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SCIENCE STUDENTS' STUDY HABITS AND THEIR CAPACITY FOR CRITICAL REASONING: A COMPARATIVE REVIEW

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Abstract

Managing the intelligence process, which constantly improves a person's capacity and creates chances for thinking skills to be applied practically in real life as a basis for human development, is one of the learning processes. The study's goal was to investigate the differences between undergraduate science students' study habits and their capacity for analytical reasoning. Male and female maths students from two Punjab University departments made up the study's population. Using a suitable sampling technique, 200 male and female students from the University of Punjab's departments of mathematics and scientific education made up the research sample. As a research tool, a test and a questionnaire were employed to gather data. According to the study's findings, there was a highly significant difference between science students' study habits and their ability to reason analytically at the undergraduate level.

Keywords: *Study habits, science students, analytical reasoning skills*

Introduction

Reasoning is the routine activity that people apply to support conclusion. However, rationales in discussion may not valid according that people are likely to use reasons repetitively without scrutiny, leading to confusion of communication. These are some types of reasoning: It is fundamentally dialogic, which is to say it potentially broadens the conversation or inquiry. Critical capacities take aim at or their point of departure from another thinker, another writer, another conversationalist or another artist (Credé, & Kuncel, 2008). Because its aim is to take the measure of some other intellectual or artistic endeavor critical reasoning essentially assesses, it examines, it tests the value of the object of inquiry (or desire). Such criticism is not necessarily harsh or negative, but it provides a suitable context or background against which one can better appreciate the object of the critical thinking (Baothman, et al., 2018). I love to read good criticism. It allows me to keep abreast of my ignorance. It grapples with facts, observations and data. It squeezes them, and, if successful, produces information. There is often a component of methodology invoked in analytic reasoning and this method is what gets applied by the analyst and the process we call--what else--analysis. Thus we prize critical reasoning for its insight and, often, its creativity; analytic reasoning, on the other hand, is disciplined, methodical--maybe even relentless. Analytic reasoning demonstrates to us that there is more than meets the eye, but simultaneously reminds us that that this truth would have remained hidden without some focused inquiry (Laliberte, et al., 2016). When I read good analytic thinking, I have to pay attention, read closely and take the risk that the technical apparatus employed may elude me. As mental exertion goes, analytic reasoning is heavy lifting. It takes us under the hood of rationality. We are alert to where assumptions end and facts pick-up. When conclusions are drawn, we cast our gaze back to the evidence and then the warrant, conducting a kind of stress-testing of the thinking (Deniz, 2013). Logical thinking takes care to construct a strong and reliable superstructure, which is itself built of language, definitions and other concepts and categories that collectively lubricate the mechanism of clear thinking (Varghese, & Pandya, 2016). Analytical reasoning is required to evaluate validity of concept. Hence, the critical factor of teaching is to encourage learners to apply analytical reasoning that promotes open-minded and fair mentality, concrete assessment criteria, and commitment to find accuracy and clarification (Cerna, & Pavliushchenko, 2015).

McDunnigan (2013) defined analytical reasoning as the ability to understand either qualitative or quantitative information in various environments and acknowledge its pattern. The structure of such data depends on the area that a person is interested such as argument structure or trend of mega data (Bocar, & Tizon, 2017; Ullah et al., 2024). Learning of these insights relies on how effective individual can apply additional information beyond his mindset or in-class learning. Person who fails to apply analytical reasoning will not be able to use additional data to create thinking structure. Kennesaw State University (2013) defined analytical reasoning as the ability to apply knowledge, skills, and information management to analyze ideas, situations, or problems properly and efficiently, either qualitative or quantitative. Reasoning entails presentation of arguments for conflicting views or positions on an issue (Yu, 2011). Paul & Elder (2006) provide a checklist for reasoning, which primarily highlights giving “inferences by which we draw conclusions and give meaning to data” They also emphasize that reasoning “has implications and consequences”. Toulmin (2000) moreover underscores the requirements of reasoning which involve “examination of the claim or position in any given issue, and analysis of the evidence and justifications offered to support such claim, along with an analysis of the refutations offered” Hence, reasoning skills involve the analytic skills of identifying sound claims or positions from unsound ones such that only applicable and sound consequences could be achieved. It is acknowledged that students need to give positions and decisions on, and to resolve, various issues (Zaidi, et al., 2019). This, in turn, demands from them clarity of ideas, justifications of claims, and the passion for critical thinking that are usually taken for granted. Reasoning skills are thus essential to students since they need to be able to discern and make valid and correct decisions on issues and problems concerning their academic and life environments. Moore & Bruder (1996) highlight the importance of reasoning skills to learning: (Reasoning) skills help students think clearly and logically, as answers to issues and problems usually entail making careful distinctions in arguments and as solutions to these issues also require logical and critical thinking (Atsuwe, & Moses, 2017).

These skills also help students keep an open mind in the face of conflicting ideas or opposing views and “seek solutions that meet standards of coherence and Reasonableness”.

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Doronila (1998) highlights the fact that students need to develop a "range of skills and competencies which would enable them to live and work as human persons, develop their potential, make critical and informed decisions, and function effectively in society". Her study on the Philippine educational system emphasizes the country's need to teach its students functional literacy skills, which include the skills to make good decisions on issues (Robbins, 2011; Ullah et al., 2024). Classical literature written about the teachings of Socrates, and even writings of Plato, Aristotle, and other medieval and modern thinkers on student learning and their acquisition of knowledge, have noted the importance of reasoning skills in the analysis of academic and life issues (Ahmad, 2021; Suryansyah, et al., 2021; Mavuru, & Ramnarain, 2020). To date, various authors have emphasized students' need for skills that would help them make valid decisions on their tasks (Cai, 2021; Adam, & Mujib, 2020; Fahmi, et al., 2019). Local studies (Ichsan, et al., 2019; Uğur, et al., 2020; Saad, 2020) have also stressed the need for students to acquire reasoning skills that would enable them to think critically and to make the right decisions claims on issues.

Objectives

- To identify the difference between male and female science students' concentration.
- To identify the difference between male and female science students, academic stress.
- To identify the difference between male and female science students, goal setting.
- To identify the difference between male and female science students, comprehension.
- To identify the difference between male and female science students, selecting main ideas.
- To identify the difference between male and female science students, use of resources.
- To identify the difference between male and female science students at exam preparation.
- To identify the difference between male and female science students, exam writing.
- To identify the difference between urban and rural science students, health habits.
- To identify the difference between urban and rural science students, time management.

Hypothesis:

H_{01}: There is no significant mean difference between male and female science students' concentration at undergraduate level.

H_{02}: There is no significant mean difference between male and female science students, academic stress at undergraduate level.

H_{03}: There is no significant mean difference between male and female science students, goal setting at undergraduate level.

H_{04}: There is no significant mean difference between male and female science students, comprehension at undergraduate level.

H_{05}: There is no significant mean difference between male and female science students, selecting main ideas at undergraduate level.

H_{06}: There is no significant mean difference between male and female science students, use of resources at undergraduate level.

H_{07}: There is no significant mean difference between male and female science students, at exam preparation undergraduate level.

H_{08}: There is no significant mean difference between male and female science students, exam writing at undergraduate level.

H_{09}: There is no significant mean difference between urban and rural science students, health habits at undergraduate level.

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H_{010}: There is no significant mean difference between urban and rural science students, time management at undergraduate level.

Research Methodology

The current study was the survey in nature and quantitative approach was used for the present study. In order to collect data from mathematics students and to know their thoughts and behaviors we used a questionnaires and a test. The population of this research study was male and female mathematics students from two department of Punjab University. The sample of research was 200 male and female students of the mathematics department and science education department of University Of Punjab by using convenient sampling technique. One questionnaire and a test were used as a research instrument to collect information about the effect of study habits of science students on their analytical reasoning skill at undergraduate level through survey. The questions were geared toward the analytical reasoning skill and their study habits. The students were supposed to tick the right responses in relation to the statements given which included the strongly agree, agree, neutral, disagree and strongly disagree. For test students were supposed to tick the right option from four given answers. It was consisted of 47 items which were divided into 11 factors. It also consists of thirteen test items.

Table 1
11 factors of study habits

Categories	No. of items	total
Health habits	1-3	3
Time management	4-8	5
Attitude	9-11	3
Concentration	12-15	4
Academic stress	16-19	4
Goal setting	20-23	4
Comprehension	24-27	4
Selecting main ideas	28-31	4
Use of resources	32-36	5
Exam preparation	37-42	6
Exam writing	43-47	5

Collection of data

Researcher personally presented questionnaire and test because direct constant is useful to explain the purpose of study clearly. The researchers themselves administrated the instrument/research questionnaire. The students fill the questionnaire in time but few students took extra time. Data analysis was done by using statistical package for social science software (SPSS) version 15.0, by which frequency and percentage of every statement of the questionnaire were calculated. Researchers applied t-test, ANOVA and HOC for comparison and effect respectively.

DATA ANALYSIS AND INTERPRETATION

Hypothesis:

H_{01}: There is no significant mean difference between male and female science students' concentration at undergraduate level.

Table 2

Independent sample t- test for mean difference between male and female science students, concentration at undergraduate level.

Variable	N	Mean	t-value	df	Sig.
Male	80	15.175	0.966	198	0.918
Female	120	14.700			

Table 2 indicates that t-value(1.22) is not significant at p<=0.05 level of significance , Therefore our null hypothesis that there is no significant mean difference between male and female science students' concentration at undergraduate level is accepted.

H_{02}: There is no significant mean difference between male and female science students, academic stress at undergraduate level.

Table 3

Independent sample t- test for mean difference between male and female science students, academic stress at undergraduate level.

Variable	N	Mean	t-value	df	Sig.
Male	80	14.875	0.310	198	0.199
Female	120	14.750			

Table 3 indicates that t-value(0.310) is not significant at p<=0.05 level of significance , Therefore our null hypothesis that there is no significant mean difference between male and female science students' academic stress at undergraduate level is accepted.

H_{03}: There is no significant mean difference between male and female science students, goal setting at undergraduate level.

Table 4

Independent sample t- test for mean difference between male and female science students goal setting at undergraduate level.

Variable	N	Mean	t-value	df	Sig.
Male	80	14.237	-1.215	198	0.412
Female	120	14.883			

Table 4 indicates that t-value(-1.215) is not significant at p<=0.05 level of significance , Therefore our null hypothesis that there is no significant mean difference between male and female science students' goal setting at undergraduate level is accepted.

H_{04}: There is no significant mean difference between male and female science students, comprehension at undergraduate level.

Table 5

Independent sample t- test for mean difference between male and female science students, comprehension at undergraduate level.

Variable	N	Mean	t-value	df	Sig.
Male	80	14.162	-0.418	198	0.697
Female	120	14.350			

Table 5 indicates that t-value(-0.418) is not significant at p<=0.05 level of significance , Therefore our null hypothesis that there is no significant mean difference between male and female science students' comprehension at undergraduate level is accepted.

H_{05}: There is no significant mean difference between male and female science students, selecting main ideas at undergraduate level.

Table 6

Independent sample t- test

Variable	N	Mean	t-value	df	Sig.
Male	80	14.826	0.327	198	0.537
Female	120	15.008			

Table 6 indicates that t-value(0.327) is not significant at p<=0.05 level of significance , Therefore our null hypothesis that there is no significant mean difference between male and female science students' selecting main ideas at undergraduate level is accepted.

H_{06}: There is no significant mean difference between male and female science students, use of resources at undergraduate level.

Table 7

Independent sample t- test

Variable	N	Mean	t-value	df	Sig.
Male	80	18.425	-0.115	198	0.038
Female	120	18.483			

Table 7 indicates that t-value (-0.115) is significant at p<=0.05 level of significance, Therefore our null hypothesis that there is no significant mean difference between male and female science students' use of resources at undergraduate level is rejected and it is concluded that there is significant mean difference between male and female science students' use of resources at undergraduate level.

H_{07}: There is no significant mean difference between male and female science students, at exam preparation undergraduate level.

Table 8

Independent sample t- test

Variable	N	Mean	t-value	Df	Sig.
Male	80	21.987	-0.294	198	0.604
Female	120	21.166			

Table 8 indicates that t-value(-0.294) is not significant at p<=0.05 level of significance , Therefore our null hypothesis that there is no significant mean difference between male and female science students' exam preparation at undergraduate level is accepted .

H_{08}: There is no significant mean difference between male and female science students, exam writing at undergraduate level.

Table 9

Independent sample t- test

Variable	N	Mean	t-value	Df	Sig.
Male	80	18.350	0.624	198	0.284
Female	120	18.025			

Table 9 indicates that t-value(0.624) is not significant at p<=0.05 level of significance , Therefore our null hypothesis that there is no significant mean difference between male and female science students' exam writing at undergraduate level is accepted .

H_{09}: There is no significant mean difference between urban and rural science students, health habits at undergraduate level.

Table 10

Independent sample t- test

Variable	N	Mean	t-value	df	Sig.
Urban	152	10.618	-1.132	198	0.506
Rural	48	11.145			

Table 10 indicates that t-value(-1.132) is not significant at p<=0.05 level of significance , Therefore our null hypothesis that there is no significant mean difference between urban and rural science students' health habits at undergraduate level is accepted .

H_{010}: There is no significant mean difference between urban and rural science students, time management at undergraduate level.

Table 11

Independent sample t- test

Variable	N	Mean	t-value	df	Sig.
Urban	152	17.500	-0.358	198	0.077
Rural	48	17.729			

Table 11 indicates that t-value(-0.358) is not significant at p<=0.05 level of significance , Therefore our null hypothesis that there is no significant mean difference between urban and rural science students' time management at undergraduate level is accepted .

Findings

1- Since the t-value (1.22) is not significant at the p<=0.05 level of significance, our null hypothesis—that there is no meaningful mean difference in the undergraduate concentration of male and female science students—is accepted.
2- The t-value (0.310) is not significant at the p<=0.05 level of significance, supporting the acceptance of our null hypothesis that there is no discernible mean difference in the academic stress experienced by male and female science undergraduate students.
3- The null hypothesis, which states that there is no significant mean difference between male and female science students' goal-setting at the undergraduate level, is accepted because the t-value (-1.215) is not significant at the p<=0.05 level of significance.
4- The t-value (-0.418) is not significant at the p<=0.05 level of significance, supporting the acceptance of our null hypothesis—that there is no meaningful mean difference in undergraduate science students' comprehension between male and female students—regarding gender.
5- Null hypothesis, which states that there is no significant mean difference between male and female science students' selection of main ideas at the undergraduate level, is accepted because the t-value (0.327) is not significant at the p<=0.05 level of significance.
6- t-value (-0.115) is significant at the p<=0.05 level of significance. As a result, our null hypothesis—which states that there is no significant mean difference between the use of resources by male and female science students at the undergraduate level and that there is—is rejected, leading us to conclude that there is a significant mean difference.
7- At the p<=0.05 level of significance, the 7-t-value (-0.294) is not significant. Consequently, our null hypothesis—that there is no significant mean difference in undergraduate science students' exam preparation between male and female students—is accepted.
8- t-value (0.624) is not significant at the p<=0.05 level of significance, supporting our null hypothesis that the mean exam writing scores of male and female science undergraduate students are not significantly different from one another.
9- Our null hypothesis, which states that there is no significant mean difference between the health habits of undergraduate science students in urban and rural areas, is

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accepted because the 9-t-value (-1.132) is not significant at the p<=0.05 level of significance.

10- The t-value (-0.358) is not significant at the p<=0.05 level of significance, supporting the acceptance of our null hypothesis that there is no meaningful mean difference in the time management skills of undergraduate science students from urban and rural areas.

Conclusion

In the light of our research it was concluded that the students form urban areas have good study habits than students in rural areas. More than half of the students did not able to solve analytical reasoning skill questions due to lack of analytical ability. Almost half of the students did not have good study habits and find analytical reasoning skill a tough task. Some students discovered that analytical reasoning skill questions are so much difficult to solve and to use mental ability plus mathematics. It was astonishing that majority of science students were unable to solve all the analytical reasoning questions (Deringöl, 2019). They did not use mental and critical thinking power to solve all the questions. Many of students skipped the questions. And it was noticed that study habits have no effect on their analytical reasoning skill. Many of students had good study habits but not good analytical reasoning skill.

According to our data, we found that there is no similarity between male and female science student's study habits but both of them had not good analytical reasoning skill. They had excellent health habits, time management, attitude and concentration. Both male and female had less academic stress. But both male and female had good exam preparation and exam writing habits. According to our data, we found that there is a huge difference of study habits of science students from rural and urban areas. We found that the science students from urban areas had excellent health habits, time management, attitude, concentration and comprehension they were excellent in selecting main ideas, using of resources, exam preparation and exam writing. But on the other hand , the science student from rural areas are not so good in health habits, time management, attitude , concentration and comprehension they were also poor in selecting main ideas, using of resources , exam preparation and exam writing. According to our research, we found that student's form mathematics department have good approach in analytical reasoning skill because they were capable to solve analytical reasoning skill questions. They had good knowledge of reasoning skill and they had also good study habits.

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