The challenges of teaching medical radiation technology without a high school physics background in Australian universities

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Abstract. This paper explores the challenges faced by Australian universities in teaching Medical Radiation Technology (MRT) to students without a high school physics background. The primary challenges identified include a lack of basic physics knowledge, difficulty in understanding complex MRT concepts, and limited problem-solving skills. These challenges often hinder students' ability to grasp advanced topics and engage in critical thinking, which are crucial for advanced medical imaging, nuclear medicine, and radiotherapy. To overcome these challenges, universities require to offer remedial physics courses. However, this is a complex issue requiring further research and discussion among educators and stakeholders in the field.

Introduction

Medical radiation education and training play an important role in the health sector, equipping professionals with the knowledge and skills necessary to effectively utilise medical radiation technology. This education is crucial for the accurate diagnosis, treatment, and monitoring of a wide range of health conditions. Through comprehensive training, students learn to operate complex imaging equipment, such as X-ray machines, CT scanners, Gamma cameras, Fluoroscopy and MRI machines. In the field of oncology, specialised training in radiation therapy is essential for the effective treatment of various types of cancer. Radiotherapists learn to plan and deliver radiation treatments with linear accelerators that maximise tumour control while minimising damage to surrounding healthy tissue. They also gain a deep understanding of radiation safety principles, ensuring the protection of both patients and healthcare workers from unnecessary radiation exposure. A solid understanding of physics is a fundamental necessity for any medical radiation technologists employed in medical radiation (radiography, radiotherapy, nuclear medicine) centres where ionising radiations are utilised. The growth of physics-related topics in medicine directly influences the educational and training needs to uphold the standard of professionalism in the field [1].

Globally over four billion medical radiological examinations/procedures, about 40 million nuclear medicine procedures, and over six million radiotherapy treatment courses are delivered per annum and the numbers are increasing every year [2]. There is a consistent need for medical radiation practitioners to perform these procedures safely and effectively. In Australia, medical radiation practitioners are registered healthcare practitioners, responsible for conducting diagnostic imaging studies on patients, planning and delivering radiation treatments, or preparing and administering nuclear medicine. To gain registration, medical radiation practitioners must complete a minimum three-year undergraduate, or two-year postgraduate master program of study approved by the Medical Radiation Practice Board of Australia (MRPBA) [3]. At present, eleven universities in Australia provide approved degree programs in medical imaging, nuclear medicine, and radiotherapy. Despite the highly competitive nature of admissions into these programs, only three universities stipulate high school physics as a prerequisite for these programs. Consequently, teaching the complex principles of radiation physics, which are fundamental to medical radiation technologies, to students without a foundational knowledge of physics, becomes a significant challenge.

Theoretical Framework

University admission into undergraduate program in Australia is mainly based on Australian Tertiary Admission Rank (ATAR). Upon completion of their final year of high school (Year 12), students undergo evaluations through government-approved examinations. Upon successful completion of these exams, they are awarded certificates. These examinations have different names and structures for different states and territory. To have a countrywide ranking system, the ATAR has been introduced. ATAR is calculated based on the results of state endorsed examinations. ATAR is a number between 0.00 and 99.95 that indicates a student's position relative to all the students in their age group. It shows the student's achievement in relation to other students [4]. In pursuit of a high ATAR, students often avoid challenging subjects like physics, where achieving high marks can be difficult. This is particularly the case when they realise that the subject is not a prerequisite for their preferred university course. As a result, many students with high ATAR receive offers for admission into medical radiation programs often have not studied physics in high school. That makes difficult for the educators in the medical radiation program at the university to teach the complex concepts, such as radiation dosimetry, relativistic motions of electrons in the x-ray production, without teaching the basic foundations in physics, such as, Newtonian mechanics, that supposed to be taught in high school.

Methods and Findings

In this study, the admission requirements and syllabus of the programs offered in all eleven Australian universities are analysed. Only three universities have placed physics as a pre-requisite for admission, so no remedial physics courses are required. Two universities offer separate bridging physics course, but the remaining six universities have some foundational lectures either included in the syllabus or placed online for optional self-study. The challenge intensifies when students in medical radiation programs begin to adopt the mindset that understanding physics concepts is unnecessary in clinical settings, where digital machines largely automate the application of physics principles.

Conclusion

Physics is not a popular subject in Australian high schools. Making it pre-requisites for all medical radiation programs will not solve the problem. With the right strategies, it is possible to equip the students with the necessary knowledge and skills to succeed in MRT. However, this issue requires further research and discussion among educators and stakeholders in the field.

References

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