Handwriting in homework associated with student performance

L.G. Boussiakou†, A. Al-Mozeini‡ & E.C. Kalkani*

King Saud University, Riyadh, Kingdom of Saudi Arabia†
Riyadh College of Technology, Riyadh, Kingdom of Saudi Arabia‡
National Technical University of Athens, Athens, Greece*

ABSTRACT: Handwriting in homework is examined in this study and its connection to student performance is analysed. Graphic expressive indicators are used in this study to evaluate the connection of the handwriting characteristics of first-year engineering students to their previous performance. The present study concludes that students with high performance develop scripts with straight lines and upright writing. Low-performance students develop scripts with fluctuating lines and greater slant. Students should be advised when doing homework to develop good writing habits and present scripts that display readability, less slant and no fluctuation. In this study, certain indicators of graphology are examined in the homework scripts of students of a small engineering class, and compared to the previous performance of the students, with the goals of enhancing both the handwriting and the teaching of engineering.

INTRODUCTION

Moving, speaking and handwriting are complex procedures of the human body that combine motion with perception and cognition. Handwriting is an expression of the state of mind of a person at the time; commands from the brain travel through the motor reflex muscles of the arm and hand to create a script on a piece of paper with the use of pen or pencil.

The study and analysis of handwriting is called graphology. The analysis of handwriting indicates certain traits of the physical, mental and emotional states of the writer. The analysis aims to identify, evaluate and interpret a person's personality and character through the patterns of handwriting. Graphology can be used to solve problems in business, law and personal issues.

People write in a different way from that taught at school, and change their handwriting according to circumstances, and the years passing. Forming characters of letters and numbers and positioning them on a piece of paper is a unique process for each person.

Graphology is used in personnel selection, along with psychometric testing. The main characteristics and qualities of the applicant that are searched for, in the script, are communication skills, handling detail, imagination, reliability, planning and organising ability, energy and drive level, initiative, ability to mix, judgment and mental balance, according to Singer [1].

The main characteristics and qualities of the applicant, the strengths and weaknesses of the person and other features of the applicant can be determined before the interview appointment.

In forensic work, graphology is used to determine the authenticity of scripts, especially signatures and wills, with no concern for the personality and characteristics of the writer of the script. Also, scripts can be examined to determine whether they were written by the same individual or not.

In education, graphology is not used to test students' personality characteristics. However, a personality test is usually given to first-year engineering students, where the goal is to create students' awareness of their personality type and character traits.

Although writing is taught at schools, educators are facing a real problem in understanding students' handwriting on homework and examination papers.

GRAPHIC EXPRESSIVE INDICATORS

Researchers created a theoretical basis on which to correlate handwriting characteristics with behavioural traits. These characteristics are called graphic expressive indicators, and each indicator specifies a characteristic behaviour of the writer.

The analysis of a script is based on the following sequence of characteristics or graphic expressive indicators [1]:

1. General appearance of the script outline: for the reader's benefit, the script should have:

    - Clarity, no double writing and scratches;
    - Brevity, no repetitions;
    - Ease of reading.

2. Pressure of the letters on the paper (darker or lighter letters) that corresponds to the energy level of the writer:

    - Heavy pressure indicates abundance of energy (successful people);
    - Medium pressure indicates average energy (average people);
    - Light pressure indicates low energy (uninterested people).

3. Degree of slant indicates the response to external factors:

    - Right slant indicates a person who expresses emotions (extrovert, caring, warm);
    - Vertical slant indicates a person who keeps emotions under control (cold, indifferent);
    - Left slant indicates a person who conceals emotions (introvert, withdrawn, self-centred).

4. Letter size, dimension of the width and height of the letters *a*, *o*, *d*, *g*, *q*:

    - Large letters indicate: inability to observe details; tendency to evaluate situations as a whole; lack of sense of duty and dependence upon others' judgment and critics;
    - Larger height to width (height greater than width, narrow letters) indicates: sharp but instinctive and superficial intuition; lack of deepening; little tendency towards science; interest in politics; easily bothered; need of stimuli and intense sensations;
    - Smaller height to width (height lesser than width, expanded letters) indicates: introverted temper and tendency to fantasy;
    - Equal height to width (proportionate width and height, round letters) indicates: a deep and rational intelligence; the ability to elaborate ideas; mental concentration; deep feelings; scientific abilities;
    - Small letters (8dmm) indicate: ability to observe; bright intelligence; intense attention; easily memorised details; respect for others' personality;
    - Very small letters indicate an inferiority complex due to a feeling of inadequacy.

5. Rhythm and spacing between letters, numbers, symbols and lines indicate movement of the script, through:

    - Word spacing;
    - Line spacing.

6. Fluency and handwriting direction:

    - Upward direction (ascending) indicates initiative, ambition, aggression, optimism, intention to become better, positive change;
    - Downward direction (descending) shows: tendency to suffer from pressure within the environment, willingness to accept others' requests, no taking of initiatives, gloominess, tendency to reject;
    - Straight horizontal line (adherence) shows: ability to cooperate with the environment; be realistic; not too enterprising; a lack of initiative;
    - Fluctuating handwriting indicates: emotional instability; shifting moods; fluctuations between safety and depression; tendency to work according to the mood of the moment; disposition towards musical and theatrical interpretation;
    - Reduction in handwriting size indicates a progressively small world view, revealing the tendency to depression.

SCRIPT EXAMINATION AND EVALUATION

The homework papers of 30 students were examined from a small class of first-year engineering students studying Renewable Energy Engineering at the National Technical University of Athens (NTUA). The graphic expressive

indicators of the scripts were recorded and categorised in Table 1. The results were processed and compared to the performance of students in the last-year class of high school.

From the graphic expressive indicators only the readability, pressure, slant, size and fluctuation were measured. Values of 10 to 20 were assigned to the indicators, with 10 corresponding to low quality and 20 to high quality. These values correlate with the students' grades, as they are recorded in the school, and correspond to the total high school score of the last year before entering the university.

Table 1: Students' grades and graphic expressive indicators.

Student	Grade	Readability	Pressure	Slant	Size	Fluctuation
1	16	14	15	13	12	12
2	18	13	15	20	19	17
3	16	15	16	17	16	14
4	19	20	14	20	13	20
5	15	15	17	12	16	18
6	15	18	20	17	15	20
7	14	14	16	11	12	12
8	17	17	14	19	18	11
9	16	18	17	20	17	17
10	14	17	11	19	20	13
11	13	11	12	13	11	11
12	15	12	17	12	13	16
13	16	16	18	15	15	17
14	15	15	15	18	17	14
15	19	13	19	13	12	18
16	19	14	13	14	14	13
17	18	12	13	11	11	15
18	19	12	16	16	18	12
19	18	16	12	15	16	19
20	15	18	13	19	20	15
21	13	17	19	16	15	14
22	17	16	20	17	13	16
23	15	19	19	14	19	20
24	19	19	18	18	18	16
25	19	12	11	18	14	13
26	17	20	20	14	17	18
27	15	11	12	11	11	11
28	18	20	14	15	20	19
29	19	19	18	16	19	15
30	17	13	11	12	14	19

The students' grades ranged from 13 to 19. Readability ranged from 11 to 20; pressure of letters on paper ranged from 11 to 20; slant varied from 11 for very inclined writing to 20 for upright writing; size varied from 11 for large letters to 20 for small letters, and fluctuation ranged from 11 for inclined lines to 20 for straight lines.

Some examples of the homework scripts of the students for small- and large-line spacing, and scratchings-out, are given in Figure 1. Examples for downward and upward writing and loose writing with low pressure are shown in Figure 2. Each of these examples within a total of 30 scripts was examined, and indicator values were assigned to each one (Table 1).

The values of the graphic expressive indicators were plotted against the student grades, and a trend line (straight line) displayed along with the corresponding first order linear equation and the R^2 value. Indicator trends are shown in Figure 3: variation of readability to student grade; Figure 4: letter size variation; Figure 5: degree of slant variation; and Figure 6: fluctuation of the script variation. Plotting the pressure on the paper versus the student grade did not give any significant trend (zero trend), hence the plot of pressure versus grade is not presented in this paper.

Readability indicates a trend line with small slope equal to 0.15. Letter size indicates a larger slope of 0.16, while the degree of slant and fluctuation indicate slopes of 0.29 and 0.35 respectively.

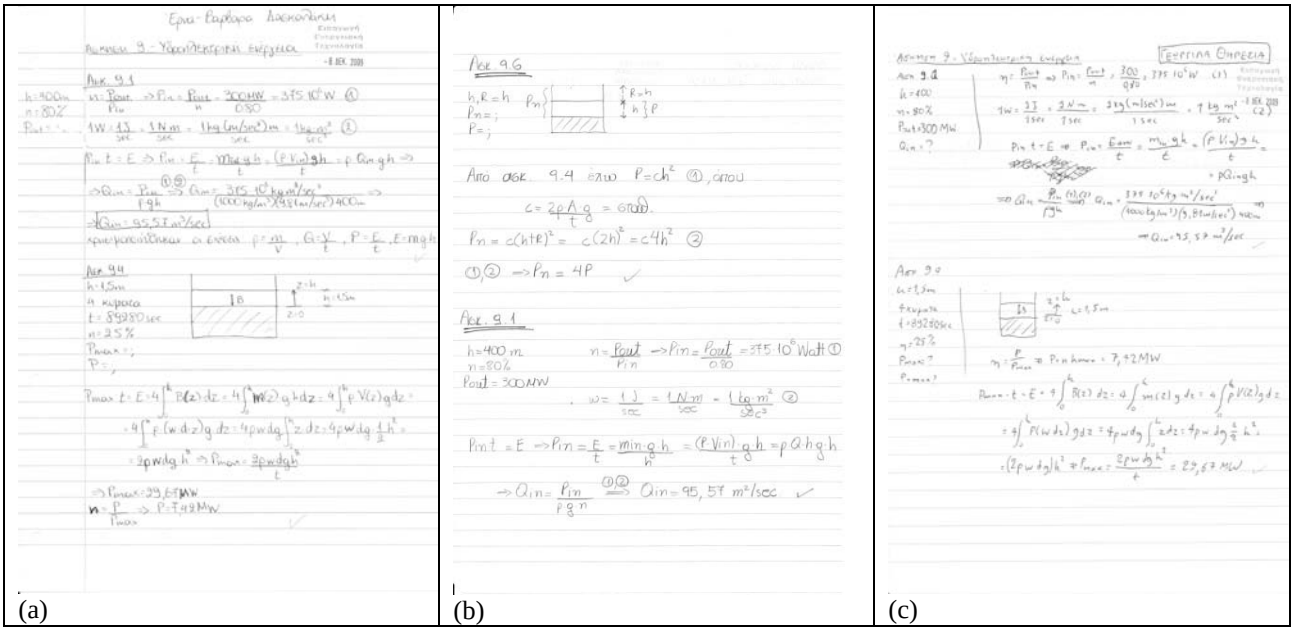

Figure 1: (a) Well-organised script with small line spacing, (b) Well-organised script with large line spacing, (c) Scratchings-out on the script.

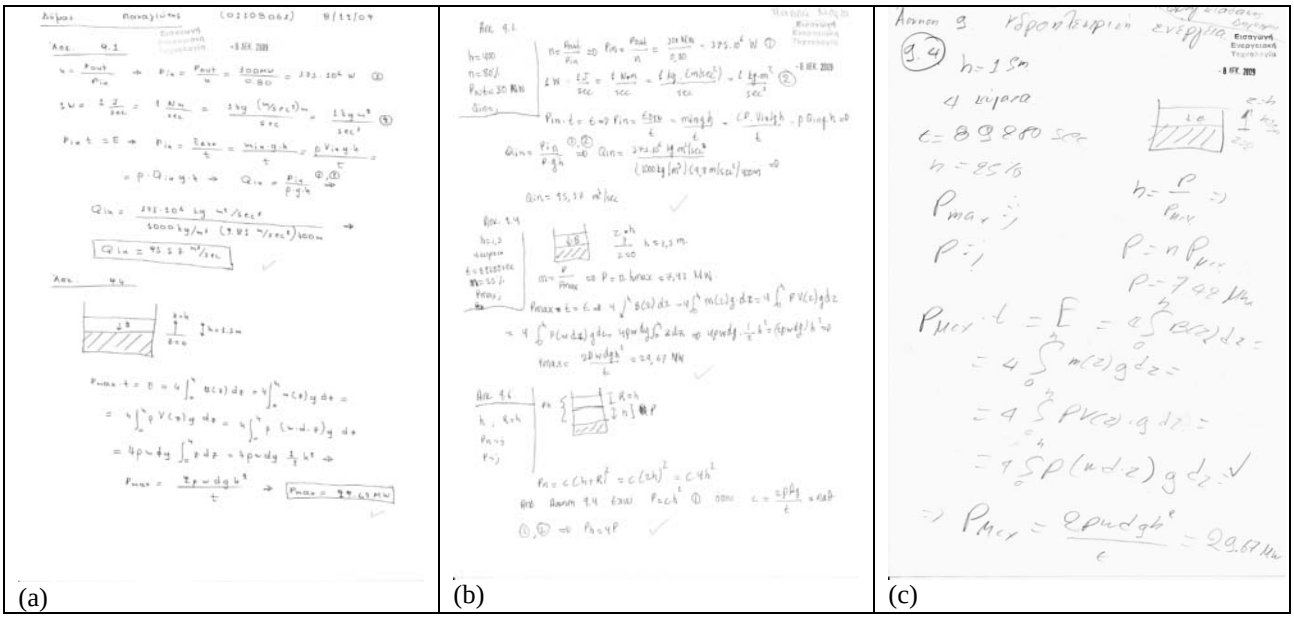

Figure 2: (a) Downward movement of the script, (b) Upward movement of the script, (c) Loose handwriting with low pressure.

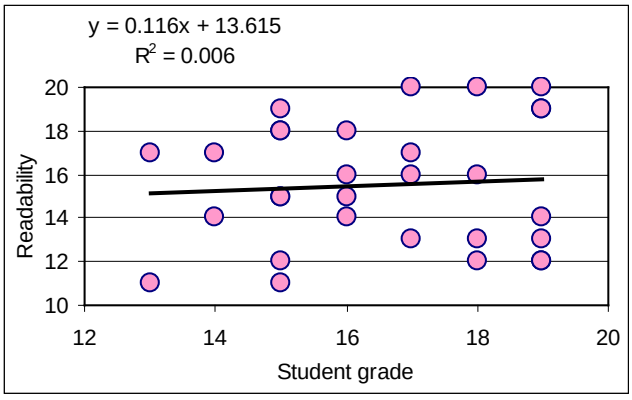

Figure 3: Connection of readability to student grade.

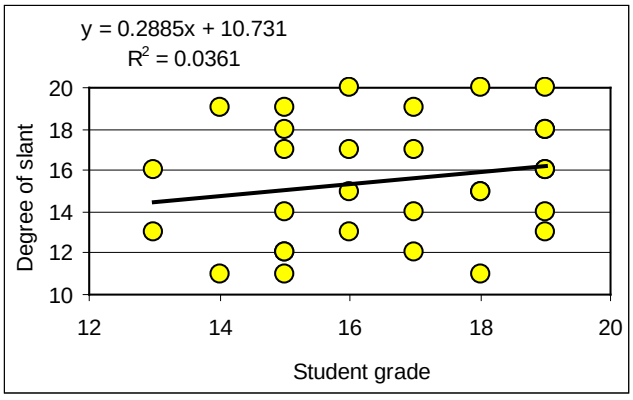

Figure 5: Connection of degree of slant to student grade.

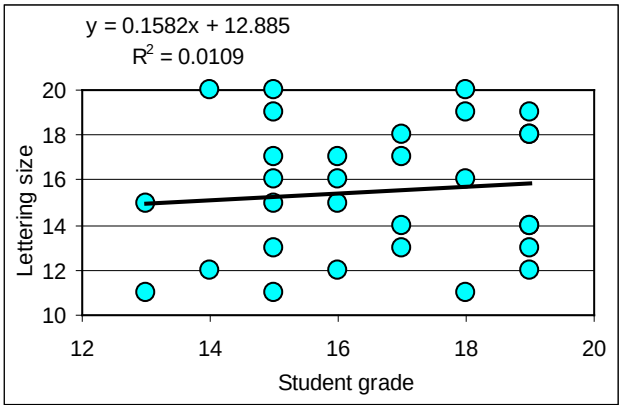

Figure 4: Connection of letter size to student grade.

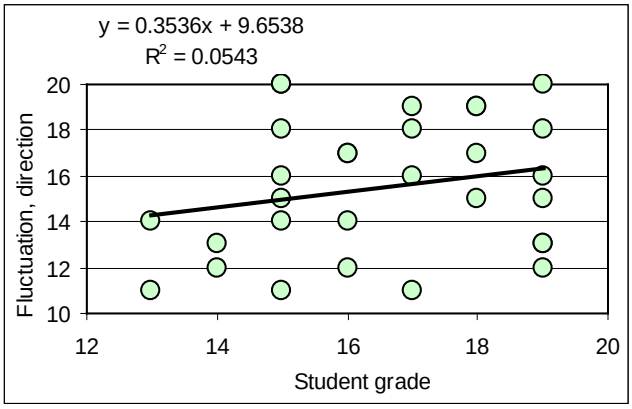

Figure 6: Connection of fluctuation and direction to student grade.

In evaluating the results, the connection of readability to student grade is insignificant, as well as that of letter size. However, the degree of slant and fluctuation indicate the trend that upright writing and straight-line writing correspond to students with higher grades.

DISCUSSION

Poggiani considers that handwriting can be as useful as verbal communication, when one is placed close to or at a distance from, the listener, if the latter is considered a friend or a stranger [2]. People defend their space that is close to them, and the same takes place on paper with the graphic gesture of moving up, down, left and right.

Basic graphic signs, according to Poggiani, have been researched regarding: ascending and descending writing; adherent lettering, and dimensions of certain letters regarding the height and width of each letter; fluctuation of the size and size reduction, as compared with personality traits [2]. For many researchers, the connection between character traits and personality has no connection to handwriting, although research has been in train for a long time. Especially, Dean stated that graphology is an insignificant factor for indicating personality [3].

According to Taylor …*Each person has his/her unique symbolic expression in handwriting* that indicates who and where the person is at a particular moment in time [4]. Psychologists use personality tests for a patient's personality evaluation and therapy. Companies and employers are interested in the personality characteristics of applicants to select qualified personnel. Individuals and students in schools are urged to use personality tests at the start of their studies, with the goal of identifying their characteristics and working on their self-improvement.

Beyerstein claims that when investigating criminal cases and using different psychological techniques and products, the validity of graphology is certainly damaging [5]. Using graphology in recruitment and personnel selection is wrong, as well. It is not known, as stated by Bradley, how many companies are using graphology for recruitment [6]. People are not rejecting graphology; they know that to affect others and change the impression they create, this can be done by changing their handwriting, as Loewenthal discloses for those who want to self-present [7].

However, within the scientific community, researchers do not find that the techniques used by graphology are valid as a way to interpret a person's personality, intentions and actions. The most acceptable uses of graphology are: verifying the person who wrote a threatening note; verifying forgery; creating the personality outline of a suspect; investigating lies; examining deceptive or truthful sentences; and detecting law enforcement deception. Although the degree of slant indicates the response to external factors, Thomas considers that mood and environmental factors affect handwriting [8]. For use in forensic cases, computerised examination of writing was developed by Luria and Rosenblum and considered the time the pen is on the paper or in the air, the length, height, width of each stroke, and pressure on the writing surface [9].

In analysing the results of this study, it can be said that the degree of slant and line fluctuation corresponds to students' competence and that no environmental factors affect the type of handwriting. The scripts examined in this study correspond to homework carried out in a secure environment and with not much pressure. These scripts are different from examination scripts produced under pressure in a class environment and are expected to give different results from the results of this study.

From the present study, we conclude that students with high performance develop scripts with straight lines and upright writing. Poor-performance students present scripts with fluctuating lines and greater slant. From this study one can end on the advice that should be given to students when doing their homework: practise good writing habits and present scripts that display readability for the instructor with less slant and no fluctuation.

CONCLUSIONS

Graphic expressive indicators are used in this study to evaluate the connection of the handwriting characteristics of first-year engineering students to their previous performance. The results of the study indicate that the degree of slant and line fluctuation is connected to students' competence, without considering external environmental factors. The scripts examined in this study correspond to homework prepared at home in a secure environment and under moderate time pressure.

From the present study, one can conclude that high-performing students develop scripts with straight lines and upright writing. Low-performance students present scripts with fluctuating lines and greater slant. Engineering students should be advised when doing homework to develop good writing habits and present scripts that display readability, less slant and no fluctuation.

REFERENCES

1. Singer, E., *A Manual of Graphology*. UK: Duckworth & Co., 245 (1969).
2. Poggiani, L., Grafologia, 2 February 2010, www.astralis.it/grafoindex_e.htm
3. Dean, G., *The Bottom Line: Effect Size*. In: Beyerstein, B.L. and Beyerstein, D.F. (Eds), The Write Stuff: Evaluations of Graphology – the Study of Handwriting Analysis. Amherst, NY: Prometheus Books (1992).
4. Taylor, C., Graphology: The Art and Science of Handwriting Analysis, 2 February 2010, http://www.thegraphologysite.co.uk
5. Beyerstein, B.L., *Graphology – A Total Write-off*. In: Sala, S.D. (Ed), Tall Tales about the Mind and Brain: Separating Fact from Fiction. Oxford: Oxford University Press (2007).
6. Bradley, N., Users of graphology: graphology. *J. of the British Academy of Graphology*, 69, 55-57 (2005).
7. Loewenthal, K., Handwriting and self-presentation. *J. of Social Psychology*, 96, 267-270 (1975).
8. Thomas, G., Your Handwriting: What Does it Tell about You? 2 February 2010, http://www.viewzone.com /handwriting6.html
9. Luria, G. and Rosenblum, S., Comparing the handwriting behaviours of true and false writing with computerized handwriting measures. *J. of Applied Cognitive Psychology* (2009) (published on-line).