Mind Mapping: An Innovative Approach to Elevate Mathematics Learning and Critical Thinking

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Abstract

There are many possibilities how to improve mathematical education and enable students to participate in the process of the cognition of new knowledge and elevate Critical Thinking. In this paper we present mind mapping as one of graphical representation of mathematical networks which may become another efficient tool for improving mathematical achievement and boost Critical Thinking. The paper establishes the relationship between Mind Mapping, Mathematical Learning and critical thinking skills.

Key Words: Critical thinking,Mathematics Learning, Mind map.

Introduction

Mind mapping is a visual technique that exploits the way we actually think—through synaptic connections and non-linear associations. Because mind mapping gives practitioners, be they professional or student, access to subconscious observations and connections, it is a powerful thinking tool, useful in a variety of situations in business and in education. It explains what is at work in the brain as we create new knowledge and how mind mapping exploits these processes to gain intuitive and concrete understanding in situations requiring critical thinking (Roxanne M. O'Connell,2014). Critical thinking, as defined by Scriven and Paul at the 8th Annual International Conference on Critical Thinking and Education Reform, is the "intellectually disciplined process of actively and skilfully conceptualizing, applying, analysing, synthesizing, and/or evaluating information gathered from, or generated by, observation, experience, reflection, reasoning, or communication, as a guide to belief and action" (1987, n.p.). We also recognize these activities as those articulated in Benjamin Bloom's taxonomy of learning, in the cognitive domain, as knowledge, comprehension, application, analysis, synthesis and evaluation (1984, p. 18).The Mind Map is an extension of Radiant Thinking and is therefore anatural function of the human mind. It is a powerful graphic technique whichprovides a universal key to unlocking the potential of the brain. The Mind Map can be applied to every aspect of life where improved learning and clearerthinking will enhance human performance.

Mind Maps

A mind map is a diagram used to visually organize information. A mind map is hierarchical and shows relationships among pieces of the whole. It is often created around a single concept, drawn as an image in the centre of a blank page, to which associated representations of ideas such as images, words and parts of words are added. Major ideas are connected directly to the central concept, and other ideas branch out from those. A central topic declares the subject of the mind map. First-level topics, sometimes known as "basic ordering ideas," define the scope of the topic to be covered by the mind map. Sub-topics radiating from them are known as "child topics." A mind map may contain as many layers of topics and subtopics needed to meet the mind map's purpose. Topics may be embellished with shape colours, fonts, size and colour. In addition, icons and images can be attached to mind maps.

Mind Mapping and Mathematics Learning

There are many advantages to using mind maps in mathematics teaching.

- It has the function of refining and compressing. It only retains some key information with keywords, graphics and connections, removes less important content, reduces the memory burden, and enables people to quickly acquire the knowledge they need.
- It can make the thinking process explicit. The mind map reveals the implicit thinking process with simple graphics, which is conducive to reflection, communication, feedback and correction.
- It is good for diverging thinking. Mind mapping can make people's thinking start from the central problem and spread to the surrounding, which helps students to cultivate creative thinking and is conducive to seeking solutions.
- It can fully tap the brain's potential. The mind map combines graphics and texts, which can make full Use of the left brain's language, words, numbers, logic and other functions and the right brain'simagination, creation, inspiration, memory and other functions to improve the learning efficiency.
- Mind Mapping can streamlinethe content. Students can write the problem conditions and problem-solving ideas with keywords, without having to write detailed problem-solving steps,which can save time and make the mind map simple and easy to understand.

- A comprehensive mind Map can help the students in preparation of exams. To establish a mind mapduring the examination, the student must find the known and implied conditions in the topic as the secondary branch of the map.
- Diversity is another important characteristic of Mind Mapping. Each student's knowledge framework is different, the way of understanding is different, and the degree of divergence of thinking is different, therefore, the established mind map can be varied.

Mind Mapping and Critical Thinking

Critical Thinking is reflective thinking that is focused on understanding an issue, creating and weighing solutions, and making informed decisions (Marzano et al. 2001). Critical Thinking is that mode of thinking-about any subject, content or program-in which the thinker improves the quality of his or her thinking by skilfully taking charge of the structures inherent in thinking and imposing intellectual standards upon them. Critical thinking includes the ability to respond to material by distinguishing between facts and opinions or personal feelings, judgments and inferences, inductive and deductive arguments, and the objective and subjective.

Meaningful learning is necessary for critical thinking. The operational definition of critical thinking is a metacognitive, nonlinear process of purposeful judgment that includes self-directed learning and self-assessment.How critical thinking should be taught and how it is learned are unclear especially at the school level. critical thinking occurs when a student penetrates beyond the surface structure of a problem and recognizes how the problem can be solved, and in addition, possesses the content knowledge integral to solving the problem. Without both components, a student may be able to critically analyse one problem, but will falter when given a similar problem in a different context. The student should be able to critically evaluate novel cases that they encounter in using their previous, albeit limited, experiences.

Mind maps can be used as a teaching tool to promote critical thinking in by encouraging students to integrate information between disciplines and understand relationships between the basic and clinical sciences. The ability to integrate information by finding valid relationships between concepts allows students who construct either mind maps to reach a metacognitive level. However, the added dimensions of pictures and colours that are unique to mind maps have not only been shown to facilitate memory but may appeal to a wide range of students withvisual- and linear-oriented learning styles. Consequently, the advantage of using mind maps in education is that this strategy may benefit more students with diverse learning styles.

Mind maps allow students to recognize the intra- and inter-relationships between concepts, which reflects the kind of real-world thinking predominant in the setting.

Conclusion

Modern Education system emphasis on all round development of a student. Critical thinking is one of the most important aspect of this. There is a need of developing new methods and strategies to enhance learning and critical thinking of the students. Mind Mapping can be considered as one of the best methods.Using mind maps in the process of solving problems can help students to clear their minds, deepen their understanding of the relationship between knowledge, and improve their ability to solve problems. Teachers should guide students to establish reasonable review maps, ideas maps and reflection maps according to certain principles and steps in solving problems. Of course, how to construct amore scientific mind map is also an important learningprocess for students, and to establish a complete solutionmap, students need to have a well-organized mathematical knowledge structure. It is necessary to elevate critical Thinking, continuously strive for bothteachers and students in order to truly exert the advantages of mind mapping.

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