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Finding Correlation between Critical Thinking and Deduction Making Skill: A Study at Bachelor Level in Pakistan

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Abstract

Deductive reasoning, or deduction, is one of the two basic types of logical inference. Deductive reasoning means a kind of reasoning in which the truth of conclusion (the output proposition) is logically guaranteed by the truth of the premises (the input proposition). This study has aimed to evaluate university students' critical thinking ability of making and recognizing deductions. To explore this aim, the present study has set two research objectives which include to know university students' attitude towards the critical thinking skill of deduction making and to evaluate university students' performance in the critical thinking skill of deduction making. To achieve these objectives, the researcher has used quantitative research methodology. The participants of this study consist of 550 male and female university students of different state-run colleges of Punjab (Pakistan). Critical thinking inventory (CTI) and Watson-Glaser's Critical Thinking Appraisal (WGCTA) (2002) have been used to collect data from the subjects of the study. The researcher used SPSS (XX) to analyze the collected data. The findings of this study reveal that the university students have highly positive attitude towards critical thinking skill of making deductions but their level of critical thinking and their ability to reflect critical thinking in their test of making deductions does not correspond with their attitude towards this skill of critical thinking.

Keywords: critical thinking, central idea, author's approach, critical reading, university students

1. Introduction

Deductive reasoning means a kind of reasoning in which the truth of conclusion (the output proposition) is logically guaranteed by the truth of the premises (the input proposition). The premises may consist of such propositions as are believed or such assumptions are explained by some reasoner. The other concept which is different from deductive reasoning is inductive reasoning as here the truth of output propositions need not be guaranteed by the truth of input premises (The Encyclopedia of the Mind).

1.1 Defining Deduction

A process of reasoning in which a conclusion follows necessarily from the premises presented, so that the conclusion cannot be false if the premises are true. (Dictionary.com) Deductive reasoning, or deduction, is one of the two basic types of logical inference. A logical inference is a connection from a first statement (a "premise") to a second statement ("the conclusion") for which the rules of logic show that if the first statement is true, the second statement should be true. Deductive reasoning implies logical certainty and tends to go from general premises to specific conclusions. It is also a top-down logic and it links premises with conclusions as it works like conditionals. Making deduction also includes using fact and rule to conclude something new, understanding conversational implicature, comprehending pragmatic and semantic meaning of a text and using previous knowledge to judge the views couched in a text. Logic and critical thinking together make up the systematic study of reasoning, and reasoning is what we do when we draw a conclusion based on other claims. Logicians divide all arguments into two broad categories: deductive arguments and inductive arguments. Every argument falls into one of these two categories. Putting our thinking in the form of an argument can help us to be reflective as it has close ties with critical thinking. Arguments are the single most important ingredient in critical thinking (Moore and Parker, 2009). Acquisition of critical thinking skills is essential for examining arguments critically because arguments cannot be accepted at face value (Tan, 2007). Thinking critically involves considering and providing reasons. Thinking critically also means to think about reasons as "reasons" to render them explicit so that they may provide right kind of evidence to make decisions. The analysis and understanding of an argument are essential to reconstruction of an argument in one's own words. The ground rules for this are stating viewpoint, providing reasoning evidence, stating the counterarguments and concluding the key evidence (McMillan and Weyers, 2013).

1.2 Research objectives

The research objectives of this study have been given as follows;

- To know university students' attitude towards the critical thinking skill of deduction making.
- To evaluate university students' performance in the critical thinking skill of deduction making.

1.3 Research questions

This study aims to find answer to some research questions which have been given as follows;

- What is university students' attitude towards the critical thinking skill of deduction

making?

- What is university students' performance in the critical thinking skill of deduction making?

2. Literature review

The researcher has divided the reviewed literature in two sections i.e. the theoretical framework of the study and the review of the related studies. Both of these sections have been discussed as follows;

2.1 Theoretical Framework of the Study

There are two theories of deduction i.e. classical logic or Aristotelian logic" and "modern symbolic logic". These theories help to understand the relations between premises and conclusion and distinguish valid arguments from invalid arguments.

2.1.1 Theory of Classical Logic

The arguments which are based on the relations of objects come under the domain of classical logic. Class means the collection of all objects which have specific characteristics in common. There are three ways in which the relation of one class with another class can be seen and understood. The propositions behind deductive arguments are known as "categorical propositions" and they can also be termed as "building blocks of argument". There are four kind of categorical propositions and they include universal affirmative propositions (A), universal negative propositions (E), particular affirmative propositions (I) and particular negative propositions (O). In other words, of these four standard-form categorical propositions, two are affirmative propositions i.e. one (A) affirms completely and the other (I) affirms partially whereas the other two are negative i.e. one (E) negates completely and the other (O) negates partially. So far as the quality of these standard form categorical propositions is concerned, they can be termed as universal or particular. While discussing the scheme of standard-form categorical propositions, Copi et al. (2011) maintain that these categorical propositions always comprise of four parts which include quantifier, subject term (S), copula and predicate term (P). This general skeleton of categorical propositions can be illustrated as follows;

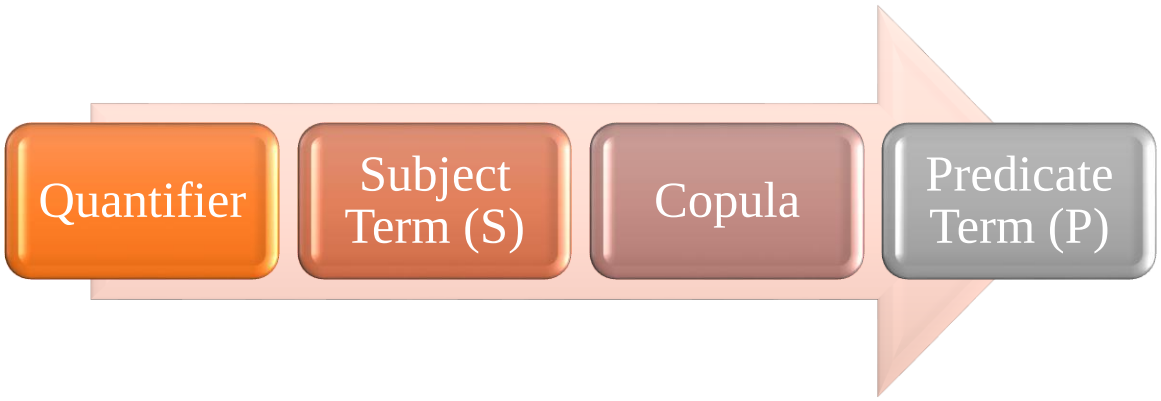

Figure 1: General skeleton of standard-form categorical propositions

Another characteristic of these standard-form categorical propositions is that of distribution.

For instance, "the subject term is distributed by the A proposition, both subject and predicate terms are distributed by the E proposition, neither subject nor predicate term is distributed by the I proposition and only predicate term is distributed by the O proposition. All these distributions can be illustrated graphically as follows;

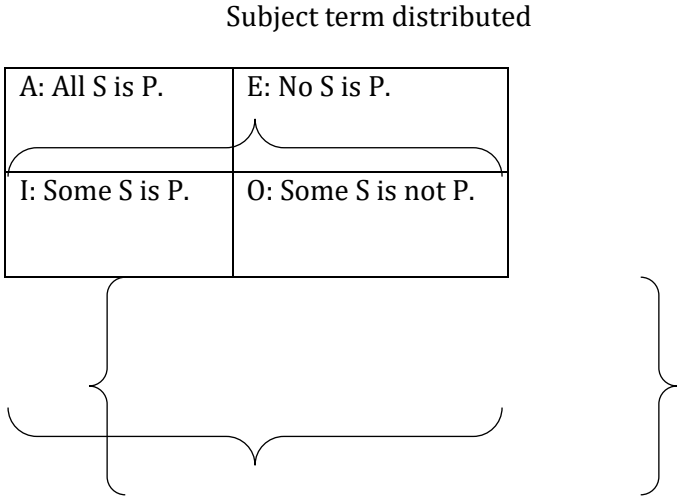

Figure 2: Graphical presentation of the distribution of subject (S) and predicate (P) terms
Adopted from: Introduction to Logic (Copi et al., 2011)

2.1.2 The Theory of Modern Logic

The second theory of deductive reasoning is called modern logic or modern symbolic logic. Like the theory of classical logic, modern logic does not deal with the system of syllogism analysis of categorical propositions for the discrimination of valid and invalid arguments. On the contrary, in modern logic, the fundamental logical connectives which constitute the base of deductive arguments are identified to render a general account of such arguments by using the identified connectives so that the methods of validating the arguments may be developed. Another difference that lies between the classical logic and modern logic is that of the use of symbols for the analysis of deductive reasoning. Copi et al. (2011) contend that the use of logical symbols in the system of modern logic extends more efficient and more complete achievement in differentiating valid arguments from invalid arguments.

According to the modern logic theory, a general argument can contain two types of statements i.e. simple and compound. There are different types of compound statements which have been discussed as follows;

2.1.2.1 Conjunction

Conjunction is the first type of compound statement. The conjunction of two statements is formed by placing the word "and" between two conjuncts i.e. statements. The symbol used to show conjunction is dot (.). For instance, if $\boldsymbol{p}$ and $\boldsymbol{q}$ are two statements (conjuncts), their conjunction can be written as $\boldsymbol{p \cdot q}$. The truth value of conjuncts determines the truth value

of conjunction. In other words, a conjunction can be termed as **"truth-functional compound statement"** whereas its conjuncts can be styled as **"truth-functional components"**. Therefore, the dot symbol is said to be **"truth-functional connective"**. There can be four possible cases of the truth value of conjunction in the given statements of ***p*** and ***q***. These truth values can be displayed as follows;

Where ***p*** is true and ***q*** is true, ***p · q*** is true
Where ***p*** is true and ***q*** is false, ***p · q*** is false
Where ***p*** is false and ***q*** is true, ***p · q*** is false
Where ***p*** is false and ***q*** is false, ***p · q*** is false

The truth values of conjuncts and that of their conjunction can be represented and illustrated with the help of the truth table (table 1) given as follows;

Table 1: Truth values of conjuncts and that of their conjunction

p	***q***	***p · q***
T	T	T
T	F	F
F	T	F
F	F	F

2.1.2.2 Negation

Negation is formed in many ways in English. For instance, an original statement is made negative by inserting "not" in it or by placing a phrase "it false that" or "it is not the case that" at its initial position. But in modern symbolic logic, the symbol of curl or tilde (**~**) is used for the formation of the negation of the statement. For example, the negation of the statement "***p***" can be written as ***~p.*** This curl can be termed as **truth-functional operator**. In this regard, Copi et al. (2011) claim that "the negation of any true statement is false and the negation of any false statement is true". This fact which indeed constitutes the definition of negation can be illustrated with the help of truth-table (table 2) given as follows;

Table 2: Truth table of negation a "~" symbol

P	**~P**
T	F
F	T

2.1.2.3 Disjunction

The combination of two statements with the insertion of the word "or" between them is called disjunction or alternation and the combined statements are called disjuncts or alternatives. According to the proponents of this theory, the word "or" has two types of meaning. The first sense of the word "or" is called "weak or inclusive" which results in the form of an inclusive disjunction. On the other hand, the word "or" has "stronger or exclusive" sense which renders an exclusive disjunction. Inclusive disjunction means an assertion in which at least one of the two components or statements are true. On the contrary, exclusive disjunction is an assertion in which at least one of the combining components is true but not both are true. To Copi et al.

(2011), in English, these two senses of the word "or" are ambiguous. The modern symbolic logic system uses the symbol of wedge **(v)** to represent the weak or inclusive sense of the word "or". For instance, the weak or inclusive disjuncts can be written as ***"p v q"***. This symbol of wedge **(v)** acts as truth-functional connective. The following truth table (table 3) illustrates the defining features of wedge.

Table 3: Truth table of defining features of wedge

P	Q	P v Q
T	T	T
T	F	T
F	T	T
F	F	F

Table 3 shows that a weak or inclusive disjunction is false only if both of its components or disjuncts are false.

2.1.2.4 Punctuation

Punctuation marks are very important in the language of symbolic logic as they help to avoid ambiguity when compound statements combine in such a way that they become more complicated. Punctuation is also important as it makes difference between falsehood and truth as different punctuation marks can assign different truth values to various compound statements.

2.2 Review of related studies

Johson-Laird (1999) has outlined three major schools of thought regarding deductive performance based on factual knowledge, mental models and formal rules of inference. According to the first theory in which deductive performance is based on factual knowledge, various actions are carried out by "the concrete contents of working memory" and thus new information is added to working memory with the result of "a chain of inferences". In this theory of deductive performance, knowledge plays most important role (Reisbeck & Schank, 1989; Kolodner, 1993). Johson-Laird (1999) highlights the drawback of this theory that it does not render an "immediate explanation of the ability to reason about the unknown". This drawback leads us to another idea that "formal rules of inference" constitute the base of deductive performance". According to this school of thought, a reasoner extracts "the logical forms of premises" and uses "rules to derive conclusion" (Nisbell, 1993; Rips, 1994; Braine, 1998; Braine & O' Brrien, 1991). The third theory of deductive performance postulates deduction "as a semantic process" which is "based on mental models". This theory holds that reasoning is based on "manipulations of mental models representing situations". Polk & Newell, 1995; Johnson-Laird & Byrne, 1991). Inductive or deductive inferences are reached by such processes as are stimulated by those models which represent the world (Glasgow, 1993; Hegarty, 1992; Rogers et al. 1992; Oakhill & Garnham, 1996).

3. Methodology

This is primarily a quantitative study. The present study has aimed to know university students' attitude towards the critical thinking skill of deduction making and evaluate university students' performance in the critical thinking skill of deduction making. To materialize these objectives of the study, the researcher has used two research tools i.e. critical thinking inventory and critical thinking test of making deduction. Critical thinking inventory (CTI) was used to know university students' attitude towards critical thinking skill of making deduction. This inventory consists of 12 questionnaire items based on five-point Likert scale. The questionnaire items of this tool were pooled from different source to target the key areas of deductive reasoning. This research tool was piloted to check its reliability prior to its proper administration. The second research tool of this study is of critical thinking test of making deduction (TMD). The researcher has used Watson-Glaser's (2002) critical thinking test to collect data to evaluate the participants' critical thinking ability of making deduction. Apart from this, this study has also computed bivariate regression to find the correlation between CTI and TMD and to know how much CTI acts a predictor for TMD. The researcher has also computed independent-samples t-test to find out the gender variance in university students' performance in CTI and TMD. The population of the present study are five hundred and fifty students of B.Sc. class. In fact, they are the students of the final year (4th Year) class from different state-run colleges of the province of the Punjab (Pakistan). To analyze the collected data, the researcher has used SPSS (XX). The results of this study have been presented in tabular and graphical form in the section of results and discussion.

4. Results and discussion

This study has aimed to find answer to two research questions. These research questions include what university students' attitude is towards the critical thinking skill of deduction making and what university students' performance is in the critical thinking skill of deduction making. The results of the present study have been discussed as follows;

4.1 University students' attitude towards making deduction

To know university students' attitude towards the critical thinking skill of making deduction, a critical thinking inventory was administered to them. The results of this critical thinking inventory have been presented and discussed as follows;

Table 4: University students' response to critical thinking inventory of making deduction

S. No.	Questionnaire Items	SA	A	NO	DA	SDA	M	STD
1	I know how to infer specific proposition while reading a text.	89	365	13	81	2	3.83	.884
2	I can use fact and rule to conclude something new.	103	367	8	67	5	3.90	.873
3	I can get the maximum sense when less information is conveyed.	72	256	7	204	11	3.32	1.159
4	I take the core ideas I obtain through reading and apply	104	272	10	157	7	3.56	1.129

	them to my life.							
5	I can understand the conversational implicature of a passage.	103	394	5	48	0	4.00	.739
6	I can generally understand the intended message of a text or a passage.	72	396	5	76	1	3.84	.827
7	I can differentiate between semantic and pragmatic meanings of a text.	54	342	6	143	5	3.54	1.011
8	My critical thinking ability reduces the cognitive biases while reading a text.	90	304	14	136	6	3.61	1.062
9	Previous knowledge enables me to judge the views couched in the text.	180	330	4	28	8	4.17	.800
10	While making a critical analysis of the given piece of text, I examine the strategies the writer uses to express his ideas.	41	371	12	116	10	3.58	.962
11	Evaluating a text's validity and relevance is difficult for me.	30	273	17	220	10	3.17	1.077
12	I often find it easy to understand the gist of a passage quickly.	69	278	12	189	2	3.41	1.097

Table 4 presents university students' attitude towards the critical thinking skill of making deduction. In this regard, this study has found that 16.2% participants strongly agree and 66.4% agree that they know how to infer specific proposition while reading a piece of text. Regarding the use of "fact and rule" to conclude something new, 85.5% subjects claim that they can do so. There are 59.6% participants who maintain that they can get maximum sense when less information is given. Of the subjects of this study, 68.4% university students have claimed that they can take the core ideas through reading and apply them to their life. So far as the understanding of the conversational implicature and the intended meaning of a given passage are concerned, 90.4% and 85% participants have responded in the positive respectively. There are 72% subjects of this study who claim that they can differentiate between the semantic and pragmatic meanings of a given text whereas there are 71.6% university students who have agreed to the statement that their critical thinking ability helps them reduce cognitive biases while reading a text. A large percentage (92.7%) of the subjects of this study has claimed that their previous knowledge helps them to judge the views couched in a given text. Apart from this, 74.9% participants agree to the statement that while making a critical analysis of the given piece of text, they examine the strategies the writer uses to express his ideas. This study has also found that the evaluation of the validity and relevance of a text pose problem for 55.1% university students. So far as the understanding of the gist of a given passage is concerned, 63.1 percent students claim that it is an easy task

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for them. These results show that the participants (university students) of this study have very positive attitude towards the critical thinking skill of making deduction and they are well-versed with this skill.

4.2 University students' performance

The second research question of this study is what university students' performance is in the critical thinking inventory (CTI) which was used to know the participants' attitude towards critical thinking skill of making deduction and critical thinking test of making deduction (TMD) which was administered to them to know the level of their critical thinking ability in making deduction. The performance demonstrated by the subjects of this study in CTI and TMD has been categorized into four categories i.e. excellent, very good, average and poor. The findings of the study to this end have been discussed as follows;

4.2.1 University students' performance in CTI

University students' performance in critical thinking inventory has been shown in the table 5 given as follows;

Table 5: University students' performance categories in CTI

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Excellent	141	25.6	25.6	25.6
	Very Good	392	71.3	71.3	96.9
	Average	17	3.1	3.1	100.0
	Total	550	100.0	100.0	

The results of this study presented in table 5 demonstrate that 25.6% (141) students have got excellent, 71.3% (392) very good and 3.1% (17) average score in critical thinking inventory while demonstrating their attitude towards the critical thinking skill of making deduction. It has also been found that 96.9% (533) participants of this study have scored above average score. From this, it can be inferred that university students have very positive attitude towards the critical thinking skill of making deduction. These results can be illustrated with the help of a figure given as follows;

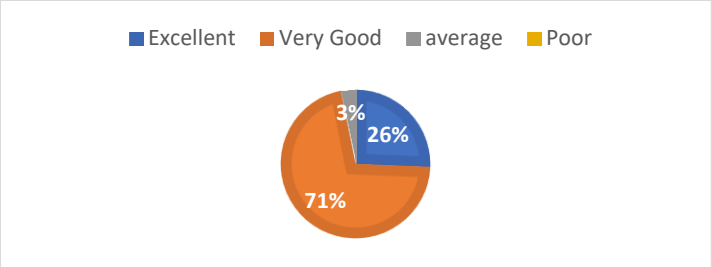

Figure 3: Visual illustration of university students' performance in CTI

4.2.2 University students' performance in TMD

To know university students' performance in critical thinking test of making deduction, the researcher administered a test of making deduction (TMD). The results of this study in this regard have been presented below in table 6.

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Table 6: University students' performance categories in TMD

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Excellent	234	42.5	42.5	42.5
	Very Good	141	25.6	25.6	68.2
	Average	123	22.4	22.4	90.5
	Poor	52	9.5	9.5	100.0
	Total	550	100.0	100.0	

Table 6 shows that in the critical thinking test of making deduction (TMD), 43% (243) participants have got excellent, 25.6% (141) very good, 22.4% (123) average and 9.5% (52) poor score in TMD. The results of TMD show that there are 68.2% university students who have got above average score. These results have been illustrated visually as follows;

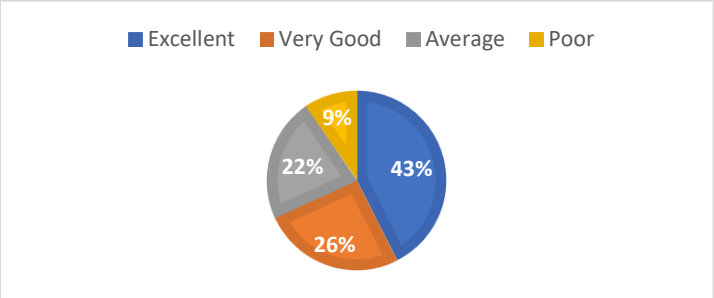

Figure 4: Visual illustration of university students' performance in TMD

4.3. Regression Analysis

To ascertain how well the score of overall critical thinking inventory (CTI) predicts level of critical thinking skill of making deduction, a bivariate regression was conducted. The results of the regression analysis have been presented and discussed below (tables 7-9) given as follows;

Table 7: R Square value for Critical Thinking Test for Making Deduction (TMD)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.031	.001	-.001	4.709

a. Predictors: (Constant) TCTI

Table 8: ANOVA table of regression

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	11.762	1	11.762	.530	.467
	Residual	12150.749	548	22.173		
	Total	12162.511	549			

a. Dependent Variable: TMD

b. Predictors: (Constant): TCTI

Table 9: Results of regression analysis

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	43.549	.563		77.305	.000
	TMD	.030	.042	.031	.728	.467

a. Dependent Variable: TMD

The correlation coefficient between the overall score of critical thinking inventory (CTI) and overall critical thinking test of making deduction (TMD) is .031(table 7). The overall regression model is not significant (F (1, 548) =.530, p = .467 (p > .05)) as shown in table 8. The results of the regression analysis also show that correlation between overall CTI and critical thinking test of making deduction (TMD) skill is not statistically significant, r (.031) = .467, p > .05. The regression equation predicting the critical thinking skill of making deduction (TMD) from critical thinking inventory (CTI) was $\hat{y}$ = 43.459 + .030x. The r^2 for this equation is .001; that is, 0.1% of the variance in critical thinking skill of making deduction (TMD) is predictable from critical thinking inventory (CTI).

4.4 Gender Variance

The present study has also aimed to know variance based on gender in participants' performance in CTI and TMD. To this end, the researcher has run independent-samples t-tests to compare the scores of CTI and TMD for the male and female students to assess whether there is significant difference in the performance of the participants with reference to their gender. The results of this study to this end have been discussed (tables 10-13) as follows;

4.4.1 Variance in CTI

The results of the independent-samples t-test for the gender variance in CTI have given as follows;

Table 10: Statistics of independent samples t-test between gender and CTI

	Gender	N	Mean	Std. Deviation	Std. Error Mean
TCTI	Male	243	42.76	4.588	.294
	Female	307	44.86	4.597	.262

Table 11: Results of independent samples t-test between gender and CTI

	Levene's Test for Equality of Variances		t-test for Equality of Means				
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference

TCTI	Equal variances assumed	.095	.758	-5.340	548	.000	-2.106	.394
	Equal variances not assumed			-5.341	519.806	.000	-2.106	.394

To know the variance in CTI score on the basis of gender, the researcher computed an independent-sample t-test. According to the results of t-test, there is a difference in the mean score of male university students (M = 42.76, SD = 4.588) and female university students (M = 44.86, SD = 4.597), t (548) = ???, p > .05. This shows that the difference in the CTI mean score of the male and female university students is not significant.

4.4.2 Variance in TMD

The results of the independent-samples t-test for the gender variance in TMD have given as follows;

Table 12: Statistics of independent samples t-test between gender and TMD

	Gender	N	Mean	Std. Deviation	Std. Error Mean
TMD	Male	243	11.06	4.269	.274
	Female	307	13.93	4.886	.279

Table 13: Results of independent samples t-test between gender and TMD

		Levene's Test for Equality of Variances		t-test for Equality of Means				
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
TMD	Equal variances assumed	12.675	.000	-7.220	548	.000	-2.867	.397
	Equal variances not assumed			-7.334	542.654	.000	-2.867	.391

To know the variance in TMD score on the basis of gender, the researcher computed an independent-sample t-test. According to the results of t-test, there is a difference in the mean score of male university students (M = 11.06, SD = 4.269) and female university students (M = 13.93, SD = 4.886), t (548) = ???, p < .05. This shows that the difference in the TMD mean score of the male and female university students is significant.

The findings of the study reveal that there are overall 75.05% participants who have very positive attitude towards critical thinking skill of making deduction. This positive attitude demonstrated by the subjects of this study has also been substantiated by the score which they have obtained in CTI. For instance, there are 96.9% university students whose score in CTI is "above-average" which has been set as a benchmark in this study. On the other hand, there are 68.2% participants who have reached this benchmark of "above-average" in TMD. This study has noted 28.7% decrease in the performance of the participants when they come to attempt the critical thinking test of making deduction (TMD). It shows that the same number of university students remain unable to translate their attitude into performance. This finding of the present study has also been seconded by another finding of the present

study. For instance, the results of the regression analysis computed in this study reveal that there is no correlation between university students' attitude towards critical thinking skill of making deduction (CTI) and critical thinking test of making deduction (TMD). Apart from this, this study has found that the performance of the female university students is slightly better than the male university students' in CTI and TMD.

5. Conclusion

This study has found out that although the university students have fairly positive attitude towards critical thinking skill of making deductions but their performance in the test of making deductions does not synchronize with their attitude towards this skill. Therefore, this study recommends that the university students be made exposed to extensive reading in their respective classrooms so that they may develop their critical thinking skills to meet the challenges of the 21st century.

References

1. Braine MDS. (1998). Steps towards a mental predicate logic. See Braine & O'Brien 1998, pp. 273–331
2. Braine MDS, O'Brien DP. (1991). A theory of If: a lexical entry, reasoning program and pragmatic principles. Psychol. Rev. 98: 182–203
3. Copi, I. M., Cohen, C., Jetli, P. & Prabhakar, M. (2011). *Introduction to Logic.* 13th Edition, Pearson.
4. Glasgow JI. (1993). Representation of spatial models for geographic information systems. In Proc. ACM Workshop on Advances in Geographic Information Systems, ed. N Pissinou, pp. 112–17. Arlington, VA: Assoc. Comput. Mach.
5. Hegarty M. (1992). Mental animation: inferring motion from static displays of mechanical systems. J. Exp. Psychol.: Learn. Mem. Cogn. 18:1084–102
6. Johnson-Laird PN, Byrne RMJ. (1991). Deduction. Hillsdale, NJ: Erlbaum
7. Kolodner J. (1993). Case-Based Reasoning. San Mateo, CA: Morgan Kaufman
8. McMillan K.& Weyers J. (2013). How to improve your critical thinking & reflective skills, Pearson.
9. Nisbett RE, ed. (1993). Rules for Reasoning. Hillsdale, NJ: Erlbaum
10. Oakhill J, Garnham A, eds. (1996). Mental Models in Cognitive Science. Hove, East Sussex, UK: Psychology Press
11. Polk TA, Newell A. (1995). Deduction as verbal reasoning. Psychol. Rev. 102:533–66
12. Riesbeck CK, Schank RC. (1989). Inside Case Based Reasoning. Hillsdale, NJ: Erlbaum
13. Rips LJ. (1994). The Psychology of Proof. Cambridge, MA: MIT Press
14. Rogers Y, Rutherford A, Bibby PA, eds. (1992). Models in the Mind: Theory, Perspective and Application. London: Academic
15. Schechter (Ed.) *The Encyclopedia of the Mind*, edited by Hal Pashler, SAGE Publishing