

CONCEPT MAPPING – A RELIABLE EDUCATIONAL TOOL

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Abstract

Learning is an active, purposeful, and joyful experience that is crucial for engaging young minds in the teaching-learning process. Concept mapping stands out as a highly effective tool to achieve the desired learning experience. Therefore, it is imperative to evaluate the reliability of concept mapping as an educational tool for enhancing the learner's experience. Concept mapping is a visual representation of concepts that illustrates their relationships. It serves as a graphical tool, aiding learners in visualizing hierarchically structured concepts, connected by labeled lines. The distinctive feature of concept mapping lies in its hierarchical structure, with the general concept positioned at the top and specific concepts arranged below.

Concept mapping offers several benefits to learners:

- Visualization of ideas and concepts in a structured manner, facilitating quick recall.
- Comprehension of complex concepts or ideas.
- An easy method for learners to take organized notes.
- Facilitation of distinguishing main points from secondary points.
- Breakdown of complex information into manageable parts, such as topics and subtopics.
- Empowerment of learners to express their perspective on a studied topic.

This study aims to assess the reliability of concept mapping through an experimental study involving teacher trainees. To support this investigation, a self-designed questionnaire was administered to a sample of two hundred teacher trainees. The findings indicate that the use of concept mapping is a reliable educational tool, contributing to a significantly improved learning experience for learners.

Keywords: Concept mapping, educational tool, Reliability, Hierarchical structure, Teacher trainees.

Highlight of the Study

The experimental study has elucidated that concept mapping significantly amplifies cognitive abilities, encompassing information processing, recall, and retention, with the experimental group exhibiting superior performance in post-tests compared to the control group. The study advocates for further investigation into demographic variables and the integration of concept mapping with other educational methodologies, providing valuable insights applicable to higher education across diverse professions.

Introduction

Education is the greatest gift that anyone can give. Individuals are empowered and assisted in understanding their own and others' life goals through education. As a result, giving a meaningful education is critical. To make a significant difference in the current situation, excellent educational technologies that improve the teaching-learning experience are required. The proper use of educational instruments engages the learner in the teaching-learning process, assists the instructor in improving the classroom atmosphere, improves memory, and makes learning a pleasurable experience.

The focus of the curriculum has shifted to the students. The basic goal is to connect new knowledge to prior knowledge. When a youngster is exposed to the world, he or she notices new bits of knowledge that are stored in the memory, retained, and recalled as needed. When the information learned is useful, it gets transferred to long-term memory. This leads to a greater grasp of what the child learns, as well as increased curiosity, critical thinking, problem-solving skills, creative thinking, and memory skills, among other things. Joseph Novak proposed Concept Mapping as an educational technique in the late 1970s during his research in child psychology. Concept maps enable the teacher to simply explain a concept from general to specific, as well as visualize the relationships between concepts.

Concept Maps

The process of graphically portraying a concept from a whole to its components while still articulating the relationship between the concepts through the use of connecting words. At a look, concept maps allow us to see a large complex concept in a meaningful schematic depiction. Within the classroom, concept maps can be used in two ways. The first is for the teacher to teach concepts that will stimulate the learner's attention and kindle their curiosity. Another goal is to improve the learner's cognitive skills by having them create concept maps that will help them communicate their perspective of the concept. Concept maps improve the intellectual ability of the learner. Although the applications of concept maps for student learning are extraordinarily wide-ranging, student-generated maps tell us the most about the development of students' reasoning (**Novak, 2005**).

The teacher can utilize concept maps in the following ways:

- ❖ Preparing a complete concept map ahead of time
- ❖ Presenting an incomplete map and encouraging students to complete it while teaching
- ❖ Creating concept maps throughout the teaching process and adding concepts as the class progresses.
- ❖ Conduct a brainstorming session to improve the learner's critical thinking as well as to aid the learner in identifying the question and finding a solution that would allow the learner to use their problem-solving skills.

Review of Literature

Sulakshana Shridhar Baliga, Padmaja Ravindra Walvekar, Girija Jagadish Mahantshetti(2021), Concept map as a teaching and learning tool for medical students; An experimental study was conducted among the third-year MBBS students of two different batches. The study was conducted in two stages (i) a Pre-test was conducted, an introductory class on tuberculosis was taken using the technique of concept mapping and later a post-test was conducted (ii) feedback was taken from the students regarding the concept mapping technique. The data were analyzed using the Wilcoxon test. There was a significant difference in the pre-test and post-test scores. More than 50% of the students scored full marks in the post-test and nearly 82% of the students gave positive feedback regarding the use of concept mapping.

V Nuuyoma, S K Fillipus(2020), Nursing students' perceptions and experiences of concept mapping as a learning tool in a human physiology course; In their qualitative descriptive study obtained data from Nursing students at the University of Namibia. The data collected from three focus discussions from 18 years old nursing students led to the result that they had a positive perspective on concept mapping as a tool to learn human physiology but felt that concept mapping is a time-consuming process and requires many learning sources. In considering the benefits of providing in-depth knowledge of the concept and addressing the issue of time management and availability of resources, concept mapping is a useful learning tool.

Pandey SK, Tyagi HK (2020) The status of concept mapping in teaching-learning process: Exploring the present awareness, use and challenges; This study was conducted to check the awareness of the teachers about concept mapping. A questionnaire containing 14 items was sent as a Google form to teachers in various schools in the country. The result highlighted that many teachers across the country are aware of concept mapping and use the technique in their everyday teaching. However, some found developing concept maps a time-consuming process and problems faced by them in implementing it.

Carmen Romero, Moisés Cazorla, Olga Buzón(2017), Meaningful learning using concept maps as a learning strategy; An experimental study along with a survey to get the feedback of the students was conducted among the students of Natural science courses in the second year of compulsory secondary education. The first session was an instruction led one to teach the technique of concept mapping and the other session was an independent session where the students were made to create a concept map. The score of the pre-test which is the assessment test was compared with the grades obtained in the assessment test after introducing the technique. The results revealed that more than 65% of the students earned grades between 7 – 9.5 in the concept maps independently created by them. This evidences the usefulness of the technique.

Ramyasmriti S Talanki(2015), Effectiveness of Concept Mapping Strategy on Understanding and Retention among Secondary School Students; In this experimental study, the researcher has developed a concept map for the structure and function of the DNA using which a sample of 9 students in a tutorial aka coaching center for excellence was treated. As the sample is below 30 the researcher used non-parametric analysis for the data collected in four stages Pre-

testing, Intervention stage, post-testing, and delayed post-testing. The result had a significant difference in the pre-test and post-test scores. Hence, it is concluded that the concept mapping technique was found to be effective.

Objectives

1. To investigate the effect of the concept mapping technique using achievement tests among the B.Ed. teacher trainees.
2. To find out the opinion of the teacher trainees on whether concept mapping is a reliable tool in the process of teaching and learning.
3. To explore whether teacher trainees in the experimental group differ in the effectiveness of concept mapping based on gender.

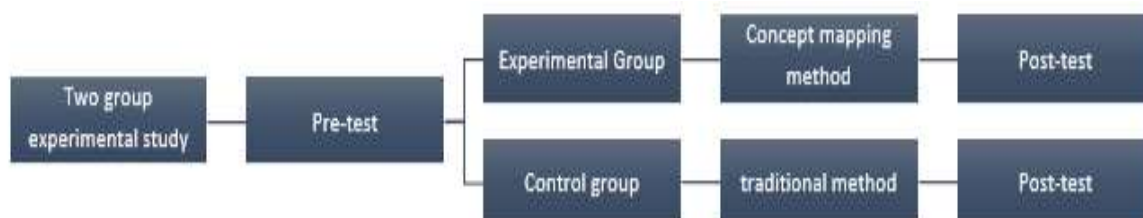
Hypotheses

1. There is no significant difference in the scores obtained in post achievement test between the experimental group and the control group.
2. There is no significant difference in the scores obtained in post achievement test in the experimental group based on gender.

Methodology

An experimental study was conducted among the B.Ed. teacher trainees. Two group experimental method was chosen by the researcher to conduct the study. The teacher trainees were divided into two groups based on their scores in the pre-test conducted. The control group consisted of 25 teacher trainees and the experimental group also consisted of 25 teacher trainees.

To get the opinion of the teacher trainees about the concept mapping method a questionnaire that consisted of 15 items was constructed by the researcher. The sample for the survey was collected from the students who participated in the experimental studies and teacher trainees of other colleges too, nearly 230 teacher trainees participated in the survey. Data collected from both the experimental and the survey method was analysed by SPSS.



Analysis of Data

The analysis of the data through experimental study and survey method were analysed. Statistical measurements like Mean, standard deviation, paired t test, percentage representation of the survey and graphs were used to draw the conclusion.

Groups	Gender		Size(N)
	Male	Female	
Experimental Group	7	18	25
Control Group	1	24	25

Table 1.1 Distribution of Experimental sample according to gender

The above table shows the distribution of the sample used for the experimental study. A total of 50 teacher trainees were involved in this study. They were divided into equal groups based on the score obtained in the pre-test.

Hypothesis:1

There is no significant difference in the scores obtained in post achievement test between the experimental group and the control group.

Table 1.2 Mean and Standard Deviation of the experimental Sample

Experimental Groups	Achievement test	Mean	SD	N
Experimental Group	Pre-test	20.02	1.194	25
	Post-test	23.16	1.248	
Control Group	Pre-test	21.05	1.246	25
	Post-test	21.78	1.473	

Table 1.2 gives the mean, standard deviation of both the pre-test and post-test conducted on the control group as well as the experimental group. From the mean values of the post-test, it is evident that there is a significant difference in the scores obtained in the post-test between the control group and the experimental group.

On observing the difference in the mean of the pre-test and post-test scores of the control group and the experimental group, we can conclude that there is a considerable difference in the mean of the pre-test and post-test scores of the experimental group ($23.16 - 20.02 = 3.14$) which indicates that concept mapping technique has enhanced the scores of the teacher trainees in the experimental group. The difference in the mean of the pre-test and post-test scores of the control group ($21.78 - 21.05 = 0.73$) is lesser when compared to that of the experimental group.

Table 1.3 Comparison of the post-test between experimental groups

Experimental Groups	Achievement test	Mean	SD	N	t-test	p-value
Experimental Group	Post-test	23.16	1.248	25	3.2811	0.0032**
Control Group	Post-test	21.78	1.473	25		

From table 1.3 it is observable that the p-value is highly significant, hence the null hypothesis is rejected at the 1% level of significance.

Hypothesis:2

There is no significant difference in the scores obtained in post achievement test in the experimental group based on gender.

Table 1.4 Mean and Standard Deviation of Experimental Group according to gender

Factor	Category	N	Pre-test		Post-test	
			Mean	SD	Mean	SD
Gender	Male	07	19.07	0.450	22.86	1.345
	Female	18	20.39	1.195	23.28	1.227

From the mean values obtained for the post-test scores in the above table, it is evident that there is a significant difference in the post-test score in the experimental group based on gender. The females scored better in the post-test than the males. Hence the null hypothesis is rejected.

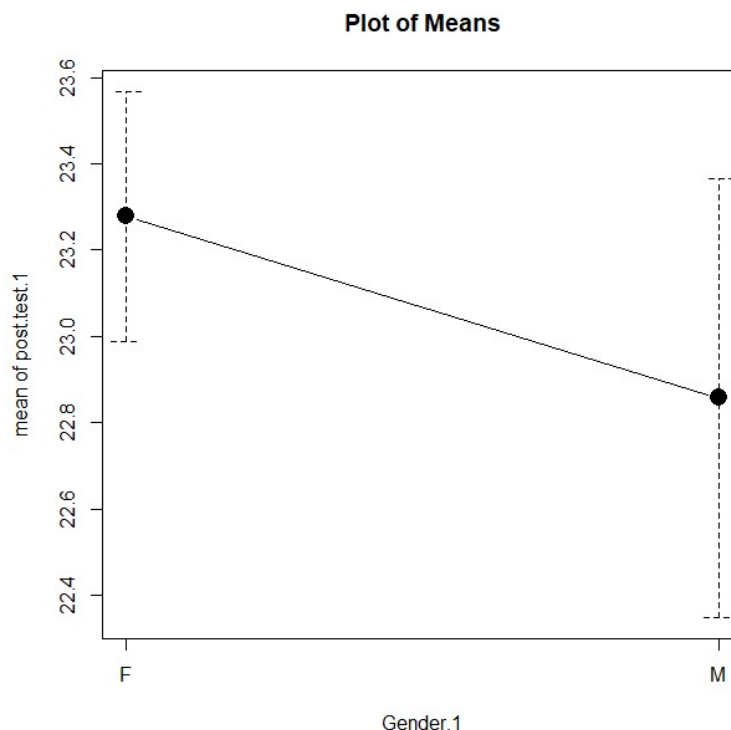


Figure 1.2 Plots of Mean of the post-test of Experimental group based on gender

The above figure shows the difference in the mean values of the post-test scores in the experimental group. The female teacher trainees have scored higher marks than the male teacher trainees.

Survey Method

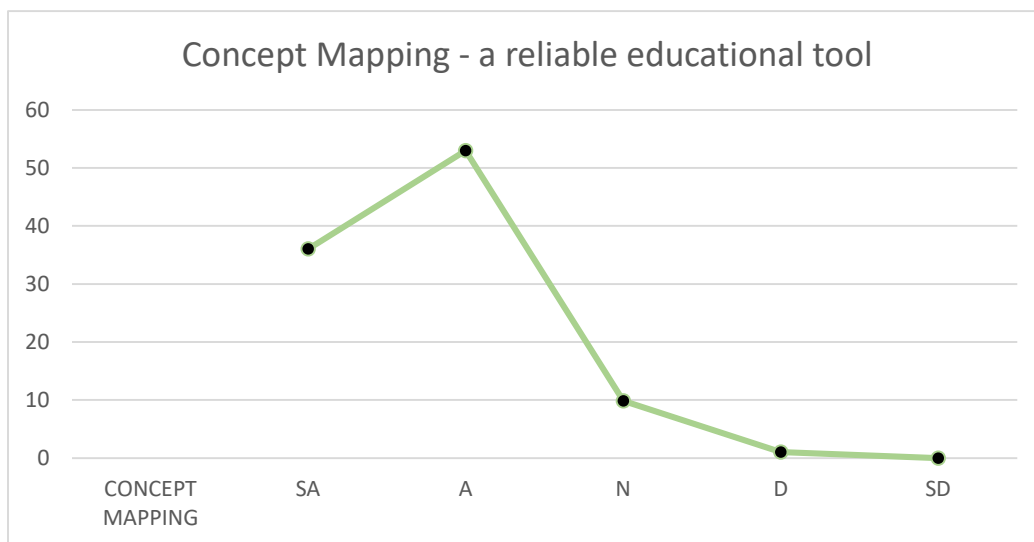
Table 1.5 The result of the survey of Concept Mapping as a reliable tool from Teacher trainees (in percentage)

S. No	Statement	SA	A	N	D	SD
1	Concept Mapping helps to easily build new knowledge to the existing knowledge	44.9	46.2	7.7	0.02	-
2	Concept Mapping helps to see the big picture of the concept in a single glance	47.4	51.3	1.3	-	-

3	Concept Mapping helps visualize the relationship between the branches of the whole concept	35.9	55.1	9	-	-
4	Concept Mapping helps to understand and store information with ease	39.7	52.6	6.4	1.3	-
5	Concept Mapping helps to combine information	35.9	52.6	10.3	1.2	-
6	Concept Mapping helps to evaluate a learner's understanding of a concept	34.6	56.4	9	-	-
7	Concept Mapping helps to get the learner's attention	28.2	61.5	7.7	2.6	-
8	Concept Mapping helps to understand the view of a learner on a particular topic	29.5	55.1	15.4	-	-
9	Improves the long-term memory skill of the learner	48.7	48.7	2.6	-	-
10	A lesser revision time is enough while studying using the Concept Mapping method	46.2	46.2	7.7	-	-
11	Concept Mapping helps to remember the details of the concept	32.1	56.4	11.5	-	-
12	I used Concept Maps to teach during my training period	34.6	56.4	9	-	-
13	Concept Mapping facilitates interconnection among chapters	30.8	51.3	16.7	1.2	-
14	Concept Mapping Assignment is a time-consuming activity	26.9	42.3	21.8	9	-
15	A brainstorming session on Concept Mapping helps to identify the problem and find a solution to that problem	25.6	62.8	11.5	-	-

Table 1.5 gives the percentage representation of the opinion given by the teacher trainees on the concept mapping technique.

Figure 1.2 Representation of the survey results in percentage



Findings & Suggestions

Learning is based on the individual's interests, but learning can be made a joyful experience, motivating the learner to learn for the pleasure he receives. Concept maps, Mind maps, educational games, and other educational tools stimulate the learner's curiosity, improve cognitive ability, improve metacognition skills, and transform the individual into a lifelong learner. It is clear from the experimental study that

1. Concept mapping improves the learner's cognitive ability, which includes information processing, storing information, recall, and retention. The experimental group outperformed the control group in the post-test. This demonstrates that concept mapping has a positive impact on the cognitive domain of the learner.
2. Female teacher trainees were more influenced by concept mapping than male teacher trainees.

Educational tools, whether digital or traditional, are essential because they improve the learner's thinking ability, creativity, and problem-solving skills. The study can be expanded to include other demographic variables. The concept mapping method can be combined with other educational methods or techniques, and its effectiveness can be evaluated using experimental methods. This experimental study can be evaluated with higher education students from other professions.

Conclusion

Concept mapping is one of the most effective educational tools to teach as well as to assess the learners. The method for creating concept maps should be taught to teacher trainees who will have the opportunity to influence and inspire young minds during their training period. Concept mapping can help teacher candidates both as a learner and a teacher. A concept map allows us to

easily correlate and interlink concepts learned in one subject with those learned in other subjects, as well as concepts learned in one chapter with those learned in other chapters. The experimental study and survey method demonstrate that concept mapping is a reliable tool for learning, educating also to assess the learner.

References

- Akinsanya, C., & Williams, M. (2004). Concept mapping for meaningful learning. *Nurse Education Today*, *24*(1), 41–46.
- Baliga S, Walvekar P, Mahantshetti G (2021).” Concept map as a teaching and learning tool for medical students”. *Journal of Education and Health Promotion*, (2021), *35*, 10(1).
- Bernstein J. M. (2011): Concept Mapping and Student Success in A College-Level Environmental Studies Course, in Science Education Montana State University, Bozeman, Montana.
- Carr-Lopez, S., Galal, S., Vyas, D., Patel, R., & Gnesa, R. (2014). The utility of concept maps to facilitate higher-level learning in a large classroom setting. *American Journal of Pharmaceutical Education*, *78*(9), 170.
- Chiou, C.-C. (2008). The effect of concept mapping on students’ learning achievements and interests. *Innovations in Education and Teaching International*, *45*(4), 375–387.
- Clayton LH. (2006): Concept mapping: An effective, active teaching, learning method. *N Edu Perp.*;27(4):197-203.
- Jason E. Dowd, Tanya Duncan, Julie A. Reynolds, Hannah Sevian (2017). “Concept Maps for Improved Science Reasoning and Writing: Complexity Isn’t Everything”. *CBE—Life Sciences Education* Vol. 14, No. 4.**
- Jennifer Moore Bernstein (2011): Concept Mapping and Student Success in a College-Level Environmental Studies Course. A professional paper submitted in partial fulfillment of the requirements for the degree Master of Science in Science Education, MONTANA STATE UNIVERSITY . Bozeman, Montana.
- Jonassen, D. H., Reeves, T., Hong, N., Harvey, D. and Peters, K. (1997). „Concept mapping as cognitive learning and assessment tools“, *Journal of Interactive Learning Research*, 8, 3–4, 289–308
- Novak, J. D. (1990). Concept mapping: A useful tool for science education. *Journal of Research in Science Teaching*, *27*, 937–949.

- Novak JD, Cañas AJ. The Theory Underlying Concept Maps and How to Construct and Use Them, Technical Report IHMC CmapTools 2006-01 Rev 01-2008.
- Novak, J.D. (2010). Learning, Creating, and Using Knowledge: Concept Maps as Facilitative Tools in Schools and Corporations. 2ed. New York: Routledge.
- Nuuyoma V, Phillipus S (2020). “Nursing students’ perceptions and experiences of concept mapping as a learning tool in a human physiology course”. *African Journal of Health Professions Education* 2020;12(3):98-102.
- Pandey S (2021). “The status of concept mapping in teaching learning process: Exploring the present awareness, use and challenges”. *Indian Journal of Science and Technology*, (2020), 3944-3949, 13(37).
- Romero C, Cazorla M, Buzón O (2017), “Meaningful learning using concept maps as a learning strategy”. *Journal of Technology and Science Education*, (2017), 313, 7(3).
- Sharma, M., & Chawla, S. (2014). Tools for creating constructivist learning environment and assessing knowledge development using concept maps. *International Journal of Advanced Research in Computer Science*, 5(8), 143–151.