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How to write a Continuing Medical Education (CME) paper for radiographers and other healthcare professionals – a tutorial

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Abstract

Continuing Medical Education (CME) papers is a method for healthcare professionals to gain new knowledge, learn new technologies and procedures and keep up with advances in their respective fields. Healthcare professionals have a lifelong responsibility to learn throughout their professional career.

CME papers generally outline a specific case, topic, or challenge in the medical field. They often conclude with an individual assessment, such as a 10-question multiple-choice exam, to test the learners understanding of the material.

Unfortunately, radiographers, nurses and other medical healthcare professionals working in the Nordic countries do not have abundant access to Continuing Professional Development (CPD) programs, which are designed to help professionals to engage and enhance skills, knowledge and abilities. Even without formal CPD programs, radiographers must stay updated to maintain high professional standards. Nordic healthcare professionals can still benefit from reading and writing CME papers and participate in CME assessments.

CPD are widely used in many other European countries such as UK and Ireland. Therefore, CME papers can be a way to facilitate new qualifications or knowledge.

Introduction

A continuing Medical Education (CME) paper is an educational article typically presenting a specific case, subject, topic, technique, disease, challenges or other health-related issues within the medical field and will typically end with an examination such as a 10-question multiple-choice exam, to test the reader's comprehension of the material. This resource is widely used by medical students and other health professionals. Many scientific radiology journals and professional or academic websites offer CME opportunities, including the new England Journal of Medicine, Journal of the American Medical Association, and the European Journal of ultrasound. CME is beneficial for all healthcare professionals, providing them with the latest knowledge, updates, and skills in their field. Engaging with CME papers allows professionals to identify and address knowledge gaps (1).

The overall purpose of CME is to (2)

- Improve practice for better healthcare outcomes
- Enhance learning and/or adapt to changes
- Support continuation and maintenance of competences
- Enhance lifelong learning

Sonographers or ultrasound reporting radiographers can benefit from CME, as there is a huge variation in educational level between countries (3). This is particularly relevant for those who may not have a formal academic education or recognized credential in sonography but perform ultrasound examinations based on hands-on and on the job training. CME examples can be ultrasound simulation (4), scanning technique (5), and diagnostics (6). Also, CME credits are important for healthcare professionals in some countries, where a specific number of CME credits or activities are required annually to maintain their licenses to practice.

Studies have shown that CME, which includes immediate feedback (interactive learning), is an effective method for learning new material (7). A recent study highlighted a shift from face-to-face CME towards online CME, finding that 70% of the included radiographers used online resources for CME. Furthermore, the study found that the respondents value free CME activities and interactive learning (8). Most CME activities are typically available year-round and are not limited to specific dates or time slots.

In the Nordic countries (Denmark, Norway, Sweden, Finland Faroe Island, Greenland, and Iceland) healthcare professionals lack continuing professional development (CPD) opportunities to enhance skill and knowledge. However, healthcare professionals can still benefit from participating in CME activities. In contrast, the United Kingdom (UK) has a long history of providing CPD for healthcare professionals. For example, diagnostic radiographers

must participate in reflective learning through CPD activities yearly to demonstrate competences through lifelong professional medical learning (9). CME activities offered by peer-reviewed journals typically include an examination or evaluation, and by participating the learner typically earn 1 CME credit (10).

In radiography, the number of CME articles seems limited, aside from sonography. This tutorial aims to highlight benefits of having CME articles in radiography, ensuring that radiographers have access to comprehensive and up-to-date free educational resources. This will enhance learner's skills and provide valuable CPD activities.

The objective of this tutorial is to provide a template for writing CME paper relevant for the radiography profession.

Learning objectives

As a result of reading this article you will

- Obtain basic knowledge of CME articles
- Learn how to write an CME article
- Get access to tips on how to write CME assessments

Writing effective CME articles

In academia, publishing CME is important as it enables both academic and clinical healthcare professionals to disseminate their research and innovations, contributing to knowledge growth and fulfilling various personal and professional goals.

The first step is to develop learning objectives for the CME article. The objective could describe the gap in knowledge and skills that the learners will gain from reading the CME article (11). The Institute for International Medicine (11) have given these examples of terms using in learning objectives such as explain, discuss, create, develop, manage, classify, describe, illustrate, use, interpret, implement, identify, list, distinguish, arrange and relate. Verbs are used in the creation of learning objectives as they communicate what the learners should be able to achieve, and they provide a reference point for what is to be assessed (12). Objectives should be written in a very precise format. In doing so, it is often advantageous to use the revised Bloom´s Taxonomy (Figure 1) (13, 14), for writing clear, effective and measurable objectives from basic recall of facts to higher-order thinking skills like evaluation and creation.

By integrating the Bloom´s Taxonomy framework (14) Table 1 illustrates how various words correspond to the categories contained within the framework. Another example can be found at the American College of Surgeons webpage (15). A maximum of 5 learning outcomes is recommended for a single CME article (16).

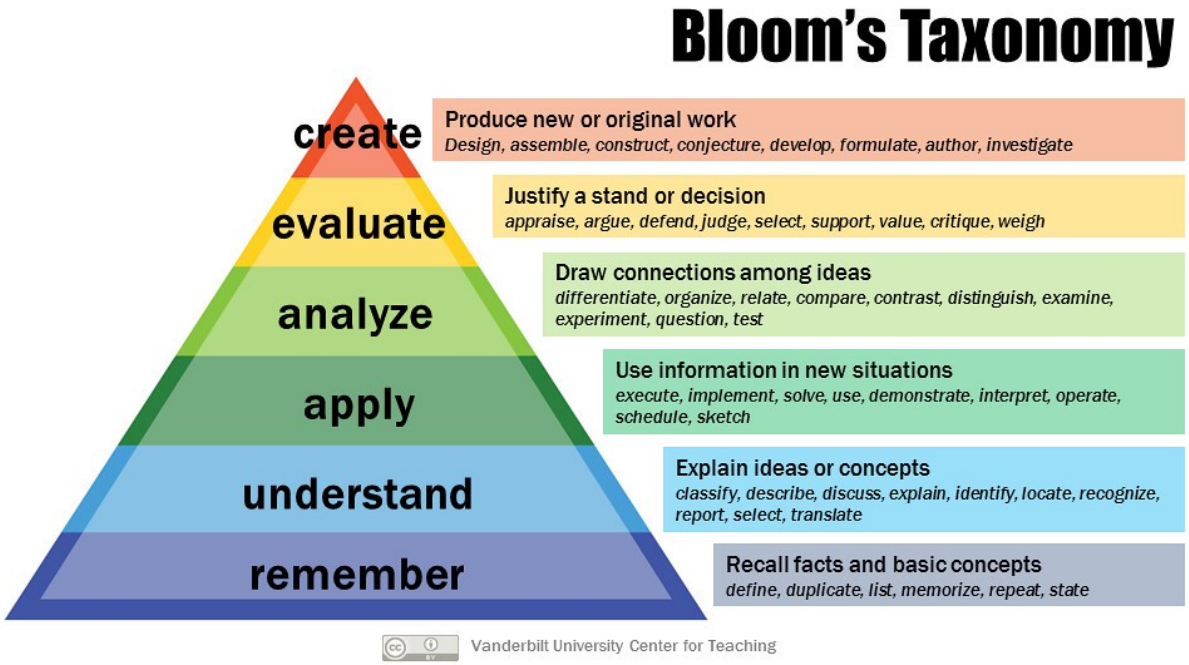

Figure 1. Bloom´s Taxonomy (14)

Examples of learning objectives (4):

- Obtain basic knowledge of ultrasound simulation
- Learn different types of simulations equipment for abdominal ultrasound
- Understand benefits of ultrasound simulation training

Table 1. Blooms Taxonomy for development of learning objectives.

Create	Evaluate	Analyze	Apply	Understand	Remember
Develop	Assess	Compare	Use	Explain	List
Plan/Design	Discriminate	Interpret	Relate	Articulate	Identify
Construct	Manage	Predict	Integrate	Categorize	Recognize
Modify	Discuss	Distinguish	Implement	Translate	Name/label
Formulate	Report	Solve/Diagnose	Formulate	Classify	Arrange

Journals may choose to invite authors with expertise in a relevant topic to write a CME article. Authors may carefully consider the learning objectives and outline the rationale for the CME article, including identifying knowledge gap(s) in published literature and presenting best practices, and should keep in mind that they are writing to peers. A neutral langue is preferred, and "it is best to avoid a patronizing approach" as suggested by Nalliah and Rampal (16). The main content of the CME article must be evidenced based, utilizing up to date scientific literature and recent references to ensure high validity and relevance. The references should support statement(s) and arguments(s). Most people, including healthcare

professionals in radiology departments, have preferences for visual information. Therefore, incorporating well-designed tables, images and figures can capture learners' interests and provide a quick overview.

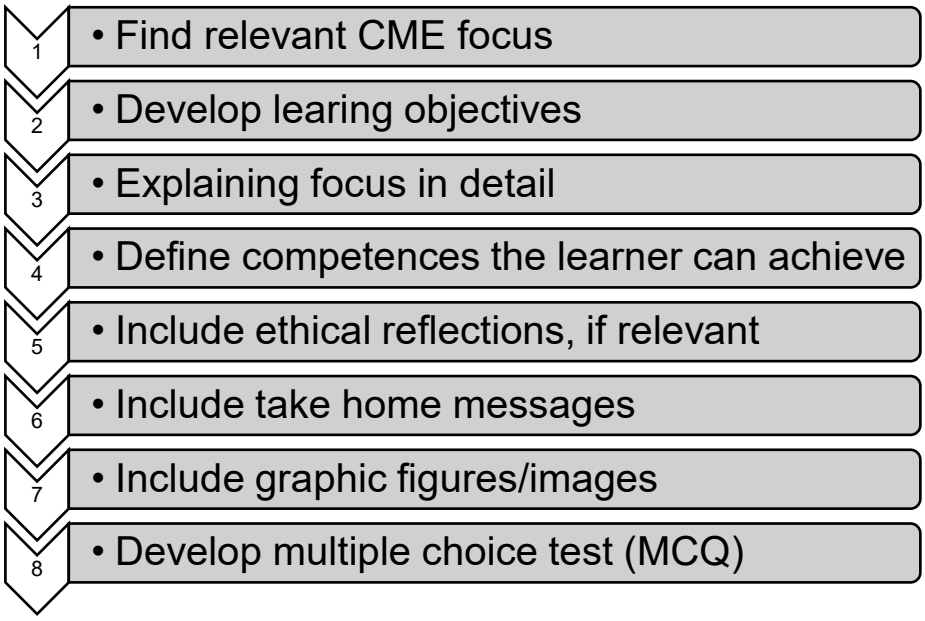

Figure 2. Overview of development of an CME article

Consider incorporating clinical cases to underline take-home messages, provide repetition, or serve as part of the final assessment. Cases can be effective tools for emphasizing important concepts and enhancing the learning experience.

When writing the main article, it is important to clearly define the expected competencies that learners can achieve, such as acquiring new medical skill or knowledge. Take-home messages can be included in the conclusion or presented in a separate figure. Well-designed tables, images and figures, such as bullet points, boxes, tables, figures, graphics, flow charts or take-home messages, are beneficial for highlighting key points and capturing learners' interest. Figure 2 shows an overview of how to build a CME paper.

CME assessment

Effective assessment is an important component of CME, ensuring that learners have successfully acquired the intended knowledge and skills. Table 2 provides an overview to consider when inventing, designing and formulating CME multiple choice assessments. For additional inspiration various websites offer valuable resources (17-21). Ideally, the test should include between 5 to 10 questions, as more than 10 questions may be too time consuming for the learners. It is advisable to avoid controversial topics and questions with ambiguous answers, as these can confuse learners, lead to frustration and negatively impact performance.

When formulating questions, it is important to be specific while avoiding complicated language or jargon. Keeping the questions simple and easy to comprehend will enhance clarity. Providing clear instruction and incorporating visual elements such as images, tables or figures can further support the understanding. Utilizing Bloom's taxonomy for learning outcomes ensures that the assessment is well-structured and comprehensive. Additionally, pilot testing the assessment can help identify any issues before it is administered. Ultimately, the questions must align closely with the learning outcomes to ensure that the assessment accurately measures the intended competencies.

Table 2. Considerations for CME assessment.

Considerations for CME questions	Avoidance CME questions
• Question should address a single problem	• Question with vague formulation such as "*which of the following statements is true*?"
• Questions must be written precise and clearly formulated	• Response options such as "*none of the above*" or "*all of the above*".
• Use five response options for each question	• Questions with a true /false response option
• A minimum of one question should focus on the take-home message	• Question formulated negative such as "*all of the following are correct except*…"
• Questions can include visualization (e.g. radiographs, images, or patient cases) to enhance relevance and interest for learners	• Question making the correct answer noticeably longer than the incorrect options.
• All the incorrect response options are plausible	• Correct response options should not always be placed in the same order, such as always being option "B".
• Provide response options with similar length	• Correct response must not be longer than the 4 incorrect response options

Lifelong learning

Lifelong learning is important as technology continues to advance. Additionally, the availability of information in our technological age means that patients are increasingly knowledgeable and proactive, seeking information about their conditions on various platforms. These include social media forums, health websites, support or patients websites

such as *patientslikeme.com (22)*, medical society websites like the society of radiographers (www.sor.org), professional organizations such as the European Federation of Radiographer Societies (www.efrs.eu) or the International Society of Radiographers and Radiological Technologists (www.isrrt.org) and scientific papers. These resources help patients connect with other patients, share experiences and gain a deeper understanding of their health conditions. It is therefore of extreme importance that healthcare professionals maintain their position as experts in the field, and endeavor to stay amply informed.

Even though healthcare professionals recognize the importance of lifelong learning, motivation can be enhanced through implementation of CPD programs. Currently, the Nordic countries lack CPD programs to support lifelong learning for healthcare professionals such as nurses and radiographers. Providing encouragement for practitioners to embracing lifelong learning is key, and one effective driver can be a CME assessment program that offers exam credit or certification opportunities. Hilty et al highlighted that certification will provide healthcare professionals with validation and visibility for their extra efforts (23). Certification can be a strong motivational factor as it offers formal recognition of skills. On a personal level, certification can enhance skills and lead to recognition from peers, supervisors, and colleagues. The process of obtaining certification requires extra effort and personal dedication, making it a rewarding experience.

Conclusion and perspectives

Young clinical healthcare professionals, especially Ph.D. students face numerous challenges in balancing academic and clinical obligations. A study by Jensen et al. highlighted the need for better integration of research into clinical practice (24), which could enhance motivation and well-being. CME articles can raise awareness about unique challenges faced by clinical academics and offer practical cases or examples of successful integration of research and clinical practice. Additionally, CME articles can provide valuable training, practical recommendations and enhance motivation among clinical academics. A survey study found that the highest motivational factor for becoming a reporting radiographer was the opportunity to gain new knowledge and face new challenges (25). This underscores the importance of new knowledge as a significant personal motivator.

CME articles should clearly outline learning objectives new competencies that learners will obtain after reading the CME article and passing the associated test. These articles can help healthcare professionals gain new knowledge and competences for current best clinical practice.

By expanding the availability of CME articles in radiography, we can foster a culture of continuous improvement and professional excellence. These articles not only support individual growth but also contribute to the overall advancement of the radiography field. They enable radiographers to stay at the forefront of technological and clinical developments, ultimately leading to better patient outcomes. Furthermore, incorporating CME into regular

practice can elevate the standard of care, inspire innovation, and promote a more engaged and knowledgeable workforce.

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