Value of Case-Based Learning in a Nuclear Medicine Clerkship

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Purpose: Medical imaging, including nuclear medicine, is a powerful tool for supporting learning in human morphology and physiology and understanding the nature of disease and response to treatment. The purposes of this study were to create a new case-based learning (CBL) model and to compare CBL and the traditional instructional approach (TIA) in a nuclear medicine clerkship.

Methods: Internal consistency and expert validity were assessed for the instrument. A quasi-experimental, two-group pretest-posttest design was used for this study. A combination of CBL and the TIA was applied to the experimental group and the TIA only to the control group. Subjects were 70 undergraduate year 5 medical students in a clerkship curriculum. Before and after the educational intervention, students were tested with the instrument.

Results: Cronbach's α coefficients of the instrument ranged from 0.79 to 0.95, indicating acceptable to strong internal consistency. For expert validity, the suitability and fitness of the instrument were verified. The overall score was significantly improved for the experimental group (from 3.51 to 3.65, $P = .03$) but not for the control group (from 3.48 to 3.44, $P = .49$). The experimental group also showed significantly improved scores in teacher assessment and learning satisfaction, the latter the only domain showing a significant difference of the differences ($P = .020$).

Conclusions: The integration of CBL, allied with the TIA, into clinical clerkships provides medical students with the opportunity to learn a nuclear medicine curriculum in an interactive and case-based format tailored specifically for medical students.

Key Words: Case-based learning, traditional instructional approach, nuclear medicine, clerkship, medical curriculum

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INTRODUCTION

Imaging-guided diagnosis and therapy are indispensable tools for patient care. With the technological advancements in medical imaging, including nuclear medicine, imaging guides many therapeutic decisions, enables clinicians to narrow differential diagnoses, and provides clinical answers [1]. In Taiwan, nuclear medicine physicians are not diagnostic radiologists. Diagnostic radiologists must receive 4 years of training and pass a certification examination to be nuclear medicine physicians, and vice versa. The field readily incorporates and illustrates subjects that have been the cornerstones of medical education, including anatomy, physiology, and pathology. Nuclear medicine education is now more integrated across the curriculum than ever. However, heavy workloads of nuclear medicine physicians, resident training, administrative duties, and pressure to maintain productivity displace time and resources needed to teach medical students. The diversity of how nuclear medicine is being taught within the medical undergraduate curriculum is extensive, with the expanding role of nuclear medicine physicians in the spectrum within the medical curriculum.

Medical curricula seem to differ widely as to the place of and importance attached to nuclear medicine clerkships. Often, it is nonnuclear medicine clinicians who teach nuclear medicine to medical students during patient rounds. Although clinicians may be knowledgeable about imaging findings within their specialties, they usually teach nuclear medicine as a correlative adjunct to physical findings and patients' clinical histories. In Europe, most medical education curricula clearly incorporate the opportunity to be involved in radiology clerkships, including nuclear medicine [2]. In US medical schools, radiology clerkships, including nuclear medicine, are instead presented as electives and are

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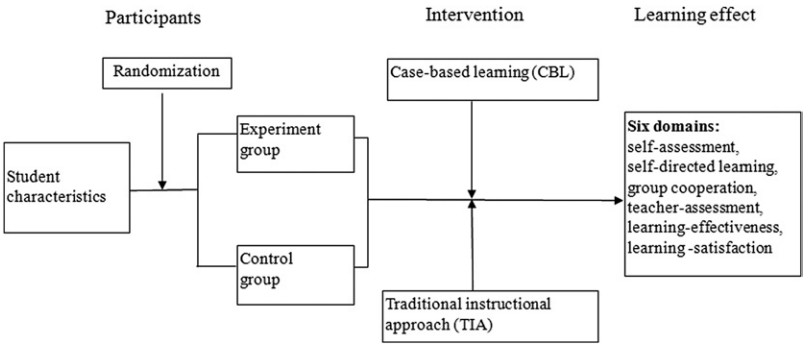

Fig 1. The conceptual framework of the research design.

to a lesser extent a mandatory curricular component of medical training during the clinical years [3,4]. Positive experiences with clerkships can influence future career decisions. Early contact with the professional radiology setting, including nuclear medicine, is expected to present opportunities to encounter inspiring role models [1]. It is hypothesized to have an impact on students who opt for radiology as a career, especially among women [4]. In our university hospital, the nuclear medicine clerkship is a mandatory component of the medical curricula for year 5 medical students. However, it is not integrated across the medical curriculum as a mandatory component for all medical schools in Taiwan.

Case-based learning (CBL) is an instructional design model that is a variant of project-oriented learning. Case teaching involves the interactive, student-centered exploration of realistic and specific situations. CBL develops students' skills in group learning, speaking, and critical thinking and is an effective, superior, and student-centered alternative to the traditional instructional approach (TIA). However, the TIA, using lecture-based instruction, is often content driven and seen as the most efficient and convenient method to offer the most information in the shortest time. Little attention is given to learning problem solving, collaboration, and lifelong learning skills. The TIA has been shown to be less effective than other teaching methods in practical application and critical thinking skills [5]. Chorney and Lewis [6] found that teaching radiology during clerkships using CBL may have some advantages in terms of learning imaging management and interpretive skills.

During the clinical training phase, students' perceptions seem to be particularly important. It has been found that satisfaction with the residency experience is associated with factors that enhance learning [7]. At our institution, during the clerkship, year 5 medical students participate in a nuclear medicine curriculum for 3 days. The related learning objectives and the schedule are clearly defined. During the first clerkship day, students are given practical information and are introduced to the learning objectives that must be attained. In an effort to expose year 5 medical students to the nuclear medicine curriculum, we developed and used a CBL tool to teach medical students nuclear medicine during clinical clerkships. In this report, we describe our experience with the development and use of CBL as an educational tool and discuss the potential benefits and drawbacks of teaching nuclear medicine using CBL.

The purposes of this study were (1) to create a new instructional design model, CBL, in a nuclear medicine clerkship curriculum; (2) to evaluate the instrument generated by the new CBL model for reliability and validity; and (3) to compare learning satisfaction and impact between the CBL group and the TIA group in a nuclear medicine clerkship curriculum.

METHODS

Design

An experimental, two-group pretest-posttest design was used for this study (Fig. 1). A combination of CBL and the TIA was applied to the experimental group (CBL group) and TIA only to the control group (TIA group).

Participants

Between September 2010 and June 2011, 6 teams of year 5 undergraduate medical students (n = 85) who registered for the 3-day course of a nuclear medicine clerkship curriculum at a university hospital in Tainan, Taiwan, participated in the study. The 6 teams of students were randomly assigned to either the CBL group or the TIA group. Each group consisted of 3 teams of 10 to 12 students each. Three teams participated in the experimental course with CBL allied with the TIA, whereas the other 3 teams participated in the control course with the TIA only. One corresponding tutor with thorough training on CBL and the TIA was responsible for the clerkship course. The structure of the nuclear medicine curriculum is described in detail in Appendix 1, available online.

In the present study, we focused on the perceived impact of the compulsory nuclear medicine clerkship for fifth-year students. The students carried out observational tasks during this period. The students had no experience with the CBL process in prior medical school classes. The CBL process is described in detail in Appendix 2, available online. Students took a class in problem-based learning in pathophysiology for 2 hours per week during year 4. In CBL and