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Research Paper

Development of critical thinking in health professions education: A meta-analysis of longitudinal studies

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ABSTRACT

Introduction: While reports of critical thinking exist in the health professions literature, development of critical thinking across a broad range of health-professions students has not been systematically reviewed.**Methods:** In this meta-analysis, multiple databases and journals were searched through February 2016 to identify longitudinal studies using standardized tests of critical thinking [California Critical Thinking Skills Test (CCTST), Health Science Reasoning Test (HSRT), and Defining Issues Test (DIT)] in any language. Two reviewers extracted information and collected information regarding primary author, publishing journal, health profession, critical thinking test, and time1/time2 means and standard deviations. Standardized mean differences (SMD) with 95% confidence intervals (CI) were reported using a random-effects model.**Results:** Four hundred sixty-two studies were screened, and 79 studies (representing 6884 students) were included. Studies contained 37 CCTST, 22 DIT, and 20 HSRT. Health professions comprised nursing, pharmacy, physical therapy, occupational therapy, dentistry, medicine, veterinary medicine, dental hygiene, clinical laboratory sciences, and allied health. Cohen's kappa was strong (0.82) for inter-reviewer agreement. Both the CCTST (SMD = 0.37, 95% CI = 0.23–0.52) and DIT (SMD = 0.28, 95%CI = 0.18–0.39) demonstrated significant increases in total scores, but the HSRT (SMD = 0.03, 95%CI = –0.05–0.12) did not show improvement.**Discussion/Conclusions:** In this meta-analysis, students from the majority of health professions consistently showed improvement in development of critical thinking. In this diverse population, only the CCTST and DIT appeared responsive to change.

Introduction

Two concepts that appear integral to higher education are critical thinking and cognitive development. Fostering critical thinking has been a universal goal of faculty at institutions of higher education as there is a well-defined association between critical thinking

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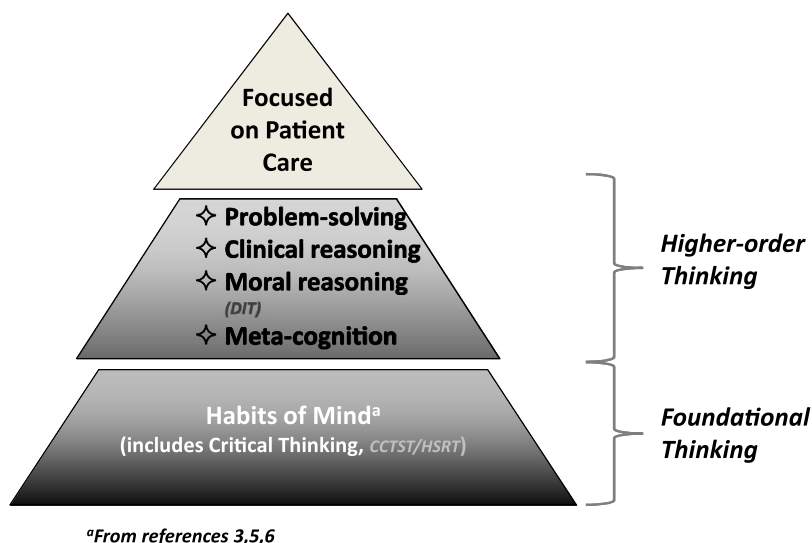


Fig. 1. A cognitive framework for cognitive abilities, including critical thinking.

and academic success.¹⁻³ Additionally, cognitive development is valuable in nurturing learners' growth.⁴ To our awareness, while reports of critical thinking exist in the health professions literature, development of critical thinking in a broad range of health-professions students has not been systematically reviewed to date.

Previously, we had reviewed development of critical thinking focused on pharmacy education.³ Using a framework from Marzano⁵ and Lane,⁶ a conceptual framework for cognitive abilities (including critical thinking) was developed,³ which is illustrated in Fig. 1. Three commonly used "critical thinking tests" were identified, although the various tests appeared to measure different cognitive abilities (also in Fig. 1). Items in the California Critical Thinking Skills Test (CCTST) and Health Sciences Reasoning Test (HSRT) were aimed at analytical inferences while the Defining Issues Test (DIT) was focused on situational moral reasoning. Within our review, these tests are described in more detail.³ Regardless of which test was employed, one substantial benefit was "convenience with administration by educators," as each test used only close-ended items assessed via self-response by test-takers. Additionally, in an accompanying meta-analysis of only student pharmacists, results showed some growth with the CCTST, mixed effects with the DIT, and no studies used the HSRT.⁷

The primary aim of this study was to broaden the application of these original findings to include a more diverse population of health-professions students using meta-analysis to systematically review and summarize development in critical thinking. A secondary aim was to evaluate these various tests' responsiveness to change among these students.

Methods

The University of Toledo Institutional Review Board (IRB) determined that this project did not require review. We performed and reported this educational research meta-analysis according to the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines.⁸

Search strategy and study selection

An academic librarian assisted in this search process. In order to collect all relevant literature, we examined multiple electronic databases including Pubmed, CINAHL, PsychINFO, EMBASE, Academic Search Complete, Proquest Dissertation and Theses A&I and Google Scholar. Conference proceedings published in the *American Journal of Pharmaceutical Education*, *Medical Education*, and *Academic Medicine* were also reviewed. All studies and proceedings reported prior to February 2016 were included. Search terms included "critical thinking," "moral development," "California Critical Thinking Skills Test" or "CCTST", "Health Science Reasoning Test" or "HSRT", and "Defining Issues Test" or "DIT". References from previously mentioned publications were searched for other potentially relevant articles. Non-English studies were included. Translators were student pharmacists, typically in their last year of pharmacy schooling; the senior author (MJP) supervised their translations.

Inclusion criteria included a targeted study population of health professions students. Only longitudinal studies that followed students' development in critical thinking using the CCTST, HSRT, or DIT administered at two or more points in a program were included.

The analysis excluded cross-sectional studies that administered the CCTST, HSRT, or DIT to more than one class of learners at the same time. The longitudinal study design (wherein investigators follow and measure the same class of learners over time) was preferred over a cross-sectional design since it yields more conclusive study results.⁹ Similarly, studies were excluded that assessed critical thinking only once (e.g., at baseline or as outcome with no prior comparison). Other exclusion criteria were studies that used

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