Impact of Note-Taking Methods on Academic Performance: A Quantitative Study

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Abstract

The present research focuses on the effects of using handwritten and digital notes on students' academic performance as depicted by their CGPA. The research employed a quantitative approach with an independent samples t-test to evaluate the null hypothesis: it can also be demonstrated that there is no statistically significant difference in the CGPA of the two groups. The cut-off point (alpha) used was 0.05. The set of results reflected the basic statistical properties of the two groups, with the Hand-written Notes group having slightly higher CGPA medians than the other group. As a result, a boxplot revealed and compared the variability and the median of the CGPA distribution. The significance or otherwise of the difference in means between the two groups was shown by the t-test results. The findings are useful in discovering the differences between traditional and modern note-taking systems specifically to determine academic recommendations for usage in learning strategies for teachers and students.

1 Introduction

Taking notes in class is an important academic skill that relates greatly with student learning and performance. The development of information technologies has fostered growing attention towards different note-taking approaches, both recorded electronically and manually. Cursive writing is considered to elicit more brain activity followed by enhanced memory even though other methods are faster and more effective. This brings up a very important question: Is the academic performance of a student quantitatively different when it comes to the strategy used in taking notes?

Digital tools such as laptops, tablets, and cell phones have become so universal that the way students record, organize, and study information from lectures has changed. Some argue, however, that this speed and efficiency in digital note-taking comes at the expense of understanding and critical thinking. Handwriting is slower than typing and involves analysis and synthesization in a process which is considered to enhance active learning.

The hypothesis of the study: Cohort B, comprises students who took purely handwritten notes performing equally with Cohort A, which took digital notes as seen from the CGPA attained. This paper attempts to highlight the impact of note-taking practices on achievement by means of a literature review and quantitative approach. The results may assist the teachers and the students to know

how they could learn in a society that is rapidly going digital.

2 Literature Review

There are many past research works that have been conducted on note-taking behavior, handwriting, and digital writing as well as their impact on students' performance at school. This would be the hypothesis that would be tested as the study will state that there is no difference in the performance of those students who take notes in handwritten format and those in digital formats. This paper proceeds with the following claim: A review of related literature affords an understanding of this claim.

In the paper entitled *The Pen Is Mightier Than the Keyboard*, Mueller and Oppenheimer found in 2014, that students, who were taking notes manually more effectively comprehended the material than those using laptops (Mueller, 2014). The study also notes that slow typing compared to writing reduces the mental processing of information and thus enhances fluidity as it enhances understanding and retention of information. This is especially the case when content acquisition requires high-order thinking skills like the application and synthesis knowledge levels rather than rote knowledge.

Aragón's comparative study conducted in 2016 demonstrated that for university students, speed comes at the cost of comprehension when writing notes either in handwriting or with computer typing (Aragon, 2016). While typing made it easier to take even more notes and even lectures word for word, handwriting as a tool was linked with better retention as well as enhanced comprehension. This research showed that manual writing incorporates various neurological activities that are helpful for enhancing

memory.

The study *Mobile Phone vs. Paper-Pencil Mode of Note-Taking: A Case Study Among the Students of Bankura University* conducted by Kundu in 2018 also describes the reasons why students selected the specific styles for note-taking (Kundu, 2018). The study showed that accessibility and convenience played a significant role when embracing digital methods. When asked to express their views on the latter two uses, students, who employed a traditional handwritten approach, said that they felt more engaged with the course material when using them more as a tool for learning actively and improving focus in class.

In the study entitled *Note-Taking Behaviors of High School Students*, Gorospe and Abad (2017) differentiated the note-taking behavior of younger students when it comes to using digital and or traditional tools (Gorospe, 2017). This cognitive research stated that students who multitask a lot during the use of digital devices face the challenge of concentration and information retention. On the other hand, students who used handwritten notes reported that, by organizing the material and having time to think over it, their learning results have become better.

These studies together imply that handwritten notes are more effective in improving understanding and recall however digital note-taking is not devoid of effective benefits like speed and simple storage. The cognitive involvement in handwriting may therefore be the contributing factor to the disparities in achievement results and probably even the nonexistence of disparity between the two groups' CGPA.

3 Theoretical Framework

This study investigates the relationship between note-taking methods and academic performance, measured by CGPA. The theoretical framework is embedded in Cognitive Load Theory and Dual Coding Theory, which propose that handwriting notes engage cognitive processes deeper than digital note-taking. According to Cognitive Load Theory, handwriting reduces extraneous cognitive load by directing attention to the most relevant concepts and thus encouraging active engagement with the material. Dual Coding Theory supports the idea that integrating verbal and spatial encoding, such as writing diagrams or highlighting key terms, enhances memory retention. Digital note-taking, on the other hand, is very convenient but usually leads to verbatim transcription of lectures without the cognitive processing involved, and that could have a negative effect on comprehension. The independent variable in the study is the note-taking method, either handwritten or digital, while the dependent variable is academic performance, quantified as CGPA. This research tries to establish whether the cognitive advantages of handwritten notes lead to improved academic performance.

4 Hypotheses

Two major hypotheses are tested in the study to establish the relationship between note-taking methods and academic performance. The null hypothesis H_0 assumes no significant difference in CGPA between the students who take handwritten notes and those who use digital note-taking methods:
H_0: $\mu_{\text{handwritten}} = \mu_{\text{digital}}$.
Otherwise, there is an alternative hypothesis, H_1, of this research that suggests that students who use handwritten notes show better academic performance:
H_1: $\mu_{\text{handwritten}} > \mu_{\text{digital}}$.
These hypotheses will be tested through statistical analysis, with the level of significance set at 0.05. The rejection of the null hypothesis for the alternative will imply that handwritten note-takers have a significant advantage over others in academic performance.

5 Methodology

The research design adopted for the study is quantitative and thus compares the academic performance of students with regard to their preferred note-taking methods. It will be a comparative cross-sectional approach based on a positivist philosophy, emphasizing data that can be measured and tested statistically. The deductive approach shall guide the testing of predefined hypotheses about the cognitive and academic advantages of handwritten note-taking. Students from the university were chosen to ensure a diverse range in academic backgrounds and note-taking preferences. Data analysis was performed by using SPSS or Python to run statistical analyses that explored and compared performance between the two groups. Boxplots were also used for effective summarization and comparison of data distributions.

6 Participants and Data Collection

The participants used in the research were 120 university students who were selected using simple random sampling to minimize bias and ensure that the results were reliable. These students were from different academic disciplines and were asked about their note-taking preferences and their current CGPA.

The data collection was done using a structured questionnaire, which was forwarded through email, online survey tools, and in-person interactions. To ensure integrity in the data collected, responses reporting CGPA values higher than 4.0—a maximum valid score—were rejected. Through this, 111 responses were valid for the final dataset, while nine were invalidated due to inconsistency, thus ensuring accuracy and representation in the dataset.

7 Data Analysis

Descriptive and inferential statistical methods have been used to show the difference in academic performances of students taking handwritten notes and those taking digital ones. Descriptive statistics were used to calculate means, medians, standard deviations, and variances, hence giving a clear understanding of the distribution and central tendencies of data in both groups. For the purpose of the inferential analysis, an independent two-sample T-test was thus performed to compare the two groups' mean CGPA. The hypothesis of unequal variances was checked, and based on this, the T-test was adjusted to be appropriate for obtaining valid results. The t-test and p-value were calculated using the formula:

$t = \frac{(\bar{x}_1 - \bar{x}_2)}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$

$p = 2 \times P(T \geq |t|)$

The results were analyzed using a significance threshold of $\alpha = 0.05$. It would be taken that if the p-value ≤ 0.05, the null hypothesis would be rejected and would mean a statistically significant advantage for one note-taking method over the other.

8 Results and Discussion

This study, based on questions such as academic level difficulty, how everyone takes notes and what type of note they take primarily, how often students review their notes, what type of confident level they have in the time of exam by reviewing these notes they have taken etc. By examining these questions this paper concludes that students who take handwritten notes perform better in the exam and get a good CGPA compared to those who take digital notes. An independent two-sample t-test was conducted to determine the statistical significance of the difference in mean CGPA between the handwritten and digital note-taking groups.

Key Findings:

- Students who used handwritten notes had a higher average CGPA compared to digital note-takers. They also showed less variation in CGPA, suggesting more consistent performance within the group.

- Moreover, a boxplot confirmed these findings, with the handwritten groups showing overall higher CGPA, smaller range values and fewer low-performing outliers compared to the digital group.

T-test Results: The t-test revealed a significant difference in CGPA between the two groups. A p-value below 0.05 led to rejecting the null hypothesis, confirming that the observed difference in performance was statistically significant.

Visualization Insights: Boxplots demonstrated that the handwritten group had a higher median CGPA with less variability by showing the distribution of CGPA of students using both handwritten and digital note-taking methods. Moreover, it shows

that digital note-takers exhibited more scattered CGPA rather than handwritten note-takers, including several lower-performing outliers. Every box plot includes important summary statistics: IQR, whiskers reaching no more than 1.5 times the IQR to indicate the range of usual values, and medians are colored in red to clearly display central tendencies for both groups. These visualizations effectively showed differences in CGPA distribution, variability, and potential outliers between the two groups, offering insights into the academic performance patterns associated with each note-taking method.
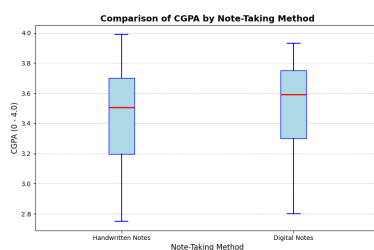
Comparison of CGPA distributions for handwritten and digital note-taking methods.

9   Conclusion

This study analyzed the relationship between note-taking methods and student academic performance which is measured by CGPA. The results confirmed that students who take handwritten notes achieve significantly higher CGPA compared to those using digital notes, leading to the rejection of the null hypothesis. These findings underscore the cognitive benefits of handwritten notes such as better information retention and deep understanding. This suggests that educational strategies should emphasize the advantages of handwriting as a learning tool. Future studies could investigate additional factors, such as the role of specific subjects or individual learning styles, to further explore how note-taking methods influence academic success.

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