Comparative Analysis of Range of Natural Variations in Documents Produced Through
Paper – Pen & Digital Pad – Stylus Combination

A RESEARCH PROPOSAL SUBMITTED BY

GRACE MARY

ASSISTANT PROFESSOR

NAGARATHINAM ANGALAMMAL ARTS & SCIENCE COLLEGE

MADURAI, TAMIL NADU

SUBMITTED TO

KALASALINGAM ACADEMY OF RESEARCH AND EDUCATION

VIRUDHUNAGAR, TAMIL NADU

AIM & OBJECTIVES

- To study the general and individual handwriting characteristics of authors in handwritten paper documents through various commonly used paper-pen combinations and account for its natural variations.

- To study the general and individual handwriting characteristics of authors in e-documents produced through various commonly used digital pad-stylus combination and account for its natural variations.

- To carry out qualitative, quantitative and comparative analysis of handwriting characteristics and the natural variations in signatures/ handwritings using Paper – Pen combination and Digital Pad – Stylus combination.

INTRODUCTION

Class Characteristics are those writing features common to a group i.e. the common pattern of handwriting, letters, their shape which are limited to a group, age or language. They are speed, skill, slant, movement, spacing, size, alignment, etc.

Individual characteristics, are those writing features that are particular to each individuals, those particular aspects or features of writing that are peculiar to a specific writer. They are i dot, t bar, hook, loop, embellishment, etc.

Natural variation is the variation which is found naturally in the handwriting of a person. No two specimens of writing prepared by one person are identical in every detail. Variation is an inherent part of natural writing. If a person writes the same word or signature a number of times, the reproductions in minutest detail are never alike. These deviations within certain limits, in form, size, proportion, slant, etc. of characters and in the combination of characters are called natural variations.

Digital Pad & Stylus

A digital pad or digital tablet is a computer input device that enables a user to hand-draw images, animations and graphics, with a special pen-like stylus, similar to the way a person draws images with a pencil and paper. These tablets may also be used to capture data or handwritten signatures. It can also be used to trace an image from a piece of paper that is taped or otherwise secured to the tablet surface The device consists of a rough surface upon which the user may "draw" or trace an image using the attached stylus.

HYPOTHESIS

The paper proposes Comparative Analysis of Natural Variations in Signatures/ handwritings produced through Paper – Pen & Digital Pad – Stylus Combination. It is hypothesized that the signatures produced through paper-pen & digital pad- stylus will likely have natural variations. If there is natural variations in signatures produced comparative analysis needs to be carried out.

Independent Variable : Paper, Pen, Digital pad & Stylus

Dependent Variable : Natural Variations

Null Hypothesis

The handwriting features (class and Individual characteristics) remains same when written with different writing instrument and written on different writing pad.

Alternate Hypothesis

The handwriting features (class and Individual characteristics) shows variation when written with different writing instrument and written on different writing pad.

LITERATURE REVIEW

- **J. Heckeroth et al.** in their work " FEATURES OF DIGITALLY CAPTURED SIGNATURES VS. PEN AND PAPER SIGNATURES: SIMILAR OR COMPLETELY DIFFERENT? " discusses about how pen lifts differ between the digital and analogue representation of one and the same signature. Subsequently, signature characteristics were compared between the three different writing conditions a) with a stylus on a pad, b) with an inking pen on a sticky note attached to a signature pad allowing to obtain a digital and an analogue version on paper of one and the same writing simultaneously, and c) with a pen on paper. Statistical multi-level models indicate significant differences between the three signature types, but minor effect sizes in most of the examined characteristics. From the point of view of the participating handwriting examiners, these factors do not fundamentally restrict the comparability between digitally captured and conventional signatures in practice. However, caution should be exercised when generalising the results, as several factors, such as the usage of different signature pads as well as signatures made with the finger instead of a stylus, could result in more important differences compared to pen and paper signatures".

- **Sabine Wollscheid et al.** in their work "THE EFFECT OF PEN AND PAPER OR TABLET COMPUTER ON EARLY WRITING – A PILOT STUDY" discusses about the need to investigate the effect of different writing instruction tools such as pencil and paper and tablet computers on early writing. The purpose of this pilot study is to develop a study design and a writing test to investigate the effect of writing instruction tool (tablet computer vs. pen and paper) and test format (digital vs. pen-and-paper) on early writing outcomes. For the writing test, our pilot study shows that pupils assessed by the digital test format wrote faster compared with those assessed by pen-and-paper

format, independent of the writing instruction tool. Given the limitations of this pilot study in scope and its quasi-experimental nature, we provide some suggestions for the design of a larger scale study by taking into account the rapid development of the field of early writing instruction.

- **Milena Pugnaloni et al.** in their study "FORENSIC HANDWRITING ANALYSIS: A RESEARCH BY MEANS OF DIGITAL BIOMETRICAL SIGNATURE" discusses about how the digital signature in biometric modality that uses, for recognition purposes, the anatomic and behavioural characteristics that an individual exhibit when signing her/his name. It also discusses about the study made on the correlation between pressure and speed.

- **Sabrina Gerth et al.** in their work "Is Handwriting Performance Affected by the Writing Surface? Comparing Preschoolers', Second Graders', and Adults' Writing Performance on a Tablet vs. Paper" discusses about the advantages tablets offer for conducting research on handwriting or for interactive use of learning apps in schools. The widespread use of tablet computers has had a great impact on handwriting in the current generation. In order to investigate how handwriting performance is affected by a difference in friction of the writing surface, three groups were recruited with varying levels of handwriting automaticity: 25 preschoolers, 27 second graders, and 25 adults. Three tasks were administered measuring graphomotor abilities, visuomotor abilities, and handwriting performance (only second graders and adults). Two aspects of handwriting performance were evaluated - the handwriting quality with a visual score and the handwriting dynamics using online handwriting measures [e.g., writing duration, writing velocity, strokes and number of inversions in velocity.

  The comparison between tablet and paper revealed a faster writing velocity for all groups and all tasks on the tablet which indicates that all participants—even the experienced writers—were influenced by the lower friction of the tablet surface.

- Mustafa Ali Abuzaraida et al. in their work "PROBLEMS OF WRITING ON DIGITAL SURFACES IN ONLINE HANDWRITING RECOGNITION SYSTEMS" discusses about the two most common input devices for personal computers are keyboards and mouse. These gadgets might not always be the only means of sending electronic data to computers, though. Other approaches might be required, especially in light of the size and transmission style of more recent mobile devices. Mobile technology, such as handheld computers, opens up a lot of possibilities for alternative devices that function in smaller forms than the conventional keyboard and mouse. Additionally, as the use of computers spreads around the globe, the demand for more natural human-machine interfaces increases. However, there are certain issues with these new methods of human-machine interfaces when they connect to the computers. In the area of script recognition, some of these issues are presented and highlighted in this work.

- Prashant Kumar et.al in their paper "STUDY OF NATURAL VARIATION IN THE SIGNATURE OF THE SAME WRITER" emphasizes about signature examination as one of the most frequent examinations a document examiner conducts. Every document examiner encounters concerns regarding a document's legitimacy frequently. An

examiner may try to determine who generated the document in order to determine whether it is authentic. They may also have to identify the time period during which it was produced. Since no two writers can produce writing identically, the analysis must compare interpersonal variation in handwriting. This a study is to provide a useful technique for examining the inevitable variations in a writer's signature across different positions.

RESEARCH METHODOLOGY

Type of Study : Empirical Study

Research Design : Experimental Study

Locale of Study : South India

Universe : The individuals handwriting samples shall constitute the universe of the study.

Sampling Method : Random sampling with voluntary participation

Sample Size : 50 (25 each category)

Requirements for Data Collections : Paper, Pen, Digital Pad and Stylus

EXPECTED OUTCOME

The comparison of natural variations in signatures produced by Paper –Pen and Digital Pad-Stylus combination can be possibly done and the expected outcome can be the to determine the degree of natural variations in writing.

This study will help in examination of the cases where digital signature is in question.

The combination will help in the determine the range of natural variation in the class and individual characteristics of handwriting.

The examination will also help in establishing the range of natural variation in the individual's writing occurring due to use of different type of writing instrument

The examination will also help in establishing the range of natural variation in the individual's writing occurring due to use of different type of writing material.

LIMITATIONS OF THE STUDY

The study does not account for shape and material of various types of stylus available. Also the variety of paper-pen combination are kept less in number looking to the sample size and limitations imposed by time limitation of the dissertation.

FUTURE SCOPE OF THE STUDY

The study can be extended by increasing the sample size as well as variety of combinations of writing surfaces and instruments in future.

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