MERGING LANES: WHERE E-LEARNING DIVERSITY MEETS FUTURE TRENDS

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THE ROLE OF VISUAL NOTE-TAKING IN ENHANCING LEARNING AND UNDERSTANDING IN MATHEMATICS

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ABSTRACT

In the age of digital education, note-taking has taken on a new role. Where classes are held online over Zoom calls and lessons are explained with the help of an online whiteboard, note-taking is also increasingly becoming more digital in form. Students and teachers are using online document editing apps and visual collaboration tools to record and share information instead of writing everything down in a book. The use of visuals to map out ideas and to showcase interrelationships between them has become extremely popular over the last few decades, especially because visuals help the brain process information much faster and enhance memory and understanding better. Unlike traditional linear note-taking, visual note-taking involves the use of graphic organisers such as diagrams, charts, concept maps, images, and colour to represent ideas and relationships between concepts. This paper aims to review the role of visual note-taking in enhancing students' comprehension, memory retention, and higher-order thinking skills. Based on existing literature, visual note-taking supports meaningful learning by helping learners make connections between new information and prior knowledge. The findings from previous studies suggest that visual representations improve cognitive processing and facilitate deeper understanding, making visual note-taking a valuable strategy for both learning and examination preparation.

Keywords: Visual note, note taking, memory, students' perceptions, mathematics

Introduction

Note-taking is an important skill that helps students understand and remember information during lessons, reading, and self-study. Many students still use traditional text-based notes, which mainly involve writing down information word for word. However, this method may not be effective for understanding complex ideas or seeing connections between concepts. Visual note-taking combines words with visuals to record information in a more meaningful way. It uses images, diagrams, symbols, and structured layouts to help learners organise ideas and understand content more easily. In mathematics, visual aids are especially helpful because they support the understanding and recall of abstract and complex concepts. Therefore, students should include visual elements, not just words and numbers, when taking notes in math classes or preparing for tests.

Visual aids help display information in a way that the brain can understand and remember. For example, drawing diagrams of shapes and angles in geometry helps students see and understand the concepts more clearly (Wienecke et.al.2023). Symbols and graphs in algebra help us grasp equations and functions. Visual aids also make studying more effective by allowing students to quickly review diagrams and symbols rather than reading lengthy notes. However, visual aids should be utilized cautiously. Notes should not be very visual, and students should focus on grasping the concepts rather than depending solely on illustrations.

Visual note-taking is an alternate technique to organizing information using visual features such as diagrams, charts, photographs, and symbols. The method students choose often depends on the learning purpose, such as understanding new content, revising, or preparing for exams. By turning written or spoken information into visual form, students become more actively involved in learning. Visual note-taking may also help exam preparation by assisting students in reorganizing knowledge into clearer study notes or improving existing notes using colour and visuals. Overall, this approach helps promote deeper understanding and meaningful learning by using simple drawings, symbols, and tables with diagrams to make information easier to compare and understand.

Literature Review

Studies on the use of strategic note-taking in mathematics reinforce the importance of visual and organizational factors. Note-taking behaviours such as structuring and highlighting key information have been linked to increased task comprehension and fewer errors when solving complex, reality-based mathematical problems. This implies that students who engage more deeply with information's visual structure are better equipped to process and apply mathematical concepts (Wienecke et. al., 2025). Visual note-taking, which includes the use of mind maps and other visual organisers, has been studied as a method of improving learning and comprehension in educational settings, including mathematics. Roehling (2017) found that visual note-taking helps students organise their thinking and stay more focused during lessons. Wammes et al. (2016) demonstrated that drawing or visual-based notes can improve memory recall up to four times compared to traditional note-taking.

According to research, visual aids assist students in organising complex information, identifying linkages between ideas, and improving retention and comprehension when compared to standard linear notes. Due to the research by Wang Simei (2024), mind maps are an innovative tool that enhances high school mathematics problem-solving by helping students organize and visualize knowledge. They address common challenges such as fragmented understanding, unclear solution steps, and low engagement in traditional instruction. By enabling students to build structured knowledge networks, mind maps improve problem-solving efficiency and strengthen logical reasoning skills. Johanna et. al. (2024), indicates that visualisation interventions in mathematics (such as diagrams,

graphs, and other visual aids) frequently result in positive learning outcomes, particularly in topics with strong visual or spatial components like geometry and calculus, even though most of the visual note-taking research has concentrated on visual tools generally rather than just mathematics. The dual coding of information through verbal and visual channels improves cognitive processing and deepens comprehension, according to multimedia learning theories, which are consistent with these findings.

The application of visual note-taking techniques, especially mind mapping, is highly supported by these theoretical ideas. Additionally, students react favourably to mind mapping as a visual learning and note-taking tool, according to a study by Sentyawati (2022) on students' opinions. Students stated that mind mapping helps them summarize material, fosters creativity, and makes it easier to organize thoughts effectively—skills that are critical for succeeding in mathematics.

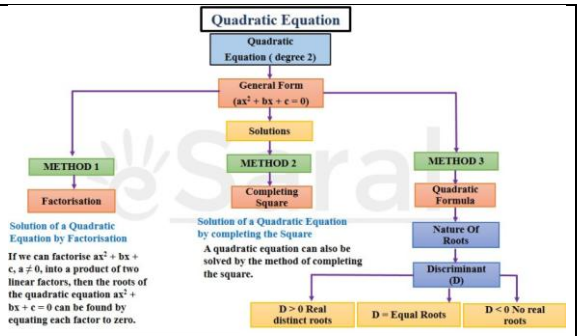
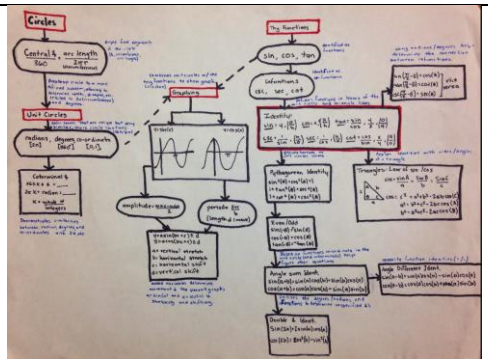
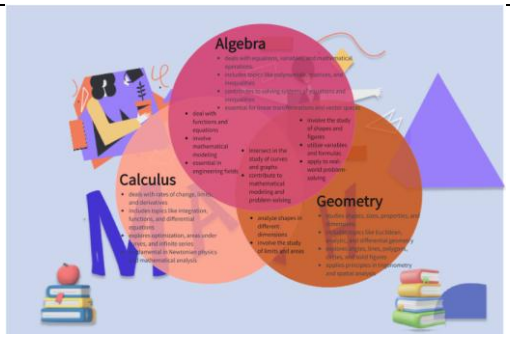
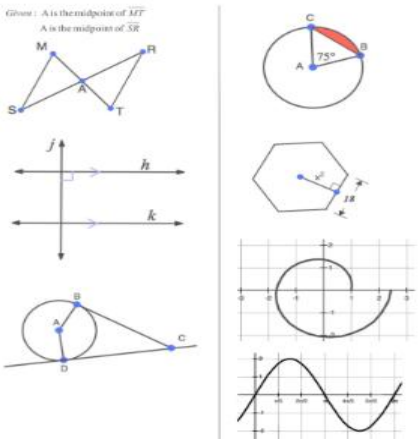
Visual Note-Taking in Mathematics Learning

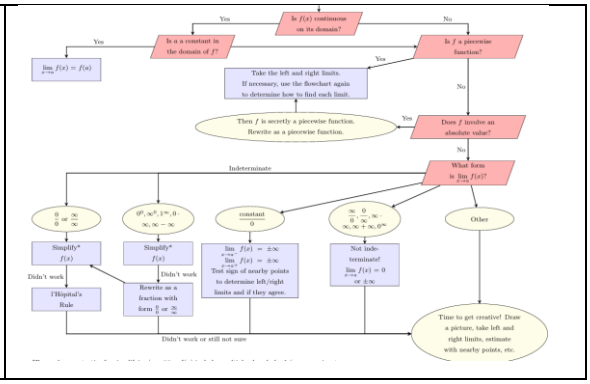
Mathematics is frequently regarded as an abstract subject since it relies on symbols and formulas, which can make learning difficult when material is solely delivered in text form. Visual note-taking helps address this issue by converting abstract ideas into clear visual representations. In mathematics, tools such as diagrams, graphs, concept maps, and flowcharts can be used to show relationships between concepts and steps in problem-solving. For example, concept maps help students connect algebraic ideas, while flowcharts illustrate the steps involved in solving equations.

Graphs are a strong kind of visual notation in mathematics, helping students grasp topics like functions, limits, and calculus by displaying relationships between variables. Drawing graphs next to equations helps connect symbols to visual meaning, and labelled geometric models make things like angles, symmetry, and transformations clearer. Visual note-taking also improves memory and problem-solving by using colours, arrows, symbols, and spatial layouts to create cues that aid recall (Santigo,2011). This systematic method enables students to access knowledge rapidly and utilise mathematical concepts more efficiently.

Visual note-taking promotes higher-order thinking in mathematics by encouraging students to analyse, identify patterns, and synthesise concepts. Learning becomes more meaningful and deeper when information is organised and restructured through the use of visual aids. Integrating these strategies can enhance conceptual understanding, engagement, and performance. However, research on the effectiveness of visual note-taking in mathematics, particularly at the university level in Malaysia, is limited. This study therefore aims to examine its impact on students' understanding and their perceptions of it as a learning tool.

Table 1: Types of visual note taking in mathematics

Mind maps Organise mathematical ideas around a central concept using branches. • Useful for summarising topics (e.g. algebra, calculus) • Show connections between formulas, rules, and examples • Effective for revision and exam preparation	
Concept Maps Use boxes or circles connected with labelled arrows. • Emphasise relationships between mathematical concepts • Helpful understanding of definitions and theories • Commonly used for abstract topics	
Venn Diagrams Compare sets or concepts. • Used in set theory, probability, and number concepts • Show similarities and differences clearly • Support reasoning and classification	
Diagrams and Drawings Diagrams visually represent mathematical objects. • Common in geometry, trigonometry, and graphs • Help students visualise shapes, angles, and relationships • Improve understanding of abstract ideas	

Flowcharts Show step-by-step problem-solving processes. • Used in algebra, calculus, and word problems • Help students follow logical procedures • Reduce errors in multi-step solutions	

Conclusion

Visual note-taking improves memory and recall because visual information is processed faster and remembered for longer than text alone. Colours, arrows, icons, and organised layouts are useful memory cues, while mind maps assist link similar concepts, such as differentiation rules, in a clear and systematic manner. These visual aids assist students in recalling information during examinations and in swiftly retrieving mathematical techniques and formulas, hence enhancing mathematical ability. The research concludes that visual note-taking is an effective technique for enhancing students' conceptual understanding of mathematics. Compared to standard linear note-taking, visual notes promote stronger cognitive processing, allowing students to organise and integrate ideas more effectively. They provide a clearer depiction of difficult topics, making abstract mathematical linkages more understandable. Visual notes can help with memory recall by giving memorable visual cues and associations, as well as increasing student engagement by making learning more interactive and visually appealing. Visual note-taking in mathematics classes is an effective tool for creating deeper and more meaningful learning experiences.

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