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Editorial

Scholarship in radiation oncology education



Improvements in the management of non-communicable disease such as heart disease and diabetes, population growth, and aging are leading to a rising number of cancer cases worldwide [1]. Radiotherapy remains a mainstay of global cancer care in both the curative and palliative setting [2]. Radiation oncology education and training are critical to maintain, replenish and expand the radiotherapy workforce worldwide, in keeping with the ever-increasing demand for this treatment. Radiation oncology education spans all professions involved in delivering high quality radiotherapy to patients including physicians, nurses, radiation therapists (RTTs), medical physicists, dosimetrists, and many others.

Analogous to the technological and clinical advances in our field which are driven by research and innovation, evolution in the domain of education is a continual process underpinned by an advancing evidence base. The 'science' of clinical education is commonly overlooked or poorly understood, leading to suboptimal or, at best, inefficient teaching and learning experiences. However, nothing could be more important than ensuring the education of all radiation oncology professionals is as robust as possible. Only if our workforce has undergone high quality education can all other aspects of our discipline function at an optimal level. Therefore, ensuring progress in educational practice through conscious effort and scholarship should not be considered an 'optional extra' but rather an imperative for all professions involved in clinical radiotherapy.

In 1990, in "Scholarship Reconsidered" from the Carnegie Foundation for the Advancement of Teaching, Boyer identified four types of academic scholarship: Discovery, Integration, Application, and Teaching [3]. Soon after release of "Scholarship Reconsidered," it became clear that the methods by which to measure the quality and rigor of scholarship needed further definition. Glassick and colleagues proposed six standards by which to measure the quality and rigor of scholarship: 1) Clear Goals, 2) Adequate Preparation, 3) Appropriate Methods, 4) Significant Results, 5) Effective Presentation, and 6) Reflective Critique [4]. These six standards are what elevate "scholarly teaching" to "scholarship of teaching." This point is well illustrated by Fincher and Work who state, "Scholarship of teaching has the potential for advancing the field, not just individual students' learning" [5].

This Special Issue of Technical Innovations and Patient Support in Radiation Oncology (tipsRO) features multiple invited reviews from radiation oncology education thought leaders around the globe. A key feature across the articles that make up this Special Issue is the high level of scholarly rigor that every article demonstrates. Each of these articles reports the authors' efforts to advance the field of radiation oncology education through rigorous educational scholarship. The articles articulate the goals of the research teams, describe the preparation and

methods used to achieve these goals, report results through effective presentation, and demonstrate thoughtful reflective critique regarding the limits of the findings and future directions for further scholarship in their respective topics of radiation oncology education.

In Table 1 we present for each Special Issue article topic a brief summary, the type of radiation oncology learner or prospective learner (profession or multiprofessional), and examples of how that project illustrates one or more of Glassick's criteria for robust educational scholarship. These criteria are highlighted for a particular article to demonstrate the application of Glassick's standards through explicit examples and do not imply that other criteria are not met by that study. For the articles in which 'Appropriate Methods' have been emphasized, it is worth noting that not only is it important that the research methodology, including instruments chosen, are appropriate to meet the stated research goals but that the methodology for designing and/or delivering effective educational interventions themselves need to follow a purposive and evidence-based development process with suitable theoretical underpinning [6].

With respect to limitations, it should be noted that all articles come from higher income countries or regions though many of the learners participating in the educational interventions described may work in low- or middle-income countries [7,8]. Likewise, most of the lessons arising from authors' analyses of various educational activities and resources or recommendations made for best educational practice and future areas of research have broad applicability in the global setting [9,10,11,12]. It is perhaps not surprising, especially in view of the impact of the Covid-19 pandemic, that 7 of 13 articles deal directly with the topics of virtual, digital or on-line learning interventions, methods or resources and several others make reference to this mode of education.

In conclusion, the articles featured here within represent a snapshot of the leading edge of radiation oncology education in 2022. It is our hope that the educational innovations described will be used to improve education in our field around the globe while also inspiring nascent radiation oncology education researchers to pursue high quality and rigorous educational scholarship in the future.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Table 1
Summary of Special Issue articles and illustrations of Glassick's Criteria [4] for robust scholarship.

Study title	First Author (alphabetical order)	Study summary	Learners or prospective learners	Illustration(s) of Glassick's criteria and explanatory notes
The landscape of digital resources in radiation oncology	Culbert, M [12]	An overview of the status of online/ virtual resources for radiation oncology education including a detailed catalogue of e-resources to supplement in-house learning.	Radiation oncologists and trainees	Appropriate methods This study applied a stringent process for identifying educational resources for radiation oncologist training through a literature search. In addition, the author applied a framework (from the University of North Carolina) to systematically evaluate each resource against relevant quality criteria. Finally, a comprehensive catalogue of digital resources is presented organised by curriculum topic, type of resource, how to access resources and other practical features.
Challenges in transition to independent radiation oncology practice and targeted interventions for Improvement	de Leo, A [13]	Examination of data from prior surveys/ focus groups through qualitative analysis to summarise challenges for United States trainees in transitioning into independent practice.	Radiation oncologists (trainees)	Reflective critique This study is valuable in compiling and analysing the work of other authors to more deeply examine factors (some political) that hamper a purely evidence-based approach to optimal education in the period where senior trainees are transitioning to independent radiation oncologists. This critique exposes gaps in training and provides a resource list of potential external learning resources to address the deficits (e.g., planning skills, leadership development).
Postgraduate education in radiation oncology during the COVID-19 pandemic – what did we learn?	Eriksen, J [7]	Evaluation of the impact of the covid-19 pandemic on the educational activities delivered through the ESTRO School	Mixed radiation oncology/ clinical oncology professionals	Clear goals Authors stated clearly their aim was to determine the impact of the covid-19 pandemic on learner-reported value and satisfaction with the activities/courses they participated in. Significant results Similarly, the study results clearly addressed the stated aim.
Promoting professional judgement through peer debate in radiation therapy undergraduate curriculum	Kearney, M [14]	Short communication outlining a deliberative approach to the development of a RTT curriculum aimed at enhancing professional judgment around complex ethical issues.	Radiation therapists	Appropriate methods of learning This work demonstrates a logical approach to curriculum development first by identifying a curricular gap for RTTs and then designing and piloting an intervention (Judgement and moral reasoning workshops) founded on adult educational principles e.g., reflection, case-based discussion and peer-to-peer learning. An evaluation followed to measure the effectiveness of learning though this was not the focus of this study.
Usability: An introduction to and literature review of usability testing for educational resources in radiation oncology	Keenan, H [15]	Explanation of the concept of usability and usability testing methods through a literature review of usability testing for online educational resources in radiation oncology.	Radiation/ clinical oncology professionals. Patients undergoing radiotherapy	Appropriate methods A rigorous literature review methodology was followed to identify radiation oncology educational resources applying usability testing during their design. Data were gathered describing the type of usability testing performed, the number of cycles of testing and the number of test subjects. Testing methods were described, and recommendations provided, for future resource educator-developers.
Screen-based digital learning methods in radiation oncology and medical education	Kok, D [9]	Review of the pedagogical evidence around screen-based learning methods in medical education and for oncology and radiation oncology more specifically.	Radiation oncology professionals and trainees	Effective presentation This article not only presented clear evidence-based recommendations around the most effective aspects of screen-based learning in adult/medical education e.g., text and image placement, but it also presented study findings mirroring these methods. For instance, colour figures in the paper involved infographics illustrating effective combinations of images and text which (as expected) allowed for practical and easy digestion of results and recommendations.
Virtual reality and augmented reality in radiation oncology education – A review and expert commentary	Kok, D [16]	Review and explanation of virtual reality and augmented reality techniques as used in clinical education, including examples in RO where these exist.	Clinicians (with a focus on radiation oncology learners)	Adequate preparation As the foundation of their work, the authors present prior research around VR and AR for medical education and proof of value in adult learning. Within oncology, the learning domains linking to these tools are presented

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Table 1 (continued)

Study title	First Author (alphabetical order)	Study summary	Learners or prospective learners	Illustration(s) of Glassick's criteria and explanatory notes
Virtual integration of patient education in radiotherapy (VIPER)	Magliozzi, M [17]	Exploration of the feasibility and acceptability of a pre-radiation therapy education program for patients using 1:1 RTT-patient video sessions as an alternative to in-person education.	Patients undergoing radiotherapy; carers and family members	including the skills encompassed within each domain and the strength of evidence for the pedagogical value in each case. Examples of VR and AR focusing on learning within RO are discussed. Effective presentation As for the companion paper above, this article used high quality photographs and colour figures as an effective way to illustrate the value of virtual and augmented reality where these could not actually be experienced by the reader. Clear goals Study goals were practical and clearly stated, for instance authors acknowledged that only patients with computer literacy would be suitable for the intervention. Adequate preparation Researchers built on prior work (including a randomised controlled trial) showing the value of pre-radiotherapy RTT-led education in preparing patients for the experience of radiotherapy. They present further rationale for their study relating to effective virtual methods for RT education delivery in other settings and as well as supporting evidence for the rapid rise of 'virtual healthcare'.
Older adults and the unique role of the radiation therapist: future directions for improving geriatric oncology training and education	Morris, L [10]	Review of resources for improving RTT geriatric-oncology knowledge. Critique of the potential influence and opportunities for RTTs to improve older patient care.	Radiation therapists	Effective presentation This study uses clear diagrams to support the article text and findings. For example, Figure 2 illustrates the multiple in-person and virtual patient-RTT interactions which provide opportunities for RTTs to impact positively on older patient care should geri-oncology education for these professionals be optimised.
A phenomenological study investigating experiences of student learning using an online radiation therapy planning curriculum	Osbourne, C [18]	Qualitative thematic analysis of data from interviews and focus groups studying radiation therapists' (RTT) experiences with an entirely on-line planning curriculum.	Radiation therapists	Appropriate research methods Qualitative methodologies such as Interpretive Phenomenological Analysis, as used in this study, have high value and provide a rich understanding of educational topics dealing with individuals' lived experiences that are often complex and emotive. Appropriate methods of learning As the authors state: '...a solid 'theoretical framework and pedagogical approach [is required] to ensure the student experience is positive, meaningful and the students are able to ... achieve the intended learning outcomes'
Training for the future: Introducing foundational skills necessary to promote patient-centred care practice in medical physics graduate programs	Padilla, L [11]	Description of, and outcomes from, an intervention to introduce patient-centric skills into a medical physics curriculum (including patient communication, bioethics and health disparity).	Medical physicists (MP)	Significant results One example in this study of achieving significant results is seen in the communication training. Using sophisticated teaching methods, including use of 'patient' actors to standardise the MP-patient interaction, researchers were able to demonstrate improved MP willingness to interact with patients for the purpose of optimising care. Clearly defining the need for learning led to targeted teaching and a suitable assessment approach to measure that the intent of learning was being met.
A new wave of leaders: early evaluation of the interdisciplinary Foundations of Leadership in Radiation Oncology (FLIRO) program	Turner, S [8]	Description and evaluation of an international blended -learning program aiming at increasing individuals' leadership capacity in the workplace and more broadly within radiation oncology	Mixed radiation oncology and clinical oncology professionals	Clear goals An identified educational gap in radiation oncology professional curricula was addressed through a novel program using an interdisciplinary learning approach with learner groups replicating workplace teams. Adequate preparation and appropriate methods for learning Topics linked to learning outcomes developed through a prior study using a Delphi consensus process. The program was underpinned by modern-day leadership theory/concepts. Learning scenarios used for interactive work

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Study title	First Author (alphabetical order)	Study summary	Learners or prospective learners	Illustration(s) of Glassick's criteria and explanatory notes
An intentional approach to the development and implementation of meaningful assessment in advanced radiation therapy practice curricula	Wright, C [6]	Exploration of theoretical constructs as they apply to assessment required to promote the development of higher-level thinking and judgement required by Advanced RTT Practitioners in Australia.	Radiation therapists	were hypothetical RO workplace scenarios providing clear context for learning. Appropriate research methods Underlying educational principles for clinicians provide a theoretical framework for interpreting findings and a structure for mapping curriculum capabilities. Appropriate methods of learning The authors recommend a national curriculum for Advanced RTT Practitioners with good Constructive Alignment (i.e. learning outcomes match assessment) be standardised. They provide examples of best-practice programmatic assessment tools such as Entrustable Professional Activities (EPAs) that might be suitable for this professional cohort.

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