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PEN PRESSURE IN HANDWRITING : INFLUENCES AND IMPLICATIONS

Malavika.M
Masters
Garden city university

ABSTRACT

Background: Pen pressure is one of the important characteristic features of writing. Pen pressure may be defined as the vertical component of the force applied via the nib, ball, or tip of the writing instrument while writing by Roy A.Huber and A.M Headrick in a book named Handwriting identification: Facts and fundamentals. The pen pressure is collaborated with the shading in which altogether named as pen control or point load.pen pressure and shading are the two facets of writing that at one time were considered to be separate entities but closely related.

Objectives: To relate the pen pressure to the other facets of hand writings.

Methodologies: Handwritings are taken from different persons with different types of writing. A table is made with the columns namely pen pressure, relative size of letters, spacing's, writing quality, slant, position, alignment, speed, etc and associating the characteristic features to the pen pressure.

Result: From this study, we had observed that the pen pressure is effected by the age, position of the person, speed etc and pen pressure has no direct effect on other general writing habits of writing.

Conclusion: The current research paper addresses the importance of the pen pressure and its correlation with the other class characteristic features of hand writing which differs from person to person.

Key words: pen pressure, class characters, slant, alignment.

INTRODUCTION

Pen pressure in question documents refers to the force applied by a writer when using a pen or stylus to create marks on paper. It is also defined as the vertical component of the force applied via the nib, ball, or tip of the writing instrument. (“Huber.R.A & Hedrick,A.M..1999). This characteristic is often scrutinized in forensic document examination to assess the authenticity and authorship of handwriting. Variations in pen pressure can reveal significant information about a person's writing habits, emotional state, and physical condition at the time of writing. By analyzing these pressure patterns, experts can detect forgeries, alterations, and inconsistencies that might indicate fraudulent activity. In digital contexts, pen pressure sensitivity plays a crucial role in rendering the naturalistic quality of handwritten notes and digital art, affecting the thickness, opacity, and flow of lines created on electronic devices.(walker.J.G..2001) Therefore, understanding pen pressure is essential in both forensic investigations and digital applications, providing valuable insights into the creation and integrity of documents.

REVIEW OF LITERATURE

THE ROLE OF PEN PRESSURE IN HANDWRITING IDENTIFICATION

Smith, J., & Brown, L. (2023)

This article explores the significance of pen pressure in forensic handwriting analysis. It discusses how varying pressure can serve as a unique identifier for individuals, aiding in criminal investigations and document verification processes.

DIGITAL PEN TECHNOLOGIES AND PEN PRESSURE SENSITIVITY

Davis, A., & Lee, K. (2022))

This paper reviews the advancements in digital pen technology, focusing on the role of pen pressure sensitivity. It highlights how modern styluses and tablets capture pressure data to enhance digital writing and drawing experiences, making them more intuitive and natural.

PEN PRESSURE AND WRITER FATIGUE: A STUDY ON HANDWRITING PERFORMANCE

Johnson, M., & Patel, S. (2021)

This study examines the relationship between pen pressure and writer fatigue. It finds that excessive pressure can lead to quicker fatigue and deteriorate handwriting quality over time, suggesting ergonomic interventions to improve writing comfort.

ANALYZING PEN PRESSURE IN GRAPHOLOGY

Williams, R., & Chen, Y. (2020)

This article delves into graphology, the study of handwriting, and how pen pressure is interpreted to reveal personality traits. It discusses the methodological approaches used to assess pressure patterns and their psychological implications.

PEN PRESSURE AS A BIOMETRIC FEATURE IN SIGNATURE VERIFICATION SYSTEMS Martinez, L., & Nguyen, T. (2019)

The focus here is on the application of pen pressure in biometric systems for signature verification. The article discusses how incorporating pressure data enhances the accuracy and security of these systems.

THE IMPACT OF PEN PRESSURE ON DIGITAL ART CREATION Martinez, L., & Nguyen, T. (2019)

This paper explores how varying pen pressure influences digital art. It evaluates different digital drawing tools and software that utilize pressure sensitivity to mimic traditional art techniques, offering insights into artists' experiences and preferences.

QUANTIFYING PEN PRESSURE IN EDUCATIONAL SETTINGS

Taylor, P., & Kim, H. (2018)

The study investigates how pen pressure can affect learning outcomes, particularly in young students. It assesses whether monitoring pressure can help in diagnosing and addressing handwriting difficulties in educational contexts.

COMPARATIVE ANALYSIS OF PEN PRESSURE ACROSS DIFFERENT WRITING INSTRUMENTS Green, D., & Singh, R. (2017)

This research compares pen pressure exerted when using various writing instruments, such as ballpoint pens, fountain pens, and digital styluses. It aims to understand how different tools influence writing mechanics and pressure application.

PEN PRESSURE VARIABILITY IN MULTILINGUAL HANDWRITING

Hernandez, F., & O'Connor, J. (2016).

This article examines how pen pressure varies when individuals write in different languages. It considers factors like script complexity and writing habits, offering insights into cross-linguistic differences in handwriting dynamics.

THE EVOLUTION OF PEN PRESSURE IN HANDWRITING RECOGNITION SYSTEMS

Brown, A., & Park, J. (2015)

This paper reviews the integration of pen pressure data in handwriting recognition systems. It highlights the technological advancements that have enabled these systems to achieve higher accuracy and better user experience through pressure-sensitive inputs.

AIM FOR RESEARCH

This study aims to explore the connection between pen pressure and different handwriting characteristics, including slant, position, alignment, speed, and line equality. Additionally, it seeks to identify how variables such as age, health, and writing speed affect pen pressure and its influence on these handwriting traits.

OBJECTIVES

1. To examine the characteristic features of handwriting.
2. To analyze the relationship between these features and pen pressure.

METHODOLOGY

The study gathered two types of writing samples from various subjects with varying ages and health conditions. The subjects were asked to write a paragraph using each of two methods: elbow and wrist. We analyzed the writings by comparing the general writing habits and individual characters and then correlated the results with pen pressure. Which are represented in tabular and graphical form.

OBSERVATION:

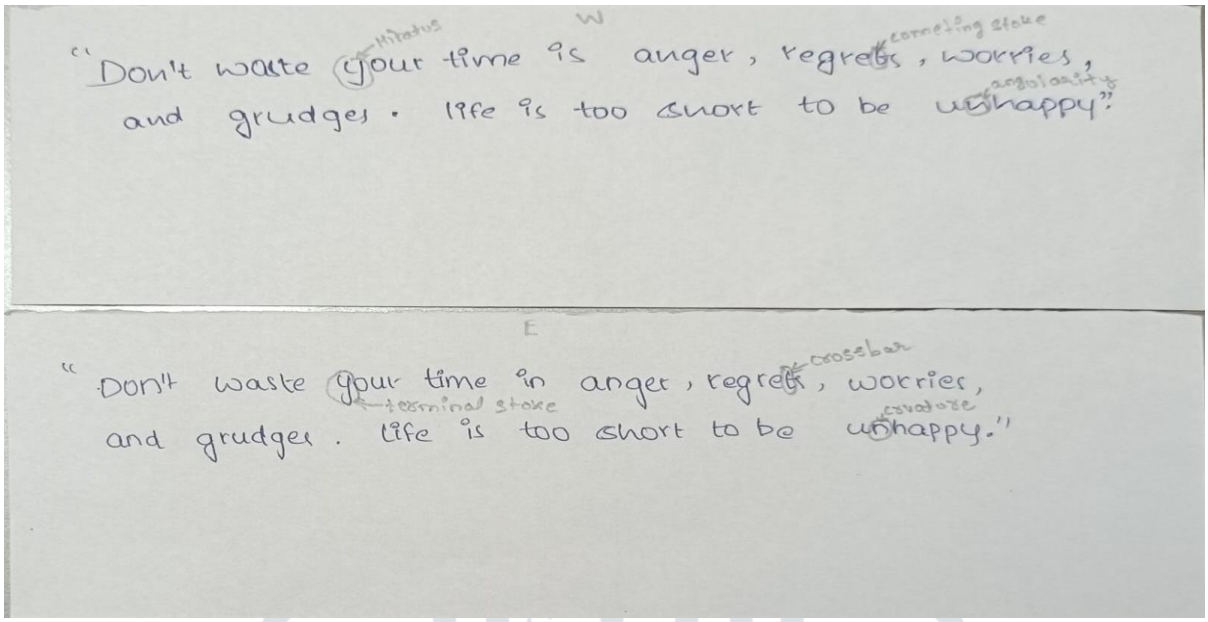


Fig 1: sample 1

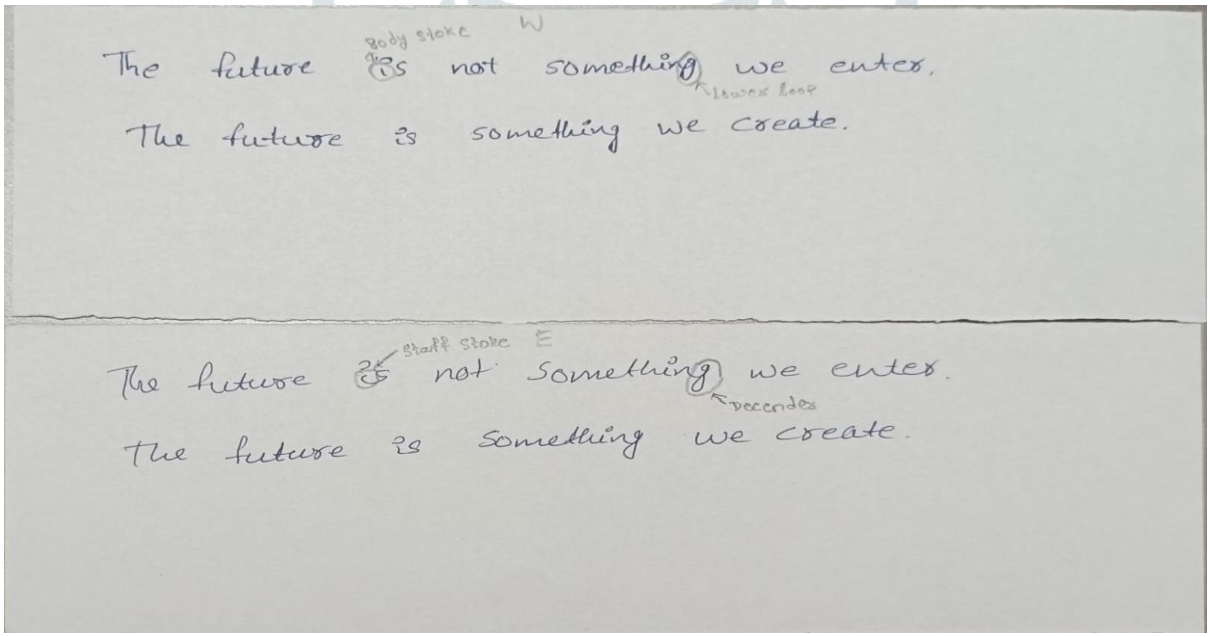
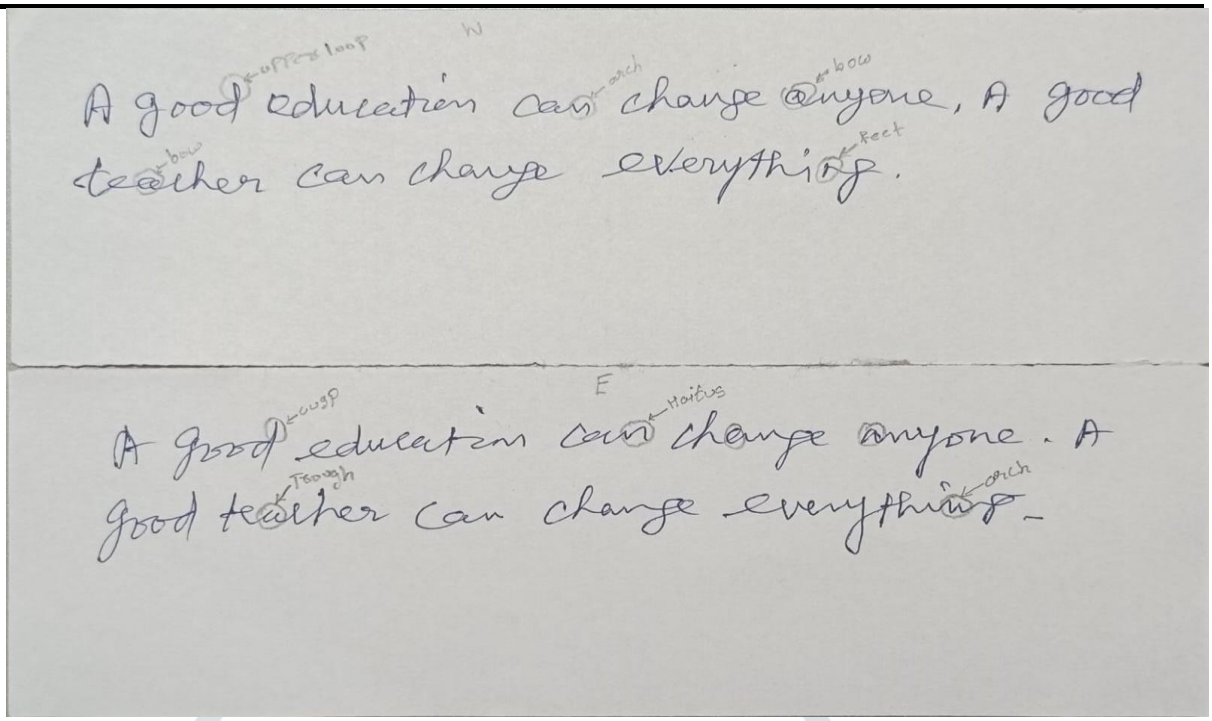


Fig 2: sample 2



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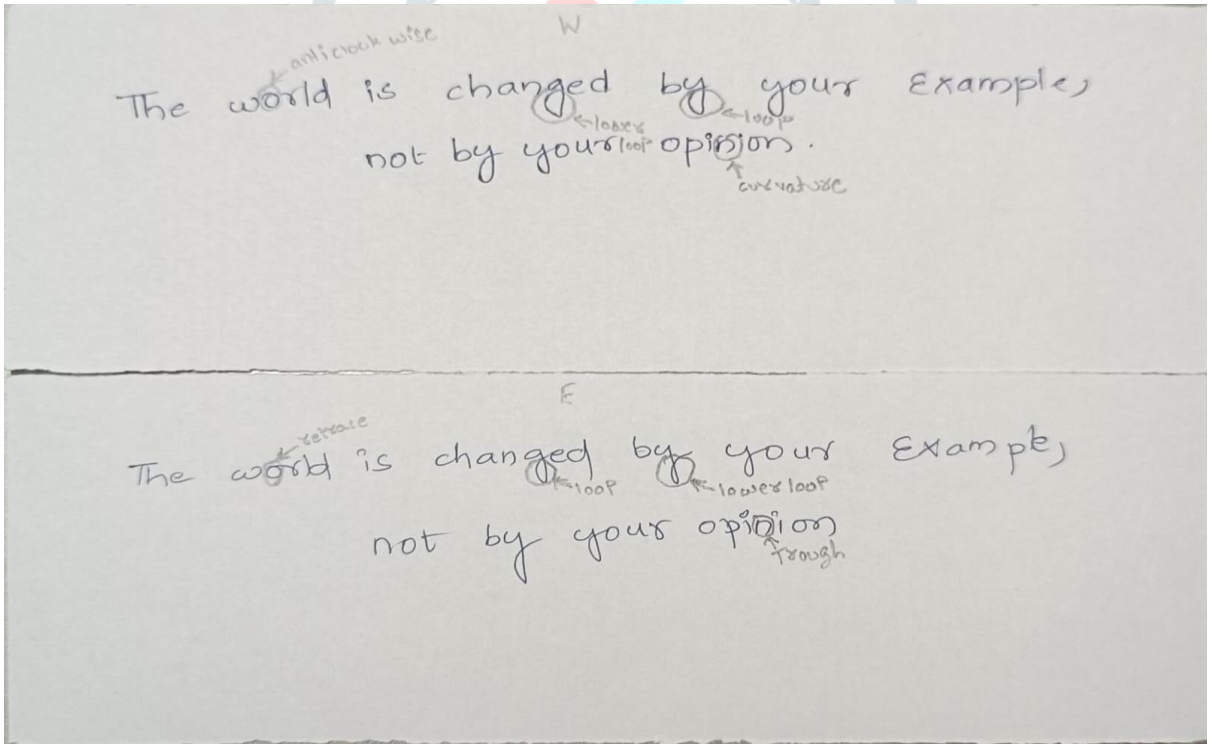

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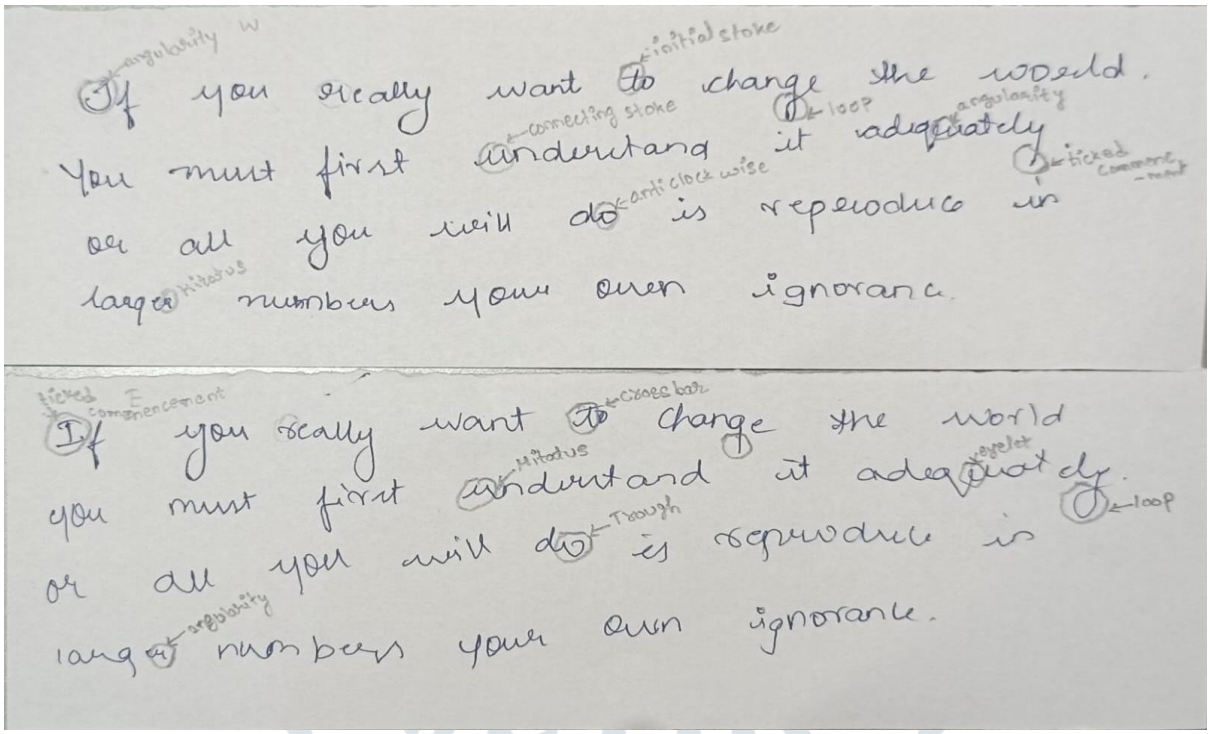

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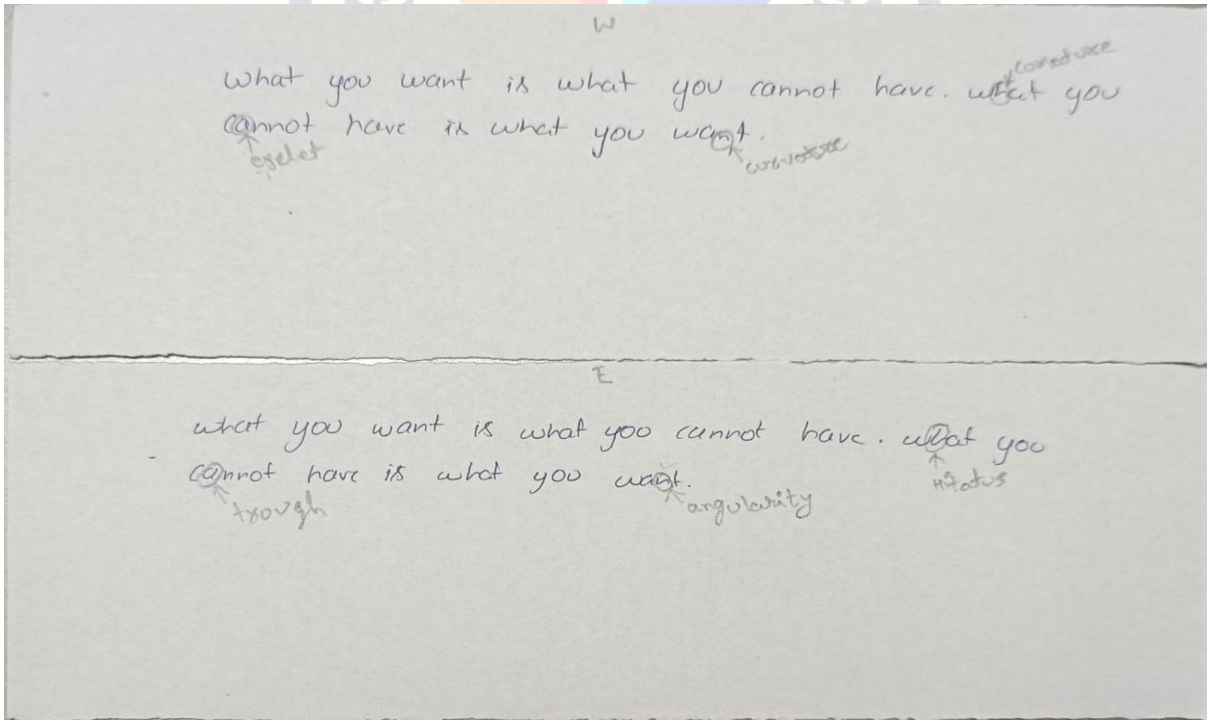

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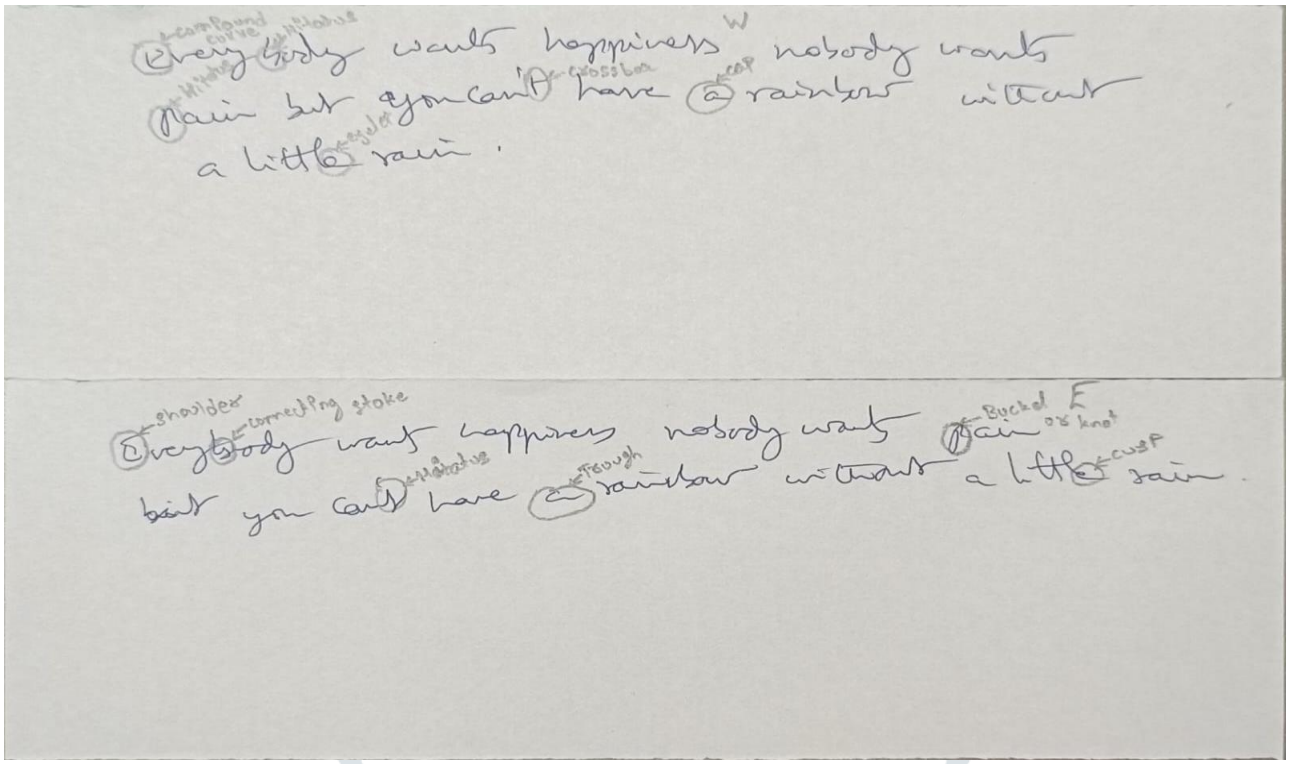

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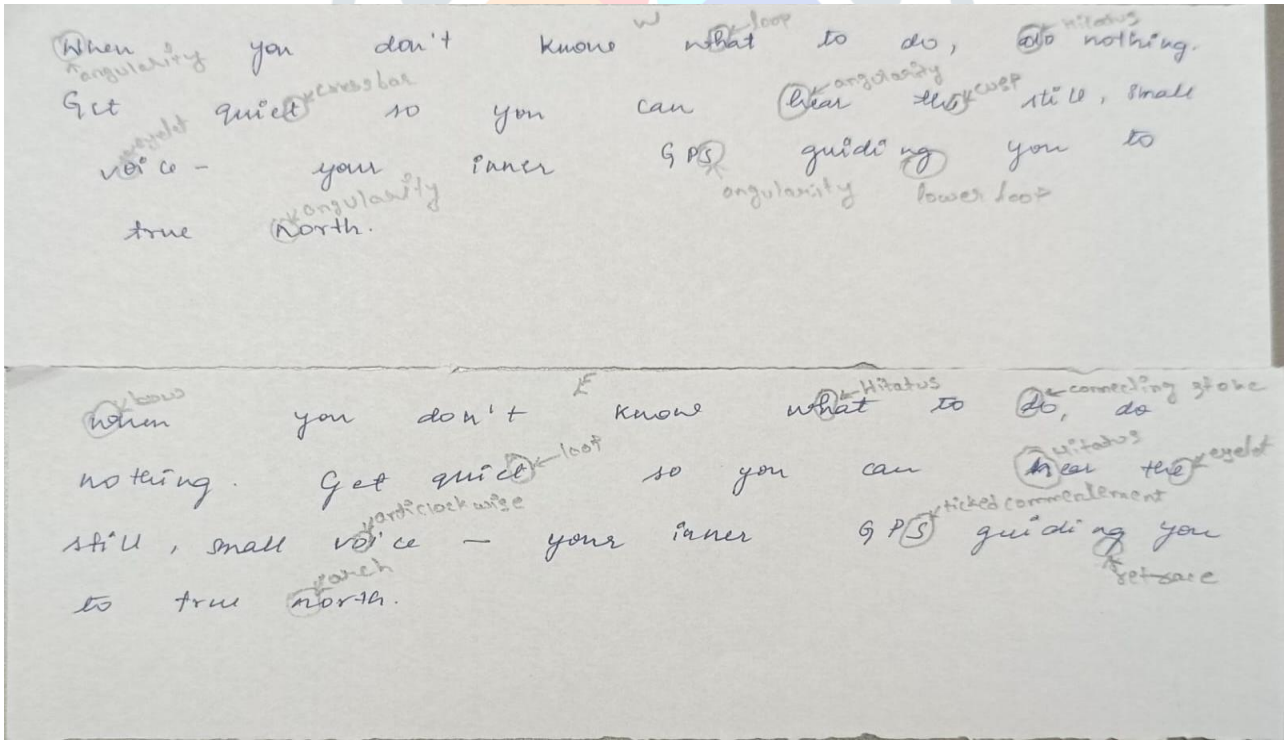

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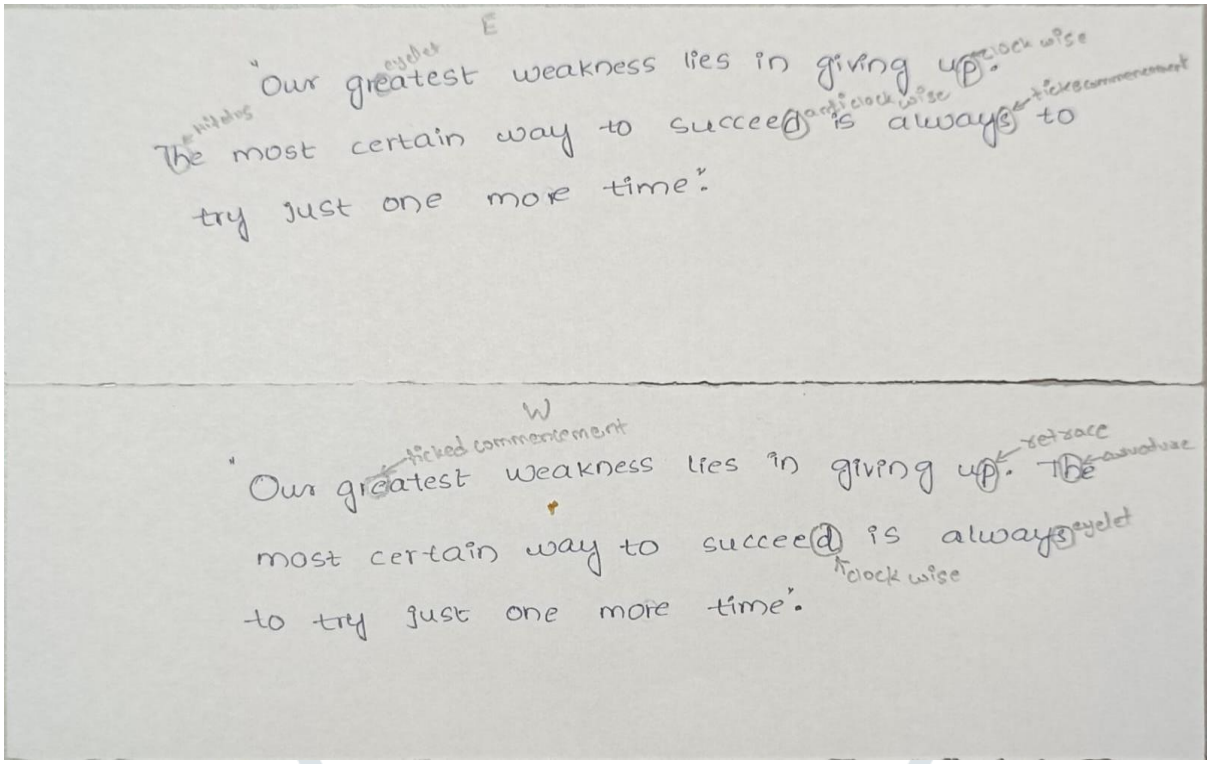

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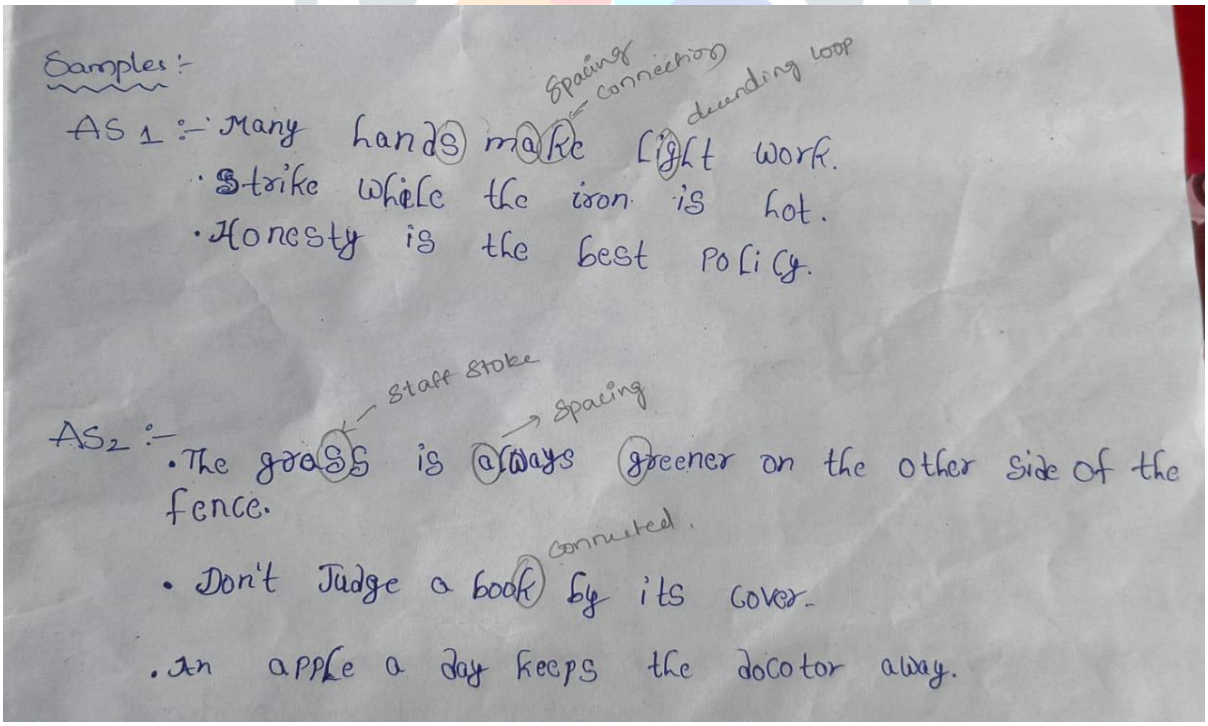

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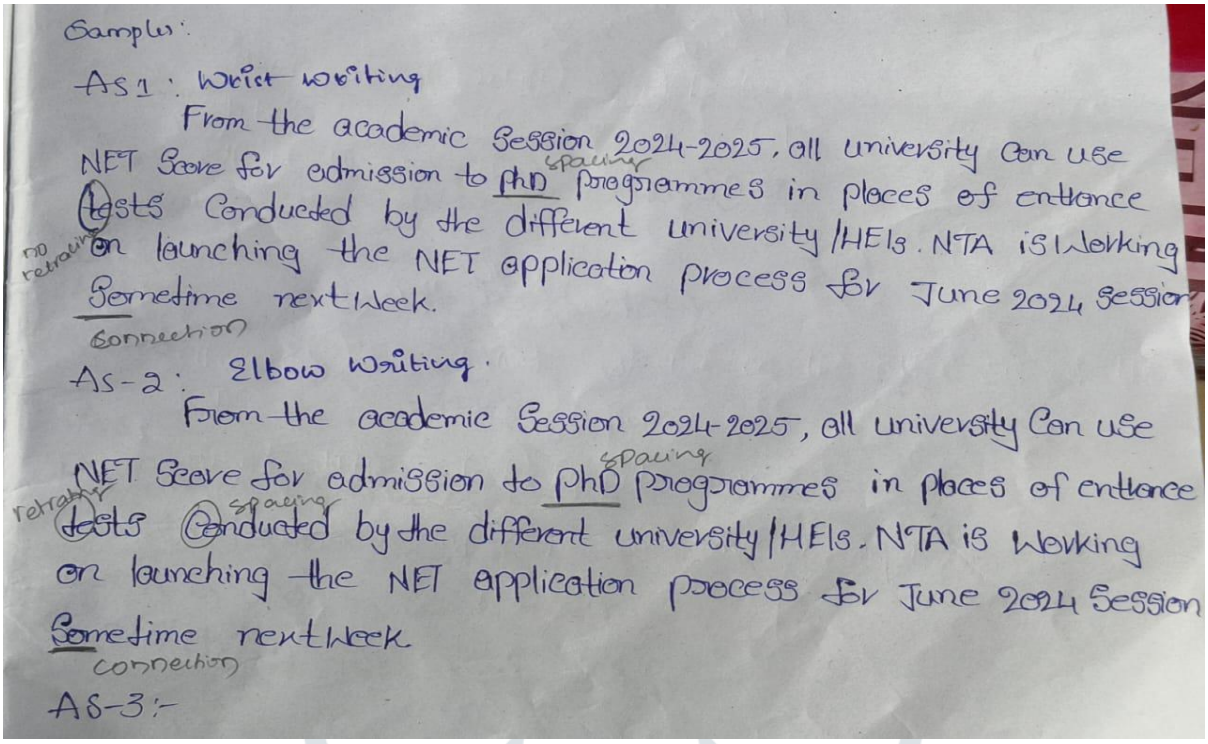

Samples:

As 1 : Wrist writing

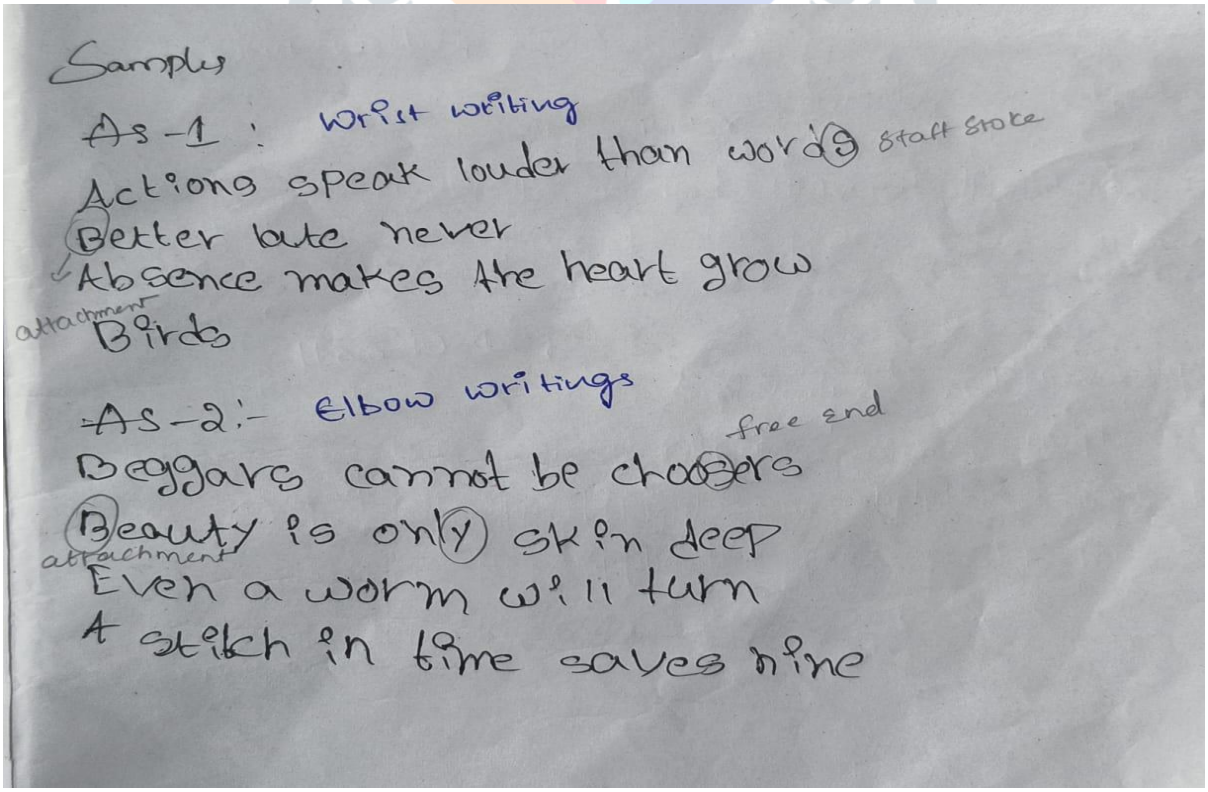
From the academic Session 2024-2025, all University Can use NET Score for admission to PhD programmes in places of entrance tests Conducted by the different university/HEIs. NTA is working on launching the NET application process for June 2024 session Sometime next week.

As-2 : Elbow Writing.

From the academic Session 2024-2025, all University Can use NET Score for admission to PhD programmes in places of entrance tests Conducted by the different university/HEIs. NTA is working on launching the NET application process for June 2024 Session Sometime next week.

As-3 :-

Fig 11: sample 11


Samples

As-1 : Wrist writing

Actions speak louder than words

Better late never

Absence makes the heart grow

Birds

As-2 :- Elbow writings

Beggars cannot be choosers

Beauty is only skin deep

Even a worm will turn

A stitch in time saves nine

Fig 12: sample 12

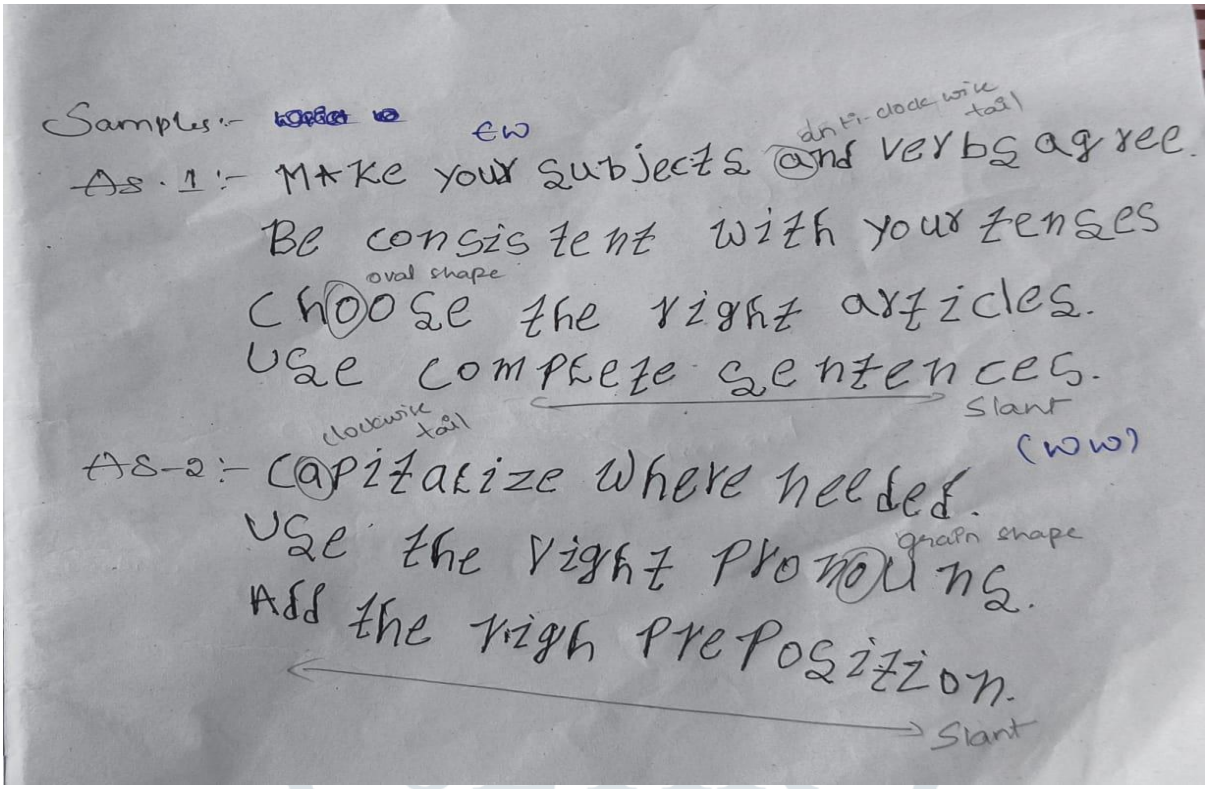


Fig 13: sample 13

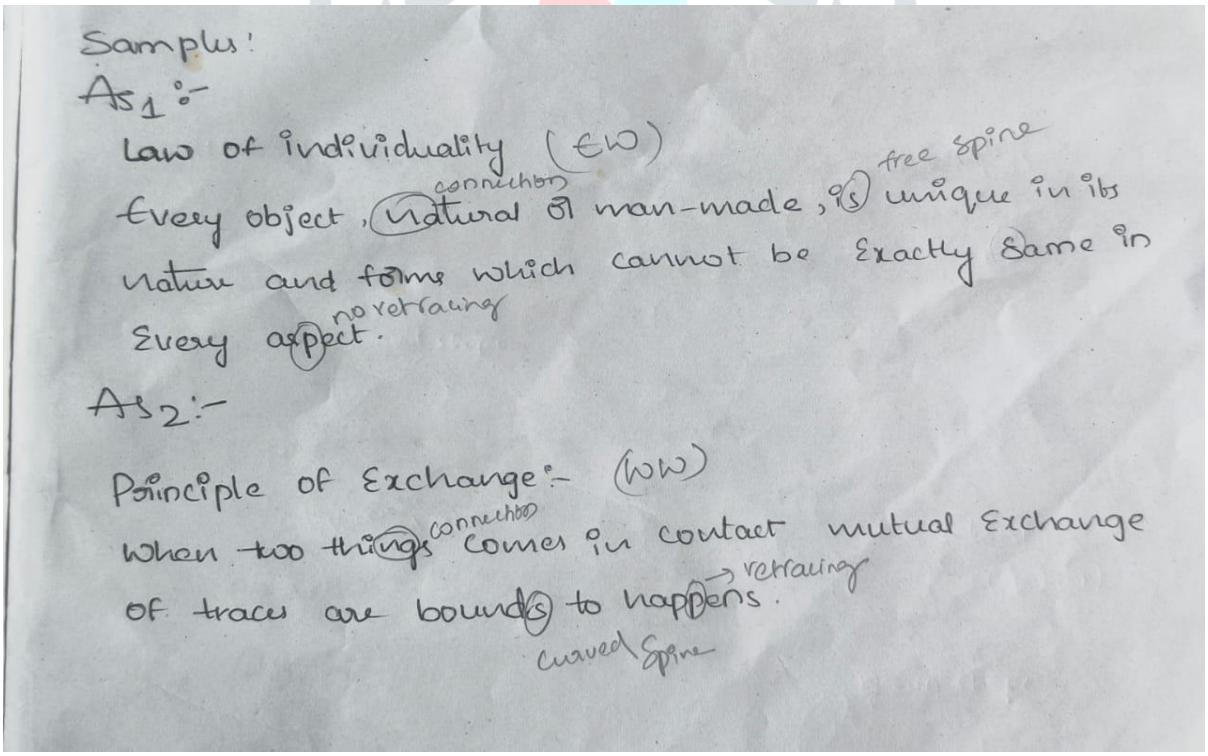


Fig 14 : sample 14

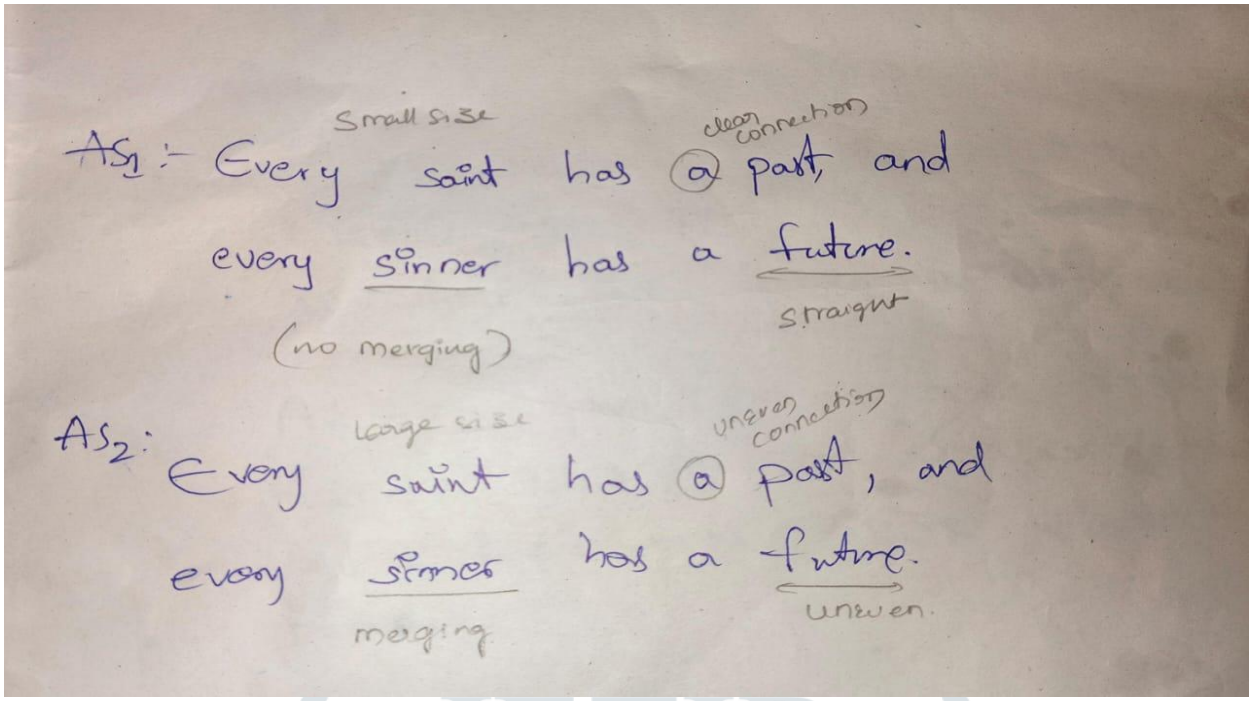


Fig 15 : sample 15

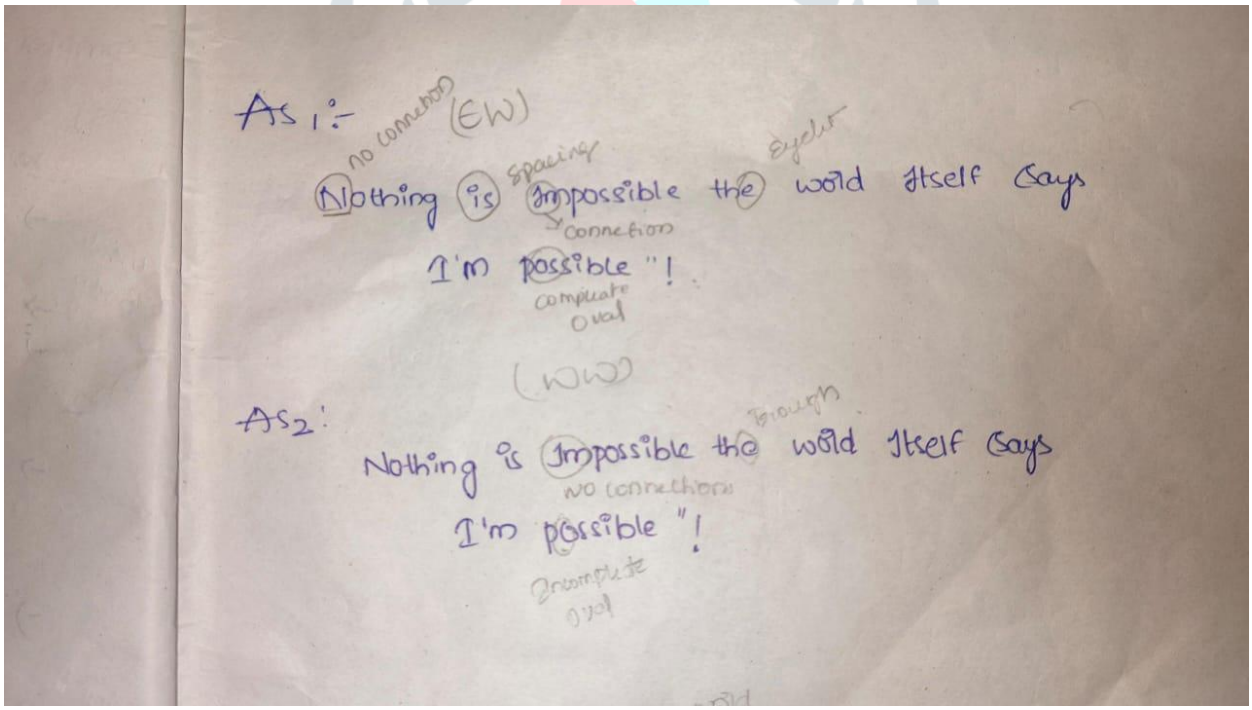


Fig 16: sample 16

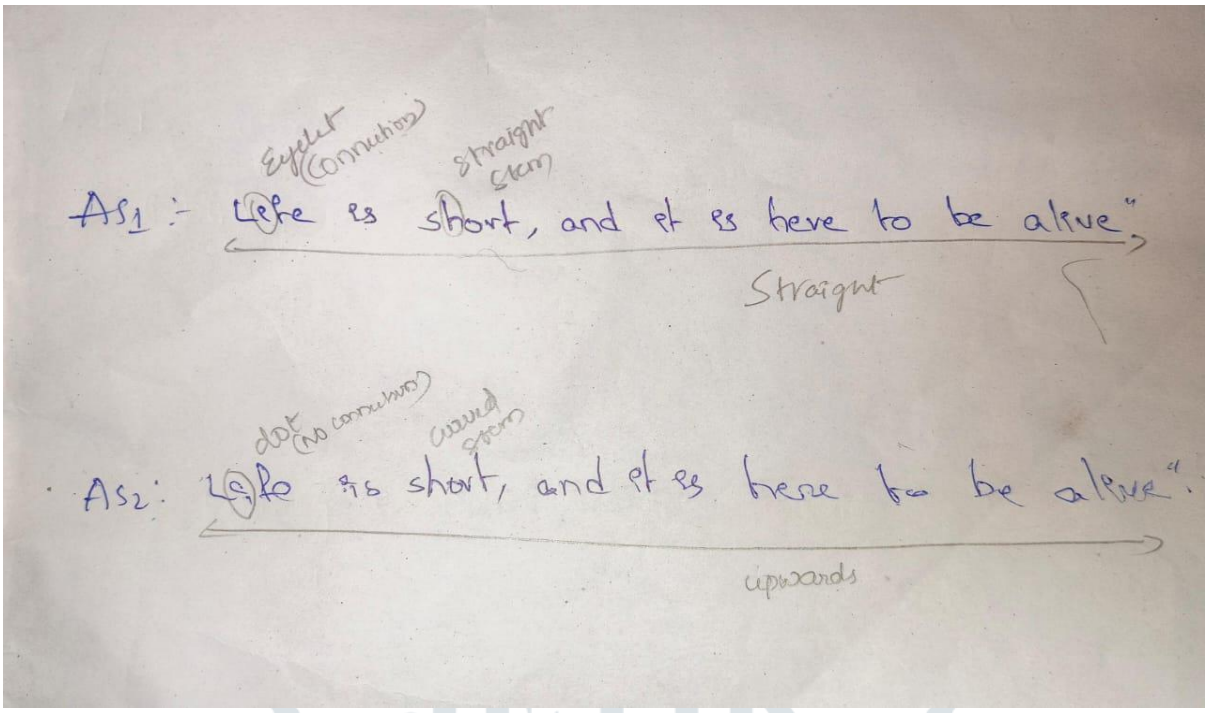


Fig 17: sample 17

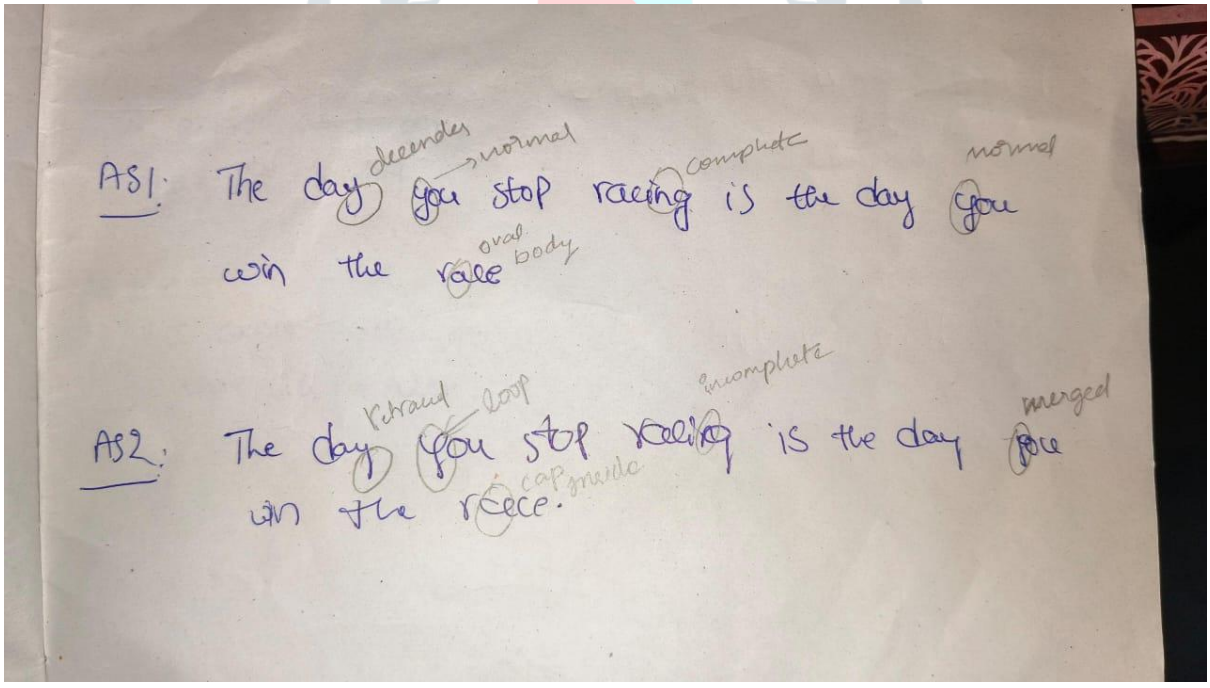


Fig 18 : sample 18

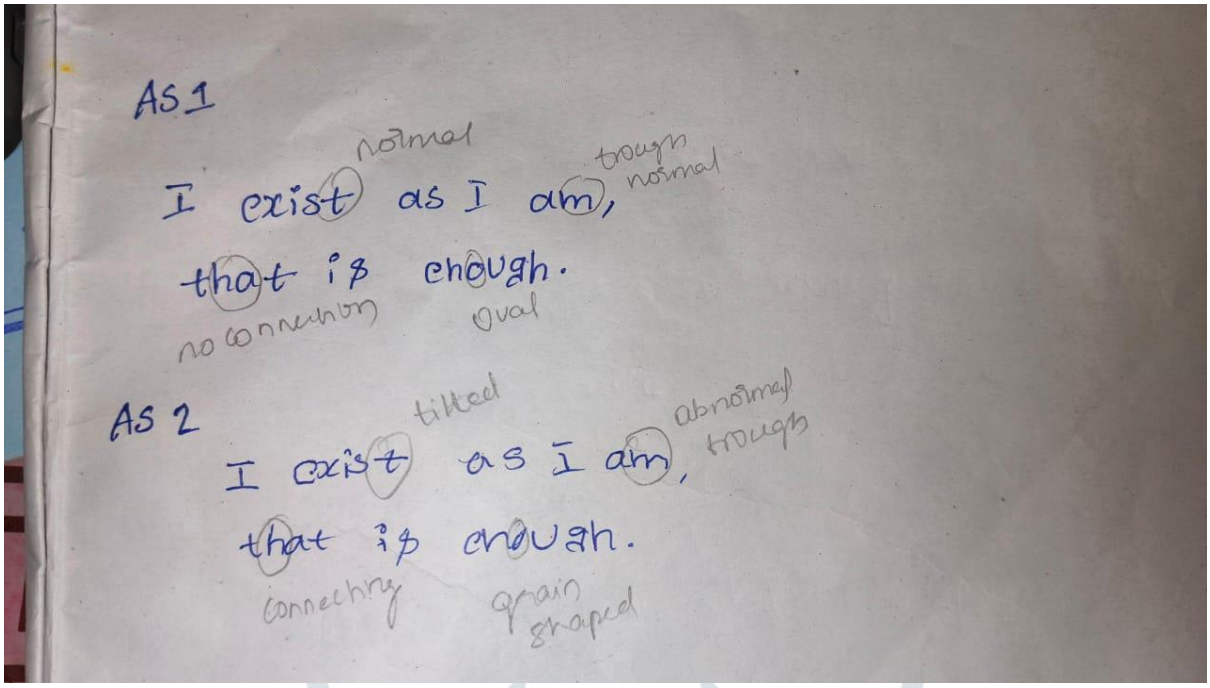


Fig 19: sample 19

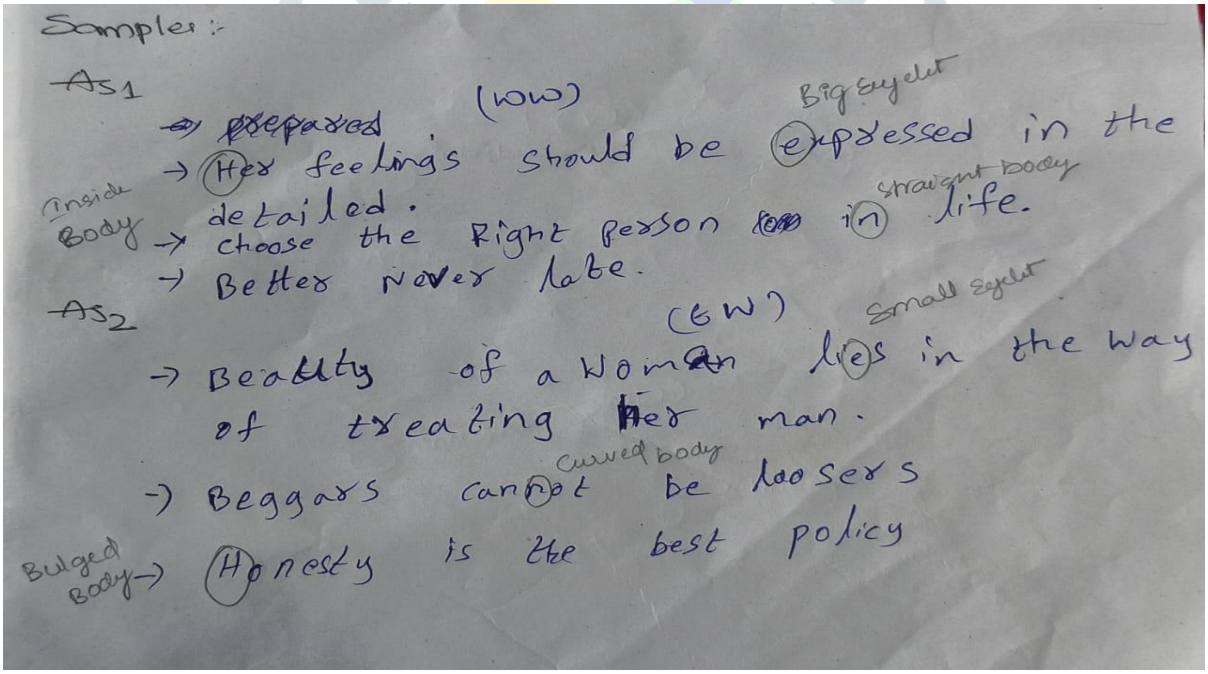
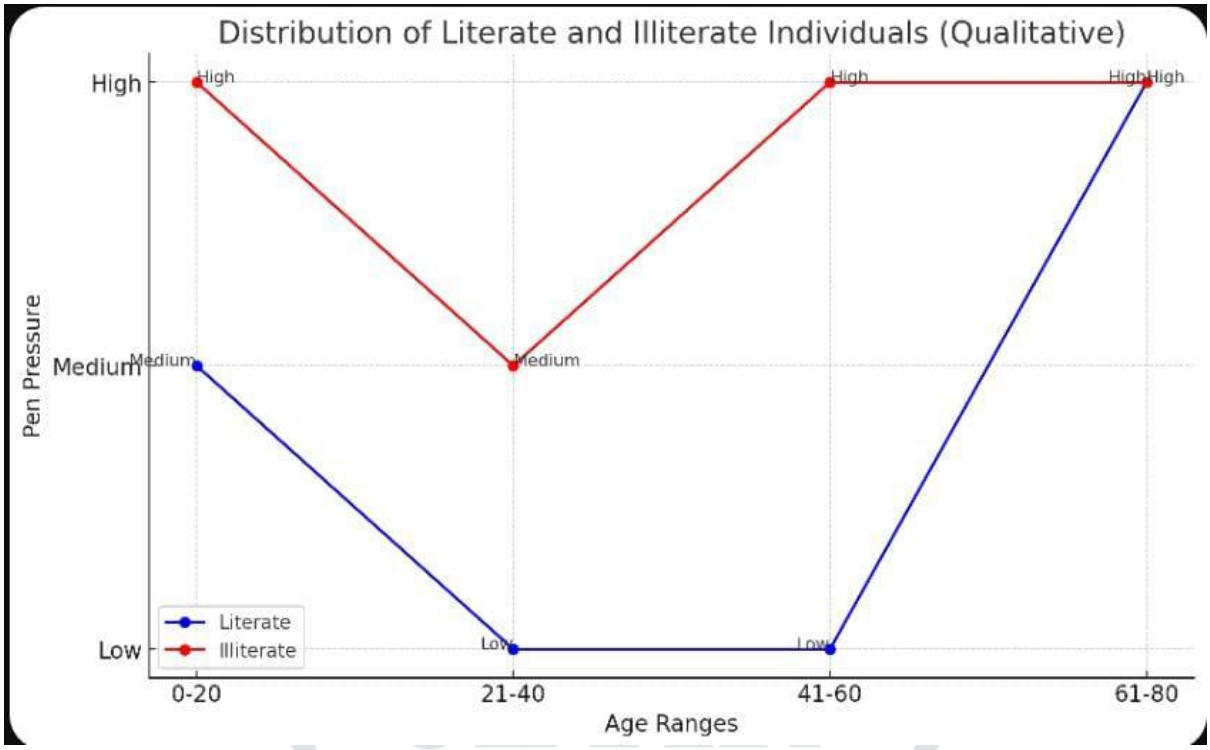


Fig 20: sample 20

Samples	Age	Literacy	Type of writing	Pressure	Spacing	Relative size	Speed	alignment	Slant	Connection
1	22	Literate	Elbow	Medium	Even	Medium	Medium	Concave	Upward	Absent
			Wrist	Medium	Even	Medium	Low	Convex	Downward	Absent
2	23	Literate	Elbow	Medium	Even	Small	Medium	Straight	Right	Absent
			Wrist	Low	Even	Small	Low	Straight	Right	Absent
3	66	Literate	Elbow	Low	Even	Medium	Medium	Straight	Straight	Absent
			Wrist	Low	Low	Small	High	Concave	Right	Present
4	22	Literate	Elbow	Medium	Even	Medium	Medium	Straight	Slightly left	Absent
			Wrist	Low	More	Medium	High	Straight	Slightly left	Present
5	23	Illiterate	Elbow	High	More	Small	Slow	Straight	Uneven	Absent
			Wrist	High	More	Small	Slow	Straight	Uneven	Absent
6	24	Literate	Elbow	Medium	Even	Medium	Medium	Downward	Slight right	Absent
			Wrist	Medium	Low	Small	High	Slightly downwards	Right	Present
7	58	illiterate	Elbow	High	More	Small	Slow	Uneven	Uneven	Absent
			Wrist	High	More	Large	Slow	Uneven	Uneven	Absent
8	71	Literate	Elbow	Low	Even	Small	High	Straight	Straight	Present
			Wrist	Low	Even	Small	High	Straight	Slight left	Present
9	25	Illiterate	Elbow	Medium	More	Medium	Slow	Uneven	Un even	Absent
			Wrist	Medium	More	Large	Slow	Uneven	Uneven	Absent
10	28	Literate	Elbow	Medium	Even	Medium	Medium	Straight	Even	Present
			Wrist	Medium	Even	Medium	Medium	Straight	Even	Present
11	12	Illiterate	Elbow	High	Uneven	Uneven	Slow	Downwards	Uneven	Absent
			Wrist	High	Uneven	Uneven	Slow	Downwards	Uneven	Absent
12	11	Literate	Elbow	Slow	Even	Large	Slow	Straight	Straight	Absent
			Wrist	Slow	Even	Large	Slow	Straight	Straight	Absent
13	18	Illiterate	Elbow	High	Even	Large	Slow	Uneven	Uneven	Absent
			Wrist	High	Even	Large	Slow	Uneven	Uneven	Absent
14	9	Literate	Elbow	High	More	Large	Slow	Straight	Uneven	Absent
			Wrist	High	More	Large	Slow	Slightly downwards	Uneven	Absent
15	22	Literate	Elbow	Medium	Even	Medium	Medium	Straight	Slightly left	Present
			Wrist	Low	More	Medium	Medium	Straight	Slightly left	Present
16	9	Literate	Elbow	High	More	Uneven	Medium	Uneven	Left	Absent
			Wrist	High	More	Uneven	Medium	Uneven	Left	Absemt
17	33	Literate	Elbow	Low	Even	Medium	Medium	Straight	Straight	Present
			Wrist	Low	Even	Medium	Medium	Straight	Straight	Present
18	55	Literate	Elbow	Medium	More	Medium	Medium	Straight	Slight right	Absent
			Wrist	Medium	More	Medium	Medium	Right	Slight left	Absent
19	42	Literate	Elbow	Medium	Even	Medium	Medium	Straight	Straight	Absent
			Wrist	Medium	Uneven	Uneven	Slow	Sight	Uneven	Present
20	45	Illiterate	Elbow	High	Even	Large	Medium	Left	Left	Absent
			Wrist	High	Even	Large	High	Left	Left	Absent

Table no.1 : Tabular representation of general writing habit of samples .

RESULTS AND DISCUSSION:



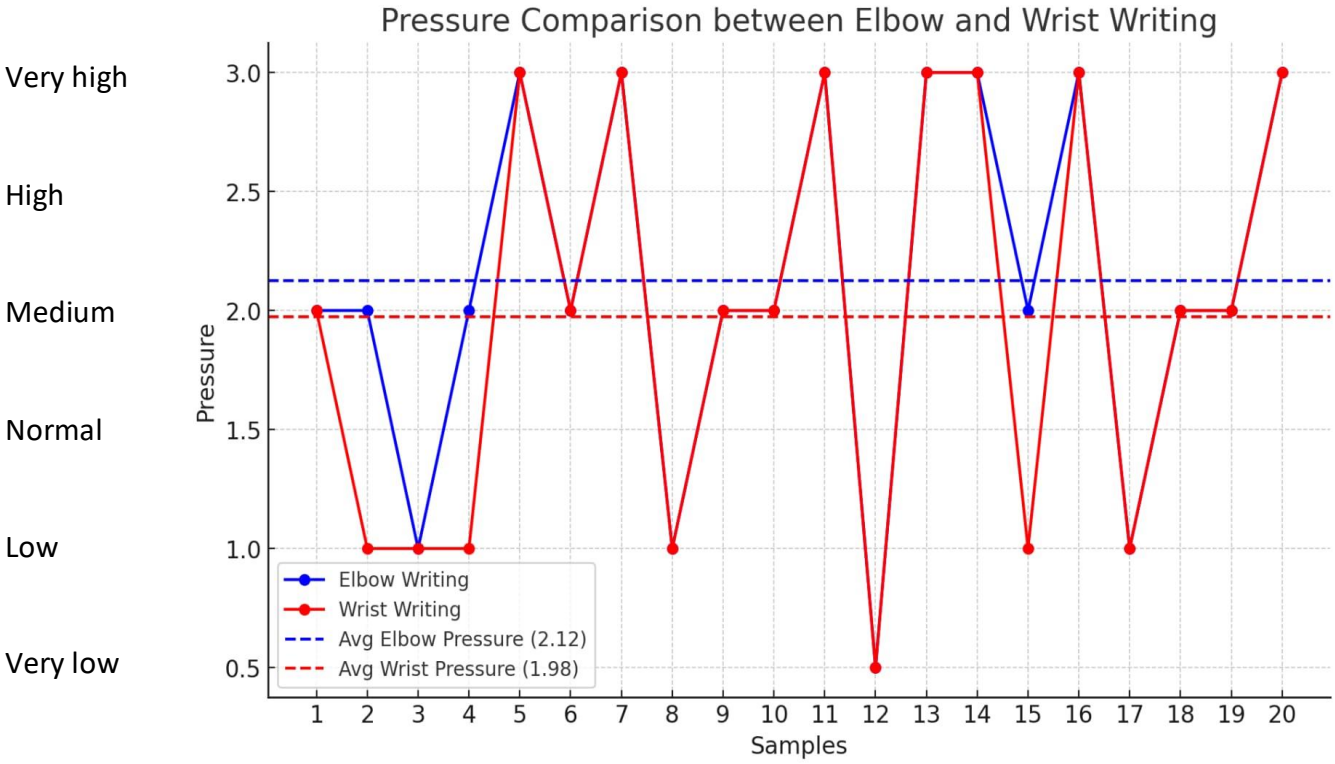
Graph 1: graphical representation of association between age and pen pressure

Samples	Type of writing	Pressure
1	Elbow	Medium
2	Elbow	Medium
3	Elbow	Low
4	Elbow	Medium
5	Elbow	High
6	Elbow	Medium
7	Elbow	High
8	Elbow	Low
9	Elbow	Medium
10	Elbow	Medium
11	Elbow	High
12	Elbow	Slow
13	Elbow	High
14	Elbow	High
15	Elbow	Medium
16	Elbow	High
17	Elbow	Low
18	Elbow	Medium
19	Elbow	Medium
20	Elbow	High

Table 2: Tabular representation of elbow writings and pen pressure with their literacy rate.

Samples	Type of writing	Pressure
1	Wrist	Medium
2	Wrist	Low
3	Wrist	Low
4	Wrist	Low
5	Wrist	High
6	Wrist	Medium
7	Wrist	High
8	Wrist	Low
9	Wrist	Medium
10	Wrist	Medium
11	Wrist	High
12	Wrist	Slow
13	Wrist	High
14	Wrist	High
15	Wrist	Low
16	Wrist	High
17	Wrist	Low
18	Wrist	Medium
19	Wrist	Medium
20	Wrist	High

Table 3: Tabular representation of pressure exerted by the wrist writings of subjects



Graph 2 : Graphical representation of average pressure comparison between elbow writings and wrist writings of subjects.

Samples	Pressure	Speed
2	Medium	Low
4	Low	Low
5	Low	Medium
6	Low	High
8	Low	High
9	High	Slow
10	High	Slow
12	Medium	High
13	High	Slow
14	High	Slow
15	Low	High
16	Low	High
17	Medium	Slow
18	Medium	Slow
21	High	Slow
22	High	Slow
25	High	Slow
26	High	Slow
27	High	Slow
28	High	Slow
30	Low	Medium
31	High	Medium
32	High	Medium
33	Low	Medium
34	Low	Medium
38	Medium	Slow
39	High	Medium
40	High	High

By analysing the contents of table 1 we can observe these variants of speed and pressure are relating each other which is inversely proportional (Bernoulli's principle- Daniel Bernoulli, 1738.)

NOTE :

Through the analysis we concluded that

- Analysis indicates that illiterate subjects tend to apply more pressure while writing and do so at a lower speed.
- It is inferred that literate subjects with writing practice write smoothly, occasionally with connected letters, and apply low pressure.
- It is considered that age and practice have a direct impact on pen pressure.
- It is assumed that alignment and slant are not influenced by pen pressure, nor do they influence pen pressure.
- The relative size of letters is found to have a minimal impact on pen pressure.
- By analysing the contents of table 1 we can observe these variants of speed and pressure are relating each other which is inversely proportional (Bernoulli's principle- Daniel Bernoulli, 1738.)

Conclusion

The current research paper addresses the importance of the pen pressure and its implications and influences over other class characteristic features and individual characteristic features of hand writing and signature which differs from person to person.

Pen pressure plays a crucial role in defining the unique characteristics of handwriting. It is a vital element in forensic document examination, offering significant insights into the authenticity and origin of questioned documents. By analyzing the variations in pressure, forensic experts can identify individual writing habits, detect potential forgeries, and reveal alterations. The examination of pen pressure involves a range of techniques, from visual and microscopic analysis to advanced methods like electrostatic detection apparatus and oblique lighting.

Understanding pen pressure and its effects on writing characteristics enhances the ability to distinguish between genuine and fraudulent documents. It helps in establishing the sequence of strokes, which can be pivotal in disputed signatures or handwritten entries. Ultimately, the analysis of pen pressure contributes to the broader field of forensic science, supporting legal and investigative processes with objective and reliable evidence.

In summary, pen pressure is not just a simple aspect of writing; it is a distinctive feature that provides a wealth of information about the writer and the circumstances under which a document was created. This makes it an indispensable tool in the realm of forensic document examination.

Scope for further enhancement

This research has been conducted with the limitations which turns into research gap, thus there will be further scope to continue the research.

By integrating advanced technologies, interdisciplinary research, and standardized methodologies, the field of pen pressure analysis in forensic document examination can be significantly enhanced. These advancements will improve the accuracy, efficiency, and reliability of identifying and authenticating questioned documents, further supporting legal and investigative efforts worldwide.

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