

A STUDY OF THE EFFECTIVENESS OF WEB TECHNOLOGY BASED CONCEPT MAP METHOD IN TEACHING SCIENCE AND TECHNOLOGY AT SECONDARY LEVEL

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ABSTRACT

The present study examined the effectiveness of a Web Technology Based Concept Map Method on the academic achievement of secondary school students in Science and Technology. A quantitative, quasi-experimental pre-test and post-test equivalent group design was employed. Sixty students of Grade IX were selected through purposive sampling and divided equally into an experimental group ($n = 30$) and a control group ($n = 30$). The experimental group was taught using web-based concept mapping tools, whereas the control group received instruction through the conventional teaching method. Data were collected using a standardized Science Achievement Test comprising 40 multiple-choice questions. Descriptive statistics and an independent samples t -test were used for analysis. The findings indicated that students taught through the Web Technology Based Concept Map Method achieved significantly higher post-test scores than those taught through the traditional method ($t = 5.84, p < .001$). The study concludes that integrating web-based concept mapping into science instruction can substantially enhance conceptual understanding and academic achievement. These findings are consistent with prior quasi-experimental studies reporting improved science achievement through concept mapping and web-supported instruction.

KEYWORDS: Web Technology, Concept Mapping, Science Education, Secondary School, Academic Achievement, Experimental Research.

1. INTRODUCTION

Science education requires instructional strategies that promote conceptual understanding rather than rote memorization. Concept mapping helps learners organize knowledge

hierarchically and identify relationships among concepts. When integrated with web-based technologies, concept mapping becomes interactive, collaborative, and visually engaging, potentially improving students' understanding and retention of scientific concepts. Previous experimental studies have reported higher science achievement among students taught with concept mapping and web-supported instructional materials compared with traditional teaching approaches.

2. Objectives

- 1) To compare the pre-test achievement scores of the experimental and control groups.
- 2) To compare the post-test achievement scores of the experimental and control groups.
- 3) To determine the effectiveness of the Web Technology Based Concept Map Method.

3. Hypotheses

H01: There is no significant difference between the pre-test achievement scores of the experimental and control groups.

H02: There is no significant difference between the post-test achievement scores of the experimental and control groups.

4. METHODOLOGY

Table 1.

Particular	Description
Research Design	Quasi-Experimental (Pre-test Post-test Equivalent Group Design)
Population	Secondary School Students
Sample	60 Students
Experimental Group	30 Students
Control Group	30 Students
Sampling Technique	Purposive Sampling
Research Tool	Science Achievement Test (40 Marks)
Duration	6 Weeks
Statistical Techniques	Mean, SD, Independent <i>t</i> -test, Cohen's <i>d</i>

5. Quantitative Data

Table 2: Pre-test Scores.

Group	N	Mean	SD	t-value	p-value
Experimental	30	18.63	3.24	0.34	0.736
Control	30	18.33	3.56		

Interpretation

There was no statistically significant difference between the pre-test scores of the two groups. Therefore, both groups were academically comparable before the intervention.

Table 3: Post-test Scores.

Group	N	Mean	SD	t-value	p-value
Experimental	30	31.87	3.42	5.84	<0.001
Control	30	25.73	4.56		

Interpretation

The experimental group obtained significantly higher post-test scores than the control group.

Table 4: Gain Scores.

Group	Pre-test Mean	Post-test Mean	Gain
Experimental	18.63	31.87	13.24
Control	18.33	25.73	7.40

The experimental group showed a substantially greater improvement in achievement.

Effect Size

Cohen's $d = 1.50$

Interpretation

According to Cohen's guidelines, an effect size of 1.50 represents a **very large educational effect**, indicating that the Web Technology Based Concept Map Method had a strong positive impact on students' science achievement.

6. FINDINGS

- 1) The pre-test achievement of the experimental and control groups did not differ significantly.
- 2) The experimental group achieved significantly higher post-test scores than the control group.
- 3) Students exposed to web-based concept mapping demonstrated greater conceptual understanding and academic improvement.
- 4) The intervention produced a large practical effect (Cohen's $d = 1.50$).

7. CONCLUSION

The study demonstrates that the Web Technology Based Concept Map Method is more effective than the conventional teaching method for teaching Science and Technology at the

secondary level. The integration of interactive web technologies with concept mapping promotes meaningful learning, improves conceptual clarity, increases learner engagement, and enhances academic achievement. Schools and teachers may consider adopting web-based concept mapping as an instructional strategy for science classrooms.

8. REFERENCES

1. Li, L. Y. (2015). Development and evaluation of a web-based e-book with a concept mapping system. *Journal of Computers in Education*, 2(2), 211-226.
2. Ural, E., & Ercan, O. (2015). The effects of web-based educational software enriched by concept maps on learning of structure and properties of matter. *Journal of Baltic Science Education*, 14(1), 7-19.
3. Kaur, G., & Khan, T. (2025). A comparative study of effectiveness of concept mapping and traditional method of teaching on science achievement of secondary school students. *International Journal of Innovative Research in Technology*.