Turkish Online Journal of Qualitative Inquiry (TOJQI)
Volume 12, Issue 9, August 2021: 3838-3855

A Study on Significance of Concept Mapping in Conducting Research Work

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Abstract

This research study included a wide-ranging discussion of concept mapping. The mapping notion varies from traditional text coding approaches for interview analysis. It generates a clear cognitive core structure and focuses on preposition sets, which may be used to build significance. The concept map format is compatible with the perceived wealth of results of the interviews. The concept map is also used to provide more evaluation and improvement in teaching techniques and to create adaptive learning assistance in adaptive learning environments. The application allows students to compare one notion to another so that they are well-known in the concept map to resolve their mathematical problems. This research demonstrates how idea maps can be utilized to produce individual and cooperative exploration and teaching instruments for the instruction of study techniques. In recent literature, despite the enormous growth in qualitative research studies little emphasis has been paid to the usage of idea maps as a methodological research approach. Concept mapping is a realistic and well-timed means of identifying and quantifying variables influencing implementation. That develops conceptual implementation models, targeting areas as an integral component of implementation preparation and active implementation, and fostering stakeholder dialogue. Concept mapping is explained and an example of its application in an implementation study is given. The consequences of using idea mapping techniques for the distribution and implementation of conductorly health care are being examined both in research and in practical contexts.

Keywords: Concept maps, Qualitative research, Knowledge structures, Interviewing, Limitation of Concept Mapping, Retrospective CM.

1. Introduction

Visual approaches can be the main methodological tool used to organize and collect ideas for research and practice. Butler - Kisber and Poldma [1] in 2010 introduced collage making to assist practitioners and researchers from different disciplines both organizationally and individually. These strategies were introduced between ideas and visualize inter-relationships. Computer created visual coordinators to new theories in a meaningful way by placing sticky notes on walls at the brainstorming meetings of employees, filled white panels with words, cycles and lines at research conferences.

The need to evaluate and understand comprehensions of complicated issues led to the creation of different approaches. Few techniques are free form so that participants have greater scope in their

responses for creativity. The amount of data forms that were generated might make it impossible to talk about conventional conception maps to isolate the general features throughout the data. In line with the guiding concepts map used to described drawn in Novak's idea maps. A product of research concept mapping was led by Novak and his coworkers (Novak & Cañas, 2006) [2] from past 25 years or so.

Many efforts to establish programs and improve behavioral health care quality and outcomes could not fully achieve their promise due to a number of basic barriers in the execution process. Special emphasis has also been given to the identification and testing of processes and systems that assist or hinder the distribution and adoption of efficient practices in this "knowledge practice gap" [3-5]. There are several dissemination and implementation conceptual patterns which typically represent various stages, including pre-execution (i.e., adoption, preparedness), primary, dynamic, full implementation, and sustainability, as well as a number of levels such as system, organization or specific [6][7].

Concept maps are utilized in several ways from issue preparation and depiction, information acquisition and organization to data evaluation and performance as a tool for doing research. As instructors, it utilizes concept maps for research work and chose to perform a literature study to discover techniques that researchers used most often using "concept maps" to better conduct personal research and educated students. This research aims at identifying and analyzing present fiction in which idea maps were expressly used as a research technique.

2. Concept Mapping

Concept maps were established in 1972 in an attempt at monitoring and understanding changes in kid knowledge of science during Novak's study program at Cornell University [8]. It was evident during study that design map was beneficial not simply to depict a development in children's comprehension of the subject but also to convey their understanding of their classes as a tool to participating pupils. The popularity of concept mapping has rapidly expanded throughout the world and has been used by users of all ages and in all areas of learning to communicate the knowledge of a person in a field of knowledge.

The concept maps could be characterized as a sort of illustration; based on the theoretical and methodical orientations of the writer, the concept maps are nevertheless further demarcated [9]. These idea plans are usually developed by practitioners in their hands or by a computer software such as that through "Institute for Human and Machine Cognition", based on a constructivist philosophical perspective. In this scenario, the concept plan shows new concepts in a mindset that is how an entity, or a group develops on existing information. "Concept maps" also be constructed by several computer programs, which would automatically provide the practitioner. This scheme can assist the practitioner and researcher comprehend that how study regions are mapped visually. The proposals comprise two or more than concepts related by connecting phrases or words to build the consistent argument. There are also known as sensory or semantic units. Figure 1 indicates an instance of the CM explaining the makeup of CMs [10].

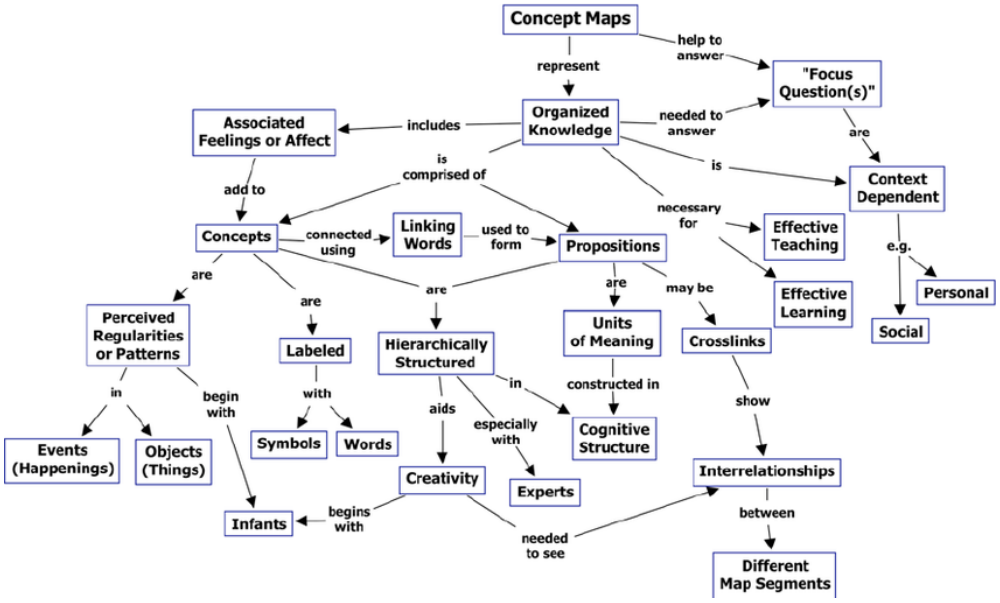


Figure 1. Concept map demonstrating the fundamental characteristics of idea maps. Concept maps are often read from top to bottom [10]

The above given figure lists "concept maps," "organized knowledge" and "focus questions" as ideas that are "represent," "needing to respond," linking terms, forming joint statements of the two proposals: “Concept Maps represent Organized Knowledge” and "organized knowledge is needed to answer focus question (s)".

Concept mapping is an approach for mixed methods which collects conceptual data from people on a specific issue and examines them statistically by means of multidimensional scaling and cluster analysis. The outcome is visual representations of complicated fields of knowledge which fulfil the standards of rigour and trustworthiness of social researchers, while being easily interpretable to practitioners. Conceptual mapping has been applied in several areas, including archaeology, psychology, and linguistics, effectively to deal with various substantial problems. In qualitative research, concept maps can also be utilized to build a category or classification system. As a technique, concept mapping was used to teach dentistry students [11] and engineering and technology students [12].

The researchers can walk across these maps to look for the hierarchy levels, the connections and recurring ideas that emerge from each interview. In combination with automated data analytical software, the category system developed must be employed. The actual data can be encoded, and concept maps can be linked or tagged to data samples after the category system is built. In the data processing process this connection and labelling again keeps the significance and study context of the participants central. The concept mapping has been significantly used in teaching, educators use this to demonstrate new ideologies, to demonstrate new learning students have used concept mapping [13].

2.1 Characteristics of Concept Mapping

“Concept maps” have special features that separate from other instruments for representing learning. Not all graphs with text in their nudges are “concept map” and the book (Web) is filled with graphics that are misrepresented as idea maps [14].

- **Propositional structure**

“Concept maps” represent the most important links among a number of concepts explicitly. The link phrases making proposals illustrate this relationship. For example, in Figure 1 the association among the ideas "Organized knowledge" and "Concepts" is indicated by the phrases "is composed of" which relate to it. The same connecting phrases are used in the proposal "Organized knowledge includes proposals". When building a concept map, one must take care that both ideas create a meaning, a claim, and a short phrase combined with their linking phrases. A concept map therefore contains a graphic depiction of a series of proposals on a subject.

Each idea map contains of the smallest number of words to represent the event or item; and the texts linked contain succinct a verb such as feasible. Linking words are not given a predetermined list. A preset list of terms would confine the users and entice them to pick from the list even if the list is not enforced, rather than trying to identify the link words that best represent the connection in line with their domain understanding.

- **Hierarchical Structure**

There is hierarchy in any field of knowledge of the ideas, in which the most general notions are at the top of the ranks and there are fewer broad concepts. According to this conceptual hierarchy, concept maps tend to be visually Hierarchical. If figure 1 is closer to the top of the hierarchy, as the more generic idea is mapped in context, the concepts “Focus Question(s)”, “Associated Feelings or Affect” are more usually while children, creativity and Experts continue to be more hierarchical. This makes it possible that idea maps are read from top to bottom. Note that this does not indicate that concept maps must be visually hierarchical: concept map of the water cycle might be cyclic, but in a concept map the concept map still has a “conceptual hierarchy” of priority and effect. This does not mean that idea maps only need a single "root" notion — more than one might exist. It has discovered, however, that it becomes simpler for the beginner to understand how concept maps are created by maintaining the concept maps hierarchically with a single root [14].

- **Focus Question**

A Focus Question, which clearly sets out the problem that the concepts map should help to tackle, is a useful method to create the framework of a concept map. Each concept map answers an issue of focus, and a solid focus may lead to a significantly richer idea map. When learning how to develop concept maps, students prefer to distinguish themselves from the focal topic and to produce a concept map which is connect to the domain. This is in the sense that the map will presumably address another focal issue, and therefore this should represent the focus question of the map. Concept Map Tools offers the focus issue field as part of a concept map information, and the focal question is shown on the window header when a map appears, explicitly giving the viewer the focus

question. It is necessary to make the learner return and build a “concept map” that answers to the initial focal question in the case of school-learning environments.

- **Cross Link**

The addition of cross-links is also an essential feature of the idea maps. There are linkages or connections among concept in various areas and areas of the “concept map”. “Cross-links” enable to find how a notion is connected to another field of knowledge on the map in one domain. Cross-links typically suggest imaginative rises on the part of the creator of information while creating new knowledge. There are two aspects of idea maps which make the creative thinking easier: the “hierarchical structure” reflected in the great map, capacity to seek used for new linkages and to describe them. In Figure 1, see how both "Kindergarten" and "Interrelation" are connected to the notion of creativity and create cross-links in each of the subdivisions of that concept map.

- **Theoretical foundation**

Concept maps are founded on the theory of assimilations of Ausubel [15] and Novak theory of learning, a strong psychological and epistemological foundation, which explains the way in which people learn innovative things by applying knowledge and search for ways to integrate the already known new knowledge and related knowledge. By integrating this new information with ideas, which is already comprehend, new concepts are integrated in cognitive knowledge system. Thus, cognitive framework a concept map shows graphically these links between concepts. For a quick explanation, see the accompanying paper How people learn, while the document Psychological Fundamentals of Human Learning details the theoretical underpinnings of idea mapping [14].

2.2 Composition Prodigious Concept Map

An area of knowledge that is very identifiable to each building map has to be created while studying a concept map. Since CM structures rely on how they are used, a document, lab or field operation part or a specific challenge or query should be defined properly. This gives a sense which helps to evaluate the “hierarchical structure” of the concept map. The choice of a modest region of information is useful for the initial idea maps.

Every CM reacts to a good focus and focus issue leads to a much stronger CM. When learners learn to create CMs and create a CM that is somewhat related to the field but does not solve the issue, they often wander from the focal topic. It was also said that “the first step to learning about anything is to ask the proper questions”.

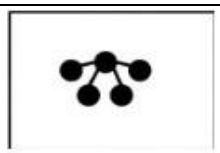
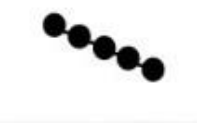
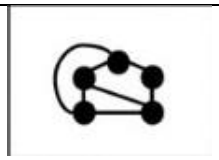
In many segments or fields of information there are relationships between ideas on the map which show how these fields are related. It is essential to help pupils comprehend that all concepts are in some manner related. Thus, it is necessary to be careful and as exact as possible to locate link words that connect concepts in the identification of crosslinks. "Box sentences," meaning whole phrases used as definitions, should also be avoided, as this generally indicates that from the box argument an entire part of the map may be generated. Once students focus on excellent words and uncover good linkages, they may understand that every idea can be related with every other concept. This also generates some fury and must also consider the most popular and very advantageous relationships.

"Concept mapping" is a simple technique to create extremely elevated levels of cognitive efficiency if the procedure is executed correctly. This is also an excellent approach for evaluation [16] by mapping the definition. Finally, update the map and rearrange concepts and produce a "final" map in ways that give a better overall organization, and coherence. So, it notes that CMs are a strong instrument for collecting, interpreting and archiving information and a powerful tool to generate new knowledge.

2.3 Concept Maps and Interviews

"Concept mapping" is effective for demonstrating knowledge. To show structures of intellectual knowledge to compare the learning process in different phases. The qualities of "concept maps" made them too familiar tool for assessing and promoting learning, which is also a helpful instrument in the armory of qualitative researchers. Excellent tools are often offered for obtaining information and the related noise that provide essential points within "interview transcripts". The idea maps are supported by quality and quantitative analysis and help to point out links and configurations within data, as shown in table 1. [17]

Table 1: Features of the three types of basic idea map morphological [18]

Parameters	Spoke	Chain	Network
Structure			
Hierarchy	Single level	All stages like ideas (but often these are unsatisfied)	Various acceptable levels
Additions	Accompaniments to the central concept do not impair others	Additions at the start of the series cannot be dealt	Additions and removals have different impacts, as the map frequently provides alternate ways
Deletions	In general, the overall structure has little influence until the core (organizing) notion is removed ("which leads to complete collapse")	Disrupt the series below the deletion	
Links	Frequently simple	Compound often (creating reason only when the map is read as a whole)	Complex and frequently rich showing deep understanding
General	These structures	These are 'active'	These are 'academic'

	show "preparedness to learn". They are versatile and can modify the learning environment	structures. Specific sets of activities have to be put out sequent in companies or healthcare practices	structures. They typically entail changing lives and even contradicting views

This approach has been adopted by the authors through structured research interviews for recording of data utilizing a structured approach concept mapping. The interviews and concept mapping are used to understand the difficulties of the research topic by stressing the way respondents assume it in a context. "The conversation to acquire research-related information is the following:

a) At pace and non-alarming tone ask the questions and lay weight on certain words that would aid the participant in understanding the question clearly.

b) Pay attention to whole reply.

c) By using non-directive prompts and probes make sure the respondent answers in full.

d) Recording the answers.

e) Ensure that they have been acknowledged by the interviewer and prompt more nuanced comments-feedback responses.

2.4 Retrospective Concept Maps

The "interview transcripts" were interpreted by the original interviewer into retrospective concept maps, which were closest to the interview content except for the responder. Since, after the interview data were collected the idea mapping was carried out instead in the interview method. Any reinterpretation of the reactions of other people certainly has a subjective component, but the notions have always been clear enough to ensure that a concept cartoon is defined readily, and the linkages were nearly always adequate to give the required details. Another information investigator has built idea maps using the same evidence as an independent test (and created on the other complicated reactions). Except for slight variations in idea labelling and distinct links, the "concept maps" in the interviews and other researchers were very similar. Because many respondents evaluated this area in terms of links and interactions, it has been beneficial to pick information to be used and to focus on the job. The translator of the complicated complex or topic area under study is likely to require more expertise in other possible mapping fields, and hence more opportunity for variants to be interpreted [19].

3. Epistemological Foundations of Concept Maps

The philosophical sector is epistemology, which addresses the essence of information and latest information production. There is a significant correlation among learning psychology and the increasing unanimity among epistemologists and philosophers that acquiring new information is a pleasant activity that incorporates both knowledge and feeling.

The building blocks are concepts for information in every field. In addition, there is an endless number of different molecules. When new artefacts or situations are created and experienced by individuals, creative people would generate new ideas and new information. Introducing new techniques to observe or document events typically brings up new opportunities for the development of fresh knowledge. For instance, the expansion of the "concept mapping" process for documenting the topics understanding resulted in new chances to investigate the learning process and to build new knowledge [20].

4. Concept Maps for Qualitative Research

There are various benefits to the purpose of the "concept maps" in "qualitative research". First, the maps support researchers to preserve the significance of the interview during the data processing. The wealth of the participants meanings can often be lost when look at an interview transcript. This meaning can be preserved since the interconnections are displayed on a concept map. Transcripts tend to depict the spoken language in a linear way, while interconnected and hierarchically, the maps convey the interview data. Concept maps generated from interview transcripts allow the researcher to examine human cognitive structures and, in the framework of proposals, to depict them through the connection of concepts. Secondly, the maps are beneficial because they reinforce the philosophical foundations of qualitative research and help to implement this philosophy in the process of data analysis [19]. Third, idea maps also contribute to reducing the data load, showing links and facilitating cross-group comparisons and site comparisons. In addition, participants can return the maps and participants can be requested to check the map and make sure that the researcher understands and communicates exactly what the participant discusses. Finally, idea maps are a qualitative technique for data analysis that can be employed in the same study for other strategies. The maps, for example, can be used to facilitate the building and categorization of coding and matrixing systems.

Qualitative analysis reveals that intervention improves the inspiration of students and improves active involvement in the construction of personal knowledge. The results revealed that the students' intervention unit worked better than the control group (CG). During the interviews, pupils should correct their connection. CMs are very helpful in providing relevant and effective learning to medical students. For participants who are unaware with the format, maps can be difficult to interpret. Other data analysis procedures in conjunction with the maps are most frequently required. Moreover, the complexity often makes it difficult for the reader to discern the important ideas and the subsidiary notions.

5. Limitations of Concept Mapping

It is improbable that retrospective concept maps based on interviews are generally useful, as with any technique. Certain conditions are not likely to perform well in this method.

a) When the interview is not concentrating on concepts and connections.

b) When respondents do not properly articulate ideas and relationships (although this is rarely necessary if the interviewer has competence).

c) When it seems that the reply has purposefully distorted the concepts and linkages.

d) If the interpreter does not grasp the respondent's world or the subject under discussion sufficiently well.

e) When the inquiry prescribes a pattern.

Some of these restrictions could be overcome by confirming that every design map created is common with the defendants as an incentive for clarification and amplification [21].

6. Review of Literature

This segment contains the discussion of the reviewed literature and summary of the research that are already published**.**

Moon B. M., Hoffman R. R., Novak J.D. & Canas A.J. (2011) [22] studied the expanding application of Concept Mapping included its role in knowledge elicitation, ideation, and institutional memory preservation. With the introduction of the "Concept Map-Tools knowledge modeling software kit, Concept Mapping is being applied with success to address a variety of problems and increased frequency in the workplace".

Xie and Sharma, (2011) [23] created concept maps with the help of a blogging mapping tool. All over the six-month period blogs were published, each post was accompanied by at least five key words and nine graduate student participants connected their key phrases to the concept map. The study focuses on the search of models for participant's identification, integration, and reflective learning evidence.

Van Manen et. al. (2012) [24] studied "patient characteristics to pertinent treatment selection for patients with personality disorders". It describes the data collecting and analytical phases employing idea maps such as: concept generation, concept and statistical analysis and interpretation.

Maxwell (2013) [25] illustrates how concept maps are used by drawing together the implications of the theory, its restrictions and its usefulness for research to illustrate a conceptual framework or theory. "Concept maps" can assistance to identify unintended linkages, flaws and contradictions and to identify ways of identifying issues. The challenge of using idea maps is that a paper trail of attempts is not automatically created.

Thomas et al. (2014) [26] investigated the Constructivist Strategy improves the effects of integrated science pupils. The research included a total of 200 participants from grade 8. A psychometrically integral test was utilized for the creation of non-equivalent control group and emotional achievement. The findings showed that the adoption of the constructivist strategy increases impacts. The findings also showed that psychosocially conductive pupils had better emotional outcomes than their peers in a non-conductive setting. There were no significant interaction effects between the factors. There was no substantial difference in emotional performance among high and poor cognitive performers.

Frazelle and McNallen et. al. (2014) [27] said that "concept maps" were used in past research by Baugh, from 1925-1965 "the history of Mary Breckenridge's Frontier Nursing Service". In this research, her experience has been used to analyze current concerns about universal access to health care. The concept mapping has shown itself to be a useful way to gather, minimize and arrange large amounts of historical data. Morrison used the idea maps of participants as a graphical illustration of

concepts and links in 2006, as an effective method for readily understanding the illustration and presenting the research information. The concept mapping was used to provide a framework for doing research.

Baugh, N. et. al., (2014) [28] were utilized "concept map" in the past research to related to the develop a gestalt data analysis and inter connectedness. Like a coding system, the relationships between concepts and comparisons of data between concept maps of the researchers have been utilized. Data synthesis and interpretation came after the process of organizing and gathering data; although researchers reported their results along the way, a synthesis of data emerged when linkages and connections were established. The advantages revealed by idea mapping are analysis clarity, intellectual rigor and facilitated conceptualization. The researchers' knowledge and the significance of the data have been described on maps.

Toraman & Demir (2016) [29] aims to perform meta-analysis of the effects on student attitudes to lessons in previous research using the Constructivist Approach and to evaluate its findings. The researcher used a methodology for meta-analysis to group comparable studies with specified criteria and to combine the results. The study results showed that students who have taught Constructivist studies have a more favorable attitude towards lessons than the control group in which students have conventional ways of learning. Only substantial variations were found as moderating variables in study participants. This was concluded when studying students' views was examined. Overall, there has been a favorable attitude to technology courses or science over mathematics and other disciplines. The results of the research are shown to have increased suitability for using the Constructivist learning approach by the nature of science and technology courses.

Olanrewaju and Friday (2017) [30] explored the impacts of concept mapping approach on student's accomplishment and retaining in mathematics of "senior secondary school" two students in Ekiti state, Nigeria. Pretest-Posttest Quartz Experimental was the design for this review. The investigative population of the Ado Local Government Area of Ekiti State, Nigeria, comprised all high school level mathematics students. The sample included fifty (50) pupils, each of whom chose a sum of 100 students from both Ado-Ekiti secondary schools. One school was chosen carelessly for the exploration, but the other for the "Control Group (CG)". The test group has been taught using the concept-mapping approach while the CG has been taught regularly.

Venkatesh (2020) [31] investigated to the influence of "concept mapping" on the self-directed learning of "secondary school physics students". The effects of the research revealed that these was an important alteration in the mean values of the self-directed learning of the investigational group regarding students of the control group from before to following the test. The results reveal that the students from the experimental group who employed mapping of physics definitions had improved their self-determination in physics learning and were more self-directed learners than those who did not use the control group. Therefore, the concept mapping makes it possible for kids to learn physics themselves.

7. Research methodology

7.1 Research design

This analysis used descriptive analytical approaches. Descriptive analyses are an important first stage in the performance of statistical studies. It provides us with an understanding of the distribution of data, helping us to identify outliers and types and allows us to identify variable relationships so that prepare for additional statistical analyses. These are the strategies employed to explain the impact of globalization on corporate cooperation.

7.2 Data Collection Strategy:

Initially, the data was gathered via an interview in order to investigate the issue of how globalization affects corporate cooperation. Secondary information on the effect of globalization in working as a corporate team was acquired via journals, internet, books, magazines etc.

7.3 Pilot Study:

The aim of this research was to check and identify the tools used in the survey. The link to the poll was given to about 50-60 persons for the completion of the pilot study. The pilot expectation enhanced the polls and contributed to the evaluation of the sample size of the study.

7.4 Analysis of Data:

"SPSS (Statistical Package for the social sciences)" is the package used to accomplish statistical analysis. SPSS is the data editing and analysis program for all types. This information might essentially emerge from any cause: statistical analyses, a customer database or even log files on a website's server.

7.5 Sampling:

The unexpected way of sampling was used to get the answers from the participants. The self-administered issue has been distributed and participants have been asked by Facebook, social media, email, Twitter, WhatsApp to take part in the survey. Members were also invited to provide the survey URL to their affiliated networks to collect more data.

7.6 Sample Size:

The sample size used for the research was 200 respondents.

7.7 Tools Used:

To study the data collected through polls, different tools were used. For the compression of massive data, a descriptive analysis, such as mean and standard deviation, was used. For the graph of data and information, various types of charts have been utilized. Several parametric and nonparametric tests were also applied for testing different theories, such as the "Chi-square test", regression test and "Analysis of Variance (ANOVA) Test".

8. Result and Discussion

Many interviewees recognized that the use of Concept Mapping (CMs) to better understand and apply mathematical principles, but that CMs did not contribute to the improvement of the application of these concepts to problems. These main themes were conflicting experiments that gave an insight into how definitive mapping might be used more effectively, given their concern about mathematics

and experience as adult students to link their needs. The students constructed a sequence of CMs during the course to show their increasing mastery of introduction mathematical topics. Participants saw in many ways the use of CM for first math's learning. The application of "concept mapping" enhanced the understanding of some individuals, hindered the learning of others, and had no meaningful effect on others. They were mostly interconnected with their qualities as adult learners. Typical aspects of adult learners who may have impacted the experience in concept mapping included past experiences in mathematical study, their acquired research patterns and methodologies, their problem-centered approach to learning, their perception of concept mapping, and time limitations. There were also several facets to the effect of conceptual mapping and early mathematics and preconceived effects.

Some pupils felt and exhibited a better ability to understand and articulate fundamental mathematical ideas. A majority felt that their capacity to connect and connect mathematical ideas affected the relational frameworks of concept mapping. Nevertheless, most did not understand the impact of idea mapping on the application of mathematical concepts for problem solving and data analysis.

Concept map is often used in quantitative methods to explain, show, and communicate outcomes; compare before and after behaviors; depict data connections; gather participant-generated ideas; create, sort, score, and analyze findings. According to results, mixed techniques approaches appear to be common. Concept maps can be useful productivity tools for the adult-educator-scholar while doing solo and collaborative study. Concept maps may be used as instructional aids by adult educators while teaching Research Methods courses and assisting students with their dissertations.

8.1 Students' Experience Using Concept Mapping to Learn Mathematics

At the start of the semester, students showed a general willingness to attempt concept mapping. Participants with concept mapping expertise saw the opportunity to coordinate their interpretation of the new concepts they anticipated learning. The idea of something that could help them navigate the maze of mathematics was accessible to other participants who were nervous about the course. Students witnessed the use of concept mapping for studying mathematics in different ways as the term progressed.

Table 2. Perceptions of the experiment group on concept mapping.

Serial Number	Perceptions	%
1	Concept mapping helped me clarify the interrelationship and integrate among curriculum contents.	97
2	Concept mapping assisted me in learning mathematics.	97
3	Concept mapping could be new mathematics learning approach and teaching.	95
4	Learning method for concept mapping encouraged me to learn to think independently	95
5	I will think utilizing concept mapping in learning mathematics.	95
6	I think the concept mapping approach could be simply utilized in more	95

	curricula.	
7	I was gratified with utilizing the concept mapping in learning mathematics.	90
8	Concept mapping helped me enhance my interest and reduce the barriers in learning mathematics.	89
9	I enjoyed utilizing concept mapping to help me in learning mathematics.	84
10	I may easily be adapted to concept mapping.	58

8.2 Positive Aspects of Experience

By the use of concept mapping, students experience an enhanced awareness of mathematical concepts. Some participants thought that by collaboratively constructing the charts, a fuller and more productive experience with concept mapping could have been achieved. The findings indicate that those students who responded well to the usage of CM in the course may have experienced more advantages than those who did not use the technique comfortably. Some of the students who were found to be comfortable with the concept mapping methodology, as demonstrated by the discussion of their previous and current experiences with concept mapping and the complexity of their CMs, suggested that CMs helped their ability to understand mathematical concepts and to connect mathematical ideas.

8.3 Negative Aspects of Experience

The use of concept mapping in the study negatively affected some students. Within and outside the study space, students shared views of concept mapping as a waste of time. Some students have found concept mapping in dissonance with their learning style, study patterns, or time constraints. These students also displayed student resistance in some way. Furthermore, some students have searched for ways to make concept mapping important to their daily or educational lives. Some (though not all have preferred to concentrate on problem- solving techniques that may or may not have involved concept mapping.

8.4 Neutral Aspects of Experience

Some students portrayed the use of CMs as having no significant impact on their mathematics learning experience. They saw it as neither aid nor a disadvantage to their process of learning. Students accustomed to a traditional teaching or learning method may not be comfortable with new methods or may not benefit from the extra time and effort needed to introduce the new approach. Some other students regarded the definition maps as evaluations. As a product for outside review instead of a method for significant learning or metacognition, they approached concept mapping.

8.5 Concept Mapping and Relating Mathematical Concepts

Mathematical concepts were viewed as a major advantage and a major obstacle to the use of CM in the learning of math. The integration of thinking in mathematical reasoning and data analysis are challenging factors. Some students have found the chance to connect new ideas via concept mapping to their existing knowledge. The integration of ideas and situations was considered the beginning of mathematical literacy. Some other students who claimed they had difficulty learning the ideas of

mathematics saw the links they required to map their notions more fully. Some students realized their capacity to connect research concepts holistically was undermined by their usage of concept mapping. Progressive mapping enabled them to develop understandings and integrate their information more meaningfully. Many students have shown difficulties representing ideas in their maps, and some have stated that they do not think their understanding of mathematical concepts has been properly represented in their CMs because of this issue. The creation of suggestions is an extremely difficult skill in design mapping which is enhanced by experience.

8.6 Concept Mapping and Applying Mathematical Concepts

Students who considered concept mapping useful in applying mathematical principles demonstrated that concept mapping's organizational advantages provided them with a guide or a set of instructions on how to apply relevant concepts to problem-solving. The fact that these maps are student-generated can influence the participant's problem-solving abilities since the learners have actively integrated their individual information systems.

8.7 Implications for Practice

The results of the research demonstrate the potential to improve the study of idea mapping in introductive mathematics. Concept mapping may help certain students relate mathematical ideas that can aid in the development of mathematical thinking. Although studies show that students did not see the ability for concept mapping to help them integrate concepts, they studied the effect of helping students solve problems by visualizing the information structures required to solve problems. They studied more integrated concept mapping and problem solving. This combination of idea mapping and problem solving may be used in individual and group settings. The idea maps may be produced together in conjunction with a group issue solvent activity. When a new thought or idea is utilized in the issue solution process, the node for this concept may be created on the map. In the issue solution process the next step or concept is then linked to the CM, and a plan would be developed. In this manner, the CM is organized with the iterations of the issue solving technique. Additionally, the efficiency and usefulness of more options and assistance for reviewing design maps. Participants remarked that they needed to make modifications to their charts to reflect their view of how the ideas were correctly linked. You also observed that connections have been changed over time to include fresh concepts into your existing map. Providing students several options for updating their subject maps helps students to distinguish ideas, identify and fix gaps and misunderstandings in knowledge and integrate information.

The findings of the research also recommend the employment of different techniques of mathematical learning. The varied views and emotions of participants regarding using CM for mathematical learning may be based on how individuals learn mathematics in different ways. Some participants highlighted their unique ways of learning in line with or in contradiction to concept mapping. The table below shows pupils in both an experimental and a controlled group the ability to comprehend mathematics.

Table 3: Students' Mathematical understanding Among Control and Experimental Groups

Statistics	Groups	
	Control	Experiment
The number of students (n)	100	100
Average	44,85	56,51
Standard deviation	15,69	14,18

Normality test of the learners' capability to transmit mathematical understanding data determined by the Chi- Square test. In the table below, it can see the full test outcome.

Table 4: Normality Test Calculation Outcome

Group	N	x^2_{obs}	x^2_{table}	Conclusion
Experiment	100	4,78	9,47	Normal distribution
Control	100	1,76	9,47	Normal distribution

It could be inferred based on Table 3 that the distributions data of the mathematical understanding skill of students in the experimental class and control group are normal distribution. The homogeneity test was conducted utilizing the Fisher test, and the outcomes of the measurement are in Table 5 (below).

Table 5. Homogeneity Test

Group	n	F_{obs}	F_{table}	Conclusion
Control	100	1.58	1.73	Variance
Ecxperiment	100	-	-	homogenous

H_0 is accepted because of $F_{obs} < F_{table}$ (1.58<1.73), which implies that all sample groups have the identical mor homogenous variance.

Built on the hypothesis testing conducted, it indicates that the capability of learners to understand mathematics with the definition mapping learning approach is greater than the average capability to understand mathematics by using traditional learning approaches. As follows, to test the hypothesis: H_0:$\mu_1 \leq \mu_2$ and H_1: $\mu_1 > \mu_2$.

The outcomes of the measurement, meanwhile, indicates that $t_{obs} > t_{table}$ (3,300>1,669). Thus, H_0 rejected i.e, the average capability to understand mathematics in CG is lower than experimental group. To sum up, the effects of the t- test is in the table 6 (below).

Table 6. hypothesis test outcomes along with t-Test

Group	n	$\bar{x}$	S.D.	t_{obs}	t_{table}	Conclusion
Control	100	44,85	15.69	3300	1669	Reject
Experiment	100	56,51	14,18	-	-	H_0

The findings of the research showed that the post-test average in the test class was 56.51. The post-test student score at intervals 52 - 60 is equal to 36.11 percent. However, there are around 38.89 percent of pupils whose results are higher than average. The average post-test score in the CG was

44,85. The post-test score for the student in 43 - 53 intervals is equal to 30.56%. The pupils that score above average amount to around 27.78%.

While the percentage of children who have scored better than the normal second grade rate indicate a lower rate, there are significant changes in the experimental group's average post-test score is 11.64 percent higher than in the experimental group. This indicates that the method of learning via a map definition impacts students' mathematics understanding. Scholars have examined several factors that differentiate between the typical class and experimental class:

1. The learning process in the classroom.
2. Concept mapping generated by students.
3. The mathematical understanding capability of students.

At the first meeting, a private meeting took place in the experimental class. The training procedure proceeded extremely well when the teacher gave a map of the beginning of the subject. Students in this lesson hesitate, however, to ask questions if no recognized objects exist, but students also seem less brave to pass on an idea. This may be because it is still adjusting to the new environment of learning.

This further involves learners and makes it harder to improve their results, especially with regard to the element of the mathematical relationship. Similar conditions occurred at the commencement of the CG meeting in the CG as in the experimental group. The students did not participate much throughout the whole learning period. This scenario was prompted by many factors, which may possibly be caused by the period of change. In the following meeting, the students started the learning process by speaking for the facilitator to the teacher. The group discussions are usually held in the control classes in the study mathematics and in experimental courses to show their enthusiasm during the discussion.

It is conceivable because pupils believe that the learning events are undergoing a new revolution. Therefore, they were not very happy with the discussion, which affected the presentations of the current community. Just a few students tried to convey the results of the discussion to the class. Creation of a CM would enable students to review the topics presented at that time and attempt to connect the CM with the other CMs produced during the previous meeting. The students attempted to classify the ideas. It is component of a broader idea. It turns out. This simplifies the storage and processing of data for learners.

9. Conclusion

Concept maps play an important part in understanding complicated situations in a more basic way. The definition map is the basis of their work in a single, studying conceptual structure. By deleting methodological techniques, it can also limit the analytical opportunities. In research investigations, the concept-mapping was utilized for analysis, sub-categorization, and categorization to enable readers to see how various approaches intersect with the needs of researchers. Concept mapping is positioned within mixed and quality approaches. Researchers can generate and construct and integrate new ideas that have already been recognized via concept mapping. This is vital to explain the methods necessary to retrospectively use this method and to effectively re-submit data (whether to encourage or conduct creative coding interview respondents, as mentioned previously). Second, it

suggests in a standard research interview or in the context of a separate research evidence collection activity, to analyze and assess the processes involved in administering design maps with the respondents (includes questions like how the interaction with each responder should be carried out and recorded efficiently).

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