Concept Maps as a Tool for Classroom Teaching and Assessment: Perceptions of University Teachers

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Abstract

Nowadays all countries aim to reach efficient education system. In the current scenario, problems of education system can only be controlled by qualified people. So, for the fruitful learning, teaching approaches, procedures, practices and tools should transfer knowledge in a way that can be inspected from different dimensions enlightening a lot of points of view, situations, and depiction of idea creation. In this way, it can be stated that one of the most important teaching and learning tool that promote meaningful learning is concept maps. The Concept mapping as a tool has gained a lot of recognition and acknowledgement in science education, both in the practice and in the literature as well. But how concept mapping is seen in the teaching profession is the aim of this research and how much beneficial and effective concept maps are in teaching learning process. Interviews were conducted from teachers. Results of the study involving 10 teachers of international Islamic university revealed that nowadays concept map is an efficient teaching tool in the classrooms used by teacher and its effectiveness can be measured through prevailing learning environment, increased student participation and understanding level of students. It also shows the advantages and some perceived difficulties associated with concept maps. The research was descriptive and focused on the understanding and specifics of experiences. Results of study led to the conclusion that at higher level the university teachers need to be aware of new and interesting teaching tools as concept map which can leave positive effects on students learning and may be used frequently in the classrooms for providing better understanding.

Keywords: Concept map, Teaching tool, Classroom teaching, Assessment

Introduction

The learning process of the students can be enriched by a number of teaching-learning strategies which have been designed by outlining the role and characteristics of

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teachers, students and contents. Presently in Pakistan, classroom environment is mostly controlled by the teacher and the students are passive learners (Iqbal, 2011).

National Curriculum of 2006 emphasizes and stresses upon the standard shift to constructivism from the behaviorism to increase conceptual learning in science and to generate such attitude towards the learning of science. Thus, such teaching-learning strategies are the demand of curriculum that can involve pupils in building of their own knowledge and considers the students as the focus of learning activity, whereas the teachers as organizers in the classroom. Concept mapping approach comes under constructivism approach as described in David Ausubel's Assimilation theory of cognitive learning that focuses on increasing significant learning by students. This approach uses a shared environment in which students work independently and in groups as well to help each other in the process of learning (Oakley, 2004b).

Novak (2002) stated that Concept mapping refers to a visual illustration of important ideas or thoughts in the form of graphics or in pictorial form. It also let the learner to identify the relationships among isolated concepts in making an organized knowledge structure. Thus, conceptualization allows the learner to understand the global concept instead of isolated facts by promoting in-depth learning above the rote memorization.

Canas (2003) describes Concept mapping as a procedure of making out sense. It infers taking a list of concepts, that is selected by labels and then organizing it in a graphical illustration in which linking phrases and sets of concepts form propositions. Hence, the key of building a concept map is based upon the set of concepts.

Today concept mapping is generally and successfully useful in many fields of education, recently there has been a lot of investigation done on concept mapping in science education but considerable accomplishment has been achieved by the solicitation of concept mapping in the teaching learning procedure to assimilate fresh concepts into the current scheme of information. Benefits of concept mapping in teaching and learning of fresh information is that it also delivers a trail into better-quality assessment and accomplishment check. Concept mapping is also cherished when there is a requirement for free-association and knowledge organization.

Usefulness of concept mapping in education is that Concept mapping can be used at any stage of teaching process, it can be used at the start of the lesson where a new concept is about to be introduced or it can be used at the conclusion of the lesson for the sake of revision. It can be applied to the children in kindergarten; it can be used by the students in their universities and also by the professionals in their respective fields. The traditional methods of teaching like lectures and learning from book by rote memorization of evidences, concepts, and philosophies are being used generally in teaching learning process nearly in all subjects at every level of education in Pakistan,

regardless of knowing the merits and demerits of these. Now days researchers, educationists, curriculum planners and all the other people from academia have taken it very seriously, they are thoughtful on how they can improve the quality of science education and all other disciplines as well by the effective use of instructional methods.

Objectives of the Study

The Objectives of research were:

- To explore the perception of teachers about concept mapping in the teaching profession at university level.
- To explore the effectiveness of concept maps in teaching learning process.
- To explore the perceived difficulties associated with concept maps.

Significance of the Study

The significance of the study lies in using results to help researchers, teachers, curriculum planners and all the other people from academia about how to increase the quality and excellence of education by integrating concept map as a teaching tool.

Related Literature Review

Effectiveness can be defined as the degree to which an action achieves its aimed goal and purpose. It is the degree of the similarity between specified aims and attainments. The possibility to achieve easy and low-standard goals is always high. So, we cannot state that quality in higher education can only be a query of attainments but it should also include decisions about the defined goals. Effectiveness that measure the quality of the attainment of a precise educational aim or the degree to which a higher education institution can be expected to achieve specific requirements (Harvey, 2017).

For effective teaching the teaching tool or teaching material is the resource for a teacher that he uses to deliver his lecture. A teacher needs so many tools to make the student learn. The purpose of all these material resources is to deliver the knowledge to the students or learners and also to encourage and engage the student with knowledge in diverse ways to enhance learning. So, concept map is one tool which can help in effective teaching and learning.

Concept map

Novak, Gowin, and Kahle (1984) defined that the Concept mapping is planned to direct association between the concepts in form of schemes. Concept map is the uniformity in objects or events designated by a specific label. Concept maps are shaped with the wider more comprehensive concepts at the uppermost level of the hierarchy linking words with former concepts. Concept maps have their foundation in the learning program called constructivism.

Concept Maps in Education

If concept maps are correctly created it is a very strong way for students to achieve higher levels of cognitive performance. It is not just a tool for learning, but a perfect tool for the evaluation of educators to measure their growth and evaluating learning of students. As students create concept maps, they create ideas using their own words and help to 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 grip concepts fully.

Concept Map as a Teaching Tool

Lee at all (2012) stated that the usage of concept maps as a teaching approach was first developed by Novak in the early 1980's. It was resultant from Ausubel's learning theory which puts focus on the impact of students' previous knowledge on significant learning.

Safdar (2010) describes that if teachers learn how to generate concept maps and use them for preparation and measuring lessons they will be able to communicate students better how to create concept maps to establish their opinions and philosophies in the classrooms.

In specialized education the method of concept mapping is used typically for teaching and for assessment. We could not find the use of concept mapping for free-associating or information organization in the occupations so it does not mean the implementation is not there in the classrooms. Concerning concept mapping in specialized education the focus was on learning and the use of concept mapping as a knowledge tool. Concept mapping as a method was involved in lots of ways, instructional stages and activity practices. Furthermore, to use as a learning tool in professional education it is also commonly used as an assessment device. Concept maps are significantly used for assessments through which teacher can self-assess themselves.

Novak (1991) stated that Concept maps are repeatedly used as learning and study instrument in the sciences. Concept maps as a learning instrument used in the areas of biology, physics, engineering, nursing and algebra. Concept maps are also being used as a device to train pre-service and current working teachers. Because they involve little amount of written text and concept maps may be typically effective apparatuses for students with low verbal abilities.

Making concept maps at the conclusion of a unit or lesson is a more actual learning plan than using them to display concepts at the start of a lesson for student's long-lasting retention of the material (Nesbit & Adesope, 2006). Concept map should complete minimum three rounds of revision so that students can attain practice. They are more effective summary creation learning plans, such as making lists or frameworks and

to comprehend the associations between important concepts, may be likewise considered real.

Use of Concept maps in Teaching and Learning

Concept maps can be used for:

- Information construction
- Learning
- assessing students in shaping of their knowledge
- Evaluating students learning
- Recording understanding
- Problem resolving
- Application of knowledge
- Integration of knowledge
- Instruction

Concept maps are useful tools to help students learn about their knowledge organization and the process of knowledge building. Concept maps also help the student to learn manifold learning. Concept mapping necessitates the learner to inculcate at cognitive domain of bloom. Concept Maps have been used to check students' previous information and to keep stream line the student's progress of knowledge in entire development for matching and doing comparisons of students at numerous stages of knowledge.

Other uses of concept maps

Empirically based publications shown that concept maps have been used in quantitative and qualitative studies; in qualitative approaches used throughout all stages of the research process while in quantitative approaches used for data analysis. Concept maps can be used to construct experiences individually and in groups in data collection and analysis in qualitative research. Concepts maps can be used to collect, reduce, organize, and interpret data. Concept maps graphically demonstrated the concepts and connections in areas such as critical thinking and online learning.

Jackson and Trochim (2002) write about the use of concept maps as an alternative approach for the examination of open-ended survey responses. It gives a snapshot of perception and allow for the refining additional data collection processes.

Maxwell (2013) shows how to use concept maps to explain a conceptual framework Concept maps can help see unforeseen links, or to identify gaps in the theory and to determine themes.

Advantages and Disadvantages of Concept Maps

Advantages

The key benefit of this method is giving an influential depiction instrument to show compound relations between various concepts. Furthermore, he stated that problematic concepts can be explained and can be organized in a logical order. This helps teachers to convey a clear general picture of the topics and their relationships to their students. Usage of concept maps can strengthen students' understanding level and to learn more easily and effectively.

Concept maps helps in testing learning and pinpoint fallacies. The usage of concept maps can also be helpful for teachers in measuring the development of teaching. Concept mapping may be used to enhance problem-resolving phases of making additional solutions and ranges in the teaching learning process. Learning is also benefited from the interaction growing possessions of concept mapping evaluation. Students' achievement can be checked or surveyed by the technique of concept mapping, as the concept maps can also be used as assessment and evaluation tools in the classroom (Stoica, Moraru & Miron, 2011).

Some of the advantages described by Jackson (2002) are:

- Concept mapping signifies ideas or views from a large group of members in an easy-to-understand setup.
- It creates data that can be interpreted qualitatively or quantitatively.
- It pinpoints complex relationships with the help of graphic format.
- It is participant motivated.
- It is simple to implement and understand.
- Concept mapping uses an organized process that can be imitated easily.
- It encourages active participation.
- It can be done using computer software or using paper.

Disadvantages

- In the lack of an organized approach for creating concept maps, this approach can become confusing and difficult to read.
- Concept mapping includes only a high-level representation so it does not easily allow for the addition of detailed information.
- In concept mapping, it may be difficult to identify all the relationships between the concepts or ideas.
- Interpretation of the concept map data may require a knowledgeable organizer.

Methodology

Sample

The study was based on data collected from teachers of international Islamic university Islamabad. The participants of the study were from two departments of faculty of social sciences 5 from Education department and 5 from Economics department.

Data Collection Tool

Semi Structured Interviews were conducted to collect data for this study. The purpose was to check the usage of concept maps and how much beneficial and effective concept maps are in teaching learning process at higher level.

Data Analysis

Data were analyzed by generating themes after transcribing the data. The common recurrent and emergent themes were usage, effectiveness of concept maps advantages and disadvantages of concept maps.

Findings

Findings revealed that teachers mostly use concept maps in the classrooms according to the requirement of the topic. One of the respondents describes that making concept map is fun and enjoyable teaching tool in the classrooms and generally used at higher level according to the requirement of the topic. Whereas other respondents explained that concept maps are usually preferred to use wherever it fits into the topic.

Most often concept maps are used in the classrooms elaborated by a respondent especially while teaching following courses:

- Teaching of general science (pedagogy course)
- Teaching of English (pedagogy course)
- Science (content course)
- Philosophy of education (core course)

Concept maps can be used in other subject or any discipline because it depends upon the topic because it is the best tool to describe lengthy chapters in shortest form.

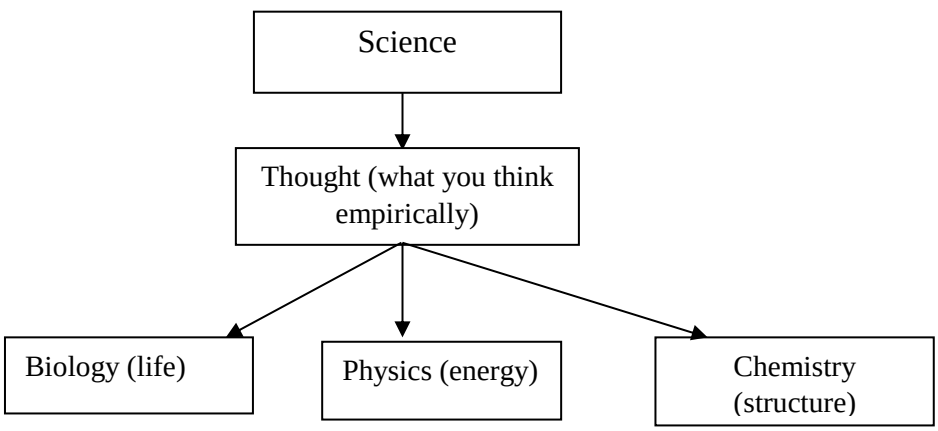
Two respondents explain the comfort level of using concept maps as they are easy to construct for giving graphical representation of the relationships or hierarchies; whereas one of them reported that Concept maps are used in Teaching of General Science as there are many concepts and topics which needs classification and organization so concept maps are helpful tool.

According to two respondents concept maps can be used in any topic because it helps the teacher to explain the content of the lecture easily. Visualization and images helps the student to enrich their information. Concept maps are better teaching material than words.

Furthermore, two respondents explain that using concept maps generates significant connections between the key idea and other related information. They can be used in the form of flowcharts. So, it has been found that Comfort level of using concept maps gives sound teaching experience for delivering the instructions in the classrooms.

As reported by one respondent that concept mapping allows the learner to identify relationships between compound concepts while increasing a consistent knowledge construction. Concept mapping while delivering the lecture promotes deep learning rather than rote memorization of the concepts in the classrooms. It helps learners to understand global concept rather than isolated facts. Presenting the topic in very systematic and hierarchical manner.it also helps in capturing the attention and thus maintaining readiness of students throughout the lesson and also supports brain storming phase of lesson delivery.

But two respondents describe that delivering the topic by concept map also helps students in the integration of new ideas out of old ones. However, two respondents also explain that the delivery of any concept by using maps is to give clear picture of the processes and relationships. It gives learners pictorial form which makes their learning easy and the use of concept maps in delivering the topic is to give more understanding of the topic. For example, science is a disciplined initiative that shapes and organizes information in way of testable clarifications and forecasts about the world. This description is understood by few students but if it is explained like the given figure

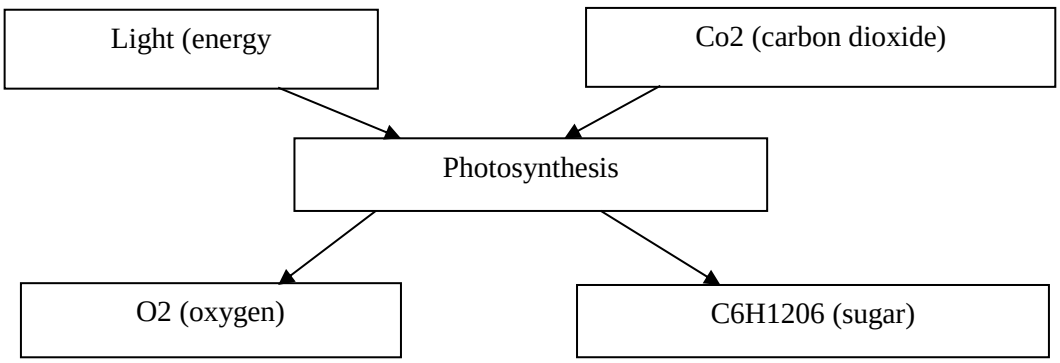


Science is thought what you think empirically. Biology is thought about life. Physics is about energy that how energy is converted from one form to another form. Chemistry is all about structures. So, by these students can easily understand the concept

of science as a subject that with how many branches it is dealing and there are three types of thoughts if we perceive science as a thought.

As far as we are concerned with concept map than it provides sequence while delivering the topic. Organization and grouping of topics provides clear picture to the learners. Dynamic feature of concept is flexibility while presenting the topic in the form of flowchart or in pictorial way and graphical outlet.

One of the respondents found the concept maps an efficient method or tool nowadays. The use of concept maps increasing day by day because it is easy way to explain. Trying to explain something that you have seen is difficult. So, if tried to explain it with diagrams and mind maps it is very easy. For example, the process of photo synthesis involves lots of procedure and process. So, students get the main idea using concept maps and can be explained like this way.



Other respondents were agreed that Concept maps are helpful in enhancing the cognitive level of the students and evaluating the understanding level of learners. Because the use of concept map is interesting it gives a whole picture in one single diagram and gives pictorial and visual demonstration of concepts. Concept maps very easy and effective because it reduces writing too much text on board but only a single picture can be drawn and verbal explanation may be provided.

Assessment is the course of collecting and deliberating information from manifold and varied sources so that to improve a deeper understanding of what pupils know, comprehend, and can fix with their information as a result of their instructive experiences in the classrooms. Two of respondents reported that assessment in education is extensive, variability of procedures and devices used to evaluate and assess the students. Asking students to draw concept maps can help teacher to assess the cognitive level of students and learners. Inductive and deductive concepts, similarities and

differences, advantages and disadvantages of any concept can be assessed through concept maps.

Brainstorming, previous knowledge testing can be done through concepts maps. Recapping the lesson or revising can also be done through it. Whereas one of the respondents put emphasis on using concept maps for assessment purpose because it is the easiest way of teaching. The teacher doesn't have to do all work or doesn't have to waste his/her stamina on minor matters. He /she can explain the whole situation just by few diagrams and arrows. If they are well arranged it can be used in any type of assessment.

According to one participant the most efficient method of teaching is the concept maps. It helps you to deliver the thoughts not just information. Its effectiveness depends on the person who is making the mind or concept map. For example, if you are trying to teach the students about some science project or information you can deliver all the information but it is not understood by students because their mind caliber is not on the same level of teacher. The teacher has to go through all the information and have done practices so it is easy to elaborate what you have seen.

Whereas one other participant explains that effectiveness of concept maps that it can be measured through increased student's participation in the classroom activities. Similarly, their readiness attention and improved performance in quiz, midterms, final exams, presentations and assignments are predictors of effectiveness of concept maps in teaching learning process. It can also be measured by evaluating the prevailing learning environment of class.

By viewing the objectives of the lesson that are being achieved than it would be easy to measure the effectiveness of concept map as explained by other participants. But two of participants while explaining effectiveness shared that it can be measured by the level of understanding of the learner using through various traditional and alternative assessment techniques. Effectiveness of concept maps relies on the evaluation and assessment.

Benefits and advantages of using concept maps cannot be denied. Concept mapping can be useful in many situations when it comes to understanding level of students, learning, memorizing, relationships, connections, main ideas and concepts, graphical understanding, organizing information, as a revision tool, easy to use, in student motivation, in developing meaning, in logical thinking. In developing hierarchical structures, works as visual learning aid, helpful in learning terms and definitions, and constructivism is huge benefit which leads to creativity.

It has been found by views of all the respondents that concept maps enhance comprehension and understanding level and helpful in checking prior knowledge and for reviewing the lesson. Linking theoretical concepts to practical experiences concept mapping is a useful device. Complex terminologies can be better explained as well as

quick learning takes place. Memorizing can be enhanced. Main ideas can be built effectively.

According to scientific research as reported by one of the participant that visual information is better to remember than other methods. He highlighted some advantages which are as follows:

- Associations and relationship between dependent and independent variable.
- It can be used as a revision tool because it has images rather than huge paragraphs.
- It has great impact on student's minds because they don't have to remember the whole lecture so lots of students are motivated by concept maps.
- It promotes logical thinking. Logical thinking through related justifications especially in analytical reasoning can be effectively implied through concept mapping e.g. research based concepts.

Interestingly two respondents quoted that:

"A picture has a worth of thousand words "

"It is not easy to forget something that you have seen with your eyes"

There are also some perceived difficulties associated with concept maps that were elaborated by three participants given as follows:

- Teachers are not well aware and well trained to draw concept maps. They don't know the importance and effectiveness of making concept maps. Awareness about nature and various formats of concept mapping is not clear among academia.
- Concept map in different subject is not common and some teachers are reluctant to use in their classrooms due to time constraints and resource unavailability.
- Inappropriate method or diagrams that are not meaningful makes no sense.
- There are many types of mapping mostly teacher's perceived difficulties which type of mapping should be used for the particular topic.

Discussion and Conclusion

Since 1990, concept maps have been used in many ways as a research topic in science stream. Kilic, & Cakmak (2013) have been proved under the validity, reliability and practicality of concept map as a method of teaching. The analysis and researches of more than 300 scientific articles about concept mapping shows that in professional education this method is more used in the subject fields which are directly connected to natural or exact sciences. The main idea of using the method is as teaching and learning tool, often combined with assessment tool. In most articles the faculty and students feedback are positive and the authors suggest the method of concept mapping for further use in classroom.

The result of this study is consistent with the views of Ausubel (1960) specifically the importance of pre-learning, the linking of new ideas to previous knowledge. And also with the findings of Kinchin (2000), Lewis (1987) that the Ausubel's teaching strategies found to enhance significantly the conceptual understanding of the students.

Data collected through interviews shows that concept maps are effective and mostly used tool in the classrooms in any discipline either Teaching of English, Teaching of Science, Philosophy of Education and in any content area. It provides comfort in delivering the topic using multiple types of mapping for multiple topics mostly in science. It provides sound experience to the teachers in transmitting knowledge to the learners. Concept maps plays a significant role for assessing students' performance. Teachers most often use concept maps for evaluating the students' performance to test that do students have main idea about the concept taught to them. Concept maps consumes less time of teachers so it has been found that most teachers often like to use concept maps for delivering the instructions. The study also sheds light on the effectiveness of concept maps and it has been found that nowadays concept map is an efficient teaching tool in the classrooms used by teacher and its effectiveness can be measured through prevailing learning environment, increased student participation and understanding level of students. The study also shows the advantages and some perceived difficulties associated with concept maps; everything in this world has some pros and cons depending upon the circumstances around so as far as concerned with concept maps they can be difficult to use because at all levels not only higher but primary & secondary the teachers are not aware of the benefits associated with concept maps they are stick to the traditional teaching tools. Construction sometimes can be challenging for complex topics but the benefits of concept maps cannot be denied.

The above discussion led to the conclusion that the university teachers need to be aware of new and interesting teaching tools as concept map, if teachers use this tool in the classrooms than it can leave positive effects on students' learning. It will help teachers to modify their instructions in easiest possible way and can enhance the students' learning.

Recommendations

1. There is a need of building up awareness about concept maps and its usage in the classrooms at higher level.
2. By keeping in view, the professional development of teachers they may have knowledge and skills to use such tools in the classrooms.
3. Teachers may be trained about how effectively they can deliver instructions to the students in the classrooms and can help in improving students learning by using concept map.

4. Teachers may use concept map as instructional strategy when the subject matter of a unit is hierarchical and basically conceptual and that this strategy be used for one unit at a time to lessen the cognitive load.

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