



## Relationship of Angle 'atd' with Performance Level of Science Students in Annual Senior Secondary Examination

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**Abstract:** The triradii present at the base of the fingers and near the wrist have been an area of interest to many scientists who have related these with various mental health and other health related issues. In this study, the angle 'atd' formed by digital triradii, 'a' at the base of index finger, 'd' the base of little finger and axial triradius 't' on hypothenar mound, on both hands has been examined to assess the relationship between academic scores and the 'atd' angle. Previous studies suggest that the range of angle 'atd' amongst 'normal' children to be between 30° to 65°. Furthermore, an effort has been made to observe whether or not the so called normal 'atd' angle of 30° to 65° can be applied to this group of students consisting of both super performers and under achievers.

**Keywords:** Angle 'atd', triradii, axial triradius, hypothenar mound.

### Introduction

From times immemorial epidermal ridges and prominent lines on hands and soles have been an area of intense curiosity, interest and research for fortune tellers, astrologers, general public and scientists. Dermatoglyphics is the descriptive study of epidermal ridges on fingers, palms, soles and toes. The term was coined in 1926 by Dr. Harold Cummins, father of American fingerprint analysis and has since been accepted and approved internationally. The epidermal ridges form prominent lines like head, heart and life line and different types of patterns like loops, whorls, arches and triradii.

According to Schaumann and Alter (1976) Chinese traditional medicine links palm prints with health and characters and is now being recognized by more and more dermatoglyphic experts. The 'atd' angle formed by triradii 'a', 'd' and 't' has been widely used in dermatoglyphic studies, although

several researchers have questioned the accurate measurement of angle 'atd' and its utility, specifically asking whether it can be measured reliably (Cummins and Mildo, 1961; Sharma, 1964; Mavalwala, 1979; Priest 1979; David, 1981a). The analysis of the reliability of the 'atd' angle in dermatoglyphics by Brunson (2006) suggests however that the 'atd' angles can be measured reliably by different readers.

### Methodology

A methodical layout was designed to study the relationship between the annual senior secondary board exam students and their angle 'atd'. This experimental work is divided into three parts:

Part 1-Sample Design

Part 2-Data collection

Part 3-Analysis

### Part 1: Sample Design

The sample size comprised of 200 girls from Post Graduate Government College for Girls, sector 42, Chandigarh. These students were selected from the science stream (medical group) with Botany, Zoology, and Chemistry as elective subjects in B.Sc. Further criteria for selection were that the students were in the age group of 18 to 20 years and belonged to middle income families.

### Part 2: Data collection

Once the sample group was identified, data was collected in two phases:-

**First phase:** In this phase attested copies of original +2 mark sheets were collected from the students of science stream with Physics, Chemistry and Biology as their main subjects in senior secondary Board Exam.

**Second Phase:** These palm prints were carefully observed and the triradii were located and marked in each case (shown in fig.1). These points are located on the volar pads at the base of each finger and on the hypothenar mound below the little finger. These were traced by using a magnifying glass. The center of each triradius was marked by putting a dot with lead pencil and lines were drawn by joining 'a' with 't' and 't' with 'd'. The angle 'atd' thus formed was measured using a protractor and magnifying glass. This angle was then rounded off to the nearest degree. Each 'atd' angle was measured and checked three times to leave no scope for the possibility of reading error and inconsistent identification of land marks.

### Part 3: Analysis

The percentages of scores obtained in senior secondary exam were calculated and these were then analyzed in order to understand the relationship between the angle "atd" and academic scores



**Fig.1: Dermatoglyphics of right hand showing angle 'atd' formation**

**Results:** The main objective of this research work is to understand the relationship between performance of students in their annual senior secondary school exam and the angle 'atd'. The data collected from the sample group was analyzed in two steps.

**Step 1:** In this phase a standard method was adopted to calculate the percentage of marks obtained in Physics, Chemistry, and Biology by the individuals in the sample group. These percentages varied between 50% and 90%. The performance level of all the students whether super performers or under achievers is depicted in Table - 1.

**“Table 1: Showing % obtained in Physics, Biology and Chemistry in annual senior secondary examination”**

S.No.	% obtained in P.C.B.	No. of Students	% of Students
1	50-59	25	12.5
2	60-69	72	36.0
3	70-79	69	34.5
4	80-89	34	17.0
Total	-	200	100

It was observed that 70% students had secured marks between 60%- 79%. Only 17% were found to have their percentage in 80%-89% and 12.5% had scores which lay in the range of 50%-59%. On the basis of these four percentage groups, the corresponding right hand and left hand angle ‘atd’ of students were analyzed. To examine the

relationship between the +2 performance level and their right hand angle ‘atd’, the readings denoting the angles were further classified into six categories ; 26° -35°, 35° – 45°, 46° –55°, 56° – 65°, 66° – 75° and 76° –85°. The results observed in each group of percentage are represented in Table – 2, 3, 4 and 5.

**“Table 2: Students with 50%- 59% marks showing different ranges of ‘atd’ angles on both hands”**

Angle ‘atd’		50% - 59% (Right hand)		50% - 59% (Left hand)	
		No. of students	%age	No. of students	%age
1	26° -35°	2	8	3	12
2	36°-45°	17	68	15	60
3	46°-55°	4	16	6	24
4	56°-65°	1	4	-	-
5	66°-75°	1	4	-	-
6	76°-85°	-	-	1	4
Total	-	25	100	25	100

It was observed that majority of students with 50 to 59% marks fall in the category of angle ‘atd’ between 36°-45°, 68% on the right hand and 60%

on the left. Only one candidate was found (4%) in the category of 56-65 and 66-75 on the right hand and 76-85 on the left hand.

“Table 3: Students with 60%- 69% marks showing different ranges of ‘atd’ angles on both hands”

Angle ‘atd’		60% - 69% (Right hand)		60% - 69% (Left hand)	
		No. of students	%	No. of students	%
1.	26° -35°	05	6.94	05	6.94
2.	36°-45°	59	81.94	52	72.22
3.	46°-55°	07	9.72	14	19.44
4.	56°-65°	01	1.40	01	1.40
5.	66°-75°	-	-	-	-
6.	76°-85°	-	-	-	-
Total	-	72	100	72	100

A similar trend was observed in the group of students obtaining 60%-69% marks. A large number of students (81.94%) with right hand angle and (72.22%) with left hand angle ‘atd’ were found in the category of 36°-45°. Only 1.4 % and

6.94% students have been observed with both right hand and left hand angle ‘atd’ in 56°-65° and below 35° respectively. None of the students had an angle ‘atd’ between 66°-85°.

“Table 4: Students with 70%- 79% marks showing different ranges of ‘atd’ angles on both hands”

Angle ‘atd’		70% - 79% (Right hand)		70% - 79% (Left hand)	
		No. of students	%	No. of students	%
1.	26° -35°	7	10.15	4	5.80
2.	36°-45°	51	73.91	52	75.36
3.	46°-55°	10	14.49	12	17.39
4.	56°-65°	1	1.45	1	1.45
5.	66°-75°	-	-	-	-
6.	76°-85°	-	-	-	-
Total	-	69	100%	69	100%

In this group of students obtaining 70%-79% marks maximum strength was again observed in the category of 36°-45° with right hand angle 'atd' equaling to 73.91% and left hand angle 'atd' to

75.36%. Only 1.45% students with both right and left hand angle 'atd' were found in the category of 56°-65°.

**“Table5: Students with 80%- 89% marks showing different ranges of ‘atd’ angles on both hands”**

Angle ‘atd’		80% - 89% (Right hand)		80% - 89% (Left hand)	
		No. of students	%	No. of students	%
1.	26° -35°	03	8.82	03	8.82
2.	36-45°	24	70.50	25	73.53
3.	46°-55°	04	11.76	05	14.71
4.	56°-65°	03	8.82	01	2.94
5.	66°-75°	-	-	-	-
6.	76°-85°	-	-	-	-
Total	-	34	100	34	100%

34 students securing 80-89% marks showed a similar pattern in their right and left hand angle 'atd'. Most students were found in the category of 36°-45° and the least in the category of 56°-65°.

**Discussion:** In our study we found that some of the students in the class, super performers (80-90% marks) as well as under achievers (less than 50% marks) were not able to sustain interest in classroom teaching. Even after a lot of coercion, encouragement, persuasion and prompting they lacked initiative and seemed unmotivated and disinterested to participate in group discussions, as well as question-answer sessions. A resistance to follow instructions, coming unprepared in class (Vashist et. al., 2009), lack of interest, and enthusiasm in practical classes was a matter of deep concern. This behavior resulted in poor

performance in house exams, lack of initiative and insensitive attitude towards studies and career, and initiated our interest in the present research. It was thought that there might be a relationship between the results obtained by students in senior secondary examinations and the angle 'atd', since the angle had in earlier studies been linked with mental retardation (Vashist et. al., 2009) and selection of athletes (Shao, 1992). Earlier studies indicate a positive relationship between palm prints and various diseases like cleft lip (Silver, 1966, Mathew, 1984), autism (Wolman, 1990; Milicic, 2003), super-intelligence (Cesarik, 1996), acyesis, schizophrenia (Zhou et al, 2002), mental retardation (Vashist et. al., 2009), depression (Agrawal and Sao, 2013) and cancer (Zhou et al, 2002). It was hypothesized that underperforming students might fall in a certain range of normal

‘atd’ angle, while super performers might fall in another range. In this research, results from senior secondary annual examinations were used as a measurement of success in academics and an effort was made to correlate right and left hand angle ‘atd’ with these results for the sample group of students.

It was observed in this research that the angle ‘atd’ in right and left hand of the sample group ranged between 30° to 76° as compared earlier research by other authors, which reported that normal angle ‘atd’ range was 30° to 65° (Vashist et. al., 2009). Previous research had also been pointed out that cases of mental retardation revealed a range of <30° to >65°, however it was found in the

present research that there was only one case with angle ‘atd’ of 70° in right and 76° in left hand having 56.67% marks in the annual senior secondary examination. Certainly this student was not a case of mental retardation.

Irrespective of the percentage scored by the sample group in their annual senior secondary exams, it was observed that a majority of the group had angle ‘atd’ in the range of 36° to 45° in both hands. Cesariket. al. (1996) in their study concluded that ‘atd’ angle decreases in both the sexes with super intelligence. This trend could not be established in the present work as both super performers and under achievers were found in each range of ‘atd’ angle.

“Table 6: Total percentage analysis”

Angle ‘atd’		(Right hand)		(Left hand)	
		No. of students	%	No. of students	%
1.	26 -35°	17	9.0	15	7.5
2.	36°-45°	151	75.5	144	72.0
3.	46°-55°	25	13.0	37	19.0
4.	56°-65°	6	3.0	3	2.0
5.	66°-75°	1	0.5	-	-
6.	76°-85°	-	-	1	0.5
Total	-	200	100%	200	100

The overall percentage analysis irrespective of the marks secured by the sample group in their annual +2 exams reveal that ‘atd’ angle of majority of students ranged between 36°-45°; right hand (75.5%) and left hand (72%). The next largest group was found to have their right and left hand angle ‘atd’ between 46°-55°. Vashishtet. al. (2009)

observed normal ‘atd’ angle range to be 30° to 65° while studying ‘atd angle’ of mentally retarded patients. More than 75% normal individuals showed angle ‘atd’ in the range of 35°-40°; whereas only 4.2% persons had above 55°. Similar study pattern could be seen in the present study in which only 3.5% candidates with right hand and

2.5% cases with left hand had angle 'atd' above 55°.

Amongst the sample of 200, a uniform pattern followed between the degree of angle 'atd' in right and left hand which is being established by the average values of angle 'atd' in both hands. This was found to be 42° which was lower than the figure given by Kumaret. al. (1974) as 44.5° and Vaishali et al. (2006) as 51.03° and 51.25° on right left hand respectively.

### Conclusion:

The present research work has been an earnest effort to explore the existence of a relationship (if any) between the angle 'atd' and performance of students in their +2 exams. This study was in part initiated with the intent of substantiating the claims made by a number of academic website, which claim to link the 'atd' angle with the academic performance of students. These websites entice over-anxious parents by claiming to use angle 'atd' to help them choose right careers for their underperforming children when they are still young. Another endeavor of the students was to understand the relationship between 'atd' and academic performance in order to use it to apprise students about better opportunities in which they could show their excellence and enhance their performance in fields, which can provide them with better opportunities.

Shao (1992) found that the 'atd' angles of exceptional athletes are significantly smaller than the general population group's 'atd' angles 41°-42° and Zhou et al (2002) stressed that angle 'atd' can be used to a certain degree to judge whether a person is agile. Therefore, it may be concluded that as found in the present study, the average angle 'atd' in both right and left hand of students being 42° signifies that they belong to the general

population and should work with enthusiasm, concentration and work hard to achieve their goals. However, through an examination of the evidence found in the present study, it is concluded that there is no direct relationship between academic performance and the angle 'atd' or rather that the angle 'atd' may not be used as an accurate measurement for the prediction of the academic performance of a student.

As others before it, the results from the present study also conclude that the usefulness of 'atd' angle in applied studies remains a very big question as no direct relationship between the angle and academic performance clearly established. Therefore its use as a reliable source of investigation for various medical or mental illnesses is debatable. It may be speculated that environmental factors such as education level of family and parents, access to good primary education, time spent studying etc, play a much bigger role in predicting success in academics than the angle 'atd'. Indeed many studies have shown contradictory results, with more than half, finding no differences in the 'atd' angles of subjects with a given condition verses unaffected controls (Wolman and colleagues, 1990; Arietta and colleagues, 1990; Milicic et. al., 2003 and Smith et al, 2012). If anything, the present research shows that further research, with varied sample groups, needs to be carried out in order to correctly establish a concrete relationship between the angle 'atd' and academic performance.

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