Journal Club – A Pedagogy Tool of Research and Postgraduate Education

Pedagogiskt docenturarbete

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Background

During research and postgraduate education, the study of other scientific articles is a vital component leading to critical thinking and research autonomy (Topf, 2017), mainly because this effort requires a broad knowledge of basic elements that include:

1) the type of study we critically analyze (epidemiological, clinical, basic research, systematic review, meta-analysis),
2) how it is designed,
3) the structure of the research work,
4) the content of each section of the article,
5) the statistical evaluation, and
6) the presentation of research data.

Hence, critical analysis of a scientific article, basically, involves an inspection and understudying in depth for biases (systematic or random), shortages or limitations in research that can lead either to erroneous results or to conclusions that do not have any scientific or clinical value (Young & Solomon 2009). Critical analysis of a scientific article, therefore it can be considered a process through which we are asked to answer questions such as: What does the survey say? Was it worth it? Why was this research effort important? What is the validity of the methodological approach? What are the questions that have been answered and what remains to be answered? Briefly, it is a process of assessing how important research findings are and what we can learn of them for the scientific research training and the clinical work of the reader as well (Millichap & Goldstein 2011).

Given this background, postgraduate students need to learn specific skills in searching literature, appraising it and incorporating it into research education and practice. One reliable method to challenge ourselves as supervisors and our doctoral students in timely and effective critical analysis of scientific articles is by applying a Journal Club (Honey & Baker 2011). A journal club (JC) has been defined “as an educational meeting in which a group of individuals discuss current articles, providing a forum for a collective effort to keep up with the literature” (Dwarakanath & Khan 2000).

Aim

In this work, I intend to discuss and to reflect the topic of JC as an advanced teaching method to facilitate learning and to promote critical appraisal skills, collaboration, and creativity in research and postgraduate education. JC is not something new and its application
in medical education is approaching 200 years (Topf et al 2017). However, its application within multidisciplinary research and postgraduate education is lacking.

**Methodology**

To provide a useful starting point for this topic, I used the method of narrative literature review (Baker 2000) focusing primarily on the existing data of JCs in relation to postgraduate education, through searching in PubMed and ERIC databases.

This literature review is divided into four sections. In the first section I discussed the nature of JCs alongside with a consideration of the literature particularly focusing on research education and learning objectives. In the second section I provided some major components of a successful JCs in order to facilitate learning in research and postgraduate education. In the fourth section, I provided an example of how to prepare a presentation in a journal club. Finally, in the fifth section, I reflected my own experience participating in JCs during my Ph.D. studies and I concluded why JC is a useful tool to promote critical appraisal skills, collaboration, and creativity in research and postgraduate education.

**Literature Review**

I. Journal club in relation to research and postgraduate education

According to the contemporary trends in higher education, the ultimate goal of teaching is to facilitate learning (Dahiya and Dahiya 2015). Especially, the research and postgraduate education should focus on deep learning because only deep learning has the ability to help trainees to gain a better understanding of the subject matter itself. On the other hand, surface learning, which basically encompasses only memorizing and reproducing information, very often it has been forgotten soon after an examination. As Dahiya and Dahiya (2015) suggested "deep learning develops through steps that allow constant refinement of newly acquired knowledge". Khan and Gee (1999) have already suggested that the steps that that allow constant refinement i.e., deep learning can be applied in JCs (Figure 1; Table 1). For example, many JCs have merged pedagogy theories and methods such as active learner participation, group discussion, tutorial, and problem-based learning (Dahiya and Dahiya 2015) in their format to facilitate deep learning. These methods have been found to provide benefits associated with effective JCs (Dahiya and Dahiya 2015).

Hence, the educational role of the JC is primarily target on objectives and learning outcomes that encourage research utilization. In addition to enabling members to keep abreast of the current scientific literature, the main objective of a JC is to teach traditional research
methodology, clinical epidemiology and statistics as well as the new trends on research methodology and biostatistics including advanced methods like systematic reviews and meta-analyses (Deenadayalan et al 2008). It also provides a platform to discuss how study results can be applied to research practice and to teach methods of grading the level of evidence from randomized controlled trials and systematic reviews with meta-analysis (see Checklist for evaluation of a systematic review on Appendix). It also provides an opportunity for social interaction and communication through exchanging of insights regarding research problems and questions problems (Afifi et al 2006). The core learning outcomes include the developing of critical appraisal skills, communication, collaboration, and creativity (Colthorpe et al 2014).

**Figure 1** The circle of acquisition of knowledge in a Journal Club (Khan & Gee 1999)

Thus, in this context a JC is of immense importance if we consider that the ultimate goal of a research and postgraduate education is to prepare highly skilled and autonomous researchers. Top universities all over the world use this tool as a way of sharing research educational resources via structured monthly meetings to argue over the strengths, weaknesses, and clinical or research applications of landmark selected articles from the current literature (Topf et al 2017).
II. Components of a successful JC in research and postgraduate education

As previously stated, a successful JC is associated with increased critical thinking and know-how in appraising the scientific literature. Without critical thinking and other learning outcomes the JC converts to a simply exercise for presentation skills (Dahiya and Dahiya 2015). The learning outcomes of the JC in research and postgraduate education, therefore, should be clearly delineated. As shown in Table 1 these should include acquisition of skills for problem defining, searching, evaluating and applying scientific literature (Khan and Gee 1999). Unsuccessful JCs often occur when no research goals or objectives are established, and when they simply turn into a summary of presentation of random articles, without attention to update research methods, critical evaluation of results and open discussion (Millichap and Goldstein, 2011). To avoid these circumstances, the use of a structured format when presenting articles (see example in Appendix) is strongly recommended. According to a published review, the components of a fruitful JC, should include: regular and anticipated meetings, mandatory attendance, clear long- and short-term purpose, appropriate meeting timing and incentives, an expert to the field leader to choose papers and lead discussion, circulating material prior to the meeting, using the internet for wider dissemination and data storage, using established critical appraisal processes and summarizing seminars findings (Deenadayalan et al 2008). Additionally, the functioning of these seminars can be assessed by monthly internal assessment by attendees (see Journal Club Evaluation Checklist in Appendix).

III. How to prepare a presentation in a journal club

Outlined here is an example from the Neurology Journal club of the basic elements of a journal club presentation. The main steps include (Millichap and Goldstein, 2011):

1. Article selection. Choose an interesting and scientifically sound article within your field of expertise with the help of your supervisor or colleagues, if needed.

2. Article presentation. Provide a structured presentation of the chosen article with the help of the following questions per article sections

   Background and significance

   • What is already known on the subject? Provide a brief (1–2 sentence) summary of the background.
• How does this study add to the available literature? Provide a brief (1–2 sentence) conclusion.

**Hypothesis and design**

• What is the research question?
• Is this question relevant? Briefly describe the context of the question.
• Is the hypothesis reasonable?
• What type of study was performed (e.g., randomized controlled, retrospective cohort, case control, or meta-analysis)?
• Is the type of study performed feasible to test the hypothesis?

**Methods**

• What methods were used?
• Why were these methods chosen?
• What population was studied?
• What was the intervention or exposure?
• What was the control?

**Results**

• What are the results? Summarize the results relating to the primary research question.
• Are the results valid? Focus on the methods and form of statistics used.

**Interpretation**

• Discuss the strengths and weaknesses.
• Do the results support the conclusions?
• Does this study change clinical practice?
• **Recourses for help.** There are several links online to help presenters to prepare a journal club.

https://wilkes.libguides.com/c.php?g=191962&p=1266771
https://guides.mclibrary.duke.edu/ebmtutorial/selecting-a-resource
https://www.cebm.net/

**IV. Reflection and conclusions**

During my PhD studies on Epidemiology, I had the opportunity to actively participate as a presenter and an audience in such forms of postgraduate training programs. We had regular monthly structured meetings and all members of the faculty actively participated according to the guidelines of a fruitful JC, as previously described (Deenadayalan et al 2008). Not only
postgraduate students but also faculty members served as presenters. This was particularly important because both the presenters and the audience, irrespectively of their academic degree learned to (Tallman and Feldman 2016):

1. Be scholars, including the language, methods, context, and analysis that are used to generate further research.
2. Form a professional network consisting of inexperienced and experienced researchers.
3. Give feedback and collaboratively problem solve with other peers.

Each presenter, then, using power point presented a selected scientifically sound meta-analysis article about 30 minutes followed by a discussion (about 20 minutes) focusing on core elements of meta-analysis methodology and interpretation of the results. Possible biases were also discussed. The informal and comfortable nature of JC alongside with the educational profile offered a common room to increase my scientific knowledge by exchanging opinions and reflective interaction among the attendees. The latter is supported by the work of Colthorpe et al (2014) who found that the improvement in student learning outcomes was significantly greater with peer feedback than with academic feedback alone, suggesting that performing peer review provides students with additional benefits.

Beyond this, my participation in JCs motivated my future research goals because they stimulated my induction with respect to the understanding of scientific knowledge. In an effective and comfortable way, because no grades were given, I taught methods and standards of communicating and sharing my and others research findings, and how to ask and answer on critical research questions. According to my experience, by participation to these seminars, a young researcher has the opportunity to understand from a closer distance how an experienced scientist thoroughly evaluate a research project (reflective learning from the experts). Indeed, JCs have been found to promote a shared knowledge base, greater appreciation for discipline-specific insights, and collegial relationships among the participants (Colthorpe et al 2014). Thus, the attendees, regardless of area of specialization, can observe by the given feedback from experienced colleagues the way of critical thinking on an actual research problem. A systematic review found that JCs improve the reading habits and critical thinking in the attendees (Honey and Baker, 2011) and another survey found a statistically significant improvement in competency in practice-based learning (Lee
et al 2006). This could have many advantages in a modern and multidisciplinary research education because it can facilitate the ongoing research education by allowing the attendees to be exposed to opinions from within and outside their own research agenda and encouraging the development of a research network across faculty, students, supervisors, and peers, in order to promote a supportive and collaborative research community. Steinbronn and Merideth (2008) suggested “making learning outcomes meaningful in the teaching environment by engaging students actively in their own learning through student-to-student, student-to-teacher, and student-to-content to build collaborative skills”. This engagement is well-applicable in a JC.

To sup up, JC is able to serve different educational purposes (Millichap and Goldstein, 2011) and, therefore, I strongly believe that JCs are robust parts to deliver high-quality research education within a medical faculty according to the principles of Linkoping’s University.

References


17. https://www.cebm.net/
Table 1. The journal club module in research and postgraduate education

Timetabling
Monthly meetings lasting 1 hour every first Monday except on public holidays

Aim
To familiarize journal club members with the use of evidence from scientific literature in guiding research decision making

Objectives
To prepare journal club members to identify, appraise and present in turn published landmark selected articles from the current literature.

Learning outcomes
At the end of each journal club session, the presenter should be comfortable with:

- framing research questions in an answerable form
- conducting a simple search for an electronic bibliographic database to identify relevant articles
- critical appraisal of the article for validity, significance of results and clinical applicability
- recording the above information in an electronic form using computer software

Reading/learning resource
Before the journal club presentation, the presenter will receive a relevant methodological paper from the current literature. Using the guidelines in these papers the presenter will appraise articles from the medical literature to inform research decision making regarding a current research problem. Computer software will be provided for making an electronic record of the critically appraised topic.

Learning/teaching methods
For each journal club presentation, the teaching and learning strategy would involve:

- deciding how to respond to a research scenario (small-group discussion)
- understanding the methodological guidelines for critical appraisal (independent learning, one-to-one tutoring and peer tutoring)
- appraisal of research paper using the methodological guidelines (independent learning, one-to-one tutoring and peer tutoring)
- deciding how to respond to the findings of research article (small-group discussion)

**Contact time**

1 hour (one-to-one tutoring)

1 hour (peer tutoring, small-group discussion and feedback during journal club session)

**Postgraduate-directed learning**

1± 2 hours (independent learning)

**Assessment**

- Peer assessment of learning objectives and feedback at the end of journal club session
- Self-assessment
- The critical appraisal of articles forms part of trainees’ progress record in their personal development.
Appendix

Journal Club Evaluation Checklist

Student Name: ______________________________ Date: __________
Supervisor Name: __________________________ Site: __________________

Evaluation Criteria: (out of 40 possible points)

1. Provided background information about the topic discussed in the journal article (i.e. introduced the topic before proceeding into the article "specifics.") (2 pts)

2. Provided a brief summary (overview) of the journal article before performing analysis. (2 pts)

3. Described the rationale for conducting the study. (2 pts)

4. Stated study objectives and hypothesis. Able to determine the null hypothesis. (3 pts)

5. Appropriately described overall study design (including primary/secondary endpoints). (4 pts)

6. Described the characteristics of the study population (inclusion/exclusion criteria). (2 pts)

7. Explained potential influence of the excluded patient population on study results. (2 pts)

8. Identified potential sources of bias. Explained how investigators overcame bias where possible. Explained how he/she would overcome/control for bias in this study. (3 pts)

9. Appropriately assessed whether drug doses and regimens reflect the current standard of care and whether duration of the study was adequate to achieve a therapeutic effect. (3 pts)

10. Explained the reliability of the measurement tool used in determining outcomes and defined/assessed all operational definitions. (3 pts)

11. Identified and assessed the appropriateness of all statistical tests used. (4 pts)

12. Reviewed all of the data obtained in the study (especially as related to the primary and secondary endpoints and safety), provided synopsis of main points for audience, and assessed to ensure data in the tables and figures coincided with text/identified dropouts or if there was missing data (4 pts)

13. State the author’s conclusions and if they were valid based upon the study’s objectives and results. (2 pts)

14. Able to articulate whether statistical significance (or lack thereof) correlates to clinical significance and how the results of the study can be used in practice. (2 pts)

15. Stated the limitations and strengths of the study. (2 pts)

_____________/40 possible points TOTAL
### Checklist for evaluation of a systematic review

#### What question (PICO) did the systematic review address?

<table>
<thead>
<tr>
<th>What is the question being addressed?</th>
<th>Where do I find the information?</th>
</tr>
</thead>
<tbody>
<tr>
<td>The main question being addressed should be clearly stated. The exposure, such as a therapy or diagnostic test, and the outcome(s) of interest will often be expressed in terms of a simple relationship.</td>
<td>The <strong>Title</strong>, <strong>Abstract</strong> or final paragraph of the <strong>Introduction</strong> should clearly state the question. If you still cannot ascertain what the focused question is after reading these sections, search for another paper.</td>
</tr>
</tbody>
</table>

This paper: **Yes**  **No**  **Unclear**

Comment: _______________

#### F - Is it unlikely that important, relevant studies were missed?

<table>
<thead>
<tr>
<th>What is the starting point for comprehensive search for all relevant studies?</th>
<th>Where do I find the information?</th>
</tr>
</thead>
<tbody>
<tr>
<td>The starting point for comprehensive search for all relevant studies is the major bibliographic databases (e.g., Medline, Cochrane, EMBASE, etc) but should also include a search of reference lists from relevant studies, and contact with experts, particularly to inquire about unpublished studies. The search should not be limited to English language only. The search strategy should include both MESH terms and text words.</td>
<td>The <strong>Methods</strong> section should describe the search strategy, including the terms used, in some detail. The <strong>Results</strong> section will outline the number of titles and abstracts reviewed, the number of full-text studies retrieved, and the number of studies excluded together with the reasons for exclusion. This information may be presented in a figure or flow chart.</td>
</tr>
</tbody>
</table>

This paper: **Yes**  **No**  **Unclear**

Comment: _______________

#### A - Were the criteria used to select articles for inclusion appropriate?

<table>
<thead>
<tr>
<th>What is the eligibility criteria?</th>
<th>Where do I find the information?</th>
</tr>
</thead>
<tbody>
<tr>
<td>The inclusion or exclusion of studies in a systematic review should be clearly defined a priori. The eligibility criteria used should specify the patients, interventions or exposures and outcomes of interest. In many cases the type of study design will also be a key component of the eligibility criteria.</td>
<td>The <strong>Methods</strong> section should describe in detail the inclusion and exclusion criteria. Normally, this will include the study design.</td>
</tr>
</tbody>
</table>

This paper: **Yes**  **No**  **Unclear**

Comment: _______________

#### A - Were the included studies sufficiently valid for the type of question asked?

<table>
<thead>
<tr>
<th>What is the quality of each study?</th>
<th>Where do I find the information?</th>
</tr>
</thead>
<tbody>
<tr>
<td>The article should describe how the quality of each study was assessed using predetermined quality criteria appropriate to the type of clinical question (e.g., randomization, blinding and completeness of follow-up)</td>
<td>The <strong>Methods</strong> section should describe the assessment of quality and the criteria used. The <strong>Results</strong> section should provide information on the quality of the individual studies.</td>
</tr>
</tbody>
</table>

This paper: **Yes**  **No**  **Unclear**

Comment: _______________

#### T - Were the results similar from study to study?

<table>
<thead>
<tr>
<th>What is the heterogeneity?</th>
<th>Where do I find the information?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ideally, the results of the different studies should be similar or homogeneous. If heterogeneity exists the authors may estimate whether the differences</td>
<td>The <strong>Results</strong> section should state whether the results are heterogeneous and discuss possible reasons. The forest plot should show the results of the chi-</td>
</tr>
</tbody>
</table>

This paper: **Yes**  **No**  **Unclear**

Comment: _______________
are significant (chi-square test). Possible reasons for the heterogeneity should be explored. Square test for heterogeneity and if discuss reasons for heterogeneity, if present. This paper: Yes  No  Unclear

Comment:

How are the results presented?

A systematic review provides a summary of the data from the results of a number of individual studies. If the results of the individual studies are similar, a statistical method (called meta-analysis) is used to combine the results from the individual studies and an overall summary estimate is calculated. The meta-analysis gives weighted values to each of the individual studies according to their size. The individual results of the studies need to be expressed in a standard way, such as relative risk, odds ratio or mean difference between the groups. Results are traditionally displayed in a figure, like the one below, called a forest plot.

<table>
<thead>
<tr>
<th>Comparison: 03 Treatment versus Placebo</th>
<th>Outcome: 01 Effect of treatment on mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Study</td>
<td>Treatment n%</td>
</tr>
<tr>
<td>Brown 1998</td>
<td>24 / 472</td>
</tr>
<tr>
<td>Goa 1987</td>
<td>120 / 2850</td>
</tr>
<tr>
<td>Meen 1986</td>
<td>5 / 61</td>
</tr>
<tr>
<td>Peters 2000</td>
<td>31 / 798</td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>236 / 6242</td>
</tr>
</tbody>
</table>

Test for heterogeneity: \( \chi^2 = 0.92 \) df=4 \( p = 0.92 \)
Test for overall effect: \( z = -4.92 \) \( p = 0.0001 \)

The forest plot depicted above represents a meta-analysis of 5 trials that assessed the effects of a hypothetical treatment on mortality. Individual studies are represented by a black square and a horizontal line, which corresponds to the point estimate and 95\% confidence interval of the odds ratio. The size of the black square reflects the weight of the study in the meta-analysis. The solid vertical line corresponds to 'no effect' of treatment - an odds ratio of 1.0. When the confidence interval includes 1 it indicates that the result is not significant at conventional levels (\( p > 0.05 \)).

The diamond at the bottom represents the combined or pooled odds ratio of all 5 trials with its 95\% confidence interval. In this case, it shows that the treatment reduces mortality by 34\% (OR 0.66 95\% CI 0.56 to 0.78). Notice that the diamond does not overlap the 'no effect' line (the confidence interval doesn't include 1) so we can be assured that the pooled OR is statistically significant. The test for overall effect also indicates statistical significance (\( p < 0.0001 \)).

Exploring heterogeneity

Heterogeneity can be assessed using the "eyeball" test or more formally with statistical tests, such as the Cochran Q test. With the "eyeball" test one looks for overlap of the confidence intervals of the trials with the summary estimate. In the example above note that the dotted line running vertically through the combined odds ratio crosses the horizontal lines of all the individual studies indicating that the studies are homogenous. Heterogeneity can also be assessed using the Cochran chi-square (Cochran Q). If Cochran Q is statistically significant there is definite heterogeneity. If Cochran Q is not statistically significant but the ratio of Cochran Q and the degrees of freedom (Q/df) is > 1 there is possible heterogeneity. If Cochran Q is not statistically significant and Q/df is < 1 then heterogeneity is very unlikely. In the example above Q/df is <1 (0.92/4= 0.23) and the p-value is not significant (0.92) indicating no heterogeneity.

Note: The level of significance for Cochran Q is often set at 0.1 due to the low power of the test to detect heterogeneity.