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Improved knowledge gain and retention for third-year medical students during surgical journal club using basic science review: A pilot study



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ABSTRACT

Background: As they enter the clinical years, medical students face large adjustments in the acquisition of medical knowledge. We hypothesized that basic science review related to the topic of journal club papers would increase the educational benefit for third-year medical students.

Methods: Students were randomized either to participation in a review session about basic science related to the journal club paper, or to no review. After one day, and after three months, students were given a 10-question quiz encompassing the basic science and the clinical implications of the paper.

Results: Twenty-six of 50 students were randomized to basic science review. These students scored better on both sections of the quiz one day after journal club, but only on basic science questions after three months.

Conclusions: Students who participated in basic science review had better knowledge gain and retention. Educational activities building upon foundational knowledge improves learning on clinical rotations.

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1. Introduction

An abrupt transition occurs as medical students enter their clinical years in both the acquisition and application of medical knowledge. Traditionally the first two years of medical school are dominated by lecture-based learning and multiple choice exams, which test basic science facts. However, the clinical years are dominated by less clear-cut learning experiences on the wards and in the operating room. This transition is anxiety-provoking for students^{1,2} and when compared to the pre-clinical years the intensified demands of in-person hours, increased responsibilities and less direction for studying make knowledge acquisition more difficult.^{3,4} Many additional variables impact the ability for students to learn effectively in this more non-standardized learning environment,⁵ including the inability to link a concrete syllabus directly to the patients with whom they are interacting, and the decreased number of formative and summative assessments when compared with their pre-clinical years.⁶

The transition from the pre-clinical to clinical years also

presents the challenge of knowledge retention, especially of the basic science content from the pre-clinical years. Fig. 1A illustrates the typical learning curves for both basic science and clinical knowledge throughout the course of a traditional four-year medical school curriculum. Attrition of basic science knowledge is a concern as the focus of study shifts to clinical medicine. Goals for improvement of this learning curve include adding more clinical material in the first two years, preventing basic science knowledge attrition during the clinical years, and increasing the slope of both learning curves.

Many strategies have been employed in an attempt to re-shape students' learning curves, and standardize and enhance the education they receive during surgical clerkships. At a minimum, students typically are given a core curriculum of lectures either at their clinical site or medical school to highlight the main topics necessary for a student's understanding of surgery. Other more creative strategies have been implemented as well. One group sought to incorporate problem-based learning into their clerkships, and ultimately assimilated a task-based learning strategy in each of ten clinical rotations.⁷ Another medical school integrated problem-based learning into their surgical curriculum and realized increased clinical knowledge and skills of their medical students.⁸ Web-based modules have also been utilized at some medical

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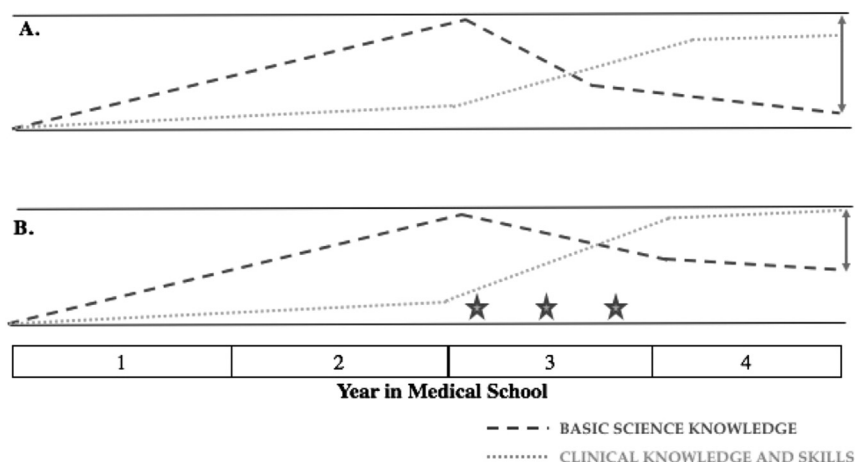


Fig. 1. Knowledge acquisition and retention in medical school. Typically, medical students lose much of their basic science knowledge during their clinical years (A.). We hypothesized that knowledge acquisitions and retention would be enhanced by reviewing this basic science knowledge with medical students in the context of clinical concepts (B., stars represent these reviews). Loss of basic science knowledge during the clinical years is represented by the vertical arrows.

schools, which have allowed core topics in surgery to be covered in their entirety during students' dedicated study time and provide formative assessments useful in giving feedback to both students and instructors during the clerkship.^{9,10}

Another challenge is in the integration of medical students into the educational activities designed more specifically for the surgical faculty and residents. While grand rounds presentations often are given at a level that is accessible to clerkship students, other activities assume a certain amount of surgical knowledge to prove beneficial to participants. Students are expected to follow complex clinical discussions without a proximate review of the underlying basic science principles necessary for the comprehension of the clinical issue. This lack of preparation may impair their ability to comprehend the core clinical principles.

Evidence-based medicine, especially in the context of unfamiliar clinical concepts, is a topic that has historically been challenging to teach to medical students^{11,12} and residents alike.^{13,14} Journal club is one such activity where depending both on the choice of literature to be reviewed and the amount of background that is infused into the discussion of the papers, medical students may come away having learned nothing at all.¹⁵ These discrete, planned educational activities may then provide an ideal venue into which academic direction and review of foundational material for clerkship students can be built. Fundamental to learning theory is the idea that new knowledge is best created when building on some form of background knowledge.¹⁶ This concept, known in the education literature as scaffolding, has been shown to be integral to medical education, especially in problem-based learning.¹⁷ Fig. 1B illustrates a potential shift of the clinical learning curve toward more efficient learning by continual review of background knowledge while learning new material.

We hypothesized that a basic science review session on material prior to journal club related to the topic of the papers to be discussed would increase clinical understanding for third-year medical students both one day and three months after the journal club activity.

2. Material and methods

2.1. Medical student selection and randomization

Third-year medical students from two medical schools were

assigned to a four- or six-week rotation on the surgical service based on their internal lottery systems. Between six and eight medical students per month were participating in the clerkship. Prior to their first day on the service, students were alphabetized by last name and assigned a consecutive number. Numbers were written on paper and randomly chosen from a pool. Starting with an assignment to basic science review (intervention, see below), numbers drawn were alternately assigned to intervention or no intervention until all numbers were chosen. The numbers were then correlated back to student names. If students were on service for a second journal club discussion, their randomization was reversed (similar to a cross-over study).

Students received an e-mail prior to their first day on service stating that they would participate in several educational activities during the clerkship, and asking for their participation in IRB-exempt research (Lankenau Institute for Medical Research Institutional Review Board, November 2014). No students declined their participation. Students were not told which of their educational activities were part of research studies, and asked to not reveal their participation in education activities to students who did not participate in the same activity.

2.2. Journal club: paper selection

Surgical residents were assigned to choose a paper for the department's monthly journal club and to then lead the journal club discussion of the paper. The only criteria for journal club papers were that their major theme be related to general surgery and that they were of high quality; all papers were approved by two faculty members. Papers for journal club were distributed to all participants one to two weeks prior to the scheduled discussion. The papers discussed in journal club for the eleven months during the study are listed in Table 1. All medical students were reminded one day prior to journal club to read the paper and be prepared to participate in the discussion.

2.3. Basic science review

Basic science concepts integral to the clinical topics of the assigned journal club articles were identified by the authors, and included at least one anatomy topic and one pathology topic (Table 1). The medical students assigned to the intervention group

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