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Think How to Think: Studying the Relationship between Critical Thinking Skills and Academic Achievement of Learners at Higher Education

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Abstract: The purpose of this research was twofold; to identify the relationship between critical thinking skills and academic achievement of students and explore the teachers' perceptions of students' critical thinking skills in higher education. Both quantitative and qualitative methodologies were adopted to collect data from university students and teachers. A public sector university was involved through purposive sampling to collect data from teachers and students. A test was developed for students based on the literature on critical thinking skills. Academic achievement was measured through the CGPA of students. A total of 800 students appeared in the test. Simple linear regression was applied to map the relationship between students' critical thinking skills and academic achievement. To collect data from teachers, a semi-structured interview protocol was developed in line with the test content. In total, 20 teachers were involved in collecting data. Thematic analysis was carried out to analyze qualitative data. The results of linear regression showed that there was no relationship between critical thinking skills and the academic achievement of students. They mainly reported their teaching methods and strategies. They rated a moderate level of critical thinking skills of their students. These results were contrasted with available research in higher education.

Introduction

In the present era, information is everything (Loftus & Loftus, 2018). When we receive information, we evaluate it to find a reason behind this claim, and if it has a reason, we accept it. The study of these three concerns is called critical thinking (Baronett, 2018). The 21st-century learning skills are of utmost importance nowadays, more than ever. The emphasis is being shifted from what to think to how to think (Basham, Irwin, Nardone, & Wallace, 2011). Thus, we need skillful graduates who work through a well-refined system of education to meet the demands of a knowledge-based economy (Dilekli & Tezci, 2016). Learners who are adroit can survive in this fast pacing world (Forawi, 2016).

Authors Agarwal (2019); Shukla and Dungsungnoen (2016) classified thinking skills into two; low-order thinking skills (LoT) and higher-order thinking skills (HoT), which are mainly based on Bloom's cognitive taxonomy (Bloom). LoTs are the basic levels of Bloom's taxonomy, e.g., remembering, understanding, and application, and HoTs are based on the upper three levels of Bloom's taxonomy, e.g., analyzing, evaluating, and creating. Lower-order thinking skills are basic thinking, while higher-order is complex and applied thinking skills (Tikhonova & Kudinova, 2015). The knowledge gained through these skills lasts longer and becomes concrete after experience because of a deep conceptual understanding of facts, principles, and theories

(Mainali, 2012). Such skills develop reasoning in students consistently; they think logically and in a coherent manner (Aminah, Kusumah, Suryadi, & Sumarmo, 2018). Their logical arguments help them to generate knowledge through deductive and inducting reasoning (Foresman, Fosl, & Watson, 2017).

Such skills guarantee learners' abilities not only in academics but in their profession as well. Learners who think critically and have problem-solving skills can immediately solve a problem with their justified decision-making skills (Kallet, 2014). It also promotes innovation and creativity among learners to think outside of the box and plan a variety of efficient solutions. They crucially check the validity and soundness of the argument before making any decision (Boss, 2012).

Although critical thinking skills are deep-rooted when it comes to our higher education system, it sounds new. Our educational system is mainly based on factual data, and learners usually reproduce the memorized material; their exams are overly subjective and lack practice. As a result, our learners are passive recipients (Ahmed & Ahmad, 2017). They get high grades without learning, which is continuously weakening the system. Productivity and innovation are deteriorating. Thus, there is a huge theory-and-practice gap in our education system (Haq, Mahmood, Shabbir, & Batool, 2020).

Problem Statement

The Pakistani higher education system is mostly based on a centuries-old style, the lecture method. Our system hardly promotes critical thinking, reasoning, and problem-solving skills in students, which are called 21st-century learning skills. Our students mostly rely on rote learning, which no longer lasts after exams. The assessment system is also designed on the same analogy, which supports such learners, but when

they go to the job market, they can hardly meet the demands of employers. We considered it a major problem in higher education, and we intended to study the relationship between students' critical thinking skills and academic achievement of learners in higher education. It is also a proven fact that a teacher's role is of great importance in the whole education system. In fact, teachers' teaching philosophy depends on the environment of the classroom. If a teacher lacks such skills and fails to create a student-centered classroom, her students can never learn such skills. Thus, the teacher's role is imperative. Considering the need, we also plan to interview teachers to know their perceptions on fostering critical thinking skills among their students and the way their students incorporate these skills into their studies.

Research objectives

- To identify the link between students' critical thinking skills and learning performance in higher education.
- To explore the teachers' perceptions of students' critical thinking skills in higher education.

Literature Review

Critical Thinking Skills

Critical thinking is described as an ability to evaluate, analyze and construct your own experience and judgments on something, which is related to higher-order thinking skills. Mountainous literature is available defining critical thinking. However, the more comprehensive definition comes from Scriven and Paul (2003), who cover all the elements of the cognitive domain in their definition. Thus, critical thinking is a logical process of adroitly conceptualizing, comprehending, applying, analyzing, evaluating, and creating the information received or generated through observation, experience, reasoning, reflection, or communication. Moreover, Scriven and Paul

(2003) also developed a framework of critical thinking which is one of the most cited frameworks in this domain. This framework is based on three key areas (a) analysis of thinking means concentrating on 'how to think, focusing on the elements of thoughts); (b) evaluation of thinking means focusing on the quality of thinking and improvements in the universal intellectual standard; (c) reflecting on thinking to make improvements which are linked to developing intellectual traits.

Foresman, Fosl, and Watson (2017) identified that critical thinking is a key element of concrete learning. It is actually based on a wide range of complex skills, e.g., evaluation of factual information, recognizing fallacies as part of that information and drawing a valid and justifiable conclusion from it (Cottrell, 2017). Critical thinking stimulates students to clearly articulate their arguments. It also enhances students' ability to develop innovative solutions. Critical thinking also enables students to develop coherent and logical arguments to present their thoughts. Furthermore, HoTs also enables learners to learn in-depth concepts (Shukla & Dungsungnoen, 2016); after recognizing and understanding the problem they try to develop efficient solutions through logical arguments, analysis, and evaluation (Widiawati, Joyoatmojo, & Sudiyanto, 2018); this helps to draw justifiable solutions (Budsankom et al., 2015); such learners also continuously monitor and reflecting on their learning so that they can make improve themselves and reduce the fallacies in the information (Mainali, 2012); learners also consider the sources of information and its genuineness to reduce inconsistencies (Shukla & Dungsungnoen, 2016); this helps to develop coherent thinking (Sani, 2019). Facione (1990) is among the key authors of critical thinking skills; he developed a taxonomy of critical thinking skills with sub-skills. This taxonomy highlights all the key skills of critical thinking, including analysis, inference, interpretation, explanation, self-regulation, and evaluation. Critical thinking

paves the way for learners to think logically, use reasoning to draw conclusions from the information (Albrecht, 1984), also to and distinguish between correct and poor arguments (Copi, Cohen, & McMahon, 2016).

Reasoning helps us to move from what we already know, extract a conclusion, and evaluate the conclusion (Sternberg & Sternberg, 2012). These skills are of great importance in the following disciplines, e.g., mathematics, law, medicine, politics, sciences, and education (Gensler, 2010). As mentioned elsewhere, there are two core types of reasoning; inductive and deductive reasoning. Inductive reasoning based on multiple premises, most of the time all true, usually combines to generate a specific conclusion. This also helps to predict behavior. The other is deductive reasoning. We present facts and draw a conclusion from them (Schraw & Robinson, 2011). Basically, reasoning has two types; inference and argument (Kelley, 2014). Inference helps to reach a conclusion dependent on the provided information (Zalaghi & Khazaei, 2016). Through argument, we evaluate the provided information and justify it through our own beliefs and claims (Quintana & Correnti, 2019).

Academic Achievement

The quality of education mainly lies in the higher-order thinking skills of students. If students learn these skills, that means they are achieving their goals. If we want to enhance the quality of education, we need to focus on the factors which contribute to student's academic achievement (Tian & Sun, 2018). Academic achievement is generally presented in the form of their final score, position, and grade. It can be in the form of quantitative and qualitative information that helps to understand how well a student does in his/her studies (Stadler et al., 2018). However, the most commonly used method to measure academic achievement is GPA (Grade-point-average) in higher education.

The link between Critical Thinking Skills and Academic Achievement

The available literature on critical thinking skills highlighted that students who have higher levels of critical thinking skills performed better in their studies, achieved educational goals, and achieved their career goals as well (Tuna, Biber, & İncikapı, 2013). As the job market requires students who are equipped with 21st-century learning skills, it is important to empower learners through these skills in their disciplines (Riyanti, Suciati, & Karyanto, 2018). Authors Tavakol and Dennick (2010) argued that rote learning does not allow learners to think deeply and comprehend the content. At a higher education level, learners not only learn the concepts but critically evaluate and analyze them to make justified decisions and applications (Spicer et al., 2019). Only getting higher grades and GPAs does not help students in the job market; they fail to justify their knowledge and skills in the new environment (Iqbal & Ahmad, 2015). To develop the abilities and personalities of learners, learners should experience higher-order thinking skills (Hasnoor, Ahmad, & Nordin, 2013).

Research Methodology

Research Procedure

The main purpose of this research was to study the relationship between students' critical thinking skills and learning performance in higher education. Moreover, we will also explore the teachers' perception in view of students' critical thinking skills. As the study objectives directed towards the multi-method design, we adopted both quantitative and qualitative research methodologies to collect data from public sector university teachers and students. This research was conducted during the Covid-19 outbreak. Thus, all the available teachers and final-semester students were invited to participate in this research. A test was developed after an in-depth literature review on critical

thinking skills to collect data from students studying in higher education. As to collecting data from teachers, an interview guide was developed covering the key aspects of critical thinking skills of students in higher education. A simple linear regression was performed to analyze the collected data. As to analyzing the interview data, thematic analysis was carried out to extract the study results. Informed consent was obtained from all the research participants, both teachers and students. All the ethical protocols were carried out to ensure the anonymity and congeniality of the research.

Population and Sample

As mentioned elsewhere, this research was conducted during the Covid-19 outbreak when the educational institutes were closed. Thus, it was challenging to involve more universities due to the time constraints of this research. Just one public sector university was involved on a purposeful basis in collecting data from teachers and students. University was partially open at that time, and only final semester students were allowed to have their classes on campus. We invite all the available students to participate in this research. In total, 800 students were willing to participate in this research. As to teachers, 20 faculty members from all eight faculties gave their consent for interviews.

Research instruments

Test: To achieve the study objectives, two research instruments were designed. Critical thinking skills are generally measured through a test. Initially, we considered some available tests to map critical thinking skills, but almost all of these tests are paid. Considering the available resources, local context, and need, we planned to design our own test. For this purpose, we evaluate all the available tests and prepare a list of contents for developing our own test. Our test is mainly based on the following standardized tests: The Cornell Conditioning-reasoning Test

Form X, the California Critical Thinking Skill Test, and Watson Glaser's Critical Thinking Appraisal. An objective type test was constructed, which was kept generically so that students from all disciplines could easily solve it. Next to demographic information (the Gender, program, department name, CGPA, etc.) mentioned on the test, the second part of the test was designed on the following items: (a) logical equivalences; (b) evaluating arguments; (c) judging inference; (d) logical puzzle; (e) ambiguous and unambiguous statements; (f) valid and un-valid arguments. The total marks of the test were 35 without any negative markings. All the test instructions were mentioned in the test. Researchers allocated 30 minutes for participants to attempt this test. Initially, pilot testing of the test was conducted involving 150 students from the same sample of 800. The reliability of the test was sound. However, some minor changes were made after the initial analysis. Researchers marked all the tests and entered test scores into the SPSS sheet.

Interview Protocol: To explore the teachers' perceptions of the critical thinking skills of students, an interview questionnaire was designed based on the critical thinking literature. We want to investigate their perceptions of two points. First, how they foster critical thinking skills in their students and teachers' opinions about their students in relation to their critical thinking skills, both the test and interview questions were aligned with each other. In total, seven questions were designed, along with some supporting questions. Some of the sample questions from the interview protocol are presented below (a) How can a teacher lead his/her students to think critically? (b) How do you incorporate critical thinking skills in assessment?

Data Collection: As mentioned above, we planned two data sets, quantitative and qualitative. Thus, we took formal permission from the head of the department from the selected university. They

officially allowed us to collect data from their students. To collect data from students, we gather them in a hall and deliver copies of tests. Researchers explain all the instructions to students to attempt the test and remain there until they complete the test. Strict monitoring was also done to avoid cheating. The test was conducted in a conducive environment. Students showed their willingness to participate in research and solve the test with full concentration. The BS final semester students were invited to attempt this test. Their average age ranged between 22–23.

As to collecting data from teachers, we sought permission from each individual teacher after presenting the interview protocol and giving them an orientation about this research. Permission was also acquired to record the interview for analysis. The interview lasted between 15–25 minutes approximately. After taking their general introduction, researchers move to ask the particular questions mentioned in the protocol. The average age of teachers ranged between 28–60, and their levels of qualifications were up to a Ph.D.

Data Analysis: SPSS version 25 was used to enter all the quantitative data for analysis. After cleaning the data sets from errors and omissions, the data set was prepared for analysis. First, we calculated the descriptive statistics, and then simple linear regression was applied to achieve certain findings. As to qualitative data, thematic analysis was carried out to infer the findings. The prescribed six steps of thematic analysis were followed to analyze data. At first, researchers transcribe all the interviews verbatim to get familiar with the data. The initial codes were identified to achieve certain themes. In the third step, themes were identified in line with the interview questions, then we reviewed the themes and merged the similar and unpopular themes. After refining the themes, the relevant interview chunks were reported to reach a conclusion. To ensure the interview reliability, we

also determined inter-rater reliability by requesting a person who was not familiar with our research to code eight interviews. Agreements between coders were calculated, the discussion was also made on the dissimilar codes, and then a final agreement was developed, which was in accordance with the prescribed benchmarks of Miles and Huberman (1984) 93%. The following section will report the results of both quantitative and qualitative data.

Results

This section will present the results of both quantitative and qualitative analysis. To identify the relationship between critical thinking skills and academic achievement, we applied a simple linear regression, and thematic analysis was carried out to infer the results from qualitative data. So, the result section is based on two parts, the quantitative results and the qualitative part.

Descriptive Statistics

At first, the descriptive statistics of the variables were calculated. Following are the mean and standard deviation values of test scores ($M = 13.34$; $SD = 3.64$) and CGPA ($M = 3.41$, $SD = 1.07$). This shows the average score on the test was 13.34, and their average CGPA was 3.41.

Simple Linear Regression

A simple linear regression analysis was conducted through SPSS by adding the variable test score and CGPA of research participants. The following regression equation was found $F(.871)$; $aR^2 = .001$, $p = .35$. The variance between test scores and academic achievement is actually not exist, which means there is no relationship between these two variables. Similarly, regression coefficients were also not significant. The values of the regression coefficient also showed the same trend in results that a value added to students' test scores (.33) would not increase students' CGPA. This means some other

factors contribute to students' results other than critical thinking skills. However, we will discuss these results in the discussion section of the manuscript.

Thematic Analysis

The following section presents the results of the thematic analysis of teachers' perception of critical thinking skills. We conducted a question-by-question analysis. So, after asking an introductory question, we asked about a teacher's philosophy in his/her classroom.

Teaching Philosophy

This first question helps us to identify many codes and related themes in teachers' interviews. However, after refining and merging the relevant themes, we gathered the data in two sub-themes (a) learner-centered classrooms and (b) teacher-centered classrooms.

Learner-centered Classroom: This is the most occurred theme in the data; the majority of the respondents shared that they try to engage their learners in the classroom and their whole teaching and classroom activities based on learners. They plan their lessons according to learners' needs, interests, and capacities. The following interview chunk is extracted as evidence of this claim:

"I think the classroom should be students centered because whatever we plan and do in our teaching it is for students, so efficient teaching is not possible without students' engagement." (Teacher-13)

Another teacher explained:

"I always take care of what my students want from me, so when I am planning lessons, I consider my students' interests and abilities and the ways to make my lesson interesting for students." (Teacher-02)

A teacher said:

"Teaching without students' participation means you are talking to yourself. You need to make sure that they are learning, they are interested in your

lesson, and leave certain questions for them to ponder on. This is how they will come back to you.” (Teacher-06)

Teacher-centered Classroom: Few teachers think that teacher-centered classrooms are more effective for teaching in higher education. Such teachers prefer the lecture method and consider it more effective and a time-saver. The following interview fragments presented their narratives:

“It’s been years I am lecturing my students, and I think my students are satisfied with my teaching and they are progressing in their fields.” (Teacher-05)

One more teacher shared:

“Usually, lecture method is good, but sometimes I involve them in question-answer session, quizzes and also give them assignments.” (Teacher-07)

Constructive Learning: For your students? Again, we received a variety of responses, and similarly, many codes were identified. On the basis of these codes following themes were formulated. We are presenting all the themes with the support of interview fragments.

We asked the second interview question about how you make your learning constructive and meaningful for your students. Again, we received a variety of responses, and similarly, many codes were identified. On the basis of these codes, the following themes were formulated. We are presenting all the themes with the support of interview fragments.

Students Engagement in Practical Work: The majority of teachers, especially from science disciplines, share that they usually keep engaging their students in practical work because by sharing through practice, they can experience the learned concept. This helps to construct their knowledge which can last longer in their memory and can also be used in the future. By doing so, learners feel motivated, and their interest in studies remains intact. The following interview pieces support this claim:

“Practical knowledge is the key in education; on the basis of experience, learners construct new knowledge and skills which enhances their learning abilities. Teaching without practical means, teaching in a vacuum.” (Teacher-14)

A teacher shared:

“Doing practical work keep students engaged in their studies, and they show interest in their work. Working together during practical work helps students learn from each other. I always plan activities in my lesson to engage students working together; this makes learning meaningful.” (Teacher-19)

Collaborative and discussion-based learning

A few respondents also highlighted the need for collaborative learning. These teachers plan certain activities for their students to work together in small and large-sized groups depending on the nature of the task. In this way, learners share their knowledge and ideas with others. Through working together, they can plan solutions to problems. They discuss the problem with each other and accumulate ideas to bring a practical solution which is the key to critical thinking skills. They explain it in the following way:

“I think, by working together, learners get a chance to share their knowledge and skills with each other. Even average and poor students sometimes give wonderful ideas; they get a chance to participate in the discussion. I usually divide the task and let the students be free to work on it and, explore the solution, prepare the assignment or presentation. This is an important component of my class activities.” (Teacher-04)

Another teacher said:

“I always design conceptual questions for my students to think about. This is how they think critically and go for in-depth study. I believe they can apply learned concepts in new situations. I encourage them to work together on their tasks.” (Teacher-12)

Incorporating Critical Thinking in Teaching

We present this key question to teachers about how they incorporate critical thinking into their teaching. Although the majority of the teachers shared their views on it, we could not identify the ways they incorporated critical thinking skills in their teaching. They again highlighted the need for discussion and practical work in their classrooms. They explain it in the following way:

"I believe discussion leads students to think critically, discussion opening the new dimensions of a particular problem." (Teacher-20)

Another teacher said:

"In my class, I always check the understanding of students and how they perceive my lecture. This also motivates them to think critically and reflect on their perceived information. I encourage students to think critically" (Teacher-03)

Some teachers again emphasized the practical work, which is already mentioned above. Some of the teachers also highlighted the need for self-regulated learning so that learners can think critically. However, some of the teachers consider it difficult. They said if we need to make them independent, then what is the role of a teacher? The following interview fragments are evidence of their claims:

"For me, if we provide notes to students, they feel independent." (Teachers-17)

Another teacher highlighted:

"Generally, our students are dependent on teachers and follow their teacher blindly." (Teacher-15)

A teacher shared:

I encourage students to learn independently, which is one of the student-centered activities. I explain the concept, provide them learning resources and let them free to solve the question provided by me." (Teacher-16)

Assessment of Higher-ordered Thinking Skills

We reach the two key themes when asked this question how do you incorporate higher-order

thinking skills in assessment? Again a variety of codes occurred; thus, we frame the following two themes:

Conceptual Questions: The majority of the teachers claimed that we ask critical questions in exams to test the knowledge of the students. The following interview chunks highlighted their responses in relation to this question:

"I usually design questions to check students' understanding in exams. I ask questions to differentiate, discuss and evaluate. If students learned the concept only then they would be able to solve such questions." (Teacher-10)

Another teacher explained:

"I check their argumentation, so I design questions to present your argument by applying xyz, etc. This is how they can think critically." (Teacher-11)

Additionally, we ask them how much proportion of critical thinking you add to your exam. A teacher explains in the following way:

"Not much, but around 20% is based on the such critical question. I ask about the practical application of the concepts." (Teacher-18)

Assessing Student's Assignments: Very few teachers shared they critically evaluate students' assignments. When students know they will be evaluated on this criterion, they will ultimately prepare their work critically. A teacher said:

"When my students submit their assignments, I design a criterion for assessment which is based on creativity, relevance, and originality." (Teacher-04)

Level of Learners' Critical Thinking Ability

In the final question, we asked teachers how they rate the critical thinking abilities of their students. The majority of the teachers highlighted that the critical thinking ability of our students is moderate.

"I think the critical thinking ability of students is moderate. In fact, the role of a teacher is very important to inculcate such skills in students. Our

curriculum is not designed to boost such skills; we mainly rely on the lecture method.” (Teacher-o2)

Another teacher said:

“I would rate it low; mostly students depend on cramming. To develop critical thinking, we have to redesign our courses to add practical work.” (Teacher-o7)

Very few teacher rate critical thinking ability high in their students. They explained:

“I would rate it high as my students are always curious to learn; they practice various tasks. They work on projects to implement their ideas, and they also make business plans and analyze different products, which enhance their critical thinking skills. (Teacher-o6)

Discussion & Conclusion

The main objective of this research is to map the relationship between critical thinking skills and the academic achievement of students and to explore the teachers’ perceptions of incorporating these skills into their teaching. To the best of our knowledge, we could not find any study conducted in the Pakistani context. Thus, we compare our results with available studies in higher education. We could not identify the relationship between critical thinking skills and the academic achievement of students in contracts for available research as the study results of Akbayir and Topçul (2021), Noor, Hassan, and Ahmad (2018) found a significant relationship between critical thinking skills and academic achievement. The reasons for such results could be many, but it is imperative to mention Pakistan is a signatory to the implementation of sustainable development goals (SDGs), where education is the key goal to uplifting lower and middle economies. Education in the 21st century is rooted in critical thinking skills and problem-based learning, but unfortunately, Pakistan is lagging behind in achieving these goals (Awan & Hussain, 2020). The research in this domain is also lacking (Mahmood, 2017).

As to exploring the perception of teaching critical thinking skills, we found certain positive results, but the actual application of these skills in teaching, curriculum, and learning were missing. This could be linked to the low level of critical thinking skills of students. These results are in line with the study findings of Rashid and Qaisar (2017); Ahmed and Ahmad (2017), who concluded that the Pakistani education system tests their students on recall of information rather than on concepts. This leads us to review our education system, curriculum, teaching methods, and assessment strategies to promote 21st-century learning skills in academia. There is a dire need to align our education system with higher-order thinking skills (Zia & Dar, 2019).

Limitations and Recommendations

This twofold research lets us adopt both qualitative and quantitative methodology. We carefully planned this research to achieve its proposed objective, yet certain limitations need to be stressed. We conducted this research at one public sector university, in spite of a sufficient amount of data from teachers and students, identifying the variance in responses. Maybe there is an institutional policy for teaching or learning. So, we suggest future research to engage more universities in their research to see the application of these skills. The quantitative results showed that there is no relationship between critical thinking skills and academic achievement, and the level of variance was almost zero, which means their teaching and learning methods are not based on critical thinking. Thus, we need to explore those factors in future research. Some of the teachers highlighted that they inculcate critical thinking skills in their teaching, but the results of their students were different from this claim. This calls for observation of the classroom, so future research could add observation as a data collection tool to see the real-time application of these skills. Adding more universities to the

sample could lead us to better results and will support advanced data analysis techniques.

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