



How to...

Critique a scientific article: a beginner's guide

Gill Marshall outlines the potential shortcomings of the review process that precedes the publication of an article, exploring why it is important to read scientific articles in a questioning, critical way and giving some points to consider when doing so. Over the page, Sean Kelly then explains why critically reading published work is a useful CPD activity and how it can be recorded.

Why is it necessary to critique published articles?

Scientific articles are published in many fora – on line, in conference proceedings, in peer reviewed journals such as *Radiography*, and in publications such as *Synergy*, where the review prior to publication is undertaken by the members of the Editorial Board.

At its most rigorous, review of material prior to publication in scientific journals is undertaken by two (peer) reviewers blinded to the comments of the other. Even with this level of scrutiny, there is acknowledgment by academics that this can be an imperfect process¹, which is potentially subject to bias, conflicts of interest and lack of reviewer expertise in the specific area^{2,3,4}. Hence, it must not be assumed that the publication of an article is a measure of its worth².

Readers should not therefore, take what is read at face value. They should consider the work with a critical mind in order to make informed decisions, for example, regarding whether to change practice based on what has been read⁵ or whether the work is suitable as a basis for future research.

Critical evaluation is defined as: *a systematic way of considering the truthfulness of a piece of research, the results and how relevant and applicable they are*⁶.

The best way to critique an article is by systematically reading each section and questioning all the key features. There are comprehensive texts regarding how to critique research articles⁷ and this topic is also covered in most research textbooks. This article is intended to offer a more general approach to critical reading of any published article.

Structure of an article

The content should be divided up into sections appropriate to the subject matter. The structure will differ depending on whether the article represents empirical research, a review, or a case study. The divisions should facilitate the reader in finding their way through the writing. At the very least, there should be a clear introduction to the purpose and scope of the work, a main body of the article, and then a conclusion that does not introduce any new information but brings to the readers' attention the key findings/pertinent points made in the article. Irrespective of the sections into which the article is divided,

the key thing is to question whether the section heading is appropriate to what follows, and also whether what is said is justified either by the findings presented or by reference to the literature base. Below is a way to evaluate a scientific article which can be modified to suit most articles published.

◆ **Title:** this may be better judged after reading the article^{3,5}. It should precisely and concisely reflect the content of the work. It should not contain jargon or buzz words that are not directly relevant but should stimulate the interest of readers and encourage them to read it⁴. A good title does not, however, mean the article is a worthy one.

◆ **Introduction:** this usually contains evidence of a recent literature review (unless the work has a historical focus), background information to the writing to orientate the reader, the aims and rationale of the study. These should be presented logically and well written^{3,8} for maximum clarity.

◆ **Materials and methods:** these are the 'recipe' for the research or study so that another worker could exactly replicate the study elsewhere, usually to allow disproof of findings. This section should include technical specifications of equipment used, procedure utilised, selection criteria, sample size, response rate and statistics used.

The justification of why this 'recipe' was used is called the methodology, ie, the study of the method, which explains the rationale for the method used. This should include consideration of the sample size selected, how the sample was identified, for example, randomly or as a convenience sample, exclusion criteria and statistics used.

The design of the work must have justification to show that the study is capable of achieving its aims⁸, for example, the use of a postal questionnaire sent a month after students graduate would be a dubious way to assess the perceptions of third year students to a study method used in their second year. Points to consider when reading how the study was done are:

Was the sample big enough to justify any claims made?

Was the group of participants randomly selected?

Was there bias in selecting participants? For example, if data was collected from outpatients on Tuesday and they were all orthopaedic patients, would that present different information to collecting data on Thursday from oncology outpatients?

Are there confounding variables? For example, if patients preferred endoscopy (A) to barium meal (B), which were done by different people, could that have been because they preferred radiographer B to endoscopist A?

This list is by no means exhaustive – the point is to think and challenge in your mind each assertion made by the author.

◆ **Results:** the way the results are presented (if the work actually produces results), will depend on the nature of the article and the results produced. The key consideration is whether the results are presented as clearly as possible.

The results should be presented in a way that the 'average' reader of the publication can easily assimilate⁸. Consequently, graphs and tables of the data, if provided, should promote clarity. They should have a title and labelled axes, and should be understandable without having to refer to the text³.

To aid understanding, the results should be sequenced logically. If

the work is a case study, for example, evaluating two projections, high quality annotated images should allow the reader to make a visual inspection of the images produced by the different techniques.

◆ **Discussion:** the discussion of the work is written to convey to the reader what the findings of the research, review or case study mean. If there were clear aims and objectives for the writing, the discussion will address whether they were met.

The discussion should explain to what extent the results are able to be generalised to a wider population. Also, there should be an explanation of how the findings of the article fit with the body of knowledge⁸. Most work has some shortcomings which may be unavoidable, but it is important that the author points out to the readership what these are and what implications they have for the findings.

In a case study, if one technique is proven to be superior to another but has other limitations, such as the time it takes, cost etc, the author needs to link the findings regarding the diagnostic superiority of one technique over another, with these other considerations.

As a reader of a published piece, you should consider whether the author's interpretation of the findings follows from the results presented, and whether it is the only possible interpretation. If this is not the case, consider whether the author presents a balanced discussion, addressing all interpretations⁴.

◆ **Conclusions:** when the article is concluded, make sure that what is said can be justified based on what has gone before. If one technique was found to be better than another in a small group of patients who were not randomly allocated to the different techniques, consider whether that would necessarily be replicated if the study was done again with a larger randomised sample. If not, the article should not conclude technique A is better than technique B.

Also there should be no new information in the conclusions, though they may usefully give rise to recommendations for future practice and/or further research.

◆ **References:** these should be produced in the house style of the journal involved and, in *Synergy*, they will be accessible via a web link. The reference list should represent all the citations in the text and should not include any extra citations.

◆ **Abstract:** if an abstract is used, it is presented first but is written last by the author/s. It is often structured, for example, purpose, method, results, conclusion. It should be concise, around 300 words, and should not contain so much information that reading the article is redundant⁸.

It is, in essence, the 'nub' of the work and it does not usually contain references. It allows readers to judge its appropriateness to their research needs⁹. If an abstract is presented, it should be capable of standing alone. If critiquing the abstract, consider whether all key elements of the work are encapsulated within it.

Summary

The above information has demonstrated the need to read literature with a critical mind. It has provided a framework and pointers with which to do this. This should help the reader to assess the value of the work and thus judge how much credence be given to it, in influencing future practice or research activities.

Article continued overleaf



Critiquing an article and its relationship to CPD

The College of Radiographers defines continuing professional development (CPD) as: *a range of learning activities that maintain and develop competence to practice within an evolving scope of practice*¹⁰. The Society of Radiographers offers further guidance with regard to CPD stating that: *Radiographers should... increase their knowledge of the science and practice of their chosen discipline (and) should recognise their professional obligation to undertake life-long learning...*¹¹.

The professional obligations are clear. Practitioners are responsible for identifying and addressing their continuing learning needs and where these impact on professional practice, arguably the point at which continuing learning becomes CPD, they should support competence to practice. This is a considerable challenge in the 21st century when the science and practice of all disciplines in healthcare are developing at an unprecedented rate, particularly in highly technology-driven areas of healthcare such as medical imaging and radiation therapy. Individual practitioners are responsible for their own practice, and good practice demands that radiographers and associated practitioners comply with a range of requirements, statutory, ethical and moral, when they deliver this to the patient.

Interestingly, although much of the technical process is set down fairly rigidly by locally determined protocols, the delivery of care and support to the patient is often left to the discretion of the practitioner, albeit influenced by service and professional culture and guidance and, to some extent, driven by patient expectations.

It is well recognised that few, if any, professionals are able to meet all of their CPD or continuing learning needs by attendance-based programmes such as study days, short courses and seminars alone and that self-directed reading can be an important CPD activity.

Professional journals are commonly cited as an appropriate source of continuing learning and many professional organisations,

including the Society and College of Radiographers, promote their journals in this way. Members are encouraged to use professional journals for some of their continuing learning needs, but an additional function of a professional journal is to share information about good practice, and this should be presented with a sound evidence base.

However, if a change in practice is to take place as the result of knowledge that has been shared in this way, the individual practitioner has to be satisfied that the evidence is sufficient to warrant such a change. It is, therefore, essential that a critical approach is taken if published material is to be studied, and this activity used for the basis of a change in practice. As this article sets out, this involves a range of techniques to determine whether what is presented is credible and relevant to the practitioner undertaking the critique.

How does critical reading translate into CPD?

If you are going to record the reading of a professional article in your CPD portfolio and wish to use it as evidence to show that what you have learned has improved your practice, you have to show that you are confident that what you have read is credible and relevant to you.

This need not imply that you have to undertake an exhaustive critique and run several trials of your own to confirm the author's results, after all, part of the purpose of the author's publication is to save every other member of the profession from having to investigate the information themselves. You should, however, make it clear when you record your CPD activity that you have considered these processes. If you are using the 'My Evidence' template in **CPD Now**, you can work this in as follows:

In 'Summary of Learning' you might add: *This was a peer reviewed article in my professional journal, Radiography, or this was an article in my professional body's technical journal, Synergy, and was clearly referenced with evidence of a recent and appropriate literature search. I have followed up these references as part of my work with this article. The methodology described was appropriate and the discussion of the findings and conclusions drawn were clear.*

In 'Practice Outcome' you might add: *Having considered the methodology, findings and conclusions carefully, I believe that they are relevant to my patient groups and practice, and I plan to modify my practice accordingly (you must, of course, describe how you will do this). I will evaluate the impact of this change and will review it in x months time.*

In 'Further Learning Needs' you might add: *My further learning needs for this piece of work will focus on the evaluation of the change to my practice. This will be achieved by, for example, general review, reference to particular cases or patient episodes, audit of practice (name the appropriate method) and I will add these findings to this record in x months time.*

Hence, reading a scientific article in a questioning, critical way, can easily and usefully be recorded as a valuable CPD activity that helps advance practice.

About the Authors

Gill Marshall is a professor at the School of Medical Imaging Sciences, St Martin's College, Lancaster.

Sean Kelly is the CPD officer at the Society of Radiographers.

References for this article are at: www.sor.org/members/pubarchive/pub_search.htm