Evaluation of Health Science Examination of Pharmacy Students Using Critical Thinking Ability

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ABSTRACT

This research aims to find a link between how well pharmacy students did on the Health Science Examination (HSE) and how well they did on a task that tests their critical thinking skills (package insert). Pharmacy students in their first year were given the HSE as part of a spring term task to help them think critically. The box insert project was finished as part of a pharmacokinetics course in the same semester. The correlation analysis was used to check for a link between HSE scores and project grades. A weak but significant link existed between the learners' grades on the task and their overall HSE rating. Team-Based Learning (TBL) is a way of teaching that gets students to learn by doing and by getting them to think critically about how to solve problems. Given a weak but meaningful link with HSE scores, this study showed that a package insert task could be used to test pharmacy students' critical thinking skills.

1. Introduction

Overview of Health Science and Pharmacy Examination

Critical thinking (CT) is a skill that grows and gets better on its own, and each person grows it in their way [1]. According to the Association of American Higher Education Institutions, CT means thinking about things, situations, and events before deciding or coming to a conclusion. To move from pharmacy school to clinical pharmacy, students must learn CT, an essential skill [2]. CT skills are an excellent way to tell if someone will do well in medical school [3]. This study aims to find out how well Team-Based Learning (TBL) improves the CT skills of pharmacy students [15]. To do this, the Health Sciences Examination (HSE) was used for complete testing, and the results were carefully reviewed [4].

The 2016 Accreditation Council Guidelines for Pharmacy Education says that students must prove they have learned CT skills. Formal feedback and self-reflective learning have been shown to help pharmacy students get better at CT [18]. Studies indicate that the enhancement of CT can be achieved through a contextual setting that promotes reflective learning (integration), assistance and encouragement towards self-reliance (scaffolding), direct observation of mental processes (model conduct), and constructive feedback through open-ended questioning (challenging presumptions) [16]. The most effective ways to regularly include these components in classroom learning still need to be determined. TBL can be an educational approach that offers many chances to cultivate CT by engaging in team-based problem-solving activities.

These studies did not utilize the HSE to validate their assessments. Given these discoveries, it is necessary to create evaluation methods that accurately measure CT abilities, which the HSE has confirmed [5]. The present research examined the correlation between HSE scores and package insert task marks in a pharmacokinetics course. The study hypothesized that there would be a strong positive link between a pupil's performance on this package insert task and their HSE score. A good association suggests that this type of task can be used to measure CT skills over time in a pharmacy course.

Background and literature survey

The TBL process promotes CT skills by emphasizing key features such as acceptance, scaffolding, modeling behavior, and challenging beliefs. Chen et al. discovered that students' judgments of their CT abilities experienced an enhancement in a microbiological course that included TBL [6]. Li et al. comparing TBL with traditional lecture format revealed that TBL led to notable improvements in student confidence and learning results [7]. Using TBL as a teaching method can enhance CT abilities

in pharmacy school. Outcomes evaluation is essential for determining the efficacy of techniques employed in medical schooling to promote CT skills. To date, no studies have been published that have compared CT skills through evaluation of outcomes before and after longitudinal TBL training.

The HSE can be used as a method to evaluate CT abilities. The HSE is a specialized assessment that assesses the essential thinking abilities of students studying health science. The HSE consists of multiple-choice questions that vary in difficulty [17]. The assessment considers the capacity for CT in eight fields: comprehension, evaluation, reasoning, clarification, assessment, induction, mathematics, and deductions [8]. Higher percentile scores suggest better CT skills than other health sciences pupils.

Research has demonstrated that the HSE is a reliable indicator of achievement in the Pharmacy Curriculum Outcomes Evaluation [9]. A review of multiple studies examining the evolution of CT abilities over time found that students in various health-related fields, such as pharmacy, did not enhance their performance on the HSE. Previous longitudinal research examining the evolution of CT abilities among pharmacy students has produced inconsistent findings. A recent study examining the CT skills of pharmacy students after completing a CT found no significant improvements in their total, percentile, or sub-domain results on the HSE [10]. There was an observed enhancement in their analytical capabilities, while their scores in induction were lower. Boso et al. discovered a positive correlation between the results of pharmacy learners on the California Critical Thinking Dispositions Inventory (CCTDI) and the duration of their program [11].

After a year of school, scholars saw only marginal progress among pharmacy learners on the CCTDI and the California Critical Thinking Skills Test (CCTST) [13]. While it is challenging to determine the differences in results among these research studies, they suggest that relying solely on standard pharmacy schooling is still being determined to enhance CT skills and that the teaching approach used has a significant role [12]. The current research assesses the CT abilities of pharmacy students before and after two years of academic education using the HSE [19,14].

2. Methodology

TBL

The study was conducted at a pharmacy program employing TBL for all theoretical courses. The cohorts vary from 69 to 220 scholars, whereas the teams comprise five to six individuals. Learners were randomly allocated to new groups at the commencement of every semester. Before teaching in the classroom, instructors received training in formulating and delivering TBL. All educational courses consisted solely of TBL units. The TBL module consisted of three stages: pre-class planning, Readiness Assurance Process (RAP), and application. The preparation phase encompassed diverse modalities, including using reading material and films, led by specific learning outcomes. The RAP consisted of a quiz comprising five to 20 multiple-choice queries. The quiz was initially done individual Readiness Assurance Test (RAT) (iRAT) and then repeated in team RAT (tRAT). iRATs accounted for 5% to 15%, and tRATs accounted for 3% to 6% of the pupil's mark for all courses. The RAP process culminated with a concise discussion of queries that the pupils found ambiguous or perplexing. Following the completion of the initial phase, teams advanced to the application stage, where they tackled complex problems through application tasks. These exercises usually consisted of multiple-choice inquiries that adhered to the 4S structure whenever applicable. Teams engaged in gallery walk-style operations. 10 Peer assessments were completed midway through and after every semester.

HSE

The HSE is a 50-item test consisting of multiple-choice questions. Questions evaluate students' proficiency in interpreting, analyzing, inferring, explaining, evaluating, inducing, using numbers, and deducing. The overall score measures one's CT abilities, where higher scores indicate more excellent proficiency in CT. The scores for each category and the total score are presented on a scale of 50 to 100. The scores are categorized as excellent (90 to 100), high (80 to 90), medium (70 to 80), poor (60 to 70), or not expressed (50 to 60). With the comprehensive CT results, a total percentile rating is

furnished, which indicates the CT proficiency of each student relative to a national cohort of test-takers.

The HSE was given to first-year pharmacy learners in the fall of 2015 (n = 82) and the fall of 2016 (n = 108) during orientations before the start of the semester. The HSE was given again two years afterward, specifically throughout the fall introduction. This occurred in the fall of 2017 for the group that joined in 2015 and in the autumn of 2018 for the group that joined in 2016.

Statistical analysis

The data underwent deidentification before being subjected to statistical evaluation. The graphical information and average scores were calculated using Microsoft Excel, version 16.0. A coupled student's t-test was used to compare HSE results before and after TBL training. Welch's t-test was used to compare the HSE scores for pupils who did and did not show improvement in their grades. The institutional reviewing board of the University of Texas at Tyler approved this project.

3. Results and discussion

Out of 250 learners, 220 were selected for this retrospective investigation after meeting the exclusion criterion. The study group comprised 54.5% female respondents, aged 25 to 60 years (mean ± standard deviation). The remaining 45.5% were male respondents, with an age range of 25 to 60 years. The pupil population consisted of roughly 46% white students and 54% students who were African, Hispanic, or Asian. Most students have completed at least two to four years of college before being admitted into the Pharmacy course. There were no notable variations in HSE results or packaging insert assigning marks across these pupil groups (Table 1).

Table 1. HSE results or packaging insert assigning

Category	Count	HSE score		Task grade	
		Mean	Variance	Mean	Variance
Gender					
Men	100	22	3	91.4	12.1
Women	120	22	8	86.4	13.7
Ethnicity					
African	42	18	6	91.3	13.2
Asian	25	21	9	89.6	15.2
Mixed	32	26	4	93.2	10.5
White	102	15	7	87.5	9.7
Hispanic	19	12	3	90.4	11.5
Credits					
60	42	23	6	89.3	12.1
90	52	28	8	92.3	15.3
120	67	19	4	95.1	10.5
150	47	21	6	90.5	9.5
180	12	24	9	87.5	14.2

The outcomes of the HSE can be contrasted with predetermined "cut values" that have been established for four levels of efficiency, utilizing the 33-point variant of the form (Table 2). A score of $28 is considered superior, indicating a level of proficiency that surpasses others and enables the individual to engage in more advanced studies. A score within the range of 20-29 indicates a high level of proficiency in job advancement and academic success. A score within the intermediate range (16-25) suggests that the pupil encounters challenges in problem-solving or decision-making abilities. Lastly, "not expressed" (0-17) indicates a lack of ideal effort or a gap in understanding when taking the test. Based on the cut results, the median HSE scores of the students in the present research were high. The ratings on the HSE are classified into substantial, modest, and not expressed cut ratings, as shown in Table 2.

Table 2. Recommended HSE score

Method	Not expressed	Medium	High	Excellent
Total HSE	1-15	16-25	26-30	>30
Analysis	1-3	4-7	>7	NA
Interferences	1-6	7-12	>12	NA
Evaluations	1-4	5-13	>13	NA
Inductions	1-5	6-16	>16	NA
Deductions	1-7	8-19	>16	NA

The median assessment ratings were categorized as vital, whereas the scale ratings for evaluation, deduction, induction, it is, and reasoning were all classified as medium. The average grade for the package insertion task, 90.8, met the criteria for the course's grading structure. The study revealed significant albeit low positive associations between pupils' task marks and general HSE scores. Modest correlations were also discovered among the task's mark and reduction (Table 3).

Table 3. Correlation HSE analysis

Method	Median	Variance	Correlation grade	p-value
Total HSE	24	7	0.15	0.006
Analysis	5	3	0.06	0.24
Interferences	7	4	0.14	0.16
Evaluations	5	3	0.09	0.27
Inductions	8	2	0.14	0.13
Deductions	9	4	0.26	0.003

4. Conclusion and future scope

Pharmacy colleges must educate students with excellent CT abilities that enable them to make well-informed clinical judgments and decisions. Implementing a systematic and efficient evaluation of CT skills across a Pharmacy program will considerably enhance student growth in these domains. This research showed that a package insert task could be employed to measure CT skills in pharmacy learners because of its weak but meaningful association with HSE results. This study presented empirical evidence that implementing a TBL curriculum can enhance students' overall capacity for CT. While additional research is necessary, these findings suggest that CT tasks are created to support and assess the ongoing growth of CT skills in pharmacy learners.

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