STUDY HABITS OF SCIENCE STUDENTS AND ANALYTICAL REASONING SKILLS: A COMPARATIVE REVIEW

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Abstract

One of the learning processes is controlling the intelligence process, which continuously enhances a person's ability and provides opportunities for thinking abilities to be utilised practically in real life as a foundation for human development. The purpose of the study was to compare the study habits and analytical reasoning abilities of undergraduate science students. The study population consisted of maths majors from two departments at Punjab University, both male and female. The research sample consisted of 200 male and female students from the mathematics and scientific education departments of the University of Punjab, selected using an appropriate sampling technique. A test and a questionnaire were used as research tools to collect data. The results of the study showed a significantly significant difference between the study habits of science students and their undergraduate analytical reasoning skills.

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

INTRODUCTION

The common practice that people use to bolster conclusions is reasoning. Reasons in discussions, however, might not hold water since people tend to employ them blindly and repeatedly, which muddles messages. Here are a few examples of reasoning styles: It has the capacity to expand the discourse or inquiry because it is essentially dialogic. According to Crédé and Kuncel (2008), critical capacities attempt to emulate or draw inspiration from the work of other thinkers, writers, conversationalists, or artists. Since critical reasoning's goal is to evaluate other creative or intellectual endeavours, it basically evaluates, scrutinises, and tests the worth of the subject of inquiry (or desire). Such feedback isn't always critical or harsh, but it does offer an appropriate framework (Baothman, et al., 2018). I adore reading insightful criticism. I can stay up to date on my stupidity thanks to it. It struggles with data, facts, and observations. It produces information if it is successful in squeezing them. In analytical reasoning, a methodology component is frequently mentioned. The analyst applies this approach, which is what we term analysis as a process. Therefore, we value critical thinking because it is insightful and frequently creative, whereas analytical reasoning is rigorous, disciplined, and sometimes even unrelenting. While analytical thinking shows us that there is more to a situation than first appears, it also serves as a reminder that this information would have stayed undiscovered in the absence of concentrated investigation (Laliberte, et al., 2016).

I have to read carefully, pay attention, and assume the chance that I won't understand the technical terms used when I come across good analytical thinking. Analytical thinking is heavy labour in terms of mental strain. It exposes us to the workings of reason. We recognise the boundary between assumptions and facts. As conclusions are reached, we reexamine the warrant and the evidence, essentially stress-testing our reasoning (Deniz, 2013). The goal of logical thinking is to create a solid and trustworthy superstructure, which is composed of words, definitions, and other ideas and classifications that work together to facilitate coherent thought (Varghese, & Pandya, 2016). It takes analytical reasoning to assess a concept's validity. Therefore, a crucial aspect of education is to motivate students to use analytical reasoning, which fosters a fair and open-minded mindset, specific evaluation standards, and a dedication to seeking out truth and explanation (Cerna, & Pavliushchenko, 2015).

According to McDunnigan (2013), analytical thinking is the capacity to recognise patterns in both quantitative and qualitative data in a variety of contexts. Such data's structure varies according to the user's area of interest, such as the megadata trend or argument structure (Bocar & Tizon, 2017). Acquiring these insights depends on how well a person can apply extra knowledge outside of his or her classroom learning or mentality. A person who does not utilise analytical reasoning will not be able to construct a thinking framework using additional data. Analytical reasoning is the capacity to utilise knowledge, skills, and information management to accurately and efficiently analyse concepts, scenarios, or issues, whether they are qualitative or quantitative, according to Kennesaw State University's (2013) definition. Presenting arguments for opposing viewpoints is a necessary part of reasoning (Yu, 2011). A reasoning checklist is presented by Paul & Elder (2006), with a focus on providing "inferences by which we draw conclusions and give meaning to data." Additionally, they stress that thinking "has implications and consequences." Furthermore, Toulmin (2000) highlights the necessity of reasoning, which entails "an analysis of the arguments put forth in support of the claim, as well as an examination of the arguments put forth in opposition to it." Therefore, the analytical ability to distinguish between valid and invalid assertions or viewpoints is a necessary component of reasoning skills, allowing for the achievement of only valid and appropriate outcomes. It is understood that students must take stances on many topics, make decisions about them, and find solutions (Zaidi, et al., 2019).

This in turn places expectations on individuals that are typically taken for granted, such as the ability to think critically and the willingness to defend their positions and views. Thus, reasoning abilities are crucial for students because they must be able to recognise concerns and problems related to their academic and real-world settings and be able to make valid and accurate conclusions about them. According to Moore & Bruder (1996), thinking abilities are critical for learning: (Reasoning) abilities aid students in thinking critically and logically since solving difficulties and concerns typically requires meticulous argument distinctions as well as logical and critical thinking (Atsuwe, & Moses, 2017).

Additionally, by using these abilities, students are better able to "seek solutions that meet standards of coherence and Reasonableness" and have an open mind in the face of contradicting ideas or viewpoints. Doronila (1998) emphasises that in order for students to fulfil their potential, live and work as human beings, make critical and informed decisions, and contribute to society, they must acquire a "range of skills and competencies." Her research on the Philippine educational system highlights the necessity of imparting to its student's practical literacy abilities, including the ability to make sound decisions on a variety of topics (Robbins, 2011).

The value of reasoning skills in the analysis of academic and real-world problems has been highlighted in classical literature about Socrates' teachings, as well as in writings by Plato, Aristotle, and other mediaeval and contemporary thinkers on student learning and knowledge acquisition (Ahmad, 2021; Suryansyah, et al., 2021; Mavuru, & Ramnarain, 2020). As of right now, a number of writers have stressed the need for students to acquire the knowledge and abilities necessary to complete their assignments with validity (Cai, 2021; Adam, & Mujib, 2020; Fahmi, et al., 2019). According to local studies (Ichsan et al., 2019; Uğur et al., 2020; Saad, 2020), students must develop reasoning abilities in order to think critically and make the best decisions possible about various topics.

Hypothesis:

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

H_{02}: There is no significant mean difference between male and female science students' time management at undergraduate level.

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

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

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

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

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

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

H_{09}: There is no significant mean difference between male and female science students, use of resources at undergraduate level.

H_{10}: There is no significant mean difference between male and female science students, at exam preparation undergraduate level.

H_{11}: There is no significant mean difference between male and female science students, exam writing at undergraduate level.

H_{12}: There is no significant mean difference between urban and rural science students, health habits at undergraduate level.

H_{13}: There is no significant mean difference between urban and rural science students, time management at undergraduate level.

H_{14}: There is no significant mean difference between urban and rural science students, attitude at undergraduate level.

H_{15}: There is no significant mean difference between urban and rural science students, concentration at undergraduate level.

RESEARCH METHODOLOGY

The current investigation was survey-based and employed a quantitative methodology. We used tests and questionnaires to get information from maths students on their attitudes and actions. 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. A survey and an exam were employed as research tools to gather data regarding the impact of science undergraduate students' study habits on their capacity for analytical thinking. Their study habits and analytical thinking abilities were the focus of the inquiries. The statements were strongly agree, agree, disagree, neutral, and strongly disagree. The students had to check the appropriate response for each item. Students had to mark the correct response from the four options provided in order to pass the test. There were 47 things total, broken down into 11 factors. There are thirteen test items in total.

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

The questionnaire and test were administered by the researcher in person since a direct constant helps to clearly convey the goal of the study. The instrument/research questionnaire was administered by the researchers themselves. Most students complete the questionnaire on time, although a small percentage took longer. The statistical package for social science (SPSS) version 15.0 was used for data analysis, allowing for the calculation of the frequency and percentage of each questionnaire statement. For comparison and effect, researchers used the t-test, ANOVA, and HOC, respectively.

DATA ANALYSIS AND INTERPRETATION

Hypothesis:

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

Table 1:

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

Variable	N	Mean	t-value	df	Sig.
Male	80	10.675	-0.286	198	0.001
Female	120	10.791			

Table 1 shows that at the p<=0.05 threshold of significance, the t-value (-0.286) is significant. Consequently, it is determined that there is a significant mean difference between the health habits of male and female science students at the undergraduate level and that our null hypothesis, which claimed that there is no significant mean difference between them, is rejected.

H_{02}: There is no significant mean difference between male and female science students' time management at undergraduate level.

Table 2:

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

Variable	N	Mean	t-value	df	Sig.
Male	80	17.92	1.22	198	0.008
Female	120	17.28			

It is concluded that there is a significant mean difference between male and female science students' health habits at the undergraduate level after Table 2 shows that t-value (1.22) 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 male and female science students' time management at the undergraduate level, is rejected.

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

Table 3:

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

Variable	N	Mean	t-value	df	Sig.
Male	80	11.475	-0.112	198	0.766
Female	120	11.533			

As a result, our null hypothesis—that there is no significant mean difference between male and female science students' attitudes at the undergraduate level—is accepted. Table 3 shows that the t-value (-0.112) is not significant at the p<=0.05 level of significance.

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

Table 4:

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			

As a result, our null hypothesis—that there is no significant mean difference between male and female science students' concentration at the undergraduate level—is accepted. Table 4 shows that the t-value (1.22) is not significant at the p<=0.05 level of significance.

$H_{05:}$ There is no significant mean difference between male and female science students, academic stress at undergraduate level.

Table 5:

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 5 shows that the t-value (0.310) is not significant at the p<=0.05 level of significance, supporting the acceptance of our null hypothesis, which states that there is no significant mean difference in academic stress between male and female science undergraduate students.

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

Table 6:

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			

As a result, our null hypothesis—that there is no significant mean difference between male and female science students' goal-setting at the undergraduate level—is accepted. Table 6 shows that the t-value (-1.215) is not significant at the p<=0.05 level of significance.

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

Table 7:

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			

As a result, our null hypothesis—that there is no significant mean difference between male and female science students' comprehension at the undergraduate level—is accepted. Table 7 shows that the t-value (-0.418) is not significant at the p<=0.05 level of significance.

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

Table 8:

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

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

As a result, our null hypothesis—that there is no significant mean difference between male and female science students' selection of main ideas at the undergraduate level—is accepted. Table 8 shows that the t-value (0.327) is not significant at the p<=0.05 level of significance.

H_{09}: There is no significant mean difference between male and female science students, use of resources at undergraduate level.

Table 9:

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

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

It is concluded that there is a significant mean difference between the use of resources by male and female science students at the undergraduate level after Table 9 shows that the t-value (-0.115) is significant at the p<=0.05 level of significance. This rejects our null hypothesis that there is no significant mean difference.

H_{10}: There is no significant mean difference between male and female science students, at exam preparation undergraduate level.

Table 10:

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

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

As a result, our null hypothesis—that there is no significant mean difference between male and female science students' exam preparation at the undergraduate level—is accepted. Table 10 shows that the t-value (-0.294) is not significant at the p<=0.05 level of significance.

H_{11}: There is no significant mean difference between male and female science students, exam writing at undergraduate level.

Table 11:

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

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

As a result, our null hypothesis—that there is no significant mean difference between male and female science students' exam writing at the undergraduate level—is accepted. Table 11 shows that the t-value (0.624) is not significant at the p<=0.05 level of significance.

H_{12}: There is no significant mean difference between urban and rural science students, health habits at undergraduate level.

Table 12:

Independent sample t- test for mean difference between urban and rural science students, health habits at undergraduate level.

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

Table 12 shows that the t-value (-1.132) is not significant at the p<=0.05 level of significance, supporting the acceptance of our null hypothesis, which states that there is no significant mean difference in the health habits of undergraduate science students from urban and rural areas.

H_{13}: There is no significant mean difference between urban and rural science students, time management at undergraduate level.

Table 13:

Independent sample t- test for mean difference between urban and rural science students, time management at undergraduate level.

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

Table 13 presents data indicating that the t-value (-0.358) is not statistically significant at the p<=0.05 level of significance. Consequently, our null hypothesis, which posits that there is no significant mean difference in time management between science undergraduate students in urban and rural areas, is accepted.

H_{14}: There is no significant mean difference between urban and rural science students, attitude at undergraduate level.

Table 14:

Independent sample t- test for mean difference between urban and rural science students, attitude at undergraduate level.

Variable	N	Mean	t-value	df	Sig.
Urban	152	11.585	0.526	198	0.655
Rural	48	11.270			

Table 14 presents a t-value of 0.526, which is not significant at the p<=0.05 level of significance. Consequently, our null hypothesis, which posits that there is no significant mean difference in the attitude of science undergraduate students between urban and rural areas, is accepted.

H_{15}: There is no significant mean difference between urban and rural science students, concentration at undergraduate level.

Table 15:

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

Variable	N	Mean	t-value	df	Sig.
Urban	152	15.159	1.995	198	0.002
Rural	48	14.041			

Our null hypothesis, which states that there is no significant mean difference between the concentration of science students in urban and rural areas at the undergraduate level, is thus rejected, and it is determined that there is a significant mean difference between the concentration of science students in urban and rural areas at the undergraduate level. Table 15 shows that the t-value (0.526) is significant at the p<=0.05 level of significance.

Findings

1- t-value (-0.286) 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' health habits at undergraduate level is rejected and it is concluded that there is significant mean difference between male and female science students' health habits at undergraduate level.
2- t-value(1.22) 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' time management at undergraduate level is rejected and it is concluded that there is significant mean difference between male and female science students' health habits at undergraduate level.
3- t-value(-0.112) 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' attitude at undergraduate level is accepted.
4- 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.
5- 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.
6- 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.
7- 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.

8- 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.
9- 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.
10- 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 .
11- 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 .
12- 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 .
13- 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 .
14- t-value(0.526) 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' attitude at undergraduate level is accepted .
15- t-value(0.526) is 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' concentration at undergraduate level is rejected and it is concluded that there is significant mean difference between urban and rural science students, concentration at undergraduate level.

CONCLUSION

Our research led us to the conclusion that pupils in urban regions have better study habits than those in rural ones. Because they lacked analytical skills, over half of the students were unable to answer questions involving analytical thinking skills. Nearly half of the students struggled with analytical reasoning skills and had poor study habits. Some pupils found that problems requiring analytical thinking skills are extremely challenging to answer and require both mental and mathematical aptitude. The majority of science students' inability to answer every analytical thinking question was startling (Deringöl, 2019). They did not answer every question by applying critical and mental thinking skills. A large number of pupils ignored the questions.

Based on our data, we discovered that while the study habits of male and female science students were dissimilar, their analytical reasoning skills were not. They demonstrated outstanding time management, focus, attitude, and health habits. Less stress was placed on academics by both genders. However, both sexes had good study and writing skills for exams. Based on our data, we discovered that scientific students from rural and urban locations have quite different study patterns. We discovered that scientific students from urban regions had outstanding time management, health habits, attitudes, comprehension, and focus. They were also very good at choosing the main ideas, making effective use of resources, preparing for exams, and writing exams.

However, scientific students from rural areas have poorer health habits, time management skills, attitudes, concentration, and comprehension. They also have poorer skills when it comes to choosing main ideas, using resources, preparing for exams, and writing exams. Our research revealed that students in the mathematics department had a strong approach to analytical reasoning skills since they could answer questions related to these skills. They possessed strong reasoning abilities and excellent study habits. Additionally, it was found that their ability to think analytically is unaffected by their study habits. While many students had excellent study habits, their analytical reasoning skills were lacking.

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