

## Development of Concept maps on microbiological concepts for undergraduate students and to study the effectiveness of concept mapping strategy

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### Abstract

*Concept mapping is a very active teaching and learning strategy that involves representation of ideas or concepts and subconcepts in a diagrammatic manner. The previous researchers have illustrated that concept mapping strategy is highly effective in improving learning and teaching process. In this research researcher has prepared concept maps for undergraduate students for microbiology subject. In the first phase researcher has selected topics from microbiology syllabus which can be studied with the help of concept mapping strategy with the help of subject experts through checklist. Concept maps were prepared using standard concept map construction method given by Novak and Gowin. Research was conducted through quasi-experimental method. Pre test post test nonequivalent group design was used. Participants were divided into control group and experimental group. Experimental group students were given orientation about key components of concept maps on given topics. The comparison of scores of pretest and post test of control and experimental groups revealed that concept mapping strategy is more effective in teaching microbiology.*

**Key Words:** concept, concept maps, quasi-experimental

### Introduction

**A** Concept map is a node link diagram showing relationship between concepts and sub concepts. A Concept map consists of nodes, arrows as linking lines and linking phrases that describes the relationship between the nodes. Two nodes connected with a labeled arrow are called propositions (Schwendiman, B.2014)

Concept mapping is a very powerful tool in the field of education. It helps students to enhance their performance at higher cognitive level. It also helps teachers in teaching complex concepts and also for the assessment of conceptual understanding of students. Concept maps also helps students to enhance their learning by establishing connecting link between previously studied concepts. Students can also use concept maps to study new concepts and ideas and also for preparation of lecture notes.

Concepts maps can also help teachers for taking pre assessment of class. Teacher can ask whole class to prepare concept maps to organize their ideas and to establish connection between the concepts. Concepts maps can also be used as

instructional devices for the preparation of lecture and for laboratory activities.

According to Asubel's meaningful learning theory, the learning becomes meaningful when there is establishment of connection between previous knowledge and new knowledge. Concept mapping is one of the most effective technique for meaningful learning which is helpful for learners to understand complex concepts. Concept mapping is an important application of constructivist approach of teaching learning process. Concept maps allow the students to demonstrate their mastery of the concepts associated within a particular body of knowledge (Marchand, D,Ivernois, Assal, Slama and Hivon, 2002)

Thus the researcher wanted to know the effectiveness of concept mapping strategy in teaching learning of microbiology subject.

This research paper illustrates the process of development of concept maps and to study effectiveness of concept mapping strategy.

### Need and Significance of the study

1. This research is important because concept maps can act as helpful tool for

understanding complex microbiological concepts.

2. For meaningful learning of microbiological concepts learners should understand all the units of the content in stepwise manner.
3. Concept maps construction is one of the best tool for the learners to reach high levels of cognitive performance.
4. Concept map when prepared by the students on their own can help learners to know their previous knowledge.
5. Concept maps when prepared by the students on their own can help learners to know their previous knowledge.
6. Concept maps are the graphical representation of knowledge, concepts and relationship between the concepts.
7. The teaching and understanding of microbiology includes lecture, discussion or laboratory activities. Concept maps can be created for all these three areas.

**Objectives of the study**

1. To select the topics from microbiology syllabus at undergraduate level for construction of concept maps.
2. To develop concept maps on selected units of microbiology.
3. To conduct orientation program for B.Sc. II year microbiology students for concept map construction.
4. To study the effectiveness of concept mapping strategy.

**Methodology**

The standard concept map construction method given by Novak and Gowin experimental method of research is used for the present research.

**Research design**

Pre-test post test non-equivalent group design is used.

**Population**

The Population of this research study comprises students of undergraduate colleges in satara district.

**Sample**

For the present research, research participants were assigned into control group and experimental group. Non-randomized non-

equivalent pre-test post test control group design was used.

**Tools**

**Check list:**

As per the objective the researcher was interested in selection of the microbiology concepts form B.Sc. II microbiology syllabus that can be studied with the help of concept mapping strategy, hence the researcher prepared the checklist for professors form undergraduate colleges in order to select major microbiological concepts from B.Sc. II year microbiology syllabus.

**Procedure**

**Orientation and training program for students about concept mapping strategy.**

The orientation and training program for students about concept mapping strategy was given to experimental groups of Urban and rural students.

The steps involved in orientation program were as follows-

**Step-1) Selection of microbiological concepts for preparation of Concept maps.**

1. This step involved in selection of important microbiological concepts from under graduate level microbiology syllabus, by discussion with subject experts.
2. During this stage researcher has given a checklist containing all important microbiology topics.
3. As per the opinions of various experts the researcher has sorted out some important microbiological concepts that can be taught using concept mapping strategy.
4. Those selected concepts were already taught to the students through traditional teaching methodology.

**Step-2) Analysis sorting and interrelation of the selected concepts**

1. During this step researcher gave all the necessary instructions to the students regarding concept map construction process.
2. The researcher illustrated the detailed standard method for concept map construction given by scientist Novak to all

the students through a power point presentation.

3. Students analysed contents for key concepts , most general and least general concepts, circled the important concepts ideas, facts associated with concepts.
4. Then arranged concepts as per their understanding in to the hierarchical structure, placed most general concepts at the top or at the Centre of the map as per the type of Concept map.
5. They arranged all other remaining items as per the relationship between the concepts (place closely related items near to each other)
6. Students recognized all the nodes, links, labels, ideas related to the same concepts.
7. They link the related concepts by writing a word or phrase by a connecting line arrow and join them with suitable link label.

**Step3 Formation of a preliminary concept map.**

1. This is the raw map prepared by the students and is also known as preliminary concept map.
2. This preliminary concept map in likely to undergo changes after getting feedback from subject experts.
3. At this step all students revised the concept map depending upon feedback.
4. The researcher guided all the students in order to define specific relationship among the selected ideas.

**Step 4) Development of final concept map.**

1. All students made their own concept maps on their own understanding and views.

2. For a single concept given students prepared number of different concept maps.
3. The researcher helped all the students in correcting mistakes in their concept maps.
4. Finally researcher analyzed and sorted all the concept maps prepared by the students and selected the most correct and appropriate concept map.

**Table No. 1**

**Difference between the pre test scores of control group and experimental group from rural area.**

Group	Me an	S. D.	Calcu lated Value	Ta ble Va lue	Level of signifi cance	Deg ree of free dom
Experi mental	28.60	5.02	0.81	2.00	0.05	0.05
Control	27.53			2.66	0.01	0.01

**Table No. 2**

**Difference between the pre test scores of control group and experimental group from Urban area.**

Group	Me an	S. D.	Calcu lated Value	Ta ble Va lue	Level of signifi cance	Degr ee of free dom
Experi mental	27.66	4.78	0.80	2.00	0.05	59
Control	26.66			2.66	0.01	

**Table No. 3**

**Difference between the pre test and post test scores of control group form rural area.**

Gro up	Me an	S. D.	Calcul ated Value	Ta ble Val ue	Level of signifi cance	Degr ee of freed om
Pre- test	27.53	6.78	1.04	2.00	0.05	59
Post -test	29.4			2.66	0.01	

**Table No. 4**

**Difference between the pre test and post test scores of control group from urban area.**

Group	Mean	S.D.	Calculated Value	Table Value	t	Level of significance	Degree of freedom
Pre-test	27.89	5.32	0.98	2.00		0.05	59
Post-test	28.06			2.66		0.01	

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**Analysis and interpretation of data**

1. From table no. 1 it is clear that there is no significant difference between the pre test scores of control and experimental groups students from rural area. Thus both groups are equivalent.
2. From table no. 2 it is clear than there is no significant difference between pre tests and post test scores of the control group of rural area students thus the control group and experimental group students in rural area are equivalent.
3. It is clear from table no. 3 that there is no significant difference between the pre test and post test scores of the control group students from rural area.
4. It is clear from table no.3 that there is no significant difference between achievement of control group students in pretest and post test as concept mapping strategy was not administered to control group students.
5. From table no. 5 and 6 it is clearly revealed that there is increase in post test score of student which indicated that concept mapping strategy was found to be effective in achievement of experimental group students.

**Table no. 5**

**Difference between pre test and post test scores of experimental group students from rural area**

Group	Mean	S.D.	Calculated Value	Table Value	t	Level of significance	Degree of freedom
Pre-test	28.6	4.04	3.94	2.00		0.05	59
Post-test	32.73			2.66		0.01	

**Finding of the study.**

1. All the student from the experimental group prepared concept maps as per the instructions given by the researcher during the orientation program conducted.
2. There is no significant difference between the pre test scores of urban and rural area.
3. There is no significant difference between the pre test scores and post test scores of control group students of urban and rural area.
4. There is significant difference between the pre-test and post test scores of experimental group students from urban as well as rural area.

**Table no. 6**

**Difference between pre test and post test scores of experimental group students from urban area**

Group	Mean	S.D.	Calculated Value	Table Value	t	Level of significance	Degree of freedom
Pre-test	27.66	4.76	0.98	2.00		0.05	59
Post-test							

**Conclusions:**

1. Concept mapping strategy was effective for learning microbiological concepts for undergraduate students.
2. The Concept mapping technique was found useful for experimental group

students as scores of students in achievement test were enhanced.

3. Experimental group students from urban area achieved greater score in post test compared with pre-test which revealed the effectiveness of concept mapping strategy.
4. Experimental group students from rural area achieved greater score compared to control group students.

Thus concept mapping strategy was found effective for learning microbiological concepts.

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