

ORIGINAL ARTICLE

Forensic Stylistics: Exploring Style and Variations Across Different Writing Positions

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Yadav S., Sharma V., Kumar S. Forensic Stylistics: Exploring Style and Variations Across Different Writing Positions. Indian J Forensic Med Pathol. 2025; 18(2): 123-133.

ABSTRACT

Background: Handwriting is a complex task as it involves neuromuscular efforts. It is a written language through any mark, drawing, or symbol to convey a meaningful message. Hence, handwriting is a medium of communication, even a single stroke can be a whole message between the communicators. Handwriting is an acquired skill influenced by many factors such as different body positions, different writing instruments, writing content, writing techniques (copy, dictated, or after recall), etc.

Aim and Objective: This paper presents a study of the style markers and variation across the written sample, when writing is executed by a person in different body positions.

Material: To achieve this study, 125 writing samples were collected from 25 participants aged 19-45 years. Each of the participants has written the sample in four different positions after filling out the basic questionnaire. The percentage distribution of variations in the handwriting characteristics and style markers associated with it was studied.

Result: During the analysis, it has been observed that copying similar content in different body positions results in variations in the general characteristics of the person's writing, including style pattern and which further draws into the range of variations in the handwriting characteristics and Individual's stylistic pattern during different writing positions.

Conclusion: This study will be helpful for forensic document examiners to lead to more accurate opinions. These observations might justify the examination of writings from different body positions as proof in a court of law when a similar condition of writing is in dispute.

KEYWORDS

- Style Handwriting characteristics
- Variations
- Forensic Document Examination
- Writing positions

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➤ **Received:** 07-05-2024 ➤ **Accepted:** 17-06-2025



INTRODUCTION

Handwriting progresses from the school's copybook styles, evolving into an individualistic master pattern that reflects consistency in writing style. This evolution has been influenced by external and internal factors. Unusual conditions, including body position, can interrupt in usual writing style¹⁻⁵. The aim is to study the influence of body position on the consistency of writing style and general features in handwriting. The rationale is the challenges and hindrances faced when the written content that has been prejudiced by unusual conditions and similar standard writing samples are not available for comparison. This study intends precision and reliability, eventually providing more robust evidence in legal contexts.

MATERIAL AND METHODOLOGY

The written samples for this study involved 25 participants aged between 19 to 45 years. The criteria for inclusion of the participants were that they should be in good physical health, as the whole content was to be copied and written in one go in all four different positions. To ensure diversity in the written samples. The participants chosen were a few random students and acquaintances of the acknowledged individuals (family and friends), irrespective of gender.

A total of 125 handwriting samples were collected from each participant writing samples in four different body positions:

1. standing with the writing paper on a wall.
2. seated on a chair with paper on the table.
3. standing with the writing paper on a table.
4. seated in a cross-legged position.

Participants were given a questionnaire of one page containing personal details and four pages of a passage "The Class of 16 letters" [https://en.wikipedia.org/wiki/Handwriting_exemplar] consisting of 145 words, which needed to be copied in four different body positions. The well-versed consent form was obtained from all participants before data collection commenced.

The passage (*Picture 1*) of 145 words [https://en.wikipedia.org/wiki/Handwriting_exemplar] with some modification have been used to serve the purpose of the study as it covered all the alphabets including punctuations, marks and symbols which is very much suitable and observed considerable for the reference sample and further has been compared with the passage that was copied in all different body positions to study the variation in the handwriting and style pattern in the written content.

The Class of "16" Letter

Dear Zach,

Well, the old class of "16" is through at last. You ask where the boys are to be. Val Brown goes on the 24th to Harvard for law. Don't forget to address him as "Esquire." [Ted <@!\$#@%\$^_/***+>] takes a position with the N. Y. W. H. & H. R. R., 892 Ladd Ave., Fall River, Massachusetts, and Jack McQuade with the D. L. & W. at Jersey City, N. J. 400 E. 6th Street. William Fellows just left for a department position in Washington; his address is 735 South G. St. At last account, Dr. Max King was to go to John Hopkins for a Ph.D. degree. Think of that! Elliott goes to Xenia, Ohio, to be a Y. M. C. A. secretary. I stay here for the present. What do you do next? How about Idaho & Utah?

Yours truly, and Goodbye

Signature of writer

Figure 1: Template for the sample collection

A set of five sheets was provided to the participants. Each set has one sheet of personal detail and four sheets of passage (*Figure 1*). Every four sheets have instructions at the

top of the sheet on where the passage has to be copied and signed, along with the date at the end of the sheet. All samples were written in one go and with one ballpoint pen. No other instructions have been given. All the participants were right-handed and well acquainted with their writing skills, as all had graduated with their minimum qualification. No hard base object has been used while writing the sample, except in a cross-legged position. Since participants were sitting in the cross-legged position, therefore used the hardboard on their knees while copying the passage, so that the formation of letters/characters/symbols would not get distorted (as shown in Picture 9: Position 4). After the collection of samples, the features mentioned in Picture 2 have been carefully observed. To observe the samples, a dimensional scale, a protector, and a hand magnifier have been used. Further style patterns and general characteristics were also evaluated to study the variation among the samples written under different writing positions.

1. Number of words per line - total number of words in a line of the passage.
2. Space between the words - fifteen random spaces are calculated between the words in a passage.
3. Space between the lines - here, each space between the lines has been measured.
4. The number of lines - total number of lines.
5. The left margin is measured
6. The right margin is measured.
7. Spelling mistakes- each spelling mistake is observed from the provided passage.
8. Overwriting - repetition of any stroke, cutting, or scribbling in the copied passage.
9. Any words/lines skipped - each word and line is observed.
10. All punctuation present - presence of all punctuation is observed in the copied passage.
11. Speed - not all person executes writing at the same speed, so it is categorized further into fast, medium, and slow speed.
 - Fast speed (Speed_Fs is the abbreviation for Fast speed) - Smooth, quickly flowing characters are generally simplified characters.
 - Medium speed (Speed_Me is the abbreviation of the Medium speed) - Characters with both blunt strokes and somewhere flowing strokes.
 - Slow speed (Speed_Sl is the abbreviation for the slow speed) - It is observed through tremulous characters with blunt initial and terminating strokes.
12. Slant - It is the angle of the axis of the letter to its baseline. This is further categorized into vertical, forward, backward, and mixed.
 - Vertical slant (Slant_Ve is the abbreviation for the vertical slant) - letter leans nowhere means the axis of the letter is forming 90° to the baseline.
 - Forward slant (Slant_Fr is the abbreviation of the forward slant) - the letter leans forward, and the axis of the letter is less than 90° to the baseline.
 - Backward slant (Slant_Bk is the abbreviation for the Backward slant) - letter leans backward when the axis of the letter is more than 90° degrees.
 - Mixed slant (Slant_Mx is the abbreviation for the Mixed slant) - a letter with all three slants
13. Alignment - it is the laying of writing concerning the baseline. It is further categorized into ascending, descending, horizontal, and mixed alignments.
 - Ascending alignment (Alignment As is the abbreviation for the Ascending alignment) - writing rests above the baseline.
 - Descending alignment (Alignment Ds is the abbreviation for Descending alignment) - writing rests below the baseline.
 - Horizontal alignment (Alignment Hr is the abbreviation for Horizontal alignment) - writing rests upon the baseline.
 - Mixed alignment (Alignment Mx is the abbreviation for Mixed alignment) - writing with mixed alignments.

14. Line Quality - it is evaluated by how skillfully the writer has copied the passage. Including the other handwriting features.

It is further categorized into (LineQ_G) good, (LineQ_P) poor, and (LineQ_A) average.

| | |
|-----------------------------|-------------------|
| 1. Number of words per line | 11. Speed |
| 2. Space between words | 12. Slant |
| 3. Space between lines | 13. Alignment |
| 4. Number of lines | 14. Line Quality. |
| 5. Left margin | |
| 6. Right margin | |
| 7. Spelling mistakes | |
| 8. Overwriting | |
| 9. All punctuations present | |
| 10. Any word/line skipped | |

Figure 2: These are the features that have been observed in this study

RESULT AND DISCUSSION

Numerous authors in previous studies provided the results in studying the relationship between writing in respect of body positions. Day-to-day variations could be observed in terms of “pen pressure, width, shape, and height of the letters, movement of the strokes of the signatures”^{6,9-11}. While considering the sitting or standing position, the highest variation was studied when the person was executing the samples in the standing position⁷⁻⁸.

There is a lot to explore about the writing style and handwriting characteristics concerning body positions, as very inadequate research papers have been published. However, position influences the execution of letters, words, and even single strokes. Still, different positions can lead to diverse features in handwriting. As such, this paper intends to study and evaluate the variations in dimensional features and style patterns in written content while executing in different body positions.

This study was undertaken to examine handwriting written under different body positions. The handwriting samples were analyzed with a hand magnifier, a scale, and a protector to observe all the occurrences of the maximum features observed with the different writing positions in *Table 1*, with the percentage given in *Table 2*.

Table 1: observed features with respect to the body positions

| Position | Maximum Features observed |
|------------|---------------------------------|
| Position 1 | Left Margin |
| | Right Margin |
| | Speed slow |
| | Spelling mistakes |
| | Poor line Quality |
| Position 2 | Overwritten |
| | Space between the lines |
| | Slant vertical |
| | Speed medium |
| Position 3 | Words/lines skipped |
| | Number of words per line |
| | Space between the words |
| | Speed Fast |
| | Number of lines |
| Position 4 | slant backward |
| | Not all punctuation is present. |
| | Alignment ascending |

Table 2: Percentage distribution of all observed features

| S. no. | Features | Position 1 | | Position 2 | | Position 3 | | Position 4 | |
|--------|--------------------------|--------------|-----|------------|-----|------------|-----|------------|-----|
| | | Average | % | Average | % | Average | % | Average | % |
| 1 | Number of Words Per Line | 11.41 | 46% | 11.75 | 47% | 12 | 47% | 11.55 | 46% |
| 2 | Space Between Words | 0.54cm | 2% | 0.54cm | 2% | 0.57cm | 2% | 0.56cm | 2% |
| 3 | Space Between Lines | 0.50cm | 2% | 0.59 cm | 2% | 0.50cm | 2% | 0.48cm | 2% |
| 4 | Number of Lines | 12 | 48% | 11 | 46% | 12 | 47% | 12.12 | 48% |
| 5 | Left Margin | 1.9cm | 8% | 1.73cm | 7% | 1.69cm | 7% | 1.7cm | 7% |
| 6 | Right Margin | 1.77cm | 7% | 1.62cm | 6% | 1.57cm | 6% | 1.7cm | 7% |
| 7 | Speed | Speed_Fs | 16% | 16% | 24% | 12% | | | |
| | | Speed_Me | 52% | 64% | 48% | 60% | | | |
| | | Speed_Sl | 32% | 20% | 28% | 28% | | | |
| | | Slant_Ve | 36% | 40% | 32% | 32% | | | |
| 8 | Slant | Slant_Fr | 24% | 24% | 24% | 20% | | | |
| | | Slant_Bk | 24% | 24% | 28% | 36% | | | |
| | | Slant_Mx | 16% | 12% | 16% | 12% | | | |
| | | Alignment As | 44% | 44% | 48% | 52% | | | |
| 9 | Alignment | Alignment Ds | 12% | 12% | 20% | 16% | | | |
| | | Alignment Hr | 32% | 32% | 24% | 24% | | | |
| | | Alignment Mx | 12% | 12% | 8% | 8% | | | |
| | | LineQ_G | 24% | 28% | 24% | 28% | | | |
| 10 | Line Quality | LineQ_A | 48% | 60% | 60% | 52% | | | |
| | | LineQ_P | 24% | 12% | 16% | 20% | | | |
| 11 | Word/Line Skipped | Yes | 48% | 52% | 24% | 20% | | | |
| | | No | 52% | 48% | 76% | 80% | | | |
| 12 | Overwriting | Yes | 64% | 44% | 44% | 40% | | | |
| | | No | 36% | 56% | 56% | 60% | | | |
| 13 | Spelling Mistake | Yes | 60% | 56% | 56% | 48% | | | |
| | | No | 40% | 52% | 44% | 52% | | | |
| 14 | All Punctuation Present | Yes | 36% | 48% | 68% | 36% | | | |
| | | No | 64% | 52% | 32% | 64% | | | |

In position 1, standing position with the writing paper on the wall:

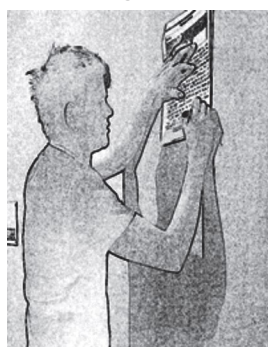


Figure 3: Position 1

Dear Zach, -
 Well, the old class of '16' is through at last. You ask
 where the boys are to be. Val Brown goes off the 24th to Harvard
 for law. Don't forget to address him as "Esquire". [Ted & @! & # @% &
 ^ - / * * * >] takes his position with the N. Y. N. H. & H. R. R., 892 Ladd
 Ave., Fall River, Massachusetts and Jack McQuade with the D. L.
 & N. at Jersey City, N. J. 400 E. 6th Street. William Fellows just left
 for a department Hopkins for a Ph. D. degree. Think of that! Elliott
 goes to Xenia, Ohio to be a Y. M. C. A. secretary. I stay here for the
 present. What do you do next? How about Idaho & Utah?
 Yours truly, and Goodbye!

Figure 4: Sample written in position 1

Figures 3 & 4 show that 46% of the participants on average wrote 11.41 words in a line while copying the passage on an A4-size sheet. 2% of participants on average had 0.54 cm space between the words while writing the passage. 2% of participants on average had 0.50cm space between the lines while writing the passage on an A4-sized sheet. 48% of participants on average wrote 12 lines of the passage. 8% of participants had 1.9cm of Left Margin, and 7% of participants had 1.7cm of Right Margin. The variations had also been observed in handwriting characteristics such as Slant, Speed, Alignment, and Line Quality. 16% of participants wrote at a fast speed, 52% wrote at a medium speed, and 32% wrote at a slow speed. 36% of participants had a vertical

slant, and 24% each had a forward as well as backward slant, while 16% wrote with mixed slant, which comprises vertical, forward & backward. 44% of participants had ascended alignment, 12% had to descend, 32% with horizontal alignment, and 12% with mixed (ascending, horizontal, and descending) alignment while copying the passage in the said position. When it comes to Line Quality, 24% of each participant wrote with good as well as poor line quality, and 48% with average line quality. 48% of participants skipped the word/line while copying the passage. 64% had overwritten, 60% had spelling mistakes, and 64% of participants were not focused while copying this position, as they had not paid much attention to the punctuation.

In position 2, table and chair sitting position:



Figure 5: Position 2

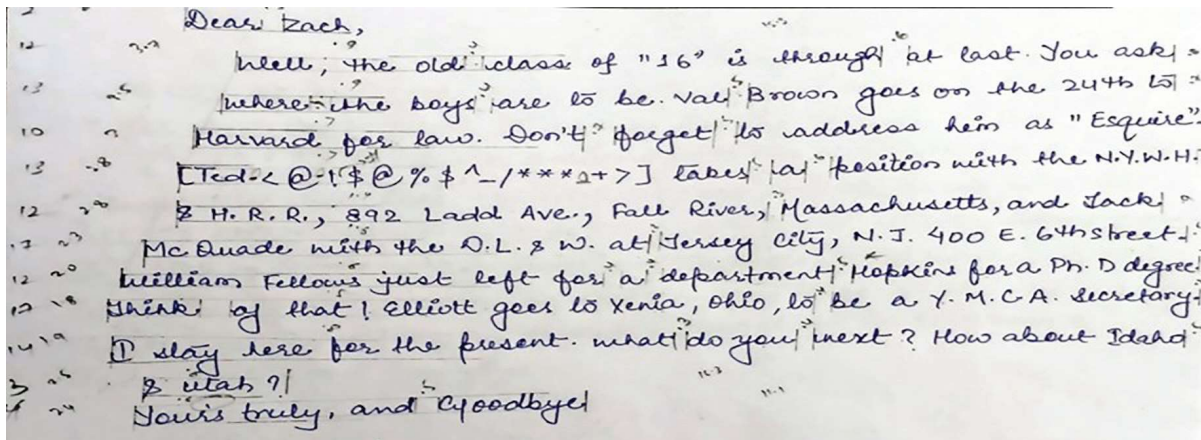


Figure 6: Sample written in position 2

Figures 5 & 6 show that 47% of the participants on average wrote 11.75 words in a line while copying the passage on an A4-size sheet. 2% of participants on average had 0.54 cm space between the words while writing the passage. 2% of participants on average had 0.59cm space between the lines while writing the passage on an A4-sized sheet. 46% of participants on average wrote 11 lines of the passage. 7% of participants had 1.73cm of Left Margin, and 6% of participants had 1.62cm of Right Margin. The variations had also been observed in handwriting characteristics such as Slant, Speed, Alignment, and Line Quality. 16% of participants wrote at a fast speed, 64% wrote at a medium speed, and 20% wrote at a slow speed. 40% of participants had a vertical

slant, and 24% each had a forward as well as backward slant, while 12% wrote with mixed slant, which comprises vertical, forward & backward. 44% of participants had ascended alignment, 12% had to descend, 32% with horizontal alignment, and 12% with mixed (ascending, horizontal, and descending) alignment while copying the passage in the said position. When it comes to Line Quality, 28% of participants wrote with good, 12% with poor line quality, and 48% with average line quality. 52% of participants skipped the word/line while copying the passage. 44% had overwritten, 56% made spelling mistakes, and 52% of participants were not focused while copying this position, as they had not paid much attention to the punctuation.

In position 3, standing position with writing a paper on the table:



Figure 7: Position 3

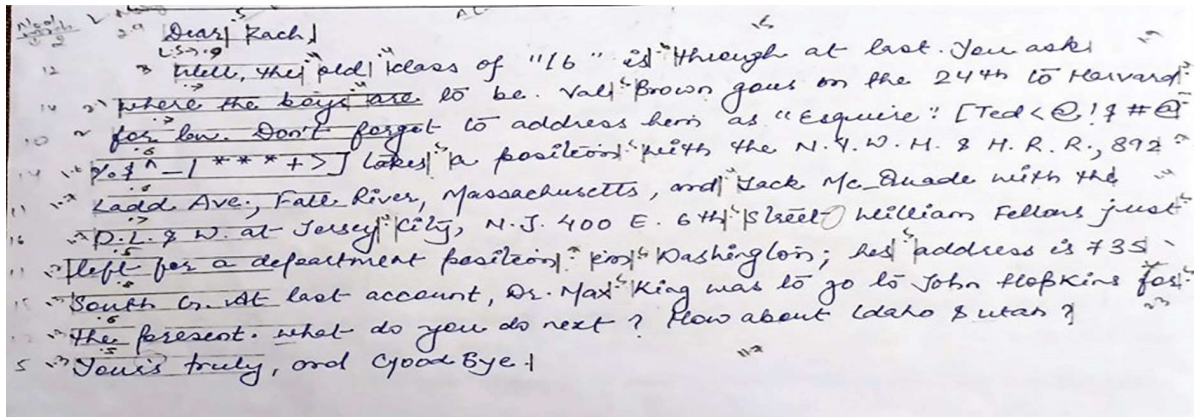


Figure 8: Sample written in position 3

Figures 7 & 8 show that 47% of the participants on average wrote 12 words in a line while copying the passage on an A4-size sheet. 2% of participants on average had 0.57 cm space between the words while writing the passage. 2% of participants on average had 0.50cm space between the lines while writing the passage on an A4-sized sheet. 47% of participants on average wrote 12 lines of the passage. 7% of participants had 1.69cm of Left Margin, and 6% of participants had 1.57cm of Right Margin. The variations had also been observed in handwriting characteristics such as Slant, Speed, Alignment, and Line Quality. 24% of participants wrote at a fast speed, 48% wrote at a medium speed, and 28% wrote at a slow speed. 32% of participants had a vertical

slant and 24% had a forward slant, 28% with a backward slant, and 16% wrote with a mixed slant, which comprises vertical, forward, and backward. 48% of participants had ascended alignment, 20% had to descend, 24% with horizontal alignment, and 8% with mixed (ascending, horizontal, and descending) alignment while copying the passage in the said position. When it comes to Line Quality, 24% of participants wrote with good, 16% with poor line quality, and 60% with average line quality. 24% of participants skipped the word/ line while copying the passage. 44% had overwritten, 56% made spelling mistakes, and 32% of participants were not focused while copying this position, as they had not paid much attention to the punctuation.

In position 4, cross-legged sitting position:



Figure 9: Position 4

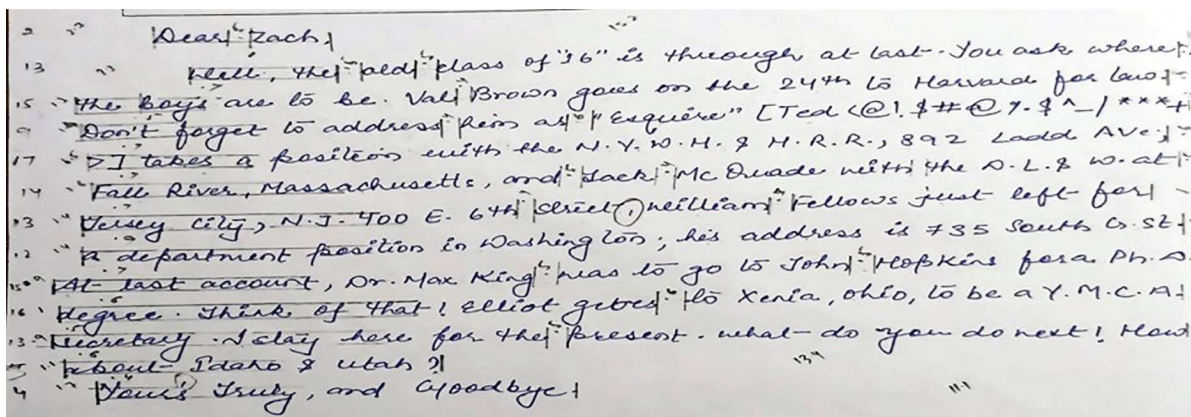


Figure 10: Sample written in position 4

Figures 9 & 10 show that 46% of the participants on average wrote 11.55 words in a line while copying the passage on an A4-size sheet. 2% of participants on average had 0.56 cm space between the words while writing the passage. 2% of participants on average had 0.48cm space between the lines while writing the passage on an A4-sized sheet. 48% of participants on average wrote 12 lines of the passage. 7% of participants had 1.7cm of Left Margin, and 6% of participants had 1.7cm of Right Margin. The variations had also been observed in handwriting characteristics such as Slant, Speed, Alignment, and Line Quality. 12% of participants wrote at a fast speed, 60% wrote at a medium speed, and 28% wrote at a slow speed. 32% of participants had a vertical slant and 20% had a forward slant,

36% with a backward slant, and 12% were written with a mixed slant, which comprises vertical, forward & and backward. 52% of participants had ascended alignment, 16% had to descend, 24% with horizontal alignment, and 8% with mixed (ascending, horizontal, and descending) alignment while copying the passage in the said position. When it comes to Line Quality, 28% of participants wrote with good, 20% with poor line quality, and 52% with average line quality. 20% of participants skipped the word/line while copying the passage. 40% had overwritten, 48% had made grammatical mistakes, and 64% of participants were not focused while copying this position, as they had not paid much attention to the punctuation.

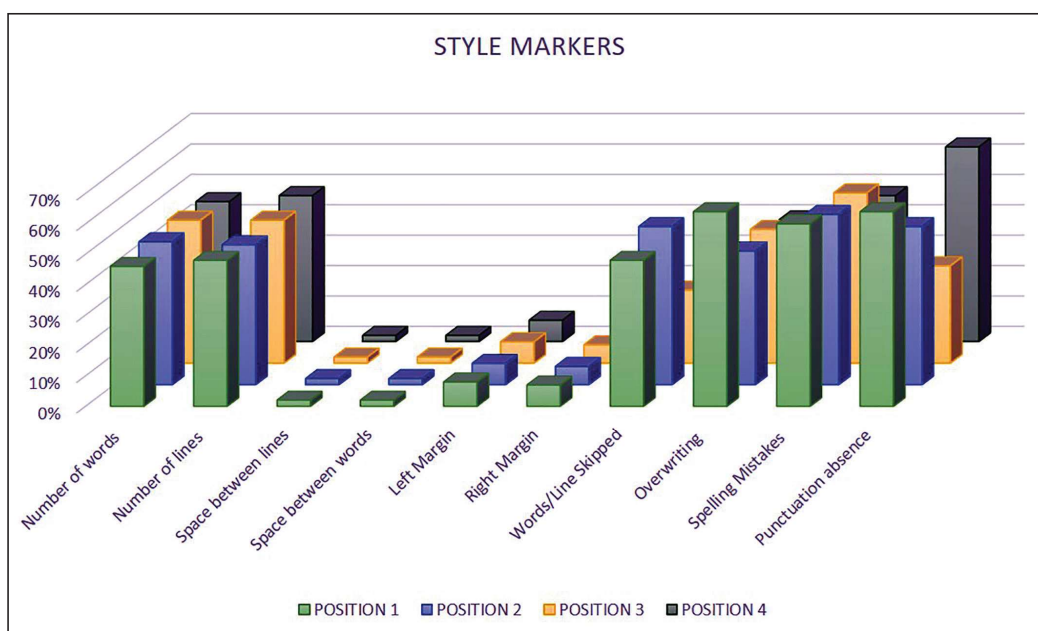


Chart 1: Shows the representation of style markers in the writing position

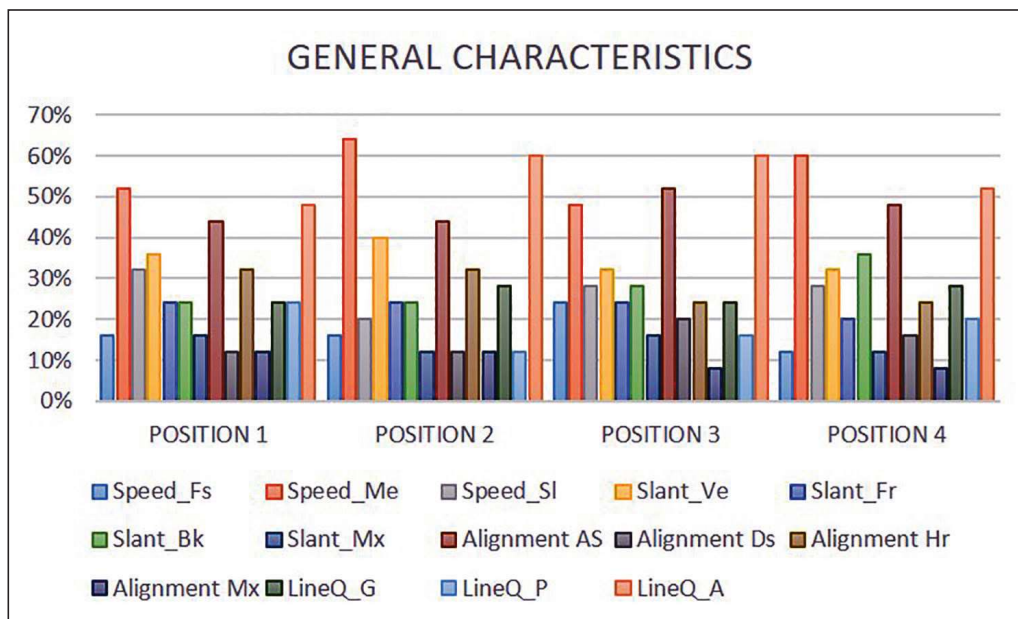


Chart 2: Shows the representation of general characteristics in all four positions

CONCLUSION

While comparing the outcome of this study with the previous studies, it is concluded that previous studies emphasized the variation in the general writing features, such as formation and execution of letters; instead, this study emphasized the style markers along with the general handwriting features. It is observed that in Position 1, the Maximum left & right margins were observed with the slowest speed, maximum spelling mistakes accompanied by overwritten letters/characters, and poor line quality in comparison to the rest of the positions. Further in Position 2, significant space was used between the lines with medium speed, mostly letters/characters were in vertical slant. While sitting in a normal table chair position, less attention from participants can be observed in copying the passage, as the maximum number of words/letters was skipped in this position in comparison to the rest of the positions. Moreover, in Position 3, that is the standing position with paper on the table, maximum space between the words with maximum words per line at the fastest speed, which was more significant in comparison to the rest of the positions. Likewise, in Position 4, i.e., cross-legged position Maximum number of lines, formation of maximum letters can be observed with backward slant and ascending alignments. Participants were not as focused on this position in comparison to the other

positions, as the maximum number of punctuations was absent, which was purposely added in the passage just to check the level of attention. As such, it can be concluded from this study that style markers and habits can be significantly observed in the content, irrespective of the fact that whether the matter is copied or written with cognitive skills. Thus, a Person's style can be observed in any written material, irrespective of the material.

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