ISSN : 2394-2975 (Online)
ISSN : 2394-6814 (Print)
Vol. 4, Issue 1 (Jan. - Mar. 2017)
International Journal of Advanced Research in Education & Technology (IJARET)

Effect of Concept Mapping on Academic Achievement of Students in Physics in Relation to Gender

[I]Sukanya Appoji, [II]Dr. H. M. Shailaja
[I]Research Scholar, School of Education, Rani Chennamma University, Belegavi, Karnataka, India
[II]Directors, School of Education, Rani Chennamma University, Belgravia, Karnataka, India

Abstract
The purpose of the study is to study the difference between pre-test and post-test of Academic achievement of girl students and boy students in Control group and Experimental group in physics. The sample of the present study includes 40 students for Control group and 40 students for Experimental group from VIII standard Physics subject of Belagavi district. Each group consists of 22 girl students and 18 boy students. The study is of Quasi Experimental in nature wherein both Control and Experimental groups are considered.

Key words
Concept Mapping, Teaching, Achievement.

Introduction

A concept map is a type of graphic organizer used to help students organize and represent knowledge of a subject. Concept maps begin with a main idea (or concept) and then branch out to show how that main idea can be broken down into specific topics.

Benefits of Concept Mapping

Concept maps have been shown to support struggling readers (Lovitt & Horton, 1994) by building off of students' prior knowledge and asking them to reflect on their understanding while reading. They are easy to construct and can be used across all content areas.

Concept mapping serves several purposes for learners:

- Helping students brainstorm and generate new ideas
- Encouraging students to discover new concepts and the propositions that connect them
- Allowing students to more clearly communicate ideas, thoughts and information
- Helping students integrate new concepts with older concepts
- Enabling students to gain enhanced knowledge of any topic and evaluate the information

Concept Maps in Education

When created correctly and thoroughly, concept mapping is a powerful way for students to reach high levels of cognitive performance. A concept map is also not just a learning tool, but an ideal evaluation tool for educators measuring the growth of and assessing student learning. As students create concept maps, they reiterate ideas using their own words and help identify incorrect ideas and concepts; educators are able to see what students do not understand, providing an accurate, objective way to evaluate areas in which students do not yet grasp concepts fully.

Concept Maps and the Teaching of Physics

A Concept map made by a pupil corresponds to a representation of the hierarchical organization of one's cognitive structure (Wandersee, 1990), allowing the exteriorization of the singularities of that structure, which is very important in the day-to-day functioning of the classroom. In fact, the conceptions with which the pupils begins a learning task become more explicit, it reveals his more or less intuitive and erroneous thought, and when it is again constructed by the same pupil it allows him/her to schematically illustrate what was learnt, how it was learnt and to what extension the pupil's concepts were enriched. The disclosure of the pupil "secrets of the mind", that "externalization" of her/his cognitive structure with the concept map, allows the teacher to make sense of the pupil misconceptions, how he/she establishes the hierarchy of the concepts, and how differentiates, relates, discriminates and integrates them. Therefore, "the construction of concept maps is a way helping learners and educators penetrate the structure and meaning of the knowledge that they are trying to understand (Nokak and Gowin 1991).

To reveal that the pupil's mind produced a good progressive differentiation of the concepts, his/her concept map must reveal a hierarchy of concepts, that is the more general and inclusive concepts should come on top of the map, and the more specific and less inclusive concepts should be placed progressively below. A map should also show many cross links between the concepts that cross it from one side to the other, in order to clarify a good integrative reconciliation of the concepts in the cognitive structure of the learner who produces it. Concept map have their foundation in a constructivist vision of the production of knowledge, as well as in the Meaningful Learning Theory (MLT) and are very important tools to improve learning.

Achievement: In the present study, the achievement of students of Class VIII in Physics subject was considered. Items of achievement test were constructed by the research scholar.

Need and Importance of the Study

Concept mapping is a type of knowledge representation. Jon assen Grabowski (1993) stated that structural knowledge may be seen as a separate type of knowledge. "Structural knowledge provides the conceptual basis for why. It describes how prior knowledge is interconnected. Structural knowledge is most often depicted in terms of some sort of concept map that visually describes the relationships between ideas in a knowledge domain". Representing knowledge in the visual formal of a concept map allows one to gain an overview of a domain of knowledge. Because the nodes contain only a keyboard or a short sentence, more interpretation is required of the reader, but this may be positive. Concept mapping can be used for several purposes:

- To generate ideas (Brainstroming)
- To design complex structures (long texts, hypermedia, large web sites);
- To communicate complex ideas
- To aid learning by explicitly integrating new and old knowledge; and

- To assess understanding or diagnose mis-understanding

Concept mapping is a technique for representing the structure of information visually. There are several uses for concept mapping, such as idea generation, design support, communication enhancement, learning enhancement, and assessment. A wide range of concept mapping is now available for most of the teachers in educational institutions.

A concept mapping strategy is helpful in this regard as while mapping the concepts to "know" the concepts and also know how a concept is similar and different in coparison with other concepts.

But, for arriving at a map, as Novak said, there can be many ways. In one method, the mapping is done, while teaching the concepts, in a progressive differentiation approach. Here the most general concepts are learnt at the beginning. Within the category of this most general concept, sub-categories are identified, and the subcategories are differentiated resulting into learning of new concepts, subordinate to the previously learnt concept. The concept map of super ordinate and subordinate concept will represent their relationship.

In another approach of concept mapping, the specific concepts are taught distinctly and an effort to map the concepts by relating the newly learnt concept with the previously learnt concept is made. Learning of a general concept will be towards the end of the process.

Both approaches of learning concepts are justified in terms of natural way of learning which is more a whole to part and sometimes familiarity of specific concepts.

For a teacher it is important to study which approach of concept mapping is more beneficial? The concept mapping strategy is proved successful for learning. But Strategies that are adopted while learning through concept mapping can be different. So it is attempted in this study to know whether the concept mapping is strategy effective for attainment of Physics concepts.

Objectives of the Study

1. To study the significant difference between pretest and posttest of academic achievement in physics of boy students in control group.
2. To study the significant difference between pretest and posttest academic achievement in physics of girl students in control group.
3. To study the significant difference between pretest and posttest of academic achievement in physics of boy students in experimental group.
4. To study the significant difference between pretest and posttest of academic achievement in physics of girl students in experimental group.

Hypotheses

1. There is no significant difference between pretest and posttest of academic achievement in physics of boy students in control group.
2. There is no significant difference between pretest and posttest academic achievement in physics of girl students in control group.
3. There is no significant difference between pretest and posttest of academic achievement in physics of boy students in experimental group.
4. There is no significant difference between pretest and posttest of academic achievement in physics of girl students in experimental group.

Methodology: The study is of Quasi Experimental in nature wherein both Control and Experimental groups are considered

Sample: The sample of the present study includes 40 students for Control group and 40 students for Experimental group from VIII standard Physics subject. Each group consists of 22 girl students and 18 boy students.

Tools: Concept Achievement test

Statistical Techniques

- Descriptive,
- Differential

Analysis and Interpretation : In order to study the difference between pre-test and post-test of Academic achievement of students in physics in Control group and Experimental group in relation to gender, paired t-test and one way ANOVA followed by Tukeys multiple posthoc procedures and presented in the following tables.

Hypothesis: There is no significant difference between pretest and posttest of academic achievement in physics of boy students in control group.

To achieve this hypothesis, the paired t test was applied and the results are presented in the following table.

Table 1: Results of 't' test between pretest and posttest academic achievement of students in physics in control group

Achievement	Mean	SD	Mean Diff.	SD Diff.	Paired t	p-value	Signi.
Pretest	32.50	2.79	-0.61	1.38	-1.8816	0.0771	>0.05, NS
Posttest	33.11	2.00					

From the results of the above table, it can be seen that, a non-significant difference was observed between pretest and posttest academic achievement of boy students in physics in control group ($t=-1.8816$, $p>0.05$) at 0.5% level of significance. Hence, the null hypothesis is not rejected. It means that, the pretest and posttest academic achievement of boy students in physics are similar in control group.

Hypothesis: There is no significant difference between pretest and posttest academic achievement in physics of girl students in control group.

To achieve this hypothesis, the paired t test was applied and the results are presented in the following table.

Table 2: Results of t test between pretest and posttest academic achievement of students in physics in experimental group

Achievement	Mean	SD	Mean Diff.	SD Diff.	Paired t	p-value	Signi.
Pretest	33.64	2.97	-0.14	1.36	-0.4718	0.6419	>0.05, NS
Posttest	33.77	2.62					

From the results of the above table, it can be seen that, a non-significant difference was observed between pretest and posttest academic achievement of girl students in physics in control group ($t=-0.4718$, $p>0.05$) at 0.5% level of significance. Hence, the null hypothesis is not rejected. It means that, the pretest and posttest academic achievement of girl students in physics are similar in control group.

Hypothesis: There is no significant difference between pretest and posttest academic achievement of boy students in physics in experimental group.

To achieve this hypothesis, the paired t test was applied and the results are presented in the following table.

Table 3 : Results of t test between pretest and posttest academic achievement of boy students in physics in experimental group

Achievement	Mean	SD	Mean Diff.	SD Diff.	Paired t	p-value	Signi.
Pretest	31.83	1.62	-13.67	2.17	-26.7287	0.0001	<0.05, S
Posttest	45.50	2.26					

From the results of the above table, it can be seen that, a significant difference was observed between pretest and posttest academic achievement of boy students in physics in experiment group ($t=-26.7287$, $p<0.05$) at 0.5% level of significance. Hence, the null hypothesis is rejected. It means that, the posttest scores in academic achievement of boy students are significantly higher as compared to pretest scores in academic achievement of boy students in physics in experimental group.

Hypothesis: There is no significant difference between pretest and posttest academic achievement of girl students in physics in experimental group

To achieve this hypothesis, the paired t test was applied and the results are presented in the following table.

Table 4: Results of t test between pretest and posttest academic achievement of girl students in physics in experimental group

Achievement	Mean	SD	Mean Diff.	SD Diff.	Paired t	p-value	Signi.
Pretest	33.00	1.98	-13.18	1.89	-32.6571	0.0001	<0.05, S
Posttest	46.18	2.17					

From the results of the above table, it can be seen that, a significant difference was observed between pretest and posttest academic achievement of girl students in physics in experiment group ($t=-32.6571$, $p<0.05$) at 0.5% level of significance. Hence, the null hypothesis is rejected. It means that, the posttest scores in academic achievement of girl students are significantly higher as compared to pretest scores in academic achievement of girl students in physics in experiment group.

Findings

1. The pretest and posttest scores of academic achievement of boy students in physics in control group are similar.
2. The pretest and posttest scores of academic achievement of girl students in physics in control group are similar.
3. The posttest scores of academic achievement of boy students are significantly higher as compared to pretest scores in experimental group in physics.
4. The posttest scores of academic achievement of girl students are significantly higher as compared to pretest scores in experimental group in physics.

Discussion and Conclusion

In this study, the researcher aimed to study the difference between pre-test and post-test of Academic achievement of girl students and boy students in physics in Control group and Experimental group. From the analysis report, it is concluded that, the pretest and posttest scores of academic achievement of boy students in physics in control group are similar. The pretest and posttest scores of academic achievement of girl students in physics in control group are similar. The posttest scores of academic achievement of boy students are significantly higher as compared to pretest scores in experimental group in physics. The posttest scores of academic achievement of girl students are significantly higher as compared to pretest scores in experimental group in physics.

Educational Implications

1. Concept mapping strategy as an instructional method would be helpful to raise the achievement levels of students.
2. Concept mapping would help the students to develop in themselves the ability to think critically, creatively and vividly.
3. Concept mapping clubbed with other activities would be a better alternative to traditional methods of teaching in physics
4. The objective of teaching-learning process can be effectively achieved with concept mapping

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