents pre-to-post scores for the three completing students, showing increases in deep approach. Student 1 increased from 27.00 at pre-intervention to 28.00 at post intervention, student 2 increased from 40.00 to 43.00 and student 3 from 39.00 to 43.00 for deep approach at post intervention. At the same time, two students had slightly higher scores for surface approach at post intervention.

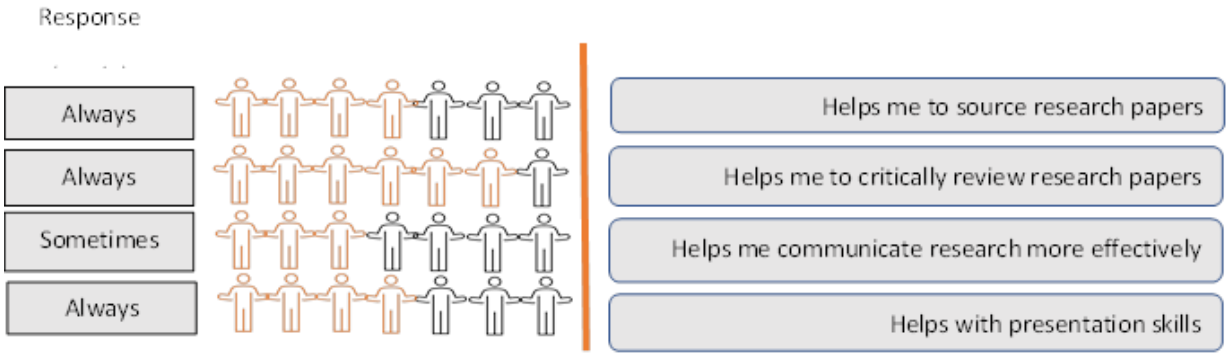
Table 8: Distribution of learning approach (n=3).

ID	Pre-intervention		Post-intervention	
	Deep	Surface	Deep	Surface
Student 1	27.00	16.00	28.00	17.00
Student 2	40.00	13.00	43.00	14.00
Student 6	39.00	17.00	43.00	16.00

Dissemination, usage of JC, and confidence in research.

The results confirm that all students have engaged in research dissemination activities, whether at conferences, with poster and oral presentations, or to peers within the JC. In addition, most (n=6) reported that they attended the JC '*regularly*', with just one student attending *'occasionally'*. Figure 2 suggests students believe they have benefitted from participation in the JC, with most agreeing that it helps them to source research papers, critically review papers and presentation skills, and a similar number indicating that it '*sometimes*' helps them to communicate research more effectively. Response options included '*always*', '*mostly*', '*sometimes*' and '*never*'.

Figure 2: Perceptions of impact of participation in JC on research skills (n=7).



The results point to a small increase, pre-to-post intervention, for self-reported confidence in research skills, with student 1 moving up from 'sometimes' to '*always*' for the statement: '*I am confident when speaking about research to my peers'*. No changes were recorded for other statements including: '*I am confident in sourcing literature'*, '*I am confident in reviewing research papers'*, '*I am confident when presenting research at a conference'*, and *'I am confident in reviewing research papers*'. Response options included '*always*', '*mostly*', '*sometimes*' and '*never*'.

4.4.2 Qualitative data analysis.

Levels of cognitive thinking among students.

Table 9 provides information about the number of students observed using or providing written quotes for each of the six levels of cognitive thinking in Bloom's taxonomy and the total number of quotes coded for each.

Table 9: Number of students and coded excerpts for cognitive levels of thinking.

Cognitive levels of thinking	Number of students with relevant quotes	Total number of quotes coded
remembering	7	40
understanding	7	33
applying	6	45
analyzing	6	41
evaluating	5	29
creating	3	16

5. Discussion.

5.1 Learning Environment.

The findings from this study show that changes to the learning environment for postgraduate research students (a short taught component, a review template for appraisals, and one hour discussion) were associated with greater awareness of knowledge gaps; actual research knowledge; an increase in deep approach; and a decrease in surface approach to learning for some students.

Subjective, perceived or self-assessed knowledge is how much an individual thinks he or she knows about a topic, whereas objective knowledge is how much the individual actually knows about it. While students showed some awareness of gaps in their research knowledge prior to the intervention, this increased with the changes introduced to the JC, with participating students showing notable signs of greater awareness of gaps. Importantly, actual knowledge increased post-intervention, lending support for changes to the learning environment of postgraduate students.

The findings suggest that changes made to the learning environment operationalized scaffolding

by making it more explicit in the JC. The tailored taught programme given at the start of JC meetings, supported deep learning by allowing students to build on existing knowledge over the course of the intervention. Students came to meetings with prepared questions to discuss, their differing perspectives serving to stimulate them to build their skills in critical thinking, evaluation and prediction evaluating. This type of group discussion about a shared task has been seen to provide '*collective scaffolding*' for students in co-construction of knowledge through negotiated meaning with peers (Ahn & Class, 2011). Chin and Osborne (2008) argue this process helps students recognise faulty reasoning and invalid assumptions, generate explanations, construct hypotheses, identify evidence that supports or refutes a hypothesis, evaluate options in a logical manner and make links between seemingly disparate ideas.

Previous research has shown that the learning environment can influence students' learning approaches (Hall, Ramsay & Raven, 2004; Law, Geng & Li, 2019). This was supported by the findings from the present study which point to a small change in deep approaches to learning for participating students and a slight increase in surface approach for some. This provides a positive, albeit small, signal to higher education providers about the potential benefits of changes to the learning environment for postgraduates. These positive outcomes concur with the findings from a large survey of 1713 students enrolled in 80 courses from a public university in Germany found teacher-guided methods were strongly associated with an increase in students' cognitive involvement, interest, learning achievement, and development of academic competencies (Fischer & Hänze 2019). In contrast, student-activating methods tended to show negative effects.

While the present study has shown positive outcomes, it is not possible to conclude that the changes in the learning environment caused the changes in subjective and objective knowledge or students' approaches to learning. We can only conclude there was an observed, but small, change in students' knowledge and approaches to learning at the same time as changes to the learning environment were introduced into the JC. Such findings can nonetheless make an important contribution to the limited literature available in this area. We can also say that the students themselves believe the JC is beneficial for their learning. They engaged in a range of dissemination activities, and most attended the JC on a regular basis, suggesting they are highly motivated, which can be a strong determinant of important life outcomes, including educational attainment and professional development (Fischer & Sliwka 2018).

The findings suggest the combination of the taught component, appraisal template and

discussion engaged all levels of Bloom's taxonomy. Importantly, it did so in an interdisciplinary context, giving students a new framework that echoes the traditional JC format, with scaffolding to promote a novel educational experience for experimenting and exploring design beyond their own disciplines. In addition, because the students need to incorporate different perspectives, they work more intensively on communicating their work to a broader audience. The interdisciplinary environment thus enriches students' thinking and allows them to make more effective progress in their learning (ibid).

Developing an educational intervention for postgraduate research students from different disciplines is challenging. However, the ongoing work and development of the JC offers the opportunity to build on existing postgraduate pedagogy and student learning. In addition, sharing our work with other academics through publication will allow us to gain feedback and to update the content of the JC with evolving evidence.

5.2 Limitations and Future Directions for Research.

This research, while limited in size, has sought to capture some of the complexity attached to postgraduate pedagogy. The number of participants is small because research students typically work on grant-funded projects and these are limited to the capacity of the research centres involved. However, the methods generated rich data, so while this study could be criticised for using a small and unrepresentative sample, given postgraduate learning has largely been ignored in the literature, and that postgraduate students are the most likely to experience the full range of research designs, this study offers depth and richness of data in a multidisciplinary JC. Future studies can build on the present research by incorporating a larger sample size through collaboration with other learning settings to offer the same intervention elsewhere.

6. Conclusion.

When students receive scaffolding for critical thinking, they engage all levels of Bloom's taxonomy in a multidisciplinary JC. In operationalizing scaffolding by means of a suitable appraisal template for critical thinking and training in research skills, student engagement and critical thinking skills are enriched. Moreover, consistently applying scaffolding techniques develops students' questioning strategies to become more systematic, as they evaluate options in search of answers.

Learning at this level reflects a higher understanding and deeper insights suggesting that the JC provides an authentic learning environment suitable for postgraduate students from different disciplines to listen, cooperate and generate new ideas. This study contributes to understanding of higher education postgraduate pedagogy in the multidisciplinary JC, although there is scope for further investigation in this area. This is particularly warranted due to the dearth of information related to interdisciplinary postgraduate teaching and learning that currently exists in the literature.

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