

Chapter #25

CRITICAL THINKING SKILLS AMONG MOROCCAN PHD STUDENTS OF HEALTH SCIENCES

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ABSTRACT

The significant weakness in problem solving and innovation continues to affect scientific production in Morocco. That's why, many reforms are set up to address the various problems raised.

The national strategy for the development of scientific research by 2025 indicates the proper conduct and methodological integrity of research work.

Literature states that critical thinking is the intellectual basis of the scientific research method. Furthermore, it has been empirically demonstrated that students with strong critical thinking skills (CTS) perform well in research methodology subjects. Therefore, the close relationship between critical thinking skills and performance in the research methodology application highlights the potential of young researchers in this area.

The present work is the subject of an exploratory study that intends to reveal CTS, considered as an essential foundation for any research methodology, among 25 participants registered as researchers belonging to health sciences majors.

The findings of this study scored moderate overall results of CTS. A significant correlation has been found between the overall score skills of the HSRT and the scores of the marks of their final projects. The correlation indicates that the success of their dissertation work was related to the deduction, evaluation, and inference subscales of the HSRT.

Keywords: scientific research, critical thinking skills, health science, HSRT, method.

1. INTRODUCTION

The Delphi Consensus Experts (American Philosophical Association, 1990) states that critical thinking skills include analysis, inference, evaluation, induction, and deduction, and each of these skills has a list of subskills, defined as:

Analysis: is the process of identifying the anticipated inferences relating statements, questions, concepts, descriptions or other representation forms intended to express beliefs, judgments, experiences, reasons, information or opinions.

Evaluation: is assessing the reliability of statements which might be viewpoints, claims or perceptions, personal experiences, judgments, beliefs, or any other representation, and review the logical bounds or intended inferences linking the abovementioned.

Inference: is to recognize constituents required to sketch reasonable conclusions; to formulate speculation and hypotheses as well as mull over significant information and to presume the consequences generated from data, statements, principles, evidence, judgments, beliefs, opinions, concepts, descriptions, questions, or other forms of representation.

Induction: is defined as decision-making in contexts of uncertainty. Then inductive reasoning skills based on inferences about what we think are based probably true on analogies, case studies, prior experience, statistical analyses, simulations, hypotheticals, and patterns recognized in familiar objects, events, experiences, and behaviors. Deduction: is decision-making in precisely defined contexts where rules, operating conditions, core beliefs, values, policies, principles, procedures, and terminology completely determine the outcome depends on strong deductive reasoning skills.

According to Benítez and Canales (2013), Boisvert (2015), Case (2005), Ennis (1985), Ennis (1993), Facione (1990), Halpern (1998), Lipman (1988), Paul (1992), Willingham (2007), critical thinking includes component skills of analyzing arguments, making inferences using inductive or deductive reasoning, judging or evaluating, making decisions or solving problems, and become stronger to face new challenges.

Otherwise, Innis (2015) stipulates that critical thinking involves several steps, most of which adults' breeze through without much thought. These steps include, identify the issue, think about the goal, brainstorm possible solutions, think through possible results, try one of the solutions, and finally, evaluate the outcome.

While Abrami et al. (2015) indicates that Critical thinking (CT) is purposeful, self-regulatory judgment that results in interpretation, analysis, evaluation, and inference, as well as explanations of the considerations on which that judgment is based.

These critical thinking skills are still in high demand in the research method. Accordingly, they are mandatory for any researcher for a better understanding and monitoring of the research process (Indrawatiningsih et al., 2019), because they are immediately apparent interactively through the research method used by researchers, which is a systematic way of achieving the objectives of the research process.

The critical thinking skills ensure a quality approach that fosters certain methodological integrity, which ultimately provides useful results for research users (Roller & Lavrakas, 2015).

Furthermore, Collins and Onwuegbuzie (2000) states that students with higher critical thinking skills perform well in research methodology courses, thus, several disciplines unanimously agree on the need to develop a way of thinking that can respond to different challenges. They stipulate an education based on reasoning, criticism, and stimulation of intelligence, to serve and facilitate training, improve practice and excel in the field of scientific research, which remains the most powerful engine for the socio-economic and cultural development of nations in a constantly changing world.

In fact, these critical thinking skills were implemented during the design of the research method at the end of the study; according to Fortin (2010), the sampling phase involves the selection of inclusion and/or exclusion criteria, the choice of sampling technique, the number and characteristics of participants and the description of the study environment. This step could induce all the cognitive skills of critical thinking.

The second phase, which includes the type and design of research, also calls for critical thinking skills that consider the research questions, purpose, and objective of the study in relation to the other components of the method.

The third phase of data collection involves defining the variables and relating them to the measurement instruments that require clarity (scale, questionnaire, etc.), and their reliability and validity must be clearly designed. This stage may also involve skills related to the analysis and evaluation of critical thinking.

Regarding the step that concerns the procedure, this should describe in detail the activities that are to follow such as recruitment of participants, data collection.

In addition, the data analysis' section describes the statistical test used and it must justify its choice and its compatibility with the purpose of the study, so it is interesting to note that the ability to analyze critical thinking is in high demand.

Regarding the results, it serves to summarize the outcomes of the application of the data collection method and the statistical test used. It includes descriptive, inferential statistics, and the significance score. This also calls for critical thinking skills related to interpretation and inference according to the research framework.

Precisely in health sciences, many researchers have proven the significant relationship between critical thinking skills and academic performance through the HSRT. In other words, HSRT is positively related to academic performances with significant correlations.

Indeed, critical thinking skills are increasingly needed in academic and clinical settings to ensure evidence-based practice (Wallmann & Hoover, 2012; Meherali, 2016).

However, there are few empirical studies to assess the relationship between the Critical Thinking Skills Test and students' skills in applying the research methodological process and to see how well the "HSRT" can predict students' skills in applying the research methodology and how successful students are in developing the final project work. Thus, the objective of this study was to assess the relationship between the grades obtained by health science students in their final research projects and their ability to think critically through the HSRT.

2. METHOD

2.1. Participants

There are 25 PhD students in health sciences from Casablanca School of Medicine, selected using a random sampling technique where 79% were female. 82 % represents a bracket-age of 24 and 30 years old.

2.2. Instrument

The HSRT is conceived as a multiple-choice format test and the time required to complete the test is 50 minutes. Items require no health science knowledge. The questions on the HSRT test varied in difficulty and complexity. HSRT test items are developed in clinical and professional practice settings. The question itself provides specialized information needed to answer correctly.

According to the American Philosophical Association (1990), The HSRT invites participants to apply their skills to the information provided in a variety of different scenarios. The information is presented in both textual and schematic formats; responses involve inference, interpretation, and analysis of information, drawing justified inferences, identification of claims and reasons, and assessment of the quality of arguments.

Each test question is based on 40 years of Insight Assessment research on the measurement of critical thinking; the questions are multidimensional and interrelated, so that individual and group test, results provide meaningful information about specific critical thinking skills.

The HSRT designed to provide both an overall score for critical thinking and a selection of scale scores to help the instructor to get the target training programs and opportunities to address the particular weaknesses of individuals and groups. The HSRT Global Raising Skills score targets the strength or weakness of an individual's ability to make thoughtful, reasoned judgments about what to believe or do. Scores reported for analysis, inference, evaluation, induction, and deduction.

The test was available in three languages: Arabic, French, English, and the doctoral student had the possibility to choose his or her language. HSRT is the most reliable and widely used for measuring critical thinking skills in the health sciences (CCTST User Manual and Resource Guide, 2019).

2.3. Procedure

A pre-test has administered to 09 students to see its adaptability and validity in our target population.

After receiving permission from the committee, and in order to ensure that the test was administered in good conditions, the head of the research pole gave us a large, well-equipped room. In addition, despite all this, there were time constraints on the study participants and it was difficult to recruit participants for a period of fifty minutes.

The participants took the Health Sciences Critical Thinking Skills Test (HSRT) for a period of one month.

3. RESULTS

The descriptive results of this study are presented in the table below which are “the means, the medians and the standard deviation pertaining to the full HSRT scales and the analysis evaluation and inference subscales. These averages were compared to the averages reported by HSRT developers (HSRT user Manual 2019). Based on the distribution of overall score percentile for participants in this study, as compared to an aggregate sample of four-year HSRT students, the percentile rank for this group is 35.

In the other words, a median score equivalent to the percentile rank was calculated by comparing the median score of the full HSRT scale in this study to the percentile rank norms reported by insight assessment for health science students. Thus, the calculated percentile of 35 for the full HSRT scale indicates that at least 50% of the present sample scored higher than the 35% norm group. As a result, the participants in the study exhibited poor critical thinking skills as compared to an aggregate sample of HSRT Undergraduate Health Sciences

Interestingly, the overall critical thinking skills score among study participants is statistically barely moderate compared to the participants' HSRT 33-Point Scale Score Interpretation.

*Table 1.
HSRT descriptive statistics.*

Measures	Average	Standard Deviation	Median
HSRT Total Score	14.25	2.6	14.5
Analysis	2.91	0.77	3
Evaluation	3.16	0.70	3
Inference	3.41	1.05	3.5

Table 2.
Correlation of test to end-of-study project scores.

Measure	Correlation coefficient
HSRT Overall score	0.73
Induction	0.51
Deduction	0.59
Analysis	-0.06
Inference	0.60
Evaluation	0.69

Pearson's correlation coefficients revealed moderate statistically significant relationships between general critical thinking skills and research work scores.

In the other words, there is a significant correlation between the overall score of the HSRT and the average score obtained from the participant's thesis rating which is 0.73.

Table 2 presents the correlation matrix involving the five subscales of the HSRT and the scores of the research papers from which the canonical correlation analysis was undertaken.

The relationship between the two sets of variables was assessed by examining the magnitude of the canonical correlation coefficients of the end-of-study project and overall HSRT scores and of each HSRT sub-scale. Thus, the Pearson correlation coefficients represented the degree of relation between the two sets of variables.

Because the strength of the relationship is indicated by its closeness to the positive or negative absolute value of (+or-1) (Fortin, 2010), thus the Pearson correlation coefficients represented the degree of relationship between the two sets of variables which stipulates being close to the positive absolute value 1.

In the present study, the correlation coefficient "r" related to evaluative reasoning skills is ($r = 0.69$), this canonical correlation is statistically significant.

Then the correlation coefficient "r" related to inference and deduction subscales with the values of 0.60 and 0.59 respectively, consequently this canonical correlation seems statistically significant

However, the canonical correlation relative to induction seems statistically moderate. There is a moderate correlation between induction and these scoring with a coefficient lower than (0.50).

Furthermore, the correlation coefficient "r" related to the analysis skills was not statistically significant with an ($r = -0.06$), consequently, there is 'not a correlation between analysis skills and their thesis rating.

This explains that the participants of the study have a lack of analytical skills. Therefore, it can be said that the overall score for critical thinking skills, which is barely moderate, returns to the low sub-scales related to analysis

In this regard, the research success of participants in the study is related to skills related to respectively evaluation, inference, deduction, and induction, nevertheless, the weakness in the overall score of the HRST is explained by the deficit related to analytical skills.

The analytical reasoning skills provide researchers with the ability to identify hypotheses, reasons, and to investigate how they interrelate in the formation of arguments. They use analysis to collect and analyses information. Furthermore, Strong analytical skills can contribute to high-quality outcomes by providing insight into the significance (American Philosophical Association, 1990).

The present study reveals a barely moderate score on all critical thinking skills among the study participants compared to the participants' HSRT 33-Point Scale Score Interpretation. In addition, there is a statistically significant correlation between the overall HSRT score and their end-of-study scores with a correlation coefficient ($r = 0.73$).

Moreover, there is a statistically significant correlation between evaluation, inference, deduction, and induction skills, while, compared to the participants' HSRT 33-Point Scale Score Interpretation, the participants in the study have insufficient analytical skills. Furthermore, there is no significant correlation between the analysis skills and study participants' research scores, with a correlation coefficient ($r = -0.06$).

4. DISCUSSION

The objective of this study was to highlight the relationship between health science students' final research work scores and critical thinking skills in the health science disciplines by the health science-reasoning test "HSRT". The significant correlation between the two research variables and the HSRT global score indicates that the HSRT generates reliable and valid critical thinking skills scores and can predict their capacity in the application of research methodology and hence their potential in scientific production.

In fact, the elaboration of research projects in particular and scientific production, in general, is dependent on critical thinking skills. Furthermore, the bidirectional relationships between these two variables, as students improve their critical thinking skills, their ability to understand and control the research process increases, and vice versa.

Consequently, in health sciences, the higher-order critical thinking skills are increasingly necessary for research and success, as clinicians are required on a daily basis to evaluate multiple bits of information about patients with multiple-systemic health concerns and make appropriate treatment decisions based on this information. Because students who have given up on continuing their work projects are the ones who lack the critical thinking skills necessary for success (Wallmann & Hoover, 2012).

In addition, student's graduates with lower critical thinking gains have higher unemployment rates (Kelsch & Friesner, 2014), moreover, university graduates lack critical thinking and problem-solving skills, both in the classroom and in the labor market (Nold, 2017).

These results are also consistent with those of a meta-analysis of studies evaluating critical thinking test scores and academic achievement of health professional students (Reale, Riche, Witt, Baker, & Peeters, 2018; Touri & Marquardt, 2013).

The principals' results of this study indicate a significant correlation between the overall score of the HSRT and participants' final dissertation scores. However, there are just moderate overall score skills than the sample of four-year HSRT health science graduate students.

Independently of the low overall score of the HSRT's participants, the competencies that are missing and that affect the global score of critical thinking skills are the analysis competencies.

However, (Collins & Onwuegbuzie, 2000) in their experimental study indicated that achievement scores were related to analysis with other skills

Because, the Analytical reasoning skills allow people to identify assumptions, reasons, and claims, and to examine how they interact in forming arguments. Moreover, the analysis enables us to gather information from tables, graphs, diagrams, spoken language, and documents. Therefore, people with strong analytical skills pay attention to diagrams and details. They identify the elements of a situation and determine how these elements interact. Strong analysis skills can contribute to a high-quality analysis by providing insight into the meaning of what a person says or what something means (American Philosophical Association, 1990). Furthermore, conclusions, assumptions, recommendations, or decisions based on erroneous analyses can bias the study, even if they have been using excellent inference skills (Facione, 1990).

To address this deficit in critical thinking skills the critical thinking skills and abilities can be developed, with specific and effective pedagogical strategies that have implemented in this field (Abrami et al., 2015; Setiawati & Corebima, 2017). For example, the implementation of Problem based learning is used to improve critical thinking skills (Puspita & Aloysius, 2019).

Furthermore, Willingham (2019) announces that in order to strengthen critical thinking skills among students, a continuous practice of critical thinking remains essential. Moreover, professors who have been trained in the concepts of critical thinking and the methods necessary to develop critical thinking skills must train novice researchers (Nold, 2017). In addition, they must assist them from their initiation to research, in the other words, from the first cycle to becoming competent researchers.

Whereas students who have critical thinking skills are able to apply the research method correctly in their research work and students who excel in applying the right research method have strong critical thinking skills, it is interesting to start research activities from an early age and provide students with activities to operationalize each critical thinking skill. Moreover, to prepare tests targeting high levels of the cognitive domain, and to present probing questions, encouraging students and instructors to participate in problem analysis and discussions, and the promotion of autonomous learning.

5. CONCLUSION

This study reveals the set of critical thinking skills of an elite group of students in health sciences through the HSRT, thus it highlights their potential of application of research method through a correlational study of their dissertation works and their overall critical thinking skills scores.

The results indicate a significant correlation between final projects and the overall score of the HSRT. A deficit in terms of analytical skills requires intervention to build capacity in this area.

Thus, whatever the field of research, whatever the knowledge acquired and whatever the quality framework developed, the apprentice researcher is expected to perform on all critical thinking skills and in particular the evaluative and analytical skills which provide useful results in a constantly changing world.

Thus, it will be useful to integrate the critical thinking approach in the training program, in particular in university studies, it, therefore, remains essential to merge critical thinking in the various teaching programs from an early age, for more practice. The critical thinking skills manage The Smart method will definitely lead to smart results that will serve society's prosperity in general.

It is interesting to note that among the limitations of the study is the high cost of the test, the unavailability of student researchers, and the time allocated to its administration.

An evaluation of research methods for graduate work in the health sciences will be the subject of a future study.

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