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Pen, Pixel, or Paraphrase? Investigating the Relationship between Note-taking Modalities and Graduate Learning Outcomes

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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Abstract

The paper addresses the relationship between note-taking modalities and learning outcomes among graduate students and specifically examines how this relationship is mediated by cognitive processing. The study analyses the connection between different styles of note- taking, including one's own word summarising, structured/systematic, analogue, digital, and verbatim note-taking, and academic performance, based on the cognitive load theory and the generative learning model. A structured survey was used to gather data from 88 graduate students, and the data were analysed using Spearman's rank-order correlation since they were not normally distributed. The findings show that note-taking in one's own words has the strongest positive association with achievement, followed by structured note-taking, with verbatim transcription showing the weakest association. The digital and analogue modalities demonstrate the same level of success, which means

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that the medium does not have as significant an influence as cognitive engagement. The mindfulness of students in relation to note-taking as an active, metacognitive process that helps to understand, organise, and revise is also evidenced by qualitative data. The research is an addition to the existing literature that has placed cognitive processing as one of the key processes linking the activities of note taking with the learning outcomes, particularly in graduate learning which is cognitively demanding. The conclusions reflect the need to have pedagogical tools that promote active change and systematization of information.

Keywords: Note-taking styles; cognitive processing; learning achievement; graduate students; cognitive load theory; generative learning.

1. Introduction

Note-taking is a core academic skill that supports students' learning achievement, memory, and self-regulated study across disciplines and levels (Jansen et al., 2017; Piolat et al., 2005). Far from being a simple transcription, note-taking requires selecting, organising, and transforming information under time pressure, placing substantial demands on attention and working memory (Kiewra, 1988; Piolat et al., 2005). The growth of laptops, tablets, and collaborative online documents has diversified note-taking styles, raising new questions about how these styles interact with cognitive processing, especially for graduate students facing conceptually dense and cognitively demanding tasks (Shi et al., 2022; Yuan, 2024; Kaplan 1995). Cognitive and learning theories describe note-taking as both an encoding activity that fosters deeper processing during learning and an external storage tool that supports later review (Jansen et al., 2017; Reed et al., 2016). At the same time, note-taking can increase cognitive load, encourage verbatim copying, and reduce comprehension when processing demands exceed learners' capacity (Jansen et al., 2017; Piolat et al., 2005). Recent work highlights specific mechanisms—generative processing, summarisation, and sustained attention—as central to the "note-taking effect" (Lalchandani & Healy, 2022; Pintrich, 2002). Yet empirical studies have rarely modelled cognitive processing as an explicit mediator between note-taking styles and learning achievement, and evidence focused on graduate students is limited (Shi et al., 2022; Yuan, 2024). Guided, structured, and collaborative note-taking approaches show promise for enhancing achievement and managing cognitive load, particularly in complex higher-education contexts (Luo & Frey, 2020; Fang et al., 2022; Shi et al., 2022). Building on cognitive load theory and information-processing perspectives, the present study aims to evaluate the extent to which cognitive processing mediates the relationship between students' note-taking and their learning outcomes.

1.1 Key Themes in Note-Taking, Cognition, and Learning

Table 1 and Fig 1 depicts the key themes in Note-taking, Cognition and Learning

Table 1. Major constructs linking note-taking, cognition, and achievement

Theme / construct	Brief insight from literature	Citations
Note taking as encoding and storage	Supports deeper processing And later review of information.	Jansen et al., 2017; Reed et al., 2016
Cognitive load and effort	Note taking can both enhance and burden cognition under time pressure.	Jansen et al., 2017; Piolat et al., 2005
Specific cognitive mechanisms	Summarization and sustained attention, more than generative processing, underlie the note taking effect.	Lalchandani & Healy, 2022
Styles and media (longhand, digital, collaborative)	Different styles show distinct patterns in achievement and cognitive load.	Shi et al., 2022; Fang et al., 2022
Guided/structured note taking	Scaffolds generative learning, self-regulation, and reduces cognitive load.	Luo & Frey, 2020; Guarochico Moreira et al., 2024
Graduate / EMI contexts	Note taking mediates navigation of linguistic and disciplinary demands.	Yuan, 2024