EFFECT OF CONCEPT MAPPING ON LEARNING EMPOWERMENT OF THE LEARNERS

Researcher

Sadia Naz

146-FSS/PHDEDU/S18

Supervisor

Dr. Munazza Mahmood

Co-Supervisor

Dr. Shamsa Aziz

DEPARTMENT OF TEACHER EDUCATION

FACULTY OF EDUCATION

INTERNATIONAL ISLAMIC UNIVERSITY, ISLAMABAD

2024

EFFECT OF CONCEPT MAPPING ON LEARNING EMPOWERMENT OF THE LEARNERS

Researcher

Sadia Naz

146-FSS/PHDEDU/S18

Supervisor

Dr. Munazza Mahmood

Co-Supervisor

Dr. Shamsa Aziz

DEPARTMENT OF TEACHER EDUCATION

FACULTY OF EDUCATION

INTERNATIONAL ISLAMIC UNIVERSITY, ISLAMABAD

2024

EFFECT OF CONCEPT MAPPING ON LEARNING EMPOWERMENT OF THE LEARNERS

Sadia Naz

146-FSS/PHDEDU/S18

This thesis is submitted for the partial fulfillment of the requirements for the degree of Ph.D. Education at

DEPARTMENT OF TEACHER EDUCATION

FACULTY OF EDUCATION

INTERNATIONAL ISLAMIC UNIVERSITY, ISLAMABAD

2024

Dedication

This dissertation is proudly dedicated to the people who serve as an inspiration, ensure the quality of education, drive social reforms, and work for the betterment of society.

SUPERVISORS' CERTIFICATE

This thesis entitled as Effect of Concept Mapping on Learning Empowerment of the Learners by Sadia Naz Reg. No. 146-FSS/PHDEDU/S18, in partial fulfillment of the requirements of Doctor of Philosophy in Education, has been completed under our guidance and supervision. We are satisfied with the quality of the student's research work and allow her to submit her thesis for further process as per IIUI rules and regulations.

Signature: _____

Supervisor: Dr. Munazza Mahmood

Signature: _____

Co-supervisor: Dr. Shamsa Aziz

APPROVAL SHEET

EFFECT OF CONCEPT MAPPING ON LEARNING EMPOWERMENT OF THE LEARNERS

By

Sadia Naz

146-FSS/PHDEDU/S18

This thesis has been accepted by the Department of Teacher Education, Faculty of Education, International Islamic University Islamabad in partial fulfillment of the degree of **PhD Education.**

Supervisor: _____
Dr. Munazza Mahmood

Co-Supervisor: _____
Dr. Shamsa Aziz

Internal Examiner: _____
Dr. Zarina Akhtar

External Examiner I: _____
Prof. Dr. Muhammad Imran Yousuf

External Examiner II: _____
Dr. Munazza Ambreen

Dated: _____

_____
Chairperson
Department of Teacher Education
International Islamic University
Islamabad- Pakistan

_____
Dean
Faculty of Education
International Islamic University
Islamabad- Pakistan

ACKNOWLEDGEMENT

Gratitude is to the Lord, the Almighty, the Self-Sufficient Master, and the Creator of the Universe, who granted me the prospect of undertaking this task. I would also like to express my earnest appreciation to my professors, chairperson, mentors, and, more particularly, my research supervisor, Dr. Munazza Mahmood, for her spontaneous propositions and firm support during the growing process of the research study. I am indebted immensely to her for her kind support, supervision, and critical observations during different segments of this research study. She instilled in me the value of effective student leadership and assisted me in developing my reasoning, knowledge, and writing through insightful inquiries.

I am grateful to my co-supervisor, Dr. Shamsa Aziz, for her nurturing and mentoring. Her incredible ideas, suggestions, assistance, and generosity significantly helped this research succeeded. She is righteous and full of human love. I would credit my entire family before naming them. My compassionate mother helped me through every difficult hour. Their confidence in me kept me driving. My elder brothers were my right and left hands. This expedition was made possible by their encouragement and morale. I am grateful for my wonderful philanthropic sisters who never disappoint me in hard times. They gave me energy and passion. Towards the end, I would like to thank my endearing husband, who tapped me on the shoulder whenever the need arose. He morally and psychologically stimulated me to undertake this difficult task. His benevolent words and soft-spoken sentences in favor of my cause brought my mission to a successful end.

Sadia Naz

ABSTRACT

The study examined how the concept mapping teaching strategy affects learning empowerment in the context of Educational Research. Further, this study aimed to determine the retention of learning empowerment as a result of intervention through concept mapping. Prospective teachers of BS programs were the target population of the study. The study was experimental. An equivalent time-series experimental design was used. Prospective teachers enrolled in Educational Research were comprised of the intervention participants. They were exposed to the treatment for one semester. At the data collection stage, two approaches were used. Quantitative data were collected through the Learning Empowerment Scale (LES), while qualitative data comprised interviews with prospective teachers. For quantitative data collection, LES was administered four times to complete the experimental Equivilant Time Series. As LES was administered four times, four forms were devised. Students' responses on LES were recorded before, during, at the end, and after the interventions. Two measurements were taken during intervention time. The mean and dependent sample t-tests were used to analyze the data. Interviews were recorded and transcribed for qualitative data. Quantitative data findings showed improvement in the mean score, which indicated the positive effects of concept mapping on learning empowerment. Likewise, themes extracted from qualitative data aligned with the subdomains of the learning empowerment scale. The connection of the findings section showed that interviews support the perceptions of the students recorded on LES. It was recommended that a concept mapping strategy be used to gain empowerment in learning.

Keywords: concept mapping, learning empowerment, research, retention.

TABLE OF CONTENT

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS AND ACRONYMS

ADDIE	Analysis, Design, Development, Implementation, and Evaluation
BS	Bachelor of Science
CPD	Continious Professional Development
HEI	Higher Education Institutions
ID	Instructional Models
LES	Learniner Empowerment Scale
OECD	Organisation for Economic Co-operation and Development
ZPD	Zone of Proximal Develoment

CHAPTER 1

INTRODUCTION

Besides the learning process, students need to understand the learning process as well as their areas of strength and improvement. In 21st century education, the emergence of ideas like reflective practices, self-directed learning, and learning empowerment put more emphasis on students' roles and highlighted their pivotal contributions to the learning process (Mythry et al, 2024). The students of today learn and think in different ways than those of the past; thus, previous approaches are not relevant to them. Neither are they relevant to the evolving workplace, where applying knowledge is now far more crucial than merely knowing it. Schools are failing to teach students to respond to rapid change and handle new information. Seven criteria for successful pupils were outlined in the report. Among the list, 'choose their hours' is related to the learner's decision-making. As a result, students must equip themselves to make decisions regarding their education. It is a shift that has been brought about by modern educational theories. The Organization of Economic Development and Cooperation (OECD) introduced the term 'learner agency' where agency implies a sense of responsibility to participate in the world and, in doing so, to influence people, events, and circumstances for the better.

The agency requires the ability to frame a guiding purpose and identify actions to achieve a goal (OECD, 2018). Concerning the resources of knowledge available, learners must opt for ways and techniques that are well suited to them. Learners' understanding of themselves and knowledge of learning approaches are important for making decisions about learning. The same views were forwarded by Pond and Rehan (1997) and Mitra (2008) that in future learning environments, students will be more expected to take

responsibility for the learning process. According to Michael and Modell (2003) it is expected that students in higher education are adult learners, which gives them some control over the process rather than just participating in it. There is a need to change the existing setup of the classrooms as research brings innovations in the roles of teachers and students (Bhandari, 2021).

Meaningful approaches enable learners to make connections in their learning. Previously learned concepts may be upgraded by linking them with newly introduced concepts. The (United Nations Educational, Scientific and Cultural Organization [UNESCO], 2014) report on sustainable education provides five pillars that will support the objectives of sustainable education. The first of the five pillars is 'learning to know'. Learning how to learn is an aspect of these pillars. It focuses on making the learners aware of knowledge, ways of knowing, and meaningful learning. The meaningfulness of learning is linked to sustainable education (UNESCO, 2014). The graphical representation is a strategy that is considered a way towards meaningful learning. It is a way to display knowledge and demonstrate relationships among various domains of the content in diagrammatic ways.

This kind of information display is employed in education to support deep learning strategies. The use of graphical representation to improve knowledge and learning has been demonstrated by empirical research. Graphical representation engages people to draw meaningful and complex relationships. It is also noted that concept mapping is effective when there is a complex set of relationships. It clearly illustrates the relationships using graphics, making things easier to understand (Schultz, 1991; Cronin, et.al, 1992; Baumann & Bergeron, 1993; Ojima, 2006). Research is essential to a country's growth process. It

results in creativity and serves as an investment for the future. Knowledge-based economies prioritize investing in research and inventions to ensure better future opportunities.

However, it is not free from the challenges of the modern world. The project report of the Higher Education Commission titled Report on The Decade Performance of Research and Development in Pakistan highlighted issues and challenges faced by Higher Education Institutions (HEI) in research. As per the study, poor coordination between academia and industry is the primary cause of the failure of the HEI. As a result, the research findings are irrelevant and do not fulfill the requirements of the field. Moreover, the research outcomes do not provide significance for implementations in the field of education. Inappropriate dealing with research at the teaching level in higher education institutions also creates hurdles (Kumari, n.d.).

The quality of research conducted in Pakistan is very low (Hassan, 2016). The way of dealing with the courses related to research is a cannon for enabling students to acquire independent conceptualization in research. Instructors of research courses observed that students' concepts regarding "research" play a pivotal role in how they approach learning methodological material, and since they are not well-equipped and trained for research skills, traditional approaches to the teaching of research should be replaced with conceptual paradigms (Ross & Dennis, 2017).

Future-based learning aims to maximize the exposure of the learners and make them more engaged and responsible for their learning. Modern education shifts responsibility from teachers to students. As a constructive paradigm of learning, students are more exposed to the creation of knowledge than its acquisition and, hence become

independent learners. This approach meets the future demands: bringing education 'out of the box' to fulfill the requirements of the labor market and make the learners more learned and potential members of society. Future-based learning is a holistic approach that bridges the existing conditions of education with the future demands of society (Elmore, 2019).

Recent educational theories have brought about changes regarding the concept of learning, the learning process, and learning outcomes. According to Canning and Callan (2010) educational theory has taken on an interest beyond conventional pedagogy. It focuses on adult-related approaches to learning. The concepts of Andragogy (self-directed learning) and heutagogy (self-determined learning) have emerged. This has caused a shift from learning to empowerment. It has encouraged students to take control of their learning and made them more engaged and involved in reflective practices. The components of this education are self-awareness, competence, emerging ideas in the mind, and self-based investigation. It results in the development of ideas that arise from one's cognitive ability (Blaschke, 2012).

Driscoll (2023) reports that most students are still being taught in the same way they were in the past, through standardized curriculum, rote learning, and personalized testing at a one-size-fits-all pace. A lot of students are struggling to learn because they are disengaged and lack motivation. Why go to school when you could learn the same information faster by watching a YouTube video or playing a computer game? Why memorize facts for a test when you have all the information in the palm of your hand anyway?

In the field of the graphic representation of knowledge, concept mapping is one of the approaches used to enhance learning and draw relationships. Concept mapping

technique is a multipurpose technique used in education. It serves various functions. One of its functions is to be used as a learning tool. As a learning tool, it is effective as a cognitive strategy. It stimulates learning by organizing and visualizing information. As a result, learners become empowered to control and regulate cognition (Mayo, 2010).

Learning empowerment is one of the aspects of the umbrella term 'empowerment'. Empowerment via learning is associated with learning, control, and regulation of learners and, consequently, their sense of self-efficacy and confidence in that particular area of learning. Several studies have examined learning empowerment as both dependent and independent variables. Learning empowerment affects communication, and communication affects learning empowerment. The teacher's communication influences the sense of empowerment of the learners (Conger & Kanungo, 1988). The study aims to see learning empowerment as the dependent variable, i.e., how it works in a learning environment where concept mapping is used as a learning approach. Concept mapping is characterized by meaningful learning as it establishes linkages among the concepts and represents them graphically.

Although much of the research has been conducted on concept mapping as an independent variable with relation to academic achievement as a dependent variable, the proposed study aimed to empower postgraduate students in research by making them more aware of and able to connect different concepts in the research methods course. The utilization of concept mapping in teaching has been implemented for this purpose. Concept mapping engages students to make graphical linkages. It produces meaningful learning and gives students the ability to make suitable connections.

The present study took a “Research Methodology” course at the BS level. The course is compulsory at the graduate and postgraduate levels. Students were required to complete individual research projects to achieve the degree. To complete research projects successfully requires a sufficient understanding of the subject on the part of the learner. Previous research illustrates that meaningful learning enables students to take control and regulate their learning, which is achieved through concept mapping. Concept mapping constitutes a substantial means of building learning empowerment in students (Paulsen & Feldman, 2005).

1.1 The Rationale of the Study

Based on the previous studies reviewed about changing roles of teachers and students the expectations in the field of education have significantly changed worldwide. The role of the teacher and students may need revision to meet the changing demands of education. Learners are more exposed to acquiring knowledge through multiple learning platforms. Educational theories, such as cognitivism and constructivism, focus on the active role of learners in constructing knowledge, problem -solving, and critical thinking. By understanding how our minds process information, we may empower ourselves to take control of our learning journey. Cognitive theories emphasize learner autonomy, metacognition, and self-regulated learning, which all contribute to learning empowerment. They should be able to control and regulate their learning. Likewise, the role of the teacher is not merely to enrich the learners in academics, i.e., in terms of grading, but to give them an actual understanding by inspiring, guiding, and supporting students on their learning journey.

To develop these skills in the learner is of paramount importance in modern educational theories. In the context of current academic practices, research is one of the important subjects to be taught along with the practical implementation of its methods in the relevant fields. Research subject is a compulsory course required at the post and undergraduate level. In every field of academics, scholars are expected to add new dimensions to the existing field of knowledge. Research is a practical activity and needs meaningful connections in its various components. Research scholars face challenges in forming these meaningful links. Research works, especially those of novice researchers, show a lack of logical connections among the different components of research studies. Researchers' incompetence is a general issue when carrying out outcome-based research studies. This study was carried out primarily to provide aspiring instructors with approaches that would empower them. Another reason for conducting the research was to enable teachers to conduct research through concept mapping strategies.

1.2 Statement of the Problem

In the current era, knowledge, research, and innovations have a significant role in contributing to countries' development and economic growth. Future researchers should be empowered to do research through pedagogical intervention. As learning paradigms shift from engagement to empowerment, Graphical representation is considered one of the teaching tools for making meaningful connections among concepts. As a result, learners gain power and take control over their learning. In the previous literature, little to no evidence was found that may increase learning empowerment through pedagogical interventions. Hence, the present study was carried out to investigate the effects of concept mapping on learning empowerment during research.

1.3 Objectives of the Study

The objectives of the study were to:

1. measure the level of learning empowerment of the learner before, during, at the end, and after the removal of the concept mapping intervention.
2. compare the level of learning empowerment of the learner before, during, at the end, and after the removal of the concept mapping intervention.

1.4 Research Questions

Four research questions were developed to address objective no 1 and one research question was developed for qualitative phase of te study.

1. What is the level of learning empowerment of the learners before the intervention?
2. What is the level of learning empowerment of the learners in the middle of the intervention?
3. What is the level of learning empowerment of the learners at the end of the intervention?
4. What is the level of learning empowerment of the learners after the removal of the intervention?
5. What are the students' perceptions of improvement through concept mapping?

1.5 Research Hypotheses

To achieve the second objective, following hypotheses were formulated. Three hypotheses were formulated for each of the subscale of LES and the last three were formulated for the overall LES.

$H_{01:}$ There is no significant difference in the mean score of meaningfulness subscale of learning empowerment of prospective teachers before the intervention and at mid of the intervention.

H_{02}: There is no significant difference in the mean score of the meaningfulness subscale of learning empowerment of prospective teachers before the intervention and at the end of the intervention.

H_{03}: There is no significant difference in the mean score of the meaningfulness subscale of learning empowerment of prospective teachers before the intervention and after withdrawal of the intervention.

H_{04}: There is no significant difference in the mean score of impact subscale of learning empowerment of prospective teachers before the intervention and at mid of the intervention.

H_{05}: There is no significant difference in the mean score of the impact subscale of learning empowerment of prospective teachers before the intervention and at the end of the intervention.

H_{06}: There is no significant difference in the mean score of the impact subscale of learning empowerment of prospective teachers before the intervention and after withdrawal of the intervention.

H_{07}: There is no significant difference in the mean score of competence subscale of learning empowerment of prospective teachers before the intervention and at mid of the intervention.

H_{08}: There is no significant difference in the mean score of the competence subscale of learning empowerment of prospective teachers before the intervention and at the end of the intervention.

H_{09}: There is no significant difference in the mean score of the competence subscale of learning empowerment of prospective teachers before the intervention and after withdrawal of the intervention.

H_{010}: There is no significant difference in the mean score of learning empowerment of prospective teachers before the intervention and at mid of the intervention.

H_{011}: There is no significant difference in the mean score of learning empowerment of prospective teachers before the intervention and at the end of the intervention.

H_{012}: There is no significant difference in the mean score of learning empowerment of prospective teachers before the intervention and after withdrawal of the intervention.

1.6 Significance of the Study

The findings of the study would be helpful for the prospective teachers to improve their conceptual understanding of the research course, as the concept mapping teaching and learning strategy has more engagement power than traditional teaching methods. The study would be helpful for teachers' educators to uprade their instructional practices by adopting more empowering pedagogies. The findings of the study would be helpful for curriculum developrers of teachers' education programme to add concept mapping as instructional strategy. The findings of the study would be used to train teachers in concept mapping techniques who will serve a diverse population of students.

The study was conducted on concept mapping with new variables of learning empowerment. It would be guide future researchers to work on learning empowerment with other variables. An original contribution to knowledge and content is the distinctive feature in the study area of the effectiveness of concept mapping in Educational Research. The findings of this study would provide ways to integrate concept mapping with existing practices of teaching Educational Research. Similarly, the findings would enable learners to be self-directed in completing the assigned tasks.

Concept mapping is generally used in science subjects at the school level. The present study took the learning area beyond science, and the sample was taken from university students. So the study is likely to bring new dimensions to the use of concept mapping. Mostly, experimental studies are conducted using true and quasi-experimental designs. This study used a time series, which would be add novelty to the field of research. The findings of the study would help educational administrators to inculcate concept mapping approaches into the curriculum of teacher training programs. The training sessions would habituate teachers to the use of concept maps.

1.7 Delimitation of the Study

At the time of the research conducted, the Institute of Education and Research had three badges or current sessions of students, and the total population was 59. The Institute of Education and Research offered admissions three times during sessions 2019-2023, 2020-2024, and 2021-2025. The study was delimited to students at Women's University Mardan enrolled in the course Research Methods in Education, session 2019–2023.

1.8 Operational Definitions

1.8.1 Learning Empowerment

Learning empowerment is the learners' attitude regarding taking control of the learning process and learning environment. Three aspects of learning empowerment, i.e., impact, meaningfulness, and competence, are taken from the literature for this study.

1.8.2 Concept Mapping

Concept mapping is defined as paper-based concept mapping. It forms meaningful connections in knowledge domains of research. In the present study, the researcher utilized three types of concept maps: spider, hierarchical, and flowchart.

1.9 Conceptual Framework

The conceptual framework is the diagrammatic representation of the dependent and independent variables and their relationships with each other. It is a roadmap for the researcher and reader to approach the process of the study. It shows the links and procedures for measuring the variables of the study (Gratton & Jones, 2004). The study included two variables: concept mapping (the teaching approach) and learning empowerment. Concept mapping is independent, whereas learning empowerment is a dependent variable. The dependent variable of learning empowerment was further divided into three categories, namely impact, meaningfulness, and competence. Women University Mardan was selected through convenient sampling. All the teachers registered in the course of Research Methods in Education were participants in the study. Prospective teachers were exposed to concept mapping for one complete semester, whereas their learning

empowerment was measured at different times, i.e., before, midway, end, and after the removal of intervention through concept mapping.

Figure 1.1

Conceptual Framework

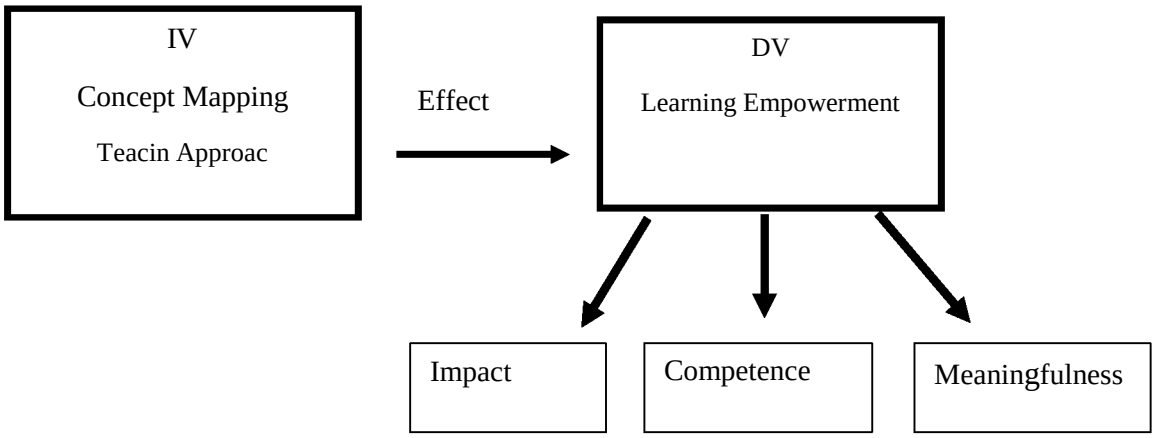


Figure 1.1 shows the methodology of the study. It reflects the procedure of how the analysis is carried out. It depicts data collection in four time slots before, during, and after the semester (study period).

1.10 Theoretical Franework

Concept mapping has a solid basis to learning due to its connection with learning theories. According to cognitivist theorists, learning results from internal and external factors (Piaget, 1953; Ausubel, 1968; Gagné & Briggs, 1974; Vygotsky, 1980). They believe that world perception and understanding largely depend on one's contact with the environment. They also support life experiences in the world's perceptions. Individual perception is the function of contact with the environment and previous experiences. Moreover, a person's perception can be changed as a result (Driscoll, 2014).

Theories of meaningful learning and schema based on environmental factors guide learning speed and quality. Environment and ways of exposure to the environment shape memory and perception. The same thoughts were forwarded by cognitive psychologists. The way you approach knowledge shapes your perception of the content. Therefore, an overview of cognitive psychology is necessary for discussing meaningful and schema theory views on learning. Researchers studying cognitive development focus on how people remember, interpret, think, talk, approach problems, and develop as they get older (Driscoll, 2014; Gagné & Briggs, 1974; Schuck, 2004; Piaget, 1953). Non-observable aspects of internal capacity like motivation, beliefs, and wants are also taken into account. Based on cognitive theories, learners grasp information by naming, interpreting, and relating new knowledge with previous experiences.

They then sort everything into categories and decide whether to keep it or throw it away. Cognitive capacities rely heavily on working memory and long-term memory. At any given time, our working memory can only hold a certain quantity of information. In terms of space for memorization, long-term memory is considered more potent than short-term memory. The first one has memory and limitless space. In the memorization of facts, information, and other fields of knowledge, it is argued that repetition, rehearsal, and application of concepts help to preserve them in long-term memory. Cognitive theory argues that significant connections must be created with new knowledge to increase the likelihood of its recovery ((Driscoll, 2014; Schuck, 2004; Gagne & Briggs, 1974; Ausubel, 1968)

The developmental perspective analyses how a student develops through time (from birth to adulthood). According to developmental theories, each stage of a human's

existence has its start and finish as he moves through different phases based on his age. Moreover, learning occurs gradually and continuously throughout our lives (Driscoll, 2014; Schuck, 2004; Vygotsky, 1980; Piaget, 1953). As children grow older, they display varied behaviours depending on their developmental stage. Piaget worked on four processes. In the very first phase, assimilation takes place in the learning process, followed by accommodation. Accommodation is the process of changing one's previous worldview after acquiring new knowledge. When accommodation reaches its maximum, then equilibration occurs. If the process disconnects at any stage, then learning cannot take place. Integration at every stage is mandatory for appropriate learning. After seeing an object for the first time, children may refer to it as the same. When this happens, assimilation takes place.

A person who is adapted goes through a complete mental transformation. Suppose that same child is told that zebras are mammals, not horses. If the child remembers this information, it means that the child's schema worked, and as a result of this modified schema, the child can classify animals accurately. This stage is called the accommodation stage. If a child reaches the accommodation stage, in the previous case, they can recognize animals correctly, so the information is retained in their long-term memory. Therefore, the accommodation stage of Piaget's theory is considered a milestone for shaping an individual's long-term memory. During Piaget's education, he felt that the learner had to choose between assimilation and accommodation, which he refers to as "equilibration." When the learner's prior knowledge, which is based on previous data, corresponds to the new knowledge, this is called equilibration. He is credited with inventing the term

"schema" as the first psychologist to do so. The term "schema" refers to a mixture of how things are arranged.

CHAPTER 2

This chapter is based on reviewing relevant literature and research regarding concept mapping and its influence on educational and learning outcomes, academic achievements, and attitudes. The researcher tried out to provide a base for taking concept mapping as an intervention for learning empowerment by using different educational and learnin g theories.

2.1 Introduction

In the first section of the chapter, the definition of concept mapping, its scope and types, and its use as an independent variable are discussed, followed by empowerment, its scope and functions, and explicitly learning empowerment. Next in the chapter, the researcher has established links between concept mapping and learning empowerment. This section is further elaborated and supported by Ausubel's Meaningful Learning Theory. The following section is based on the measurement of empowerment, specifically learning empowerment. The literature review consisted of eight parts:

Part 1. Research Competence

Part 2. Prospective Teachers' Research Competence

Part 3. Issues Related to Research Competence

Part 4. Research Culture in Pakistan

Part 5. Concept Mapping, its scope in research, types, and influence as an independent variable

Part 6. Empowerment, learning empowerment, measurement of empowerment

Part 7. Ausubel's Meaningful Learning Theory and its provision of the basis for learning empowerment through concept mapping.

Part 8. Learning Retention

2.2 Research Competence

A research course is an integral part of the graduate and postgraduate program. The course is offered at the BS level in Higher Education Institutions in Pakistan. It aims to enable the students to complete their research projects in the BS program and empower future researchers with knowledge, skills, and the development of their attitude toward practical research. Studies have revealed that the development of research skills in the institutes of higher education is the urge of the day. The main task of university education is to train professionals to bring innovations and modifications, and for this reason, research endeavors are prioritized, and a vibrant research culture is maintained.

New planning and policies must be proposed in order to achieve the goal as mentioned earlier. These precautions must be taken while completing coursework. The foundational area of competencies, such as gathering data and producing significant and worthwhile outcomes, is methodology. After that, the research students will be qualified to make a pertinent recommendation (Aguirre, 2016). Furthermore, the study also demonstrated various research competencies along with the academic reading and writing skills of the university students and future researchers. Since a considerable amount of attention is required from educationists in higher studies, research-oriented skills are needed for students of higher education with the ability to conduct research studies in such a way that may support the education system and reshape and rebuild as per emerging trends (Castillo-Martnez & Ramirez-Montoya, 2021).

2.3 Issues with Conducting Research

In this section of the literature review, the researcher introduces significant challenges reported in previous research studies. The following are the issues related to conducting quality research:

Hassan et al., (2013) highlighted the following issues related to the overall research quality and specifically about the teaching of research in academic institutions. Among the various causes of the lack of quality research, he also mentioned inappropriate pedagogy. Research is a practical subject that requires skill application, but it has been observed that it has been limited to note-taking and memorization in our academic set-ups. The following issues were addressed:

- The education system lacks research-based activities.
- The teaching system relies on the typical lecture format, providing notes, and students' dependence on teachers.
- The revision does not take place relevant to the content, notes, and lecture mode.
- Students are free to choose their research area while they do not have expertise due to the lack of guidance.
- Supervisors' consultation is not up to the level required during topic selection.
- The supervisor is not assigned on time, and students are not well-informed at the beginning, which leads to issues like students' interests do not align with the supervisors'.
- Supervisors are not knowledgeable about the issues raised by research, system, structure, and research procedures.

- Unequal allocation of research scholars is also one of the problems in our research culture. This causes frustration and restlessness in students as well as supervisors.
- Appropriate time allocation on the part of the supervisor is another challenge. Due to this factor, students are deprived of proper guidance. This adversely affects the quality of research.
- There is a lack of an appropriate channel and means of communication regarding the point mentioned above.
- Lack of awareness of the current findings in the area is also one of the problems on the part of the supervisor.
- Monetary benefits are the reason for taking research and not conducting research in an absolute sense.
- Students are not well-informed about how to consult with their supervisor on their research and how to incorporate supervisors' feedback.
- Most institutions lack documented plans, written procedures, and deadlines for submission.
- Lack of institutional support is evident.
- Documentation and written formalities associated with the research procedure cause the system to work at a slow pace.
- Statistical inexpertise on the part of students results in demotivation of the students for research.
- Students do not know how to utilize libraries for research-related activities. It is also a problem, especially with undergraduate students.
- Libraries are not diligent in performing their role in the facilitation of research.

- The role of the librarian is also essential in research activities. However, they are unaware of the process of searching materials and how to access different sources.

2.4 Research Culture in Pakistan

Quality research is hindered by many factors. Hassan et al., (2013) identified two issues in teaching research subjects in institutions: first off, it is not followed by the subject demands; it is treated like a theoretical subject by providing notes to the students and, secondly, by reading materials given to students lacking in comprehension based on old interpretations of concepts.

A study was conducted to address the advancements in the research sector in Pakistan. The study focused on various areas of research that directly or indirectly impact research growth in Pakistan. In the section on how to improve the quality of research, it was observed that the majority of faculty involved in teaching and supervision of research under the head of the faculty had little exposure to and capabilities in the study (Ahmad, 2017).

2.5 Empowerment

Rapoport (1984) noted that it is not easy to consider empowerment in action, while it is easy to define it. It is contextual because empowerment takes different forms and meanings in various contexts. So, in this way, a solid definition of empowerment is also lacking. Precisely defining constructs like empowerment is not an easy task; it involves much subjectivity. In this regard, Zimmerman (1984) has stated that an open way of explaining the concept of empowerment may cause the issue of subjectivity, so a single and specified definition may overcome the issue of subjectivity and make it an objective

phenomenon. The same view was also discussed by Bailey (1992), namely that defining empowerment is subject to the person and subject to the organization.

In the process of empowerment, individuals gain power, influence others, have control over their own lives, and have access to resources. In empowerment, one considers a high caliber level for individual and collective levels of aspiration (Robbins et al., 1998). From the perspective of social reformers, empowerment is a social and multi-dimensional process. In this process, individuals and groups can gain social control over their own lives and those of others. The enhanced status of empowerment benefits not only the specific individual but also communities and societies (Czuba, 1999).

Empowerment is a set of four cognitions that reflect a person's perspective on their work: meaning, competence, self-determination, and impact. Meaning is where a person's beliefs, values, and actions align with the requirements of their work roles. According to this definition, the four cognitions may be the following (Wach et al., 2016):

- Competence is the self-belief in one's ability to succeed in their job duties.
- Self-determination is being able to decide what actions to take.
- The impact can be defined as an individual's ability to influence outcomes at work related to strategy, administration, or operation.
- Empowerment comes from within and manifests in decisions.

Empowerment is the process of taking control of a situation. A program that is aimed at empowering participants should provide opportunities for increasing their abilities and confidence. The term 'empowerment' refers to a process of conferring authority and status to an individual or group of people in a specific scenario (Collis Dictionary, 2021).

Both individuals and organizational groups may be affected by the empowerment process. So, individual students and class activities can be affected by empowerment processes. Self-directedness is the main component of empowerment. It enables an individual to be an independent learner and improve his learning process.

Empowerment is a shared discipline. It can be observed in community development, the field of psychology, teaching and learning, trade and economic matters, and also in the social development of individuals and groups. The concept of empowerment is understood differently discipline-wise. That is the reason for assuming the meaning of empowerment contextually rather than taking one specific definition. Empowerment is a perception that may vary from person to person and organization to organization.

2.6 Empowerment in Education

According to UNESCO (2018) empowerment is the process of engaging individuals and communities in the learning process where they create, cooperate, and share knowledge. To improve their own lives and those of others, they design and develop various techniques. They involved communities in the process rather than taking sole responsibility.

2.7 Learner Empowerment

Learner empowerment also refers to task motivation, and the features of empowered learners are that they are always involved in meaningful tasks. They have the sense of competence to perform them and believe that they can influence their surroundings (Frymier et al., 1996). If such behavior is persistently exercised by a teacher, it will

eradicate the sense of powerlessness and replace it with a sense of responsibility, meaningfulness, ownership, and self-efficacy (Schulman et al., 1995).

Table 2.1

Studies on Empowerment

Number of Studies on Empowerment	Time	Targeted Area
96	1974-1986	Including the root word "Empower"
686	1887-1993	Business
861	1974-1994	Sociology based
66	1966-1981	Management
2261	1982-199	Human Resources
	2010 onward	Education

Students develop a positive attitude and emotion towards learning and take most of the learning process seriously. Throughout this process, teachers play an active and influential role. They engage in the construction of this particular form of good sentiment towards education. Teachers have a crucial role in empowering kids. Essentially, the teacher's duty should not be limited to one student but should be distributed across the entire class in order to provide attention to each individual . Learner autonomy and empowerment are both terms that have the same meaning. Learner autonomy is a shift of responsibility from teacher to learner. It also refers to a self-directed learning approach.

Empowering classrooms requires teachers who design a class environment where students are actively engaged and participative (Brunson & Vogt, 1996). This type of class

is designed based on students' needs and interests. The purpose of empowerment is to enable the students to take responsibility for their learning and take corrective actions (Burant, 1999). Autonomous learning focuses on a responsibility shift, and that shift occurs from the teacher's side to the student's side. It covers all the learning processes. Due to recent trends in education, learner autonomy is mandatory for future empowerment in learning. A study revealed that the concept of learner autonomy is universal. Autonomous learning is also a legitimate learning mode for Thai students with no extreme cultural incongruence between Western countries and Thailand (Swatevacharkul, 2009).

Empowerment in students results in an awareness of the learning process. They may pave the way for learning by becoming more aware and empowered. Theories connect the concept of empowerment in lifelong learning to the concept of meaningfulness in education. Meaningful learning enables the learners to apply classroom knowledge in real-life contexts. The scope of lifelong learning is seen in educational as well as professional settings. Especially in a professional setup where learning takes place in laboratories and is directly applied in the field (Kirby et al., 2010). Empowerment is often considered the building block of that process or the result of that process (Spencer, 2019). Learner empowerment is an umbrella term. It is multidimensional. It covers aspects of the learner's life. Their self-efficacy, communication, and control over their learning

Autonomy is exercised in at least five different ways (Benson & Voller, 1997). First, it is used in a situation in which learners obtain knowledge independently. Second, it involves skills that learners can acquire and apply to their learning. Third, it is a capacity that can be developed through learning. Fourth, it is a learning responsibility assumed by learners for their learning process. Last, it means that students have a right to shape and

direct their learning. Therefore, future learning may depend on the learner's self-concept. Self-concept refers to lifelong learning. It is well-established that autonomous students are observed to exhibit more responsibility and take greater initiative. However, the empowerment process takes place due to the participation of both teachers and students. Students are conscious of their learning. Moreover, teachers encourage students to take independent actions and do not threaten students' autonomy. Longworth (2003) forwarded the same views on shifting roles in the learning process that the ownership of learning falls on students instead of teachers.

Researcher called it a 180-degree shift of power in the context of learning in the modern changing requirements in the field of education. The idea of a teacher as a sage on stage was abolished, and mode as a guide is at the emergence. It means not to stop the teacher's role but to change and reshap. Learner autonomy involves a series of steps, one of which is the selection of an activity plan. In all processes, learners' self-perception is most important. Here, the role of educators helps learners gain empowerment by encouraging them to step in with the selection and planning of activities (Ponton et al., 2005).

The philosophy behind empowerment is to develop learning habits in the students. Autonomy keeps students more responsible. Another feature of the empowered learner is the ability to present more self-regulatory practices, such as self-control and self-efficacy (Cleary & Zimmerman, 2004). Moreover, empowerment occurs due to meaningful and lifelong learning. Today's classrooms require more on the part of the learners. It's not only sufficient to participate in the learning activities, but they also need to make decisions about their learning and for their education. They feel empowered by the whole process of

learning. One crucial factor aiding the process is timely feedback, and it is the responsibility of the teachers to inform them of their understanding and improvement. It is also part of the empowerment process that learners should give feedback to their fellow learners and suggest ways of improving. It is a way to encourage and build confidence among the students (Novak, 2013).

Kabeer (1999) explained that empowerment is the attitude and ability of the people that enable them to make choices that they previously denied and ignored. Another tout regarding learning empowerment is that we often focus on student engagement, but student empowerment is a step further. The focus shifts from the teacher's role to the student's contribution resulting in empowerment (Spencer, 2019).

The process of empowering students is tied to their attitudes; it is appropriately structured and takes into account cultural differences. Students so acquire the ability to decide for themselves and control the educational process. Empowered learners have an impact on their learning and also the learning of their fellow learners throughout education. Mok (2006) explains the critical components of student empowerment: empowerment through involvement and empowerment through partnership. Firstly, student empowerment is possible only through active participation in their learning, and the best ways to empower students are to allow them to be prearranged and to let them make their own decisions. Secondly, student empowerment is not a one-party activity. It requires genuine understanding and acceptance on the part of the school authority, including teachers and administration. Without teamwork, student empowerment in the school setting is impossible. In this regard, empowering students is essential, and they should have confidence in the knowledge and skills they possess.

Thomas and Velthouse (1990) reported the novelty of the said concept in an educational context, and they urged researchers to explore the concept with new variants and impacts through research. Based on the previous work done by Conger and Kanungo (1988) they identified empowerment as an intrinsic motivational attitude regarding assigned tasks. This attitude requires some specific environment where the learners feel more energetic and ready to accomplish the task. The researcher called this energy self-efficacy in the research context. Four components were identified for empowerment: impact, meaningfulness, competence, and choice. They also describe each component and how they work. For instance, the first component of impact is the degree to which students perceive supporting behavior as producing the desired result and effect of the task.

The second component of competence refers to the ability of the individual to accomplish the task skillfully. Meaningfulness relates to the individual's perceptions of how they value the assigned task and take it as necessary in the current situation and future tasks. The study showed a positive effect on the meaningfulness subscale of learning empowerment. It was also supported by the survey of Ningrum and Nandi (2021). For geography teaching at higher secondary schools, concept maps can be utilized for meaningful connections. Meaningful connections among the topics as well as between different study units. It also helps to observe students' constructive approaches to content understanding or to assess their progress visually.

Concept mapping in teaching and learning can boost the students' confidence level in the learning environment,help with rapid learning, and increase students' success rates. This is what the traditional approaches lack, for they depend on the teacher. Concept mapping values the learner's awareness of searching and discussing skills in the learning

process. Students gain control over their learning, which makes them self-directed learners. Concept mapping significantly increases the competence level of the students, which was also supported by the study of Sultan (2014). The study supported the idea that learners may exercise self-control and be independent learners by using concept mapping. For constructing concept maps, students require reading, comprehension, and the ability to organize and reorganize their thoughts.

2.8 Learning Empowerment

Empowerment is the process of gaining power and control over a specified situation. Context determines empowerment. It is seen in several social settings, including those related to education, business, and other social interactions. Empowerment is a problem that affects both individuals and groups. Women's empowerment, employee empowerment, teacher empowerment, and student empowerment are the different contacts where empowerment may be observed (Sewagegn & Diale, 2019). Learning empowerment is vital in organizations because advancement and innovation come from learning and updating learning. This responsibility lies on the part of the organization's workforce, not the organization itself. For this reason, every worker in the organization also works as a learner and is responsible for bringing new ideas for betterment. Usually, learning is considered the transmission of knowledge, but this is not the case, as only transmission can take longer than changes and learning. Long-term learning and retention require the engagement of the students in the learning process. In active learning, learners construct and formulate knowledge based on previously acquired beliefs and experiences. This theory has made a considerable contribution to empowering learners using active learning

methodologies. The process is instructed to enable learners to use active learning, which requires dynamic interaction between the learners and their experiences.

The theoretical foundation of critical thinking and higher-order thinking skills is the constructivist principle of learning through experience (Mickelson et al., 2013). Therefore, empowerment is the way to reach the target. By empowering learners, their knowledge can be extended and increased. As such, instructors who empower their students must communicate in a way that creates an environment in which students are motivated to succeed. As Frymier et al. (1996) suggested, the urge for faculty empowerment and to address the responsible factors for promoting feelings of students less empowered instead be used to foster feelings of ownership and intrinsic motivation of self-efficacy to learn. An increase in productivity is responsible for one's empowerment, so in the learning environment, one will be empowered if their struggle ensures desired results or increases their output. Empowered persons take responsibility, just as empowered learners take responsibility for their learning process.

2.9 Empowerment Measurement

The measurement of empowerment is not an easy task. Its contextual nature makes it challenging to build a standard notion for its measurement. Laszlo et al. (2017) noted that there are almost as many different instruments used to measure empowerment as there are research papers or development projects that utilize them. Early attempts to measure empowerment relied primarily on proxy variables such as education or ownership of assets and equated them with empowerment (Malhotra et al., 2002). This often resulted in measurements that confused empowerment with its drivers, such as ownership of assets or education, or its outcomes, such as access to paid employment.

There is an enigmatic relationship between empowerment, its various components, and other influencing variables. Researchers interpret the definition in their contexts. Maiorano et al. (2021) measure people's empowerment (women's empowerment) in decision-making. The study views decision-making as an element of empowerment. Decision-making was observed on three subdomains of choices: people's decision-making practices; secondly, values: whether they attached importance to being in the decision-making process; and the last category is the norm: whether their community members are involved in the decision-making process or not. Multiple definitions of empowerment resulted in numerous attempts to measure it. Michelsen (2021) measures empowerment in the workplace environment with variables such as stress management, defense routines, motivation, and engagement.

Various organizations worked on measuring empowerment based on their target variables. The Commonwealth for Learning (COL) developed a three-dimensional measurement toolkit for empowerment. The COL suggested its use for development practitioners, government officials, academics, monitoring and evaluation specialists, and researchers. Empowerment was first conceptualized in the workforce with its dimensions by Thomas and Velthouse (1990). They took four aspects and sub-indicators of empowerment to measure. The empowerment scale for the business sector was validated with four dimensions of meaning, competence, self-determination, and impact (Spreitzer, 1995). Frymier et al. (1996), Weber and Patterson (2000), Weber et al. (2005), and Tibbles et al. (2008), all examined the empowerment concept in the instructional context. Frymier et al. (1996) applied the idea of empowerment to the classroom context and defined learner empowerment as consisting of three dimensions: meaningfulness, competence, and impact.

Therefore, empowerment is the way to reach the target. By empowering them, they increase and expand their knowledge. As such, instructors who empower their students must communicate in a way that creates an environment in which students are motivated to succeed. As Frymier et al. (1996) suggested the urge for faculty empowerment and to address the responsible factors for promoting feelings of students less empowered instead be used to foster feelings of ownership and intrinsic motivation of self-efficacy to learn. An increase in productivity is responsible for one's empowerment, so in the learning environment, one will be empowered if one's struggle ensures desired results or increases one's output. Empowered persons take responsibility, just as empowered learners take responsibility for their learning process.

2.10 Concept Mapping

Literature shows the use of concept mapping in science education for the last 40 years. Science education is the most prominent area in the study of conceptual maps. However, its application has been observed in other fields of study in the recent decade. Initially, students' assessment remained the purpose of concept mapping, but later, it was considered an effective tool for learning and teaching. According to Joshi et al. (2022), concept maps can potentially develop metacognitive skills in learning as they provide a platform for using learned material for new learning. The prominence of concept mapping is due to its feature of meaningful connections among the concepts.

Therefore, concept mapping is a tool for Ausubel's Theory (1962) of Meaningful Learning. Concept mapping represents an individual's knowledge of a specific domain or problem (Novak, 1998). A concept map consists of interrelated nodes and links in an integrated, hierarchical manner. Concept mapping typically starts with brainstorming to

generate words related to the topic and sorting them into groups of associations. Students then draw organizational structures, label them with words, and connect them to labeled links based on their ideas on the topic. Through concept mapping, learners consciously reflect on their knowledge of relevant concepts or propositions to construct their knowledge structure (Novak, 1998). Graphics of concept maps were created by Novak and Canas (2008) and explain the theory behind the construction of concept maps, their structure, and their characteristics.

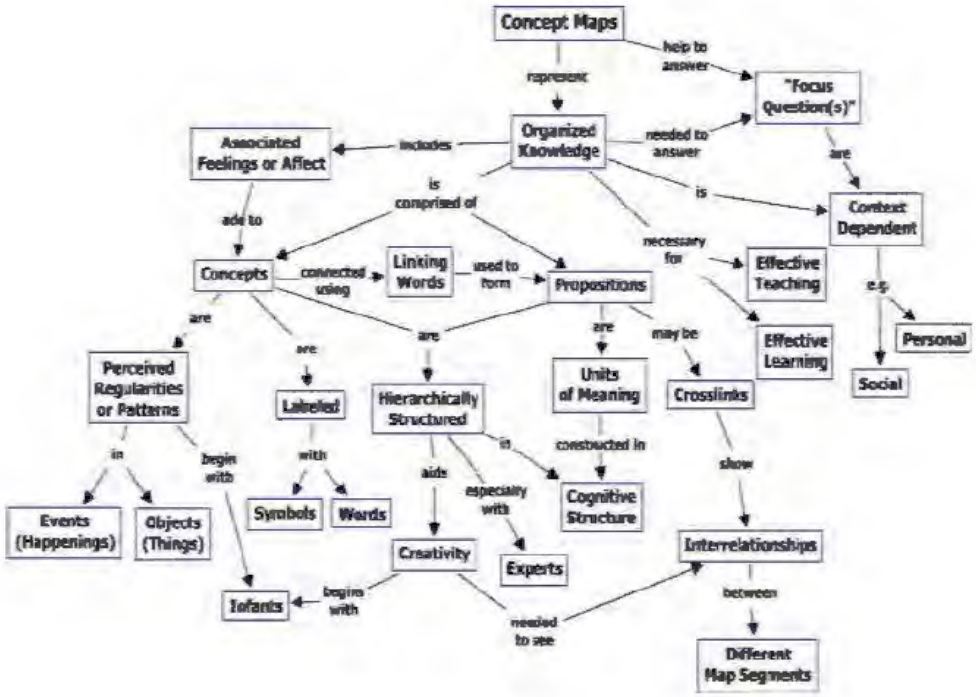
Concept mapping helps in the organization of information, which requires an integrated system. According to Ausubel and Robinson (1969) a hierarchy of the content is necessary for the organization of knowledge. In a hierarchy, general ideas are placed at the top, and more specific ideas are placed under them. Forgetting information is the result of a poorly organized cognitive system. The prime responsibility of the teachers is to present new information in such an organized way that students can match it with previously learned materials. The teacher provides appropriate organizers for learning (Stanley, 1998).

Figure 2.1 shows a general approach to constructing a concept map. It is recommended that the broader and more general questions be answered in the following steps. In the next step, the related key concepts must be considered. They advised starting at the point where a person considers a certain study field and a focused query. The centralized concept is the target area that the mappers want to explore and answer. Novak & Canas (2008) recommended listing all the key concepts before constructing the concept map. The centralized concept is the target area that mappers want to explore and answer. This list is called a parking lot. This list drops from the top to the bottom. Now is the time

to start creating a map of the listed concepts. Constructing a concept map by placing concepts in nodes is the next step of the process.

Figure 2.1

Concept Maps Reproduced from Novak and Cañas (2008)



Usually, these nodes have the shape of ovals or blocks. These blocks are arranged in the form of a hierarchy or spider form. Lines are used to connect these concepts, showing relationships among them. The relationship is mentioned by the words that are written on the lines. These words are called prepositions (Novak & Canas, 2008). The wideness and extension of the concept map depend on the details and complexity of the concepts.

2.11 Types of Concepts Mapping

The type of knowledge we want to convey and the nature of the information will determine whether or not we use concept mapping. Concept maps are classified into four

distinct groups based on the purpose and details of the content. To opt for one specific type of concept map depends on the nature of the concept and the kind of knowledge intended via concept maps.

i. Spider mapping allows content to be arranged in a way that the main topic is in a center and related topics take place around the main topic. Spider mapping is effective when there is a single idea and is intended to build upon the sub-topics and themes.

ii. Hierarchy, in hierarchical forms, the main topic is at the top, and subtopics are connected with arrows or straight lines under the main topic. It allows subtopics to make further hierarchies if needed. It is effective when one is concerned with understanding different elements of the system according to their relevant position.

iii. Flowchart organization follows a linear format. All topics and contents are arranged in a linear style. This type of concept mapping may be utilized to understand the process, different steps, and their sequence.

iv. The system type of concept mapping takes the same style as a flowchart and has additional features for input and output. Due to its input and output features, it considers detailed and complex types of concept mapping. At the same time, the central idea is connected to different dimensions.

2.12 Theories behind using Concept Mapping in Learning and Teaching

2.12.1 Cognitivism

Concept mapping has a solid basis to learning due to its connection with learning theories. According to cognitivist theorists, learning results from internal and external factors (Vygotsky, 1980; Gagné & Briggs, 1974; Ausubel, 1968; Piaget, 1953). They believe that world perception and understanding largely depend on one's contact with the environment. They also support life experiences in the world's perceptions. Individual perception is the function of contact with the environment and previous experiences. Moreover, a person's perception can be changed as a result (Driscoll, 2014).

Theories of meaningful learning and schema based on environmental factors guide learning speed and quality. Environment and ways of exposure to the environment shape memory and perception. The same thoughts were forwarded by cognitive psychologists. The way you approach knowledge shapes your perception of the content. Therefore, an overview of cognitive psychology is necessary for discussing meaningful and schema theory views on learning. Researchers studying cognitive development focus on how people remember, interpret, think, talk, approach problems, and develop as they get older (Driscoll, 2014; Gagné & Briggs, 1974; Schuck, 2004; Piaget, 1953). Non-observable aspects of internal capacity like motivation, beliefs, and wants are also taken into account.

Based on cognitive theories, learners grasp information by naming, interpreting, and relating new knowledge with previous experiences. They then sort everything into categories and decide whether to keep it or throw it away. Cognitive capacities rely heavily on working memory and long-term memory. At any given time, our working memory can

only hold a certain quantity of information. In terms of space for memorization, long-term memory is considered more potent than short-term memory. The first one has memory and limitless space. In the memorization of facts, information, and other fields of knowledge, it is argued that repetition, rehearsal, and application of concepts help to preserve them in long-term memory. Cognitive theory argues that significant connections must be created with new knowledge to increase the likelihood of its recovery (Driscoll, 2014; Schuck, 2004; Gagné & Briggs, 1974; Ausubel, 1968).

The developmental perspective analyses how a student develops through time (from birth to adulthood). According to developmental theories, each stage of a human's existence has its start and finish as he moves through different phases based on his age. Moreover, learning occurs gradually and continuously throughout our lives (Driscoll, 2014; Schuck, 2004; Vygotsky, 1980; Piaget, 1953). As children grow older, they display varied behaviours depending on their developmental stage. Piaget worked on four processes. In the very first phase, assimilation takes place in the learning process, followed by accommodation. Accommodation is the process of changing one’s previous worldview after acquiring new knowledge. When accommodation reaches its maximum, then equilibration occurs. If the process disconnects at any stage, then learning cannot take place. Integration at every stage is mandatory for appropriate learning. After seeing an object for the first time, children may refer to it as the same. When this happens, assimilation takes place. A person who is adapted goes through a complete mental transformation. Suppose that same child is told that zebras are mammals, not horses. If the child remembers this information, it means that the child's schema worked, and as a result

of this modified schema, the child can classify animals accurately. This stage is called the accommodation stage.

If a child reaches the accommodation stage, in the previous case, they can recognize animals correctly, so the information is retained in their long-term memory. Therefore, the accommodation stage of Piaget's theory is considered a milestone for shaping an individual's long-term memory. During Piaget's education, he felt that the learner had to choose between assimilation and accommodation, which he refers to as "equilibration." When the learner's prior knowledge, which is based on previous data, corresponds to the new knowledge, this is called equilibration. He is credited with inventing the term "schema" as the first psychologist to do so. The term "schema" refers to a mixture of how things are arranged.

If learning is organized around schemas, new ones may be created to update the previous ones (Piaget, 1953). The principles of Piaget's theory and psychological theory have an immense impact on parents' parenting behaviors and educators' instructional approaches (Driscoll, 2014). Inhelder and Piaget expanded Piaget's original learning theory in 1958, which extended into adulthood and was dubbed the "formal operational stage." They discovered in their research that early children develop abstract thinking from concrete thinking and that by the age of 12, children can find new things, have things more creatively, and build relations with distinct objects. Besides, this logical way of resolving issues is also noticeable in this age (Siegler & Richards, 1979; Schaffer, 1986; Inhelder & Piaget, 1958).

Novak (1977) referenced his theoretical alignment with Vygotsky's work on the Zone of Proximal Development (ZPD). He used the concept of ZPD in serial concept

mapping. In this study, the interaction caused the learners to consider each aspect of their maps before peer feedback. The structured feedback loop supported metacognition, a high-order thinking skill. Lev Vygotsky is another notable name among the central agents in cognitive learning theories. Vygotsky (1978, 1980) started to question whether human connections, culture, and traits are the essential components of a learning process. Zone of Proximal Development (ZPD) is known by his name. The concept of ZPD is the original contribution to learning psychology. It describes how information is gathered and maintained at different stages of development. Their current developmental level defines every learner's development level, ZPD, and distant zone.

A person's developmental level is based on what they can do or understand independently. When a person is unable to complete the task on their own but can complete it successfully with the help of another person. Because this research is based on meaningful learning theory. The ZPD point highlights the importance of obtaining knowledge without the support of other people. It is particularly pertinent because it highlights the role of deciding where a learner is in the process of obtaining knowledge about a specific concept as well as how information from another source may influence that knowledge structure.

Jerome Bruner has been cited among other pioneers of cognitive development. Beginning in the 1930s and 1940s, Bruner (1966) studied the reaction speed of children from various socio-economic backgrounds. According to his research, internal factors and experiences appeared to influence reaction speeds. He forces internal processes on top of the observable behavior of a person. Internal processes guide observable behavior. Observable behaviors act as internal process guides. Bruner focused on scaffolding in the

1970s. Based on his discovery that new knowledge is always based on what is known to students, he reached the point that learners belonging to any age and stage are always in the position to learn something new in the learning process (Driscoll, 2014; Bruner, 1966). On the other hand, this principle opens a way to think about learning from a social perspective. Social learning theory results from these thoughts and argues that learning's meaningfulness is conditioned by its application in the real world.

2.12.2 Theory of Schema Learning

After examining mental development theories and theorists, it makes sense to go on to schema learning theory because all preceding theories consider a person's prior knowledge and current abilities. Even though schema is built on the work of cognitive psychologists, it maintains its creature. The schema learning hypothesis is a hybrid of associative and prior learning that contains multiple layers. The brain must build connections between such understandings to boost retention. As our brains make connections, there's a better possibility that knowledge will be stored systematically so that it may be remembered from our long-term memory when required. Schema is all about how people perceive things and how they interact with others throughout their lives. The brain can retain and developmental models.

Here, the selection of stimuli must be relevant to previously built schema our schemas and pay greater attention to stimuli that are plainly at odds with them (Kuklinski et al., 1991). Stimuli that are schema-relevant are perceived and activate the schema, which directs how the stimulus is processed. Things are more likely to be seen, understood, and recalled in the manner we anticipate being or in line with our previously established knowledge or schemas. These schemas are used to fill gaps in knowledge and

data provided by previous learning experiences. Schema-based interaction enables them to dig out this knowledge gap and fill it with more solid answers. As a result, there is a great deal of obliviousness, misconstruction, and recollections, as well as spiritual discernment, insight, and precise recall.

The linking of new and previously learned experiences and the importance of those experiences are fundamental for meaningful learning. Forming a schema can't be possible without this combination of experiences. Schema theory addresses the chain of learning interactions. Schema shows one's links with their external environment and how they perceive it. It can also be observed in the science of schema how they present mental sketches of their perceptions. For information processing and environmental connection, schema is considered a quick approach (Gureckis & Goldstone, 2010). It is a fast approach to information processing and environmental connections.

On the other hand, "fill in" is what we usually expect to be present, reducing cognitive strain. Schemas, on the other hand, enable us to forecast or infer unknown information in entirely new circumstances. It is developed as a result of these elements, and it directs choices and behavior, aids in recalling knowledge, and aids in forecasting the future based on prior experiences. Assimilation and accommodation, as outlined by Piaget (1961) are thought to aid in the development of schema. Assimilation refers to the process of taking new information into an established schema. Accommodation is the advanced stage of assimilation where a person is in the position to modify or change the previous schema. A new schema may emerge throughout the accommodation process. For example, after completing a session early with kids and not having a plan for unexpected time and extra time available, teachers at elementary schools who plan lessons may

experience these events in classrooms. When one's schema is entirely adjusted or changed, this is referred to as accommodation (Piaget, 1961). A child who has only seen dogs learns that all four-legged hairy animals are referred to as dogs.

2.12.3 Theory of Meaningful Learning

Though there are many cognitive techniques, David Ausubel's (1968) theory follows schema in the learning process and establishes meaningful learning theory. Meaningful learning theory takes into account things essential to the learning process. One is the previous learning, the second is what to learn, and finally, there is a connection between them. Meaningful learning uses prior knowledge to attend a new class and allows students to do all this. It allows students to arrange material based on preconceived associations, helping them get a deeper understanding by connecting the dots. This also makes it possible to recall facts in groups rather than individually. The learner will be aided in thinking about the linkages between the learned materials.

They activate the knowledge in their long-term memory by recalling it in the process of attending a new one. Ausubel was the first to do a systematic study and empirical testing of his theory, which continues to affect education in the twenty-first century. He prioritized meaningful learning as compared to rote learning. Rote learning stays in short-term memory and is removed after a short period. He felt linkages among the concepts that were basic for working long-term memory. This type of learning hierarchically takes place, so teaching should be organized accordingly for this purpose. Teachers planning for lessons matter a lot in this scenario. Teachers' content organization makes it easy for students to make connections among them.

The brain accepts logic, so the brain is ready to give more weight to the information that is arranged logically. In graphic forms, the most known and general elements come on the top and other surrounding areas logically (Ausubel, 1968). Meaningful learning focuses not on classroom activities but on student exposure to the environment. Pre-service teachers are not in a position to access previous knowledge of the students, but it can be accessed through teaching experience. For retention of learning, it is crucial to recall previous learning, lso arrange, organize, and make connections for recalling information. It is easier to understand when information is presented in this way (Driscoll, 2014).

Many researchers like Brewer and Treyens (1981) attempted modest tests to measure memory level. It is discovered that prior information has a big impact on the subject's success. As a result, most instructional design (ID) approaches include significant learning theory components. Analyze, Design, Develop, Implement and Evaluation (ADDIE), for example, was created in the 1970s to teach instructional designers how to examine participants before producing instruction. It is recommended that when instructional designers plan any instruction or training, they must assess the situation and the level of learners. Before organizing a class, Gerlach et al. (1971) recommended that educators examine their students' entering behaviors. According to Driscoll (2014) the majority of ID models require the instructional designer to assess the learner's prior knowledge before determining the best educational approach for the target audience.

According to Ausubel, building logical connections between old and new ideas is the principle of meaningful learning. Ausubel's learning theory can help transfer knowledge to long-term memory. Finally, students' previous schema and level of knowledge must be considered by instructional designers when they plan instructions for the class. Previous

experiences must be revisited at this planning time. Instructional designers not only revisit but also assess the previously built schema. They highlight the gaps in learning and design new learning based on this connection, which leads to meaningful learning experienced by individuals. A situation like this helps to create a meaningful learning environment. According to the report, educators must understand that how learners acquire, integrate, retain, and recall information (Chenne, 1993). This study attempts to learn more about how aspiring teachers think about concept mapping, an instructional tool that connects new knowledge to old concepts in a structured and hierarchical manner

2.12.4 Contribution of Joseph Novak

To facilitate a system of organized information, a hierarchical structure was presented based on the meaningful connection of learning. This approach was proposed by Novak in 1972. He further explained how connections are build and how they work in a learning environment (Ausubel et al., 1978). "Concept mapping is an educational tool; it was created expressly to tap into a student's cognitive structure and to externalize, for both the learner and the instructor, what the learner already understands" (Novak & Gowin, 1984). Through the visual presentation of knowledge, concept mapping is a cognitive strategy that students can learn and utilize to improve their learning (Stevenson et al., 2017). "How can we assist folks in reflecting on their experience and generating new, more powerful meanings?" is the question that concept mapping was initiated to tackle (Novak & Gowin, 1984). Ausubel's theory showed sensitivity to structuring new knowledge and recommended carefully structuring it to help learners connect it to their present thinking (Ausubel et al., 1978).

Novak created a concept mapping tool where students organize and simplify information in hierarchical order. They placed significant on top, or center, and subheadings after that. This instructional instrument helps to clarify one's thoughts and understand concept mapping. As Novak and Gowin (1984) stated, "Students take ownership of their learning when they learn about learning in the way we advocate". Because Novak's tool has been primarily created to elicit relevant learning opportunities for learners, understanding instructors' perspectives on this instrument is critical. Furthermore, Novak's concept mapping methodology was developed to extract student preconceptions and uncover misconceptions, two areas where inexperienced teachers report being uninformed of instructional tactics to achieve those aims (Cox, Steegen, & De Cock, 2016; Gomez-Zwiep, 2008; Seo, Park & Choi, 2017). In the following section, Novak's work with concept mapping will be discussed in more depth:

2.13 Concept Mapping and Meaningful Learning

The concept mapping technique stems from Ausubel's (1968) Meaningful Learning Theory. According to Ausubel's Cognitive Learning Theory (1968), learning is a continuous cognitive process of building, expanding, and modifying old concepts over time as new relationships are introduced and linked with previous concepts. Meaningful learning (Ausubel, 1968) requires the learner to already know about the regularity of the object or event, and the acquisition of the label facilitates learning. The concept mapping technique can foster learners' processes of meaningful learning, and it helps students relate and link previous learning with new thinking and ideas. Students organize ideas and put them in a hierarchy according to their importance. Concept maps work for students as a

framework. In this framework, students arrange their learned and unlearned materials and content (Novak, 1998).

In addition, concept mapping enhances meaningful learning by providing dual coding for the arrangement of information. Both verbal and nonverbal approaches can be used in dual coding. Graphics are more powerful when creating maps. It strengthens the processes of cue-making and information recall (Clark & Paivio, 1991). Specifically, novice foreign language learners can remember visual images in conjunction with new vocabulary. Thus, language learning strategies should involve nonlinguistic, visual, and conceptual systems (Bahr & Dansereau, 2005). In a concept map, the graphic cues may include boxes for concepts and labeled links for propositions. In the concept map, invented by Tony Buzan in his 1993 book 'The Mind Map' he stated that concept mapping provides an opportunity to unlock the potential of the brain. That was the reason Buzan's subtitle is "How to Use Radiant Thinking to Maximize Your Brain's Untapped Potential". Here, the main focus is on using maps in different ways. More than 100 uses of concept maps were discussed. A concept map provides a way for organizing ideas either as they emerge or after the fact. Perhaps the mind map's greatest strength lies in its appeal to the visual sense.

The Opeduca concept (Training and Education Program throughout Life) in Education for Sustainable Development is responsible for the implementation of the UNESCO projects under this program in the secondary education section. Various European projects are involved in this project. Flight for Knowledge was the first phase of the project, and the central theme of the phase was to make the students aware of the need for a graphical representation of the knowledge, especially in the context of research on

sustainable development. Therefore, the creation of the concept maps by students was the initial step of the project. For this purpose, a survey was conducted in the participating countries on the validity and benefits of the concept mapping technique for both teachers and students. The survey was named Spring Event.

The spring event highlighted the importance of concept maps. The experimentation of the project was discussed at the spring event in terms of the context in which concept maps were used. The element of interest was the most reported element of the use of concept maps. Besides these, various other benefits were highlighted. Participants also reported sharing mind mapping with their teachers according to the Brain Rules (2008). It was fairly concluded that, if presented orally, the chance of remembering is 10%. If presented in pictorial form, it increases the chance by up to 65% and lasts for 72 hours. This is because of the visual presentation, which is strongly supported by metacognitive principles.

Concept mapping has been recognized as an effective method for conceptual and linguistic development (Heimlich & Pittelman, 1986). Researchers reported that concept maps can be used as visual thinking tools for enhancing literacy (Anderson-Inman & Horney, 1996; Dansereau, 1989; Hall & O'Donnell, 1996). Structural properties of the map format activate learners' spatial processing channels to effectively memorize main concepts (Dansereau, 1989). Presenting and creating concept maps may enhance students' recall of vocabulary and expressions (Hall & O'Donnell, 1996).

Thus, language classes have implemented concept mapping to promote reading and writing processes (Baumann & Bergeron, 1993; Cronin, Sinatra, & Barkley, 1992; Schultz, 1991; Ojima, 2006). Specifically, Schultz (1991) argues that the mapping process helps

second-language learners visualize their ideas as multidimensional constructs imitate the movement of thought itself. The map format can maximize intellectual input without constraining thinking through the imposition of a rigid format, such as a traditional linear outline, which might make students feel compelled to fill in numerals and letters (Schultz, 1991).

The mapping technique can also assist in helping inexperienced authors concentrate and arrange their thoughts before starting an essay. The concept mapping activity in Korean classes was established to alleviate students' concerns about making mistakes and to encourage students to develop ideas, words, concepts, or propositions on a writing topic. In addition, students were asked to generate ideas and share their thoughts on vocabulary and stories related to the topic during the collaborative construction of maps. Concept mapping assists the students in the following areas:

I. How to operate associations of ideas
II. Asking relevant questions that bring answers
III. Broadening the scope of their thinking
IV. Ordering ideas
V. Classifying information
VI. Defining subthemes
VII. Determining keywords
VIII. Deducting problematic

2.14 Relating Concept Mapping as a Learning Tool to Constructivism

Novak's interpretations of Ausubel's ideas concentrate on the concept of meaningful learning as well as his cognitive theories of learning that rely on the

hierarchical and relational character of learning. Concept mapping is very consistent with constructivist philosophy in this way. The creator of a concept map must express information through a hierarchy of concepts and the interconnectedness, or connecting, of those concepts. This illustration supports the constructivist viewpoint that knowledge development relies mainly on the individual's ability to relate new concepts to previous knowledge. Novak's primary epistemological assumption that "knowledge is a human fabrication of concepts and concept relationships" conforms to this (Novak & Musonda, 1991).

A physical expression of this relationship-building is the act of making an idea map. Explicitly identifying the concepts and linkages in a map necessitates active learning, reflection, and ownership of the map's ideas, all of which are hallmarks of constructivist thinking. "In attempting to build a concept map, students frequently rapidly discover for themselves what concepts and linkages are not clearly understood or grasped (Baroody & Bartels, 2001). This self-evaluation may lead them to make a connection, conduct research, or ask questions.

Social constructivism and socio-cultural theory are both compatible with concept mapping as a learning technique. According to Novak (1995) the dialogue and reflection that occur as a result of defending one's concept map or collaboratively creating concept maps lead to knowledge and abilities and can underscore the fact that now the construction of knowledge is very much a social process (Novak, 1995; Baroody & Bartels, 2000). The theory of semiotic mediation, or the use of signs and symbols as an element of psychological development, connects concept mapping to Vygotsky's socio-cultural framework.

According to Vygotsky, the use of semiotic instruments is critical to the mediation of the internal and exterior components of knowledge generation. Vygotsky considered drawings, diagrams, and maps to be semiotic tools in addition to words. Concept mapping, for example, is considered critical to "the appropriation of information by the developing individual through representational action (John-Steiner & Mann, 1996). The evolution of an individual's concept map improves as ideas get more sophisticated, as Baroody and Bartels (2000) have shown, which is consistent with radical constructivism and indicates the dynamic or subjective nature of knowledge.

2.15 Effects of Concept Mapping on Metacognition

Metacognition is the state of knowing one's level of thinking. According to Joshi et al. (2022), concept maps have the potential to develop metacognitive skills in learning as they provide a platform for using learned material for new learning. Mapping concepts allows students to think and make connections among concepts, which helps learners think independently. Silver (2013) focused on reflection. He takes reflection in two ways: one in general and another in the course-specific. Metacognition is the phase of metacognition where one can think about one's thinking. The moment of Meta is standing above how one speaks apart from oneself. Mind mapping regulates thinkers visually. Bloom's higher order was analyzed, and the positive impact of mind maps on these skills was reported. Metacognition in learning is an old idea that traces back to Socrates' questioning method. Its importance was also highlighted as reflecting on experiences is an excellent way to deepen teachers' proficiency (Dewey, 1933). In the recent decade, work on metacognition has been coined with the work of Flavell (1970) as well.

Concept maps have been described as metacognitive tools that enable people to visually represent their reflections on what they know about meaning and relationships (Mintzes et al., 1997). Constantly varying decisions regarding linking and delinking concepts while putting them in maps is a critical task. As a result of which, the processes of creation and modification take place. It enables them to reflect and rethink their previous learning (McAleese, 1998) and also control the processes of planning, organizing, and managing (Brown, 1987). Flexibility and selective knowledge are the benefits of the metacognition process for students. It takes learners to a deeper understanding, especially in the context of self-directed learning (Georghiades, 2000).

One of the potentials of graphical representation is the facilitation of inquiry-based learning. This is the case, especially in reasoning and answering questions in the study areas, where students have difficulties with theoretical concepts. Inquiry learning is also connected with external representation. This study brings novelty to concept mapping with a three-dimensional approach. The study reported high levels of academic achievement and a positive attitude toward inquiry-based learning. A mixed approach was used to validate the results. On the other hand, the results also showed a low level of students' anxiety. Concept mapping works positively on all students of all calibres like high, medium, and low-level students (Chen, 2017).

2.16 Integration of Technology in Concept Mapping

Technology takes place in every field of life. In the same way, in education, from planning to classroom instruction, the importance of technology and its use is being acknowledged and exercised. Due to this, the concept of mapping knowledge is not limited to paper-based mapping. Technology provides new dimensions in the field. Since computer

software and mobile phone applications enable students to draw concept maps more technically, applications of concept maps in teaching and learning have become more facilitated with the advancement of touch technology. For example, mobile applications and interactive whiteboards allow for the display of various content, increasing learners' interest and questioning habits (Hung et al., 2010; Hwang, 2003). Research by Smith (2000) reported the appropriateness of interactive boards for all types of content and grades. It provides an opportunity to display visual presentations of theoretical content. An increase in teachers' autonomy and flexibility was also reported as a result of these types of technologies (Xu & Moloney, 2011; Kennewell, 2005).

2.17 Mobile Phone Applications for Concept Mapping

With the emergence of technology, especially mobile technology, concept mapping apps have been introduced. These apps are available with different names and provide different functions. Following are the details and appropriate usages of the apps:

- **Bubbl.us:** This is famous for creating attractive visual concept maps. It reduces the need to download more applications and software. It allows the user to create and save maps in image forms.
- **Popplet:** Popplet is another option for the students to create good concept maps using technologies. It is advanced with features of recording notes, creating, and sharing with others. Created docs can be saved and shared in the form of PDF or JPEG. It also supports several languages.
- **MindMap:** This is simpler and more accessible for beginners. It provides an opportunity to create free maps and save them in the Cloud. The user may develop

as many maps as they like, considering that there are no restrictions. Furthermore, saving in Clouds makes it possible to approach your maps from anywhere.

- **Creately:** The app's greatest strengths are its unlimited options, ability to facilitate collaborative work, and integration with other tools from multiple facets of the system, such as the Chrome Store and Google apps.
- **Coggle:** It is an online app for creating and sharing concept maps. There is no need to download and install mapping apps.
- **MindMeister:** It is also an online app for creating concept maps. With this app, one can capture, develop, and share ideas. Sharing with more people is the friendly feature of this app.
- **Lucidchart:** Specifically designed for creating concept maps in the form of flow charts and other types of diagrams, it supports work in collaboration. It allows users to approach from different devices. Besides this, it provides a guide manual on how to use and work with the app.
- **Mindomo:** The app is famous for presenting work in the form of slides and presentations. These can be converted into video and pictorial forms. It’s not complicated to use, and converting in videos can be done with a single click.
- **Spiderscribe:** It's an internet application, and its primary function is brainstorming. Its recognizing features are the way ideas are linked together and arranged.

2.18 Application of Concept Mapping in Education

Use of concept mappin in te environment of teacin and learnin is multidimensional. Its application encompases teacin aid by assessment of students learning. Followin is te application of concept mapping:

2.18.1 Concept Mapping as an Assessment Tool

Concept mapping gives more potential to the teaching process in diagnosing the needs of diverse students and assessing the variety of knowledge from the surface to the deeper level of knowledge. The mapping technique facilitates various forms of assessment, such as formative and summative assessment (Anohina-Naumeca, 2019). Diagnostic assessment is used by teachers to identify the level of students in that specific content. After starting the instruction, teachers measure the progress level and understanding of the students. It was used to monitor changes in the learner's level of experience. At the end of instruction, mapping can be used to evaluate learners as feedback.

A teacher can approach the student's mind in terms of knowledge and identify the level and nature of knowledge by using concept maps. It helps the teacher establish a baseline for further instructions and activities (Diagnostic assessment). During instruction, teachers observe and record changes in the students, and students' pick up power and knowledge that they grasp. Therefore,a concept map can be utilized to sketch learning during the learning process (formative assessment). Likewise, after the completion of instructions for measuring learning outcomes, students may be asked to sketch what they perceived and learned. So, for evaluation purposes, concept maps can also be brought into the class (summative assessment) and can tell the effectiveness of formative feedback activities.

Concept maps as assessment tools are usually evaluated in content knowledge as valid and effective assessment tools and are implemented to gauge understanding or changes in knowledge. Ask students to create a mental map of idea X taught in class instead of a standard quiz at the beginning of class or a five-minute paper at the end. This alternate

experiment will provide a different way for students to learn and add to their metacognitive toolbox (Sweet, 2017). Concept mapping can be used as an instructional tool, an evaluation tool, or a learning tool, among other things. Concept mapping has been used to improve the organization and sequence of education (Starr & Krajcik, 1990).

The concept mapping approach could be utilized as a tool for evaluation. Teachers may employ formative rather than summative assessments more frequently. Previous research showed that the concept mapping method has a potential to assess multi level of performance and make it easier to understand pupils' knowledge than traditional assessments. Although concept mapping is not the only "correct" assessment technique, it does provide an opportunity for pupils to be evaluated. It was also observed that while utilizing the idea of concept mapping to assess students, it is necessary to remind them of the work's objective. That has a significant impact on the outcome. Concept mapping may be used as a technique for evaluation, and it can be as flexible as required. At least three types of concept maps for assessment are proposed by the authors: maps with open propositions, maps with closed propositions, and maps with semi-open propositions. (Alonso & Araya, 2008; Sweet, 2017; Baroody & Bartels, 2001).

Wilcox (1998) discussed concept mapping as part of a large-scale collaboration between classroom teachers, mathematicians, educators, and graduate student researchers to develop assessment methodologies and better match them with the National Council of Teachers of Mathematics (NCTM) Standards vision. By creating, collaborating, and debating concept maps, Wilcox described how these parties better understood what topics, ideas, and relationships are crucial to explore in a classroom context. Wilcox also demonstrated how a middle school mathematics teacher used student-created concept maps

to track students' knowledge improvement over time. The use of concept mapping in this setting had several advantages, including providing an extra assessment tool, stimulating student introspection and dialogue, and providing students with a sense of empowerment based on their observed improvement reflected in their concept maps. Hasemann and Mansfield (1995) presented the findings of two studies that looked at the ability of concept mapping activities to assess improvements in comprehension in elementary and middle school pupils over time. Both studies concentrated on specific mathematical topics, such as fractions and geometry.

In both experiments, students created concept maps by organizing and connecting supplied concept categories at various time intervals during the topic's instruction. The findings imply that concept maps can be used to illustrate understanding, growth, reveal how students connect and arrange concepts, and detect misconceptions and learning issues. Merrill (1987) for example, looked at how concept maps could be used to assess understanding of a specific topic: division. After receiving training in idea mapping, pre-service teachers were directed to map their grasp of division. The findings support the use of concept map scores as a predictor of math achievement.

Williams (1998) investigated the validity of concept maps as a tool for assessing conceptual knowledge of a single concept: function. The author looked at idea maps created by specialists (Ph.D. mathematicians) and college students taking traditional and reform Calculus classes. The maps were analyzed and found to have slight variance among expert-created maps and significant variance between expert-created maps and student-created maps. Further findings indicated that there are variances between the two student groups. The author concluded that idea maps can be utilized for evaluating conceptual

knowledge and even identifying minute variations in comprehension. Wholeben's (1994) quantitative study of daily changes in teachers' understanding of fractals, chaos, and dynamics in a five-day professional development workshop and Grunow's (1998) mixed-design study of teachers' growth in rational number understanding throughout a two-week professional development course both confirmed that concept maps are a valid and reliable instrument for the assessment of content knowledge.

2.18.2 Concept Mapping and Students' Retention

Remembering the previously learned concepts is an ability of the students that leads them towards better comprehension and understanding of the new concepts. Various studies have also examined the retention ability and the use of concept maps among students. One such study investigated the effect of concept mapping on the subject of biology (Ahmed et al., 21). A quasi-experimental design was used. The study revealed that the students exposed to concept mapping instructions in the experimental and control groups differed in their retention rates. Based on this finding, it was therefore concluded that concept maps can be used to enhance the conceptual understanding of students. The study examined the relationship between concept mapping and retention of concepts in an electric energy course in Jordan.

Findings showed that mapping of the concepts had a significant effect on students' retention rates as compared with conventional teaching methods for electric energy concepts (Bawaneh, 2019). Learning with the concept mapping method proves to be efficient, especially in the case of long-term memory regarding the study of anatomy in first-year students (Nicoara et al., 2020). Similarly, one study was conducted in Nigeria to investigate the retention of learning in basic science. The study took 310 students from

government secondary schools as its sample. The study's findings showed that students who were taught the science subject with the help of concept maps retained more information. For a longer time, they remembered the idea of the content (Adeniran et al., 2018).

A meta-analysis observed the impact of mapping on students' retention in medical courses (Nicoara et al., 2017). The study observed variations in the retention rate. The study also displayed significant improvement in short-term memory when concept maps were used for a more extended period. Awodun (2017) also reported the positive effect of concept maps on students learning retention. Students gained a higher score on the retention test than other groups.

2.19 Critical Summary

The present study's focus was to analyze the effect of concept mapping as a teaching strategy on students' learning empowerment. A section-wise literature review was done for the study. The study was concerned with evaluating the effects of concept mapping instructional strategy on learning empowerment in the area of research in which it was studied. So, the focus of the first section was to understand the research activities and research-oriented skills in Pakistan. In this regard, the findings of the study Sheikh et al., (2021) reported a lack of research skills among professionals, and an improper way of instructing research as one of the reasons.

In the same way, Aguirre (2016) recommended an appropriate way of dealing with research subjects during instruction to enable research students to recommend something relevant. Hassan et al. (2013) highlighted issues related to the overall quality of research

and specifically the teaching of research in academic institutions. More issues concern the way research is taught at early stages. The research subject was chosen for the study to observe changes in learning empowerment through concept mapping. Concept maps were used in the study as treatment variables instead of traditional methods.

Literature on concept maps showed its use and effectiveness with academic achievement and learning of the students, mainly in science subjects, with the target population of elementary or secondary level students in Pakistan and at the international level too. The conclusion was made that postgraduate education does not effectively utilize concept maps for teaching and learning purposes. Therefore, the study aimed to fill the said gap by applying concept maps at the university level by using learning empowerment with its three variables i.e meaningfulness, impact and competence susuested by Frymier et al. (1996) as dependent variable rather than academic achievement and learning.

CHAPTER 3

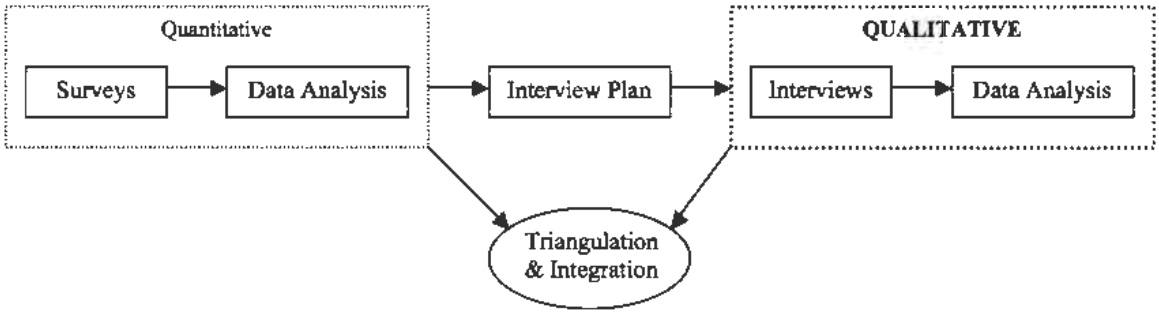
RESEARCH METHODOLOGY

3.1 Research Design

The study was conducted utilizing a sequential explanatory mixed-method approach, which comprised collecting and analyzing quantitative data first, followed by qualitative data. Using this approach facilitates a more profound comprehension of the research outcomes since qualitative data aids in explaining and contextualizing the quantitative findings (Creswell & Creswell, 2018). The study primarily emphasized using quantitative data, while qualitative data were used to verify and support the findings obtained via quantitative analysis.

Figure 3.1

Sequential Exploratory Mixed Method Design



Source: Wu and Philip (2011)

The third Chapter of the study was structured into four Parts:

First Part: Research Design

Second Part: Quantitative Phase of the Study

Third Part: Lessons Details

Fourth Part: Qualitative Part of the Study

3.2 Quantitative Phase of the Study

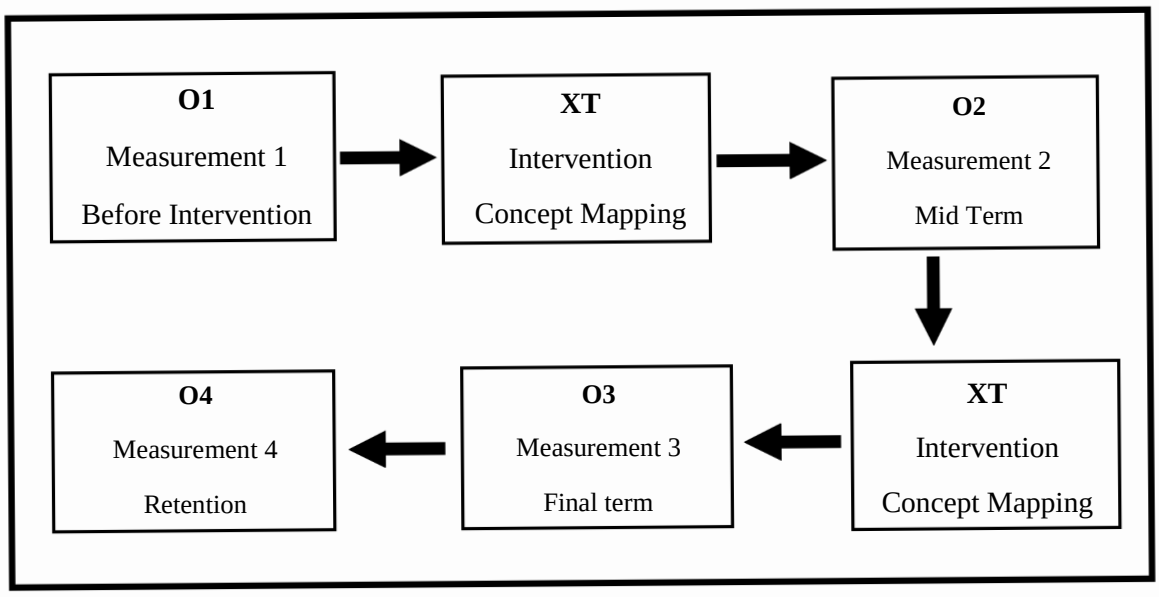
In the first phase of the study, an experiment was performed, and prospective teachers were given practical exposure to concept mapping and analyzed its effects on learning empowerment. An explanatory sequential mixed method is appropriate when the group size is small, and it is not possible to make equivalent groups. In time series design, the same group works as an experimental and control group as well (Creswell, 2012). This design allows one to study the same group for a longer time. In time series design, a single group is exposed to a single intervention more than once (Creswell, 2012). Numerous observations for the same group make measurements more valid and reliable (Gay, 1996; Cohen et al., 2007). Repeatibility in observation considers cause to reliability (Bartlett & Frost, 2008). Time series design was used for two reasons.

Firstly, repeated measurements increase the validity and reliability of the results. Secondly, Time Series design is used when the sample size is small and the formation of groups is not possible. When the number of subjects is sufficient to form experimental and control groups, and when the researcher intends to study the intervention for a more extended period using repeated measures (Creswell, 2012; Gay, 2009). In this study, one class of prospective teachers was exposed to concept mapping four times. Educational research classes were observed at different time slots after the completion of specific

learning units in the academic research subjects. A visual representation of the time series is given in the following diagram.

Figure 3.2

Equivilant Time Series Design



O1: Before starting intervention (teaching with concept mapping)

O2: After two months of implementing the intervention (teaching with concept mapping)

O3: At the End of the intervention (teaching with concept mapping)

O4: After removal of intervention (teaching with concept mapping). One month after the third measurement.

3.2.1 Population of the Study

All the students enrolled in the course of educational research in 7th semester under HEC approved curriculum was the target population of the study. The participants for the study were prospective teachers of BS 7th who were taking an introductory research course

(EDU-375) at Women University Mardan. All members of the class N=15 constituted the population of the study.

3.2.2 Sample and Sampling Techniques of the Study

As at the time of the study a single batch of the students pursuing a Bachelor of Science in Education was selected as the sample of the study as there was only one class of 15 students of that batch was available so single group experimental design was used for the study. Census sampling technique was used where all the elements of the population were taken under study (Nirel, 2009). Prospective teachers in their 7^{th} semester of the BS program at the Institution of Education and Research were introduced to the notion of concept mapping in their Research Methods in Education course. Due to the utilization of a time series design, the study did not include matching groups and was performed with a sample size of n=15.

3.2.3 Instrumentation

The following instrument was used in the study.

3.2.3.1 Learner Empowerment Scale (LES)

The Learner Empowerment Scale (LES) was adopted to measure the learning empowerment of the learners (Frymier, 1996). The scale comprised of three domains of learning Empowerment. According to this scale, empowerment is the function of impact, meaningfulness, and competence. Three domains were further distributed in 38 items. Items 1 to 15, 16 to 26, and 27 to 38 were laid in domains of impact, meaningfulness, and competence dimensions, respectively (See Annexure I).

Commonwealth for Learning (COL) developed a three-dimensional measurement toolkit for empowerment. The COL suggested its use for development practitioners, government officials, academics, monitoring and evaluation specialists, and researchers. Empowerment was conceptualized for the first time in the workforce by Thomas and Velthouse (1990). In this early stage of empowerment, four aspects and sub-indicators were used for measuring purposes. The empowerment scale for the business sector was validated with four dimensions of meaning, competence, self-determination, and impact (Spreitzer, 1995).

Frymier et al. (1996); Weber and Patterson (2000); Weber et al. (2005); and Tibbles et al. (2008) all examined the concept of empowerment in the instructional context. Frymier et al. (1996) applied the concept of empowerment to the classroom context and defined learner empowerment as the function of the three elements of meaningfulness, competence, and impact by empowering students to increase and expand their knowledge. As such, instructors who empower their students must communicate in a way that creates an environment in which students are motivated to succeed. The instrument was utilized by other studies (Daggol, 2020; Cakir & Erodogan, 2014). A study developed a learning empowerment scale utilized the constructs of sense of control, competency academic efficacy and impact which were mostly links to the subscale of LES (Guzeldereli, 2019).

Table 3.1 showed subscales and the number of itmes in the LES.

Table 3.1

Factors Variables and Items Details of LES Scale

Factors	Items Serial Numbers	No. of Items
Impact	1-15	15
Meaningfulness	16-26	11
Competence	27-38	12

3.2.3.2 Adopting of the Research Instrument (LES)

For the current research, the instrument needed minor changes in terms of class and subject context. Adopting of research instrument may be on different level i.e used as it is, used as it is and validate for new context and modify few items and then validate depends on te context instrumentas been to used (Korb, 2012). The scale was revised for Research Methods in Education. For instance, the item in the original scale was 'I have the power to make a difference in how things are done in my class' revised for the current study for the learning context of educational research as 'I have the power to make a difference in how things are done in educational research class.'

3.2.3.3 Validity of the Instrument

Validity is a process to check the instrument's ability to what extent it measures what it claims to measure (Rosendahl et al., 2019). Like a newly developed instrument, the validity of the adopted instrument also needs to be checked (Carretero-Dios & Pérez, 2007). The learning empowerment scale was validated by the experts. Face validity was ensured by the subject expert and language expert. Expert details are attached (See Annexure F).

3.2.3.4 Pilot Study

An instrument was adopted for the current study, but due to the cultural element, it was needed to validate the research instrument. So, a pilot study was carried out. A pilot study is meant to see the feasibility of the proposed research. A pilot study can also be the pre-testing or 'trying out' of a particular research instrument (Baker, 1994). A pilot study was the first practical application of the adopted learning empowerment scale. It was carried out in spring 2020. It was conducted for the following reasons:

i. Identify unclear or ambiguous items in the questionnaire in the context of the present study.
ii. Time consumed by respondents of the present study for the specific feedback format.

3.2.3.5 Reliability

The scale was adopted with moderate changes after it was suggested to ensure its reliability in the changed context. Cronbach's Alpha was used to check the reliability of the research instrument. The aim of calculating Cronbach's Alpha scores was to confirm the reliability and compare the relevancy of various items (Brown & Danaher, 2019). Overall Reliability of the instrument was .840, which is considered suitable for social sciences. The following tables show the reliability statistics:

Table 3.2

Reliability statistics of the Learning Empowerment Scale as a whole

No Item	Alpha Value
38	.840

George and Mallery (2003) suggested the following rules of thumb:

"_ > .8 – Good".

The reliability statistics of items range from .802 to .887. Therefore, the item-wise reliability of the learning empowerment scale is good.

Table 3.3

Item-wise Reliability Statistics of Learning Empowerment Scale

Item No	Alpha Value	Item No	Alpha Value
1	.871	20	.880
2	.874	21	.834
3	.842	22	.829
4	.830	23	.858
5	.875	24	.841
6	.844	25	.853
7	.821	26	.878
8	.874	27	.872
9	.831	28	.846
10	.872	29	.802
11	.823	30	.835
12	.877	31	.870
13	.819	32	.855
14	.807	33	.858
15	.829	34	.887
16	.825	35	.805
17	.873	36	.824
18	.808	37	.848
19	.831	38	.840

3.2.4 Administration of the Learning Empowerment Scale

Learner Empowerment Measurement (LES) was administered four times. To minimize the testing effect, the same scale was administered in four different ways. By generation of two equivalent forms, it was administered to the whole class at once, and the scales were administered individually. To address the testing effect in time series, different forms may be generated by changing the order of the subscales or items and by changing

the setting for administering the instrument (Creswell, 2012). The details of administration are given in the following paragraphs.

3.2.4.1 First Time Research Scale Administration

The Learning Empowerment Scale (LES) was administered one month after the commencement of the classes of Spring 2021. It was the month of December. Students were exposed to the scale. The setup for data collection is the classroom setting. Students were guided about the scale, its variables, and subdomains.

Administration Protocol: Form 1 of the two equivalent forms (See Annexure A)

Setting: All Students were investigated in the class at once.

3.2.4.2 Second Time Research Scale Administration

It was the month of April when the LES was administered for the second time. The setting of administering the LES was changed to avoid the maturation effect of the experiment. Students were surveyed individually using the same data collection scale, unlike the administration for the first time in the class.

Administration Protocol: Form 2 of the two equivalent forms (See Annexure B)

Setting: Students were investigated individually on the scale.

3.2.4.3 Third Time Research Scale Administration

It was the time of the final exams, the month of June when the scale was administered. The arrangement of the scale was changed to avoid the maturation effect. The sequence of domains in the scale was changed, and items were shuffled in the domains.

Administration Protocol: Form 1 of the two equivilant forms (See Annexure B)

Setting: All Students were investigated in the class at once.

3.2.4.4 Fourth Time Research Scale Administration

Data were collected after the completion of the course and experiment. It was done after the month of the third measurement. The purpose of measuring at this point was to know the retention of empowerment and to increase the data points to see a clearer picture of the changes in the result of the concept mapping intervention.

Administration Protocol: Form 1 of the two equivalent forms (See Annexure A)

Setting: Students were investigated individually on the scale.

3.2.5 Experimental Procedure/ Treatment

The experiment was initiated in the 7th semester of the BS Education program. Reseach course was selected for the study. Research is a scientific and systematic way where every successive step based on the previous one. So creating linkage among the content is very necessary for conceptual understanding of the subject. One semester was devoted to instructing aspiring teachers using concept mapping as a method of instruction. Four phases comprised the design of the study: before, during, final and after the intervention. In order to collect additional data points, the instrument was administered twice throughout the intervention. The final assessment of the research instrument was conducted after the withdrawal of the intervention in order to evaluate the participants' continued learning empowerment. For retention, one month time was taken as a gap period after instruction.

3.2.6 Application of Concept Mapping

Literature showed four types of concept mapping with varying uses. Keeping this in mind, the study employed three of them i.e. spider, hierarchical, and flowchart, according to the nature of the content. For example, spider maps were used on the topic of

‘types of research’, a flowchart was used in ‘research methodology’, and hierarchical ‘sample and sampling techniques’. For some of the topics, it was enough to complete with a single type of map, although some of the topics were explained with more than one type depending on the content complexity and students’ maturity in using concept mapping.

3.2.7 Quantitative Data Collection

Data were collected according to the data collection plan given in the first section of the chapter. The researcher collected the data herself, and the small sample size made it easy to ensure a 100 percent response rate. The following are the details of data collection for different time slots.

1. Students' learning empowerment was measured on the Learning Empowerment Scale (LES) before exposing them to the intervention of concept mapping in the educational research course. It was the first measurement to determine prospective teachers’ learning empowerment level.
2. The intervention of teaching through concept mapping was taken in the class.
3. An orientation class was organized to instruct prospective teachers regarding the use of concept mapping in their course of research methods in education.
4. At the time of mid-term exams, two and half months after administering the LES scale for the first time, prospective teachers were measured on the Learning Empowerment Scale (LES) for the second time.
5. The first and second measurements were analyzed and compared. Differences were noted.
6. Intervention remained continued till the end of the semester.

7. At the time of the final term exam, students were measured on the Learning Empowerment Scale (LES) for the third time.
8. For recording data on retention, the scale was administered after one month of completion of the study period (intervention time).
9. Overall, four measurements were observed and compared, and differences were noted.

3.2.8 Quantitative Data Analysis

A time-series experimental design was used to analyze the collected data. As the sample size was small, data normality was needed to ensure. For this purpose, the Shapiro-Wilk test was used. The Shapiro-Wilk test shows results of data normality at the significance level and, second, skewness of the distribution. This study used a skewness approach for data normality. There were two objectives for the study. The first objective targeted measurement of learning empowerment by using mean and standard deviation, which were employed to get the magnitude of the change. The second objective was concerned with the comparison of learning empowerment, and a paired sample t-test was used for it. Besides, Cohen's D formula was used to calculate the significance of the effect size.

3.2.9 Threats to Validity

3.2.9.1 Internal Validity

Table 3.4

Ways to Control Internal Threats to Equivalent Time Series

S.No	Threats	How to Treat?
1	Related to Participants	
	History	Minimized by short time intervals
	Regression	The researcher observed the pre-test score and controlled the outliers.
	Selection	Not Relevant as one group was used in the study
	Mortality	Students were bound to complete the course.
2	Related to Treatments	
	Diffusion of Treatment	Not Relevant due to research design
	Compensatory equalization	Not Relevant due to research design
3	Related to Procedure	
	Testing	The researcher used different forms of measures.
	Instrumentation	Equivalent forms of measures were used.

Time series design is considered to decrease the threats to internal validity where randomization is absent. Time series design controls all the factors related to internal validity except the history factor (Swaminathan & Algina, 2010). Testing is considered one of the threats to internal validity as participants have become familiar with the measuring

instruments. In this study, threats to internal validity were handled by applying recommended techniques, i.e., developing different forms of learning empowerment scales. The order of the constructs and items were changed in various forms of tests (Creswell, 2012).

3.2.9.2 External Validity

Time series design is free from randomization. It takes place in the natural environment. The whole BS class was selected for the study, which improved its external validity.

3.3 Lesson Details

The following table (3.5) shows the course timetable details. The classes were started on February 8, 2021. On the first day of the commencement of the classes, students were introduced to the course and concept mapping teaching strategy. They were instructed regarding technology and mobile apps for concept mapping. Mobile apps have different difficulty levels. Some apps allow you to extend topics to level five, like the MINDOMO app, and some allow for more complex concept maps, like Spider Scribe. The first home task was assigned to the class: search for concept mapping apps on their cell phones and share their experiences in a WhatsApp group. 11 out of 15 students shared their screenshots and discussed them.

Table 3.5

Lesson Details / Course Breakdown

S.No	Date	Topic	Type of Concept Map
1	08-February-2021	Orientation Class on the course	Spider Maps
2	10- February -2021	Definition of Research and Educational Research	Spider Maps
4	17- February -2021	Importance of Educational Research	Spider Maps
5	22- February-2021	Ethics of Educational Research	Spider Maps
6	24- February -2021	Selection of Research Problem and Topics	Flow Chart
7	01- March -2021	Writing research topic	Hieraecical Maps
8	03-March -2021	Locating Research topic	Spider Maps
9	08-March -2021	Types of Educational Research	Herarcical Maps
10	10- March -2021	Descriptive Research	Spider Maps
9	15-March -2021	Experimental Research	Spider Maps
10	17-March -2021	Historical Research	Spider Maps
11	22- March -2021	Quantitative Research	Spider Maps
12	24-March -2021	Qualitative Research	Spider Maps
	Mid-Term Exam Spring 2021 29th March 2021- 12th April 2021		
13	14-April-2021	Literature Review	Flow Chart, Spider Maps
14	19- April-2021	Techniques of Reviewing Literature Primary sources	Spider Maps
15	21- April-2021	Techniques of Reviewing Literature Secondary sources	Spider Maps
16	26-April-2021	Population	Hierarchical Maps
17	26-April-2021	Sample and Sampling	Flow Chart and Spider Maps
18	01-May-2021	Sampling Techniques	Hierarchical Maps

19	03-May-2021	Data and its types	Hierarchical Maps
20	08-May-2021	Data collection Instrument	Hierarchical Maps
21	10-May-2021	Questionnaire	Spider maps
22	15-May-2021	Interview	Spider maps
23	17- May-2021	Quality of a good research instrument	Spider maps
24	03-May-2021	Item Analysis	Flow Chart
21	22-May-2021	Data Analysis	Spider maps
22	27-May-2021	Descriptive statistics	Spider maps
23	29-May-2021	Inferential statistics	Spider maps
24	03-June-2021	Report Writing	Flow Chart, Spider maps, Hierarchical Maps
	05-June-2021		

Final Term Exam Spring 2021

1st Week of June

3.4 Qualitative Phase of the Study

Qualitative data collection was the second phase, during which participants in the experiment were interviewed regarding their experiences with concept mapping.

3.4.1 Sampling and Sample of the Study

As interviews were conducted at the end of the program, so conveniently selected students were interviewed. Six out of 15 participants in the experiment were interviewed. Therefore, the sample size for qualitative data was six. Three to ten individuals are sufficient to collect data about phenomena (Creswell & Creswell, 2019).

3.4.2 Qualitative Research Instrument

Semi-structured interviews were conducted at the end of the experiment. The interview consisted of one guiding question and sub-questions relevant to the Learning Empowerment Scale. Guiding question of the interview was:

1. What are the students' perceptions about improvement in learning empowerment through concept mapping?

3.4.3 Qualitative Data Collection

Data collection started at the end of the experiment. The time allotted for each participant was approximately thirty minutes. Responses were audio recorded and transcribed.

3.4.4 Qualitative Data Analysis

Data analysis were carried out systematically. Creswell and Creswell (2018) recommended a step procedure for qualitative data analysis.

1. Transcribed students' responses regarding learning empowerment through concept mapping
2. By coding, all the data were categorized into segments.
3. These categories were further utilized to generate themes.
4. Extracted themes were related to the subcategories of the learning empowerment scale.

Number of themes generated was 25 and number of themes related to each domain of LES i.e meaninfulness, impact and competence was 8, 6 and 6 respectively. (Details of themes are given in section 4.14.2 and 4.14.3).

CHAPTER 4

DATA ANALYSIS AND INTERPRETATION

This chapter is based on the analysis of the data. A time-series experimental design was used in the study. Data were collected using The Learning Empowerment Scale. Mean, and paired sample t-tests were employed to analyze the quantitative data. Paired sample t-test was used to compare the effects of variables in four measurements. The differences in the four measurements have also been depicted in the mean score. The second analysis was carried out through interviews with participants. Conveniently selected, six participants were interviewed on their experiences with concept mapping. To seek the answer to the question of how concept mapping as a teaching method affects the learning empowerment of students in the course of research methods in education, the following research questions and hypotheses were drawn:

i. What is the level of learning empowerment of the learners before the intervention of concept mapping as a teaching method?
ii. What is the level of learning empowerment of the learners in the middle of the intervention of concept mapping as a teaching method?
iii. What is the level of learning empowerment of the learners at the end of the intervention of concept mapping as a teaching method?
iv. What is the level of learning empowerment of the learners after the removal of intervention of concept mapping as a teaching method?

Hypotheses were drawn for the second objective which was related to the comparisons of different measurements.

$H_{01:}$ There is no significant difference in the mean score of the meaningfulness subscale of learning empowerment of prospective teachers before the intervention and mid of the intervention.

$H_{02:}$ There is no significant difference in the mean score of the meaningfulness subscale of learning empowerment of prospective teachers before the intervention and at the end of the intervention.

H_{03}: There is no significant difference in the mean score of the meaningfulness subscale of learning empowerment of prospective teachers before the intervention and after withdrawal of the intervention.

H_{04}: There is no significant difference in the mean score of the impact subscale of learning empowerment of prospective teachers before the intervention and mid of the intervention.

H_{05}: There is no significant difference in the mean score of the impact subscale of learning empowerment of prospective teachers before the intervention and at the end of the intervention.

H_{06}: There is no significant difference in the mean score of the impact subscale of learning empowerment of prospective teachers before the intervention and after withdrawal of the intervention.

H_{07}: There is no significant difference in the mean score of competence subscale of learning empowerment of prospective teachers before the intervention and mid of mid-intervention.

H_{08}: There is no significant difference in the mean score of the competence subscale of learning empowerment of prospective teachers before the intervention and at the end of the intervention.

H_{09}: There is no significant difference in the mean score of the competence subscale of learning empowerment of prospective teachers before the intervention and after withdrawal of the intervention.

H_{010}: There is no significant difference in the mean score of learning empowerment of prospective teachers before the intervention and mid of the intervention.

H_{011}: There is no significant difference in the mean score of learning empowerment of prospective teachers before the intervention and at the end of the intervention.

H_{012}: There is no significant difference in the mean score of learning empowerment of prospective teachers before the intervention and after withdrawal of the intervention.

4.1 Quantitative Data Analysis Plan

Data were collected in four time slots, before the intervention of the concept mapping and after the intervention of the concept mapping. The following process shows the data collection process.

Table 4.1

Process of Data Collection

S.No	Time of collecting data	Nomenclature
Before Intervention	One month before the start of the semester	Measurement 1
During Intervention	At the time of the mid-term exam	Measurement 2
	At the time of the Final term exam	Measurement 3
After Intervention	After ending of the semester	Measurement 4

Data collected through the above procedure was analyzed by regression curve, mean score and paired sample t-test. Mean score was used to analyze the data related to the first objective of the study, as it was concerned with measuring the learning empowerment of the students in four different slots of measurement, while paired sample t-test was used to analyze the effect of intervention in four slots of measurement.

4.2 Data Normality

Because of the small sample size, Shapiro Wilks test was chosen for testing the normality of the data. The said test is recommended when the sample size is small ranging between 5-38 (Boyer, 2013). The null hypothesis of the test was that the scores were normally distributed. To investigate the normality of distribution, a rule of thumb was used that the data would be normal if the value of skewness is less than double the value of the standard error of the skewness. Then the distributions of the data were explored, and the value of skewness was found less than the value of double the standard error. So, the

distribution was found to be normal. Tables 4.2, 4.3, 4.4, and 4.5 showed that data were normally distributed. The values of skewness of the three subscales (impact, meaningfulness, and competence) were less than the double standard error mean.

Table 4.2

Normality Before Intervention

Construct	Skewness	Standard Error	2 SE	Comment
Impact	-.265	.580	0.336	Normal
Meaningfulness	.256	.580	0.336	Normal
Competence	-.433	.580	0.336	Normal

Table 4.3

Normality of Mid-Intervention

Construct	Skewness	Standard Error	2 SE	Comment
Impact	-.224	.580	0.336	Normal
Meaningfulness	-.193	.580	0.336	Normal
Competence	-.099	.580	0.336	Normal

Table 4.4

Normality of Final Intervention

Construct	Skewness	Standard Error	2 SE	Comment
Impact	-.306	.580	0.336	Normal
Meaningfulness	-.310	.580	0.336	Normal
Competence	.260	.580	0.336	Normal

Table 4.5

Normality of Retention

Construct	Skewness	Standard Error	2 SE	Comment
Impact	.309	.580	0.336	Normal
Meaningfulness	.306	.580	0.336	Normal
Competence	.313	.580	0.336	Normal

4.3 Data Analysis

Three groups of data were prepared for analysis purposes. The first measurement was taken as a base for comparison purposes. Following is the detail of three sets of data:

i. Before and mid of intervention (impact, meaningfulness, competence, whole)

ii. Before and Final Intervention (impact, meaningfulness, competence, whole)

iii. Before and withdrawal of intervention (impact, meaningfulness, competence, whole)

The following table shows the data analysis protocol. The study was analyzed based on two objectives. The first objective was to measure the level of learning empowerment, while comparison of the learning empowerment was the intent of the second objective. Descriptive statistics (mean) and inferential statistics (Independent sample t-test) were used respectively. Cohen's D statistics was used to calculate the effect size of the difference between the mean scores of the two measurements.

Table 4.6

Data Analysis Protocol

S.No	Objectives	Hypotheses/ Research Questions	Statistics for Analysis
1	To measure the level of learning empowerment of the prospective teachers before, during, and after the intervention.	Research Questions (1-4) Research Questions 5	Mean Thematic Analysis
2	To compare the level of learning empowerment of the prospective teachers before, during, in the end, and after the removal of intervention.	Hypotheses	Paired Sample t-test Cohen's D for Effect Size

Descriptive analysis was used to calculate the central tendency. In addition, inferential analysis was applied to the data to compare the learnin empowerment of the students within and across the groups. The significance level (0.05) was applied for the comparison of the groups for the acceptance or rejection of the hypotheses. Furthermore, effect sizes for the differences were also computed to gauge the magnitude of the differences between different measurements. The effect size was computed through the Cohen's D test. Cohen's D value used in the research is parallel with the significance of the t-test, which shows the effect size. Cohen describes three levels of the observed effect. These levels are:

Small	if = or < than 0.2
Medium	if round about 0.5
Large	if = or > than 0.8

The mean score was used to measure the learning empowerment before, at mid, at the end, and after the withdrawal of the intervention. The second objective was to compare the learning empowerment of the prospective teacher before the intervention, in the middle, at the end, and after the withdrawal of the intervention. Hypotheses were generated. A paired sample t-test was used to compare the mean values of the intervention results. The steps that were taken to analyze the data are discussed below.

Analyses and interpretation of data have been described as follows:

4.4 Item-wise Analysis

Item-wise analysis was run, and the mean score was calculated for each item. Four-time measurements of each item showed a slight increase during the intervention of concept mapping and after the intervention. The first item under the subscale of meaningfulness has a greater mean value of 4.89 at the time of the last measurement while the mean score of

the same item was 2.71in previous measurements.. Likewise, the mean score of item no. 25 was related to the usefulness of class activities, so before the intervention, the mean score was 3.22, and after the withdrawal of the intervention, the mean score was 0.44 (see Appendix I)

4.5 Learning empowerment subscales of prospective teachers before the interventions

Table 4.7

Learning empowerment subscales of prospective teachers before the interventions

	N	Mean
Impact	15	28.60
Meaningfulness	15	18.40
Competence	15	20.53
Total	15	

Table 4.7 indicates that 15 candidates in the experimental group were tested before the instruction. Three subscales of learning empowerment were tested: "impact", "meaningfulness" and "competence". At the first observation, the impact had a greater mean score of 28.60, while meaningfulness and competence had a mean score of 18.40 and 20.53.

4.6 Learning empowerment subscales of prospective teachers at mid of the interventions

Table 4.8

Learning empowerment subscales of prospective teachers at mid of the intervention

	N	Mean
Impact	15	30.33
Meaningfulness	15	20.40
Competence	15	22.80
Total	15	

Table 4.8 shows that 15 candidates in the experimental group were tested in the middle of the instruction. Three subscales of learning empowerment were tested: "impact", "meaningfulness" and "competence". The mean scores of these subscales were 30.33, 20.40,0, and 22.80,0, respectively. The subscale of impact has the highest mean value, while competence and meaningfulness have the lowest mean value of 20.40. The mean scores of these subscales were 30.33, 20.40,0, and 22.80, respectively.

4.7 Comparison of learning empowerment subscales of prospective teachers before the interventions and at mid of the interventions

This part of the analysis was concerned with comparing learning empowerment scores before and after intervention. Analysis was carried out in three parts. The first part comprised the first subscale, ‘impact’ of learning empowerment—likewise, the second and third parts of the analysis comprised competence’ and meaningfulness.

4.7.1 Comparison of impact between before intervention and mid of intervention

Table 4.9

Description of impact before intervention and mid of intervention

	Mean	N
Before intervention	28.60	15
Mid of intervention	30.33	15

Table 4.9 shows the mean scores, of subscale impact before and after intervention. The mean impact scores before intervention and mid-intervention remained at 28.60 and 30.33, respectively.

Table 4.10

Comparison of impact between before intervention and mid of intervention

Mean Difference	t	df	p	Cohen's D
1.73	11.30	14	.000	.17

Table 4.10 shows that the mean score difference between the impact score before intervention and the impact score mid of intervention is 1.73 the t value is 11.30 and the significance value is less than 0.05. There was a clear difference in mean scores between the two values of impact before and mid of intervention. The significant difference was interpreted by the value of significance, which was less than 0.05.

4.7.2 Comparison of meaningfulness between before intervention and mid of intervention

Table 4.11

Description of meaningfulness between before intervention and mid of intervention

	Mean	N
Before intervention	18.40	15
Mid of intervention	20.40	15

Table 4.11 illustrates mean scores, standard deviation mean, and standard error mean of subscale meaningfulness before and mid of intervention. The mean score of meaningfulness before intervention and mid-intervention remained 18.40 and 20.40 respectively.

Table 4.12

Comparison of meaningfulness between before intervention and mid of intervention

Mean Difference	t	df	P	Cohen's D
2.00	2.27	14	.03	.19

Table 4.12 shows that the mean score difference between the meaningfulness score before intervention and mid of intervention is 2.00 while the t-value is 2.27 and the significance value is 0.03 which is less than 0.05. There was a clear difference in mean scores between the two values of meaningfulness before intervention and mid of intervention. The significant difference was interpreted by the value of significance which is less than 0.05.

Cohen's D value is 0.19 which showed a smaller effect size. It confirms that there is no significant difference in the score of meaningfulness before

4.7.3 Comparison of competence between before intervention and mid of intervention

Table 4.13

Description of competence between before intervention and mid of intervention

	Mean	N
Before intervention	20.53	15
Mid of intervention	22.80	15

Table 4.13 showed the mean scores of competence before and mid of intervention, which were 20.53 and 22.80, respectively. It has a greater mean in the middle of the intervention than before the intervention. It also observed that before-intervention data spread more than mid of intervention.

Table 4.14

Comparison of competence between before intervention and mid of intervention

Mean Difference	t	df	p	Cohen's D
2.26	4.27	14	.001	.2

Table 4.14 shows that the mean score difference between the competence score before intervention and mid of intervention is 2.26 while the value is 4.27 and the significance value is less than 0.05. There was a clear difference in mean scores between

the two values of competence before intervention and mid of intervention. The significant difference was interpreted by the value of significance which is less than 0.05. Cohen's D value is 0.2 which confirmed the effect size.

4.8 Learning empowerment subscales of prospective teachers at the end of the interventions.

Table 4.15

Learning empowerment subscales of prospective teachers at the end of the intervention

	N	Mean
Impact	15	33.53
Meaningfulness	15	19.40
Competence	15	26.26
Total	15	

Table 4.15 confirms that 15 candidates in the experimental group were tested at the end of the instruction. Three subscales of learning empowerment were tested, which were “impact”, “meaningfulness” and “competence”. The mean scores of these subscales were 33.53, 19.40, and 26.26, respectively.

4.9 Comparison of learning empowerment subscales of prospective teachers before the interventions and at the end of the interventions

This part of the analysis was concerned with comparing learning empowerment scores before the intervention and at the end of the intervention. Analysis was carried out in three parts. The first part comprised the first subscale, ‘impact’ of learning

empowerment. Likewise, the second and third parts of the analysis comprised competence' and meaningfulness.

4.9.1 Comparison of the impact of prospective teachers before the interventions and at the end of the interventions

Table 4.16

Description of impact between before intervention and final intervention

	Mean	N
Before intervention	28.60	15
Final intervention	33.53	15

Table 4.16 reflects mean scores of subscale 'impact' before and mid of intervention. The mean score of impact before intervention and final intervention remained at 28.60 and 33.53, respectively.

Table 4.17

Comparison of impact between before intervention and final intervention

Mean difference	t	Df	p	Cohen's D
4.93	12.09	14	.001	1.28

Table 4.17 shows that the mean score difference between the impact score before the intervention and the impact score of the final intervention is 4.93 while the t value is 12.09 and the significance value is less than 0.05. There was a clear difference in mean scores between the two values of impact before intervention and final intervention. The

significant difference was interpreted by the value of significance which is less than 0.05. This difference was also confirmed by Cohen's D value of 1.28, which is greater than .8.

4.9.2 Comparison of meaningfulness of prospective teachers before the interventions and at the end of the interventions

Table 4.18

Description of meaningfulness between before intervention and final intervention

	Mean	N
Before intervention	18.40	15
Final intervention	19.40	15

Table 4.18 shows mean scores and standard deviation of subscale meaningfulness before and final intervention. The mean score of meaningfulness before intervention and final intervention remained at 18.40 and 19.40, respectively.

Table 4.19

Comparison of meaningfulness between before intervention and final intervention

Mean difference	t	df	p	Cohen's D
1.00	3.09	14	.008	1.83

Table 4.19 explains that the mean score difference between the meaningfulness score before intervention and final intervention is 1.00 while the t value is 3.09 and the significance value is less than 0.05. There was a clear difference in mean scores between the two values of meaningfulness before intervention and final intervention. The significant

difference was interpreted by the value of significance which is less than 0.05. This difference was also confirmed by the Cohen's D value 1.83 which is greater than .8.

4.9.3 Comparison of competence of prospective teachers before the interventions and at the end of the interventions

Table 4.20

Description of competence between before intervention and final intervention

	Mean	N
Before intervention	20.53	15
Final intervention	26.26	15

Table 4.20 explains the means of scores and standard deviation of subscale competence before and after the intervention. The mean score of competence before intervention and final intervention remained at 20.53 and 26.26, respectively.

Table 4.21

Comparison of competence between before intervention and final intervention

Mean Difference	t	df	p	Cohen's D
5.73	9.01	14	.000	1.48

Table 4.21 shows that the mean score difference between the competence score before intervention and final intervention is 5.73 while the t value is 9.01 and the significance value is less than 0.05. There was a clear difference in mean scores between the two values of competence before intervention and final intervention. The significant

difference was interpreted by the value of significance which is less than 0.05. This difference was also confirmed by Cohen's D value of 1.48, which is greater than .8.

4.10 Learning empowerment subscales of prospective teachers after removal of the interventions (retention).

Table 4.22

Learning empowerment subscales of prospective teachers after removal of the interventions (retention)

	N	Mean
Impact	15	40.73
Meaningful	15	26.06
Competence	15	26.73
Total	15	

Table 4.22 states that 15 candidates in the experimental group were tested for retention after the instruction. Three subscales of learning empowerment were tested, which were "impact, "meaningfulness" and "competence". The mean scores of these subscales were 40.73, 26.06, and 26.73, respectively.

4.11 Learning empowerment subscales of prospective teachers before the interventions and after removal of the interventions (retention)

This part of the analysis was concerned with comparing learning empowerment scores before and at the removal of the intervention. Analysis was carried out in three parts. The first part comprised the first subscale, 'impact' of learning empowerment. Likewise, the second and third parts of the analysis comprised competence' and meaningfulness.

4.11.1 Comparison of the impact of prospective teachers before the interventions and after removal of the interventions (retention)

Table 4.23

Comparison of Impact before Intervention and after Removal of Intervention

	Mean	N
Before	28.60	15
Retention	40.73	15

Table 4.23 shows the mean score and standard deviation of subscale impact on final intervention and retention. The mean score of impact final intervention and retention remained at 33.53 and 40.73, respectively.

Table 4.24

Comparison of impact between before intervention and retention

Mean difference	t	df	p	Cohen's D
7.20	4.69	14	0.01	1.41

Table 4.24 shows that the mean score difference between the impact score before intervention and retention is 7.20 while the t value is 4.69 and the significance value is less than 0.05. There was a clear difference in mean scores between the two values of impact final intervention and retention. The significant difference was interpreted by the value of significance which is less than 0.05.

4.11.2 Comparison of meaningfulness of prospective teachers before the interventions and after removal of the interventions (retention)

Table 4.25

Description of meaningfulness between before intervention and retention

	Mean	N
Before	18.40	15
Retention	26.06	15

Table 4.25 shows mean scores and standard deviation of subscale meaningfulness before intervention and retention. The mean score of meaningfulness final intervention and retention remained at 19.40 and 26.06, respectively.

Table 4.26

Comparison of meaningfulness between before intervention and retention scores

Mean difference	T	df	p	Cohen's D
6.66	4.85	14	.000	1.32

Table 4.26 shows that the mean score difference between meaningfulness before intervention and retention is 6.66 while the t value is 4.85 and the significance value is less than 0.05. There was a clear difference in mean scores between the two values of meaningfulness final intervention, and retention. The significant difference was interpreted by the value of significance which is less than 0.05.

4.11.3 Comparison of competence of prospective teachers before the interventions and after removal of the interventions (retention)

Table 4.27

Description of competence between before intervention and retention

	Mean	N
Before	20.53	15
Retention	26.73	15

Table 4.27 shows mean scores and standard deviation of subscale competence before intervention and retention. The mean score of competence final intervention and retention remained at 26.26 and 26.73, respectively.

Table 4.28

Comparison of competence between before intervention and retention

Mean difference	T	df	P	Cohen's D
.46	.37	14	.71	.14

Table 4.28 shows that the mean score difference between competence before the intervention and retention is -0.46 while the t value is -0.73 and the significance value is less than 0.05. There was a clear difference in mean scores between the two values of competence final intervention and retention. There is no significant difference was interpreted by the value of significance which is 0.71 and is more than 0.05. Cohen's D value of .14 is less than .2, which showed the size the smaller value of .14 is less that .2 which showed the size was smaller.

4.12 To measure the level of learning empowerment of the prospective teachers before, during, and after the intervention and at retention (objective 1)

Table 4. 29

Measurement of learning empowerment

	N	Mean
Before	15	69.53
Mid	15	73.53
After	15	79.20
Retention	15	93.53
Total	15	

Table 4.29 indicates the measurement of learning empowerment scores before, during, and after the intervention, and at retention. The mean scores before, during, after the intervention, and at retention are 69.53, 73.53, 79.20, and 93.53, respectively. There is a very small spread of score data after intervention, which is 6.14, and retention data has the largest spread out, which is 14.94.

4.13 To compare the level of learning empowerment of the prospective teachers before, during, after the intervention, and at retention (Objective 2)

This part of the analysis was concerned with comparing learning empowerment scores for mid-intervention and at the end-of-intervention. Analysis was carried out in three

parts. The first part comprised the first subscale, 'impact' of learning empowerment. Likewise the second and third parts of the analysis comprised competence' and meaningfulness.

4.13.1 Comparison of Learning Empowerment Before and mid-intervention

Table 4.30

Learning empowerment and effect size before and mid-intervention

	Mean	df	t	P	Cohen's D
Before intervention	69.53				
Mid of intervention	73.53	14	7.61	0.001	0.89

According to table 4.30, the Mean scores of the before intervention and mid of intervention for learning empowerment are 69.53 and 73.53, respectively. This indicates that the score data for the mid-intervention is less spread out than before the intervention. In addition, the t-value is 7.61, and the level of significance is 0.000, which is less than the alpha value of 0.05. [t (14) = 7.61; $p < 0.001$; r=0.89]. The magnitude of the difference was computed to calculate the effect size. So the value of effect size remained at 0.89 and the magnitude of the difference was large. In this connection, the results imply that there is a significant difference in both the results of learning empowerment. Therefore, the null hypothesis (H010) failed to be accepted because there is a significant difference in the learning empowerment of the prospective teachers before and mid of intervention.

4.13.2 Comparison of learning empowerment before and final intervention

Table 4.31

Learning empowerment and effect size before and final intervention

	Mean	df	t	P v	Cohen's D
Before intervention	69.53				
Final intervention	79.20	14	9.37	0.001	0.93

According to table 4.31, Mean scores of the before-intervention and final intervention for learning empowerment are 69.53 and 79.20, respectively. In addition, the t value is 9.37 and the level of significance is 0.000, which is less than the alpha value of 0.05. [t (14) = 9.37; $p < 0.001$; r=0.93]. The magnitude of the difference was computed to calculate the effect size. So, the value of effect size remained 0.93, and the magnitude of the difference was large. In this connection, the results imply that there is a significant difference in both the results of learning empowerment. Therefore, the null hypothesis (H11) fails to be accepted because there is a significant difference in the learning empowerment of the teacher educators before and final the intervention.

4.13.3 Comparison of learning empowerment before and retention intervention

Table 4.32

learning empowerment and effect size before intervention and retention

	Mean	df	t	P	Cohen's D
Before intervention	79.20				
Retention	93.53	14	3.90	0.005	0.72

According to table 4.32, Mean scores of the final intervention and mid of intervention for learning empowerment are 79.20 and 93.53, respectively. IIn addition, the t-value is 3.90 and the level of significance is 0.002, which is less than the alpha value of 0.05. [t (14) = 3.90; p < 0.002; r=0.72]. The magnitude of the difference was computed to calculate the effect size. So the value of effect size remained at 0.72 and the magnitude of the difference was large. In this connection, the results imply that there is a significant difference in both the results of learning empowerment. Therefore, the null hypothesis (H012) fails to be accepted because there is a significant difference in the learning empowerment of the prospective teachers in final intervention and retention.

4.14 Qualitative Data Analysis

4.14.1 Qualitative Data

Apart from the quantitative data, students were interviewed to strengthen the results found on the numerical scale. Qualitative data were collected through interviews. A total of six students were approached based on convenient sampling. Semi-structured interview

form was used with one guiding question followed by three themes of the Learning Empowerment Scale (impact, competence, meaningfulness) was used in the interviews.

For the analysis of qualitative data, three steps were followed which are

- Reading/Memoing
- Describing
- Classifying (Gay, 2015)

Students' responses were put into categories. Respondents' narratives were analyzed based on three categories of the Learning Empowerment Scale. (Impact, Meaningfulness, Competence)

4.14.1.1 Respondent 1

Concept maps were helpful in linking different concepts. Thinking and trying to relate different concepts helped me understand the essence of the topic. I remember the first class when students were assigned a task to map the course content, and that activity is still part of my active memory.

4.14.1.2 Respondent 2

Concept mapping is a thoroughly artistic work. I loved to work with concept mapping. Drawing lines, making connections, and gradually expanding the diagram is a satisfactory activity. I remember working on the topic's research hypothesis. Concept maps gave meaning to abstract concepts.

4.14.1.3 Respondent 3

Working with concept mapping increased my confidence level. Working with concept mapping was not easy, but once I created a map, I observed an improvement in my response level. It had been prompt and valid. Concept maps allow one to present one topic in multiple ways because of its different types. There was a lot of busy work. Students waited for others' work to see how they linked and extended the concept.

4.14.1.4 Respondent 4

I found it helpful when I applied it beyond the subject, for example, in other courses. Concept mapping gave sense to overall understanding. Concept mapping was time-consuming. My created maps are considered helpful and productive in the class.

4.14.1.5 Respondent 5

At first, it was challenging for me to work, but later on, it was conducive when there was a discussion on an assigned home task in the subject. Mapping concepts retain learning for longer as the whole picture is displayed in the mind. The entire class actively listened and participated in this process.

4.14.1.6 Respondent 6

It helped me learn the research concept. It was an enjoyable activity. I did not feel bored because concept maps gave me multiple ways of working on the same concepts. At home, I felt more excited about the same topic, and a variety of pictorial

presentations were displayed in the next class. Concept maps, in particular, made it easy to give answers to the questions in the class.

4.14.2 Themes Extracted from Interviews

4.14.2.1 Interviewer 1.

1. Helpful to link different concepts
2. Understand the essence of the topic
3. Still the part of my active memory.

4.14.2.2 Interviewer 2

1. Artistic work.
2. I loved to work with concept mapping.
3. Satisfactory.
4. Gave meaning to the abstract concepts.
5. Comfortable in class discussion.

4.14.2.3 Interviewer 3

1. Increased my confidence level.
2. Working with concept mapping was not easy
3. I observed improvement in my response level.
4. Prompt and valid response
5. Busy work.

4.14.2.4 Interviewer 4

1. Useful when applied beyond the subject.
2. Provided sense to different concepts by linking.

3. Students wanted to participate in class activities.
4. Time consuming.

4.14.2.5 Interviewer 5

1. Challenging at the initial stage
2. Help retain learning for a longer time
3. Students Active involvement in class discussion

4.14.2.6 Interviewer 6

1. Enjoyable activity.
2. Did not feel bored.
3. Give me multiple ways of working on the same concepts.
4. Comfortable in answering the question.
5. Failing to connect concepts demotivated me.

4.14.3 Themes Related to the Learning Empowerment Scale (LES)

The Learning Empowerment Scale (LES) has three subcategories. The following table shows extracted themes in the relevant category of the LES. Students belief that concept mapping were helpful to link different concepts, understand the essence of the topic and give meaning to the abstract concepts. In the category of impact students feel that with work with concept mapping, others students showed interst in my workand give opportunity to work in multiple styles. Like wise in the category of compcetence, students feel more confident, comfortable during discussions.

Table 4.33

Themes Related to Categories of Learning Empowerment Scale

Respondents	Relevant to Meaningfulness	Relevant to Impact	Relevant to Competence
1	1.Helpful to link different concepts 2.Understand the essence of the topic	1.Other students showed interest in my work	1. Confident feeling
2	1. Gave meaning to the abstract concepts.	1.Satisfactory activity learning with concept mapping 2. Loved to work with concept mapping	1.Feeling comfortable in class discussion
3	1. The work of fellow students is considered important.	1. Opportunity to present Work in multiple styles.	1. Increased my confidence level. Observed 2.Improvement in my response level
4	1.Useful when applied in other areas of learning	1. My work is considered important in the class.	
5	1. Retain learning for a longer time		1. Students Active involvement in class discussion
6	1.Enjoyable activity 2. Did not feel bored	1.Provided multiple ways of working on the same concepts	1. Comfortable in answering the question.

Table 4.33 shows students resposes rearding use of concept maps in educational research course. Students responses were categorized and relate to the domains of LES. Total number of themes were enerated from participants responses were 25. Among them 8 themes were related to meaningfulness and six themes were related to the domains of impct and competence each.

4.15 Integration of Data

Triangulation may be at three levels of mixed metod research i.e at desin level, metod level and reportin level (Alele and Malau-Aduli, 2023). So in this study the researcher integrate two approaches at design level and at conclusion level so details are given in chapter 3 and 5.In the final stage of the data integration, the findings of the qualitative and quantitative data were converged. The findings of the quantitative data analysis revealed that concept mapping has a positive effect on learning empowerment, while the same findings were forwarded by analysis of qualitative data. It showed the trustworthiness of the quantitative data.

CHAPTER 5

SUMMARY, FINDINGS, DISCUSSION, CONCLUSIONS, AND RECOMMENDATIONS

5.1 Summary

The purpose of this study was to investigate the impact of the concept-mapping instructional approach on the learning empowerment of students within the framework of educational research. It is universally recognized that research plays a crucial role in informing actions. Effective research holds profound implications for the progress of the country. Particular emphasis must be placed on the learning phase of the research before undertaking actual studies in the respective field. A comprehensive conceptual comprehension of the research is critical in order to enhance its quality. The extent to which students possess a solid understanding of the subject is largely contingent upon the way teachers deal with the teaching of research.

Concept mapping is considered a teaching strategy that engages learners in the construction of knowledge based on existing schemas in mind. Concept mapping is the process of making meaningful relationships by representing knowledge graphically. It creates systematic connections among the concepts. Research studies show its positive effect on learning and academic performance. The effectiveness of concept mapping has been proven in science subjects. Since research is a purely scientific study; therefore, concept mapping may be an effective teaching tool for the teaching of research. Several studies have been conducted to determine the effectiveness of concept mapping in the teaching and learning process at the school level.

The purpose of the study was to determine the effect of concept mapping on the learning empowerment of prospective teachers. Learning empowerment is a newly emerging area in education. It is the state of gaining power and control over learning and the process of learning. Secondly, the study aimed to determine the retention of learning empowerment as a result of intervention through concept mapping. To achieve the objectives, an explanatory mixed method sequential design was adopted where the researcher initially collected quantitative data and for confirmation of the results, qualitative data was collected. Prospective teachers of the BS program were the target population of the study. A sequential explanatory mixed method design was used for the study. An equivalent time-series experimental design was used in the first phase of the study. Prospective teachers in educational research comprised the subjects for intervention. The subjects were exposed to the treatment for one semester. The "learning empowerment scale" was adopted for quantitative data while qualitative data comprised respondents' narratives. Learning Empowerment Scale (LES), was developed to measure empowerment (Frymier & Shulman, 1996). LES was administered four times to complete the equivalent time series experimental design. LES was administered four times to record observations via the scale and its basic requirement was to establish different forms and settings. For this purpose, different structures of the scales and different settings for administering were used in the study. Measurements were taken before, during, at the end, and after the interventions. Two measurements have been taken during intervention time. Measurements have been compared and recorded at different time intervals. The mean, standard deviation, sample t-test, and thematic

analysis were used to analyze the data. The following findings were drawn from the study:

5.2 Quantitative Data Findings

The purpose of the study was to determine how students' learning empowerment was impacted by the implementation of concept mapping as an instructional method. To calculate their numerical values, research questions and hypotheses were generated for statistical reasons. The following findings were drawn in light of the analysis. The findings were organized based on research questions and hypotheses.

5.2.1 Research Question 1

1. The first research question was related to exploring the level of learning empowerment before the intervention and for it, fifteen participants were asked. It was the time of data measurement when participants were not exposed to the concept mapping. Recorded data indicated the level of learning empowerment of the students for the research subject. (Table 4.8)

5.2.2 Research Question 2

2. The second research question was to explore the level of learners' learning empowerment at the middle of intervention. The observations recorded via LES (Learning Empowerment Subscale) revealed continuous improvement in the empowering attitude of the students during educational research. After the intervention, it was revealed that there was an increase in the level of empowering attitude of the students towards the research subject (Table 4.9).

5.2.3 Research Question 3

3. The third research question was to explore the level of learners' learning empowerment at the end of the intervention. It was revealed that there was continuous improvement in the empowering attitude of the students during educational research. After the intervention, it was revealed that there was an increase in the level of empowering attitude of the students towards the research subject (Table 4.15).

5.2.4 Research Question 4

4. The fourth research question was to explore the level of learners' learning empowerment and analysis of collected data after withdrawal of the intervention revealed that students had a greater empowering attitude for learning as compared to previous measurements. At this point, meaningfulness subscale showed a decrease in the mean score (Table. 4.28).

1. The score on impact increased throughout the intervention of concept mapping.
2. The score on meaningfulness remained the same before and mid of the intervention, while it showed a decrease in the final of the intervention. At the time of retention, the score of meaningfulness increases.
3. The score of competence also showed an increase throughout the intervention of concept mapping.

5.2.5 Meaningfulness

5. $H_{01:}$ There is no significant difference in the mean scores of meaningfulness subscale of learning empowerment of prospective teachers before the intervention and mid of intervention. (Fail to accept)

t-test showed significant differences ($p < 0.05$) between the measurements before the intervention and mid of the intervention. Analysis of the data indicated a slight increase in the mean scores of the meaningfulness subscale of the LES. At this point, students were exposed to the intervention of concept mapping for two months. The t-value is 2.27 and the significance value is 0.03 which is less than 0.05. Data analysis revealed that students showed an increase in the empowerment attitude towards research subjects with concept mapping intervention. (4.11).

6. H_{02}: There is no significant difference in the mean scores of the meaningfulness subscale of learning empowerment of prospective teachers before the intervention and at the end of the intervention. (Fail to accept)

   A second comparison was made between the two measurements before and at the end of the intervention. It was observed from the data analysis that the mean scores were improved than the second measurement. It was also depicted from the t-test ($p < 0.05$). Students felt that research subjects and activities in this were important for them. The mean scores of impact before intervention and final intervention remained at 28.60 and 33.53 respectively. The mean score difference between the impact score before the intervention and the impact score final intervention is 4.93 the standard deviation is 1.57, the t value is 12.09 and the significance value is less than 0.05. There was a clear difference in mean scores between the two values of impact before intervention and final intervention. The significant difference was interpreted by the value of significance which is less than 0.05. Here is a considerable difference between the scores. Therefore, the null hypothesis was rejected.

7. H_{03}: There is no significant difference in the mean score of the meaningfulness subscale of learning empowerment of prospective teachers before the intervention and after withdrawal of the intervention. (Rejected)

   The comparison was made between the measurements before the intervention and after the withdrawal of the intervention. It was revealed that students had retained an empowering attitude towards learning via concept mapping. The mean score difference between meaningfulness final intervention and retention is 6.66 and standard deviation is 5.31, the t value is 4.85 and the significance value is less than 0.05. There was a clear difference in mean scores between the two values of meaningfulness final intervention and retention. The significant difference was interpreted by the value of significance which is less than 0.05. Here is a significant difference between the scores. Therefore, the null hypothesis was rejected. (4.38).

5.2.6 Impact

4. H_{04}: There is no significant difference in the mean score of the impact subscale of learning empowerment of prospective teachers before the intervention and mid of intervention. (Fail to accept)

   There is a significant difference between the mean scores of the two measurements. The impact was the second subscale of the LES. First comparison was made between the measurement of before the intervention and mid of intervention. Mean scores of impact before intervention and mid of intervention remained at 28.60 and 30.33, respectively. The mean score difference between the impact score before intervention and the impact score mid of intervention is 1.73 the standard deviation is 0.59, the t value is 11.30 and the significance value is less than 0.05. There was

a clear difference in mean scores between the two values of impact before intervention and mid of intervention. The significant difference was interpreted by the value of significance which is less than 0.05. Here is a significant difference between the scores. Therefore, the null hypothesis was fail to accept (Table.4.10).

5. H_{05}: There is no significant difference in the mean scores of impact subscale of learning empowerment of prospective teachers before the intervention and at end of the intervention. (Rejected) (Table.4.17).

   There is a significant difference in the mean scores of the impact before the intervention and at the end of the intervention. The mean scores of impact before intervention and final intervention remained at 28.60 and 33.53, respectively. The mean score difference between the impact score before intervention and the impact score final intervention is 4.93 the standard deviation is 1.57, the t value is 12.09 and the significance value is less than 0.05. There was a clear difference in mean scores between the two values of impact before intervention and final intervention. The significant difference was interpreted by the value of significance which is less than 0.05. This difference was also confirmed by Cohen's D value of 1.28 which is greater than .8. Here is a significant difference between the scores. Therefore, the null hypothesis was rejected (Fail to accept.)

10. H_{06}: There is no significant difference in the mean scores of the impact subscale of learning empowerment of prospective teachers before the intervention and after withdrawal (retention) of the intervention. (Fail to accept)

    There is a significant difference in the mean scores of the two measurements. The mean score of impact before intervention and retention remained at 33.53 and 40.73

respectively. The mean score difference between impact scores final intervention and retention is 7.20 the t value is 4.69 and the significance value is less than 0.05. There was a clear difference in mean scores between the two values of impact before intervention and retention. The significant difference was interpreted by the value of significance which is less than 0.05. Here is a significant difference between the scores. Therefore, the null hypothesis failed to be accepted. (Table 4.30)

5.2.7 Competence

6. H_{07}: There is no significant difference in the mean scores of competence subscale of learning empowerment of prospective teachers before the intervention and mid of the intervention. (Failed to accept)

   There is a significant difference in the means of the two measurements. The mean score of competence before intervention and mid of intervention remained at 20.53 and 22.80 respectively. The mean score difference between the competence score before intervention and mid of intervention is 2.26 and standard deviation is 2.05, the t value is 4.27 and the significance value is less than 0.05. There was a clear difference in mean scores between the two values of competence before intervention and mid of intervention. The significant difference was interpreted by the value of significance which is less than 0.05. Here is a significant difference between the scores. Therefore, the null hypothesis failed to be accepted. (Table 4.14).

7. H_{08}: There is no significant difference in the mean scores of the competence subscale of learning empowerment of prospective teachers before the intervention and at the end of the intervention. (Failed to accept)

There is a significant difference between the mean scores of the two measurements recorded before the intervention and at the end of the intervention. The mean scores of competence before intervention and final intervention remained at 20.53 and 26.26, respectively. The mean score difference between the competence score before the intervention and the final intervention is 5.73 and standard deviation is 2.46, the t value is 9.01 and the significance value is less than 0.05. There was a clear difference in mean scores between the two values of competence before intervention and final intervention. The significant difference was interpreted by the value of significance which is less than 0.05. This difference was also confirmed by Cohen's D value of 1.48 which is greater than .8. Here is a significant difference between the scores. Therefore, the null hypothesis failed to be accepted. (Table 4.21).

8. H_{09}: There is no significant difference in the mean scores of the competence subscale of learning empowerment of prospective teachers before the intervention and after withdrawal of the intervention. (Accepted) (Table 4.34).

There is no significant difference in the mean scores of the competence subscale before the intervention and after the withdrawal of the intervention. The mean scores of competence, final intervention and retention remained at 26.26 and 26.73, respectively. The mean score difference between competence final intervention and retention is 0.46, t value is -0.73 and the significance value is less than 0.05. There was a clear difference in mean scores between the two values of competence final intervention and retention. There is no significant difference was interpreted by the value of significance which is 0.71 and is more than 0.05. Cohen's D value of .14 is less than .2 which showed the

size was smaller. Statistics showed that difference was not significant, so the null hypothesis was accepted.

9. $H_{010:}$ There is no significant difference in the mean score of learning empowerment of prospective teachers before the intervention and mid of the intervention. (Failed to accept)

   There is a significant difference in the mean scores of the learning empowerment of the prospective teachers before the intervention and mid of the intervention. The Mean scores of the before-intervention and mid of intervention for learning empowerment are 69.53 and 73.53 respectively.. In addition, the t-value is 7.61 and the level of significance is 0.000, which is less than the alpha value of 0.05. [t (14) = 7.61; $p < 0.001$; r=0.89]. The magnitude of the difference was computed to calculate the effect size. So the value of effect size remained at 0.89, and the magnitude of the difference was large. In this connection, the results imply that there is a significant difference in both the results of learning empowerment. Therefore, the null hypothesis (H_{10}) is rejected because there is a significant difference in the learning empowerment of the prospective teachers before and mid of the intervention. (Table 4.42).

10. H_{011}: There is no significant difference in the mean scores of learning empowerment of prospective teachers before the intervention and at the end of the intervention. (Failed to accept) (Table 4.43).

    There is a significant difference between the mean scores of the learning empowerment of the prospective teachers before the intervention and at the end of the intervention. The mean scores of the before-intervention and final intervention for learning empowerment are 69.53 and 79.20, respectively. Moreover, the values of

standard deviation before intervention and final intervention are 9.67 and 6.14, respectively. This indicates that the score data for the final intervention is less spread out than before the intervention. In addition, the t value is 9.37 and the level of significance is 0.000, which is less than the alpha value of 0.05. [t (14) = 9.37; $p < 0.001$; r=0.93]. The magnitude of the difference was computed to calculate the effect size. So, the value of effect size remained 0.93, and the magnitude of the difference was large. In this connection, the results imply that there is a significant difference in both the results of learning empowerment. Therefore, the null hypothesis (H_{011}) was rejected because there is a significant difference in the learning empowerment of the teacher educators before and after the intervention.

11. H_{012}: There is no significant difference in the mean scores of learning empowerment of prospective teachers before the intervention and after withdrawal of the intervention. (Failed to accept) (Table 4.45)

There is a significant difference between the mean scores of the learning empowerment of the prospective teachers before the intervention and after the withdrawal of the intervention. The mean scores for the final intervention and the middle of the intervention for learning empowerment are 79.20 and 93.53 respectively. Moreover, the values of standard deviation in final intervention and retention are 6.14 and 14.94, respectively. This indicates that the score data for the final intervention is less spread out than that for retention. In addition, the t-value is 3.90 and the level of significance is 0.002, which is less than the alpha value of 0.05. [t(14) = 3.90; $p < 0.002$; r=0.72]. The magnitude of the difference was computed to calculate the effect size. So, the value of effect size remained 0.72, and the magnitude of the difference was large. In this

connection, the results imply that there is a significant difference in both the results of learning empowerment. Therefore, the null hypothesis (H_{012}) failed to be accepted because there is a significant difference in the learning empowerment of the prospective teachers in final intervention and retention.

5.3 Qualitative Data Findings

1. Participants' responses indicated that concept mapping helped empower students to learn the subject of research.
2. Creating links among the concepts enables them to understand the conceptual understanding.
3. It allows us to understand the breadth and depth of the concepts. In this process, students gain confidence and are able to retain concepts for a longer time.
4. It was also indicated that concept maps make it easy for students to explain in their own words the materials displayed in pictorial form.
5. Codes under subcategories of the learning empowerment scale indicated the positive influence of concept mapping on the overall learning empowerment of the students.

5.4 Integration of Quantitative and Qualitative Findings

Triangulation may be at three levels of mixed metod research i.e at design level, method level and reporting level (Alele and Malau-Aduli, 2023). So in this study the researcher integrate two approaches at design level and at conclusion level so details are given in chapter 3 and 5.In the final stage of the data integration, the findings of the qualitative and quantitative data were converged. The findings of the quantitative data analysis revealed that concept mapping has a positive effect on learning empowerment,

while the same findings were forwarded by analysis of qualitative data. It showed the trustworthiness of the quantitative data.

5.5 Discussion

The result showed differences in the mean scores of the measurements observed in four-time slots. It is observed that the mean scores of each subsequent measurement were greater than the previous one. An upward increase was observed in the mean score of the learning empowerment before, mid, and final intervention. While this increase has shown a decline at the time of retention measurement. Although the mean score has remained greater than the first two measurements taken before and mid of intervention. While observing the second objective, where the researcher intended to make a comparison of the mean differences, statistics showed significant differences in the mean scores of the different measurement groups. Multiple factors are responsible for the above-stated results. The most important one is that concept mapping provides the opportunity to make links and connections in the wide concepts of the subjects. It was also supported by Ausubel's (1968) Meaningful Learning Theory, which, as a result, allows students to gain more confidence in the subject. According to Joshi et al. (2022), concept maps have the potential to develop metacognitive skills in leaning as they provide a platform to use learned material for new learning. Likewise, the results of the study are aligned with previous empirical studies Macfall (1999), Chei (2008), Brain (1998), Aldebai (2000), Anahita et al. (2013), for the effectiveness of concept mapping in learning paradigm. Concept maps depend on the logical arrangements of the contents. As a result, students gain confidence in the learning material and process, which empowers them to learn independently during the course.

The results showed that university students' engagement in research courses via concept maps has a positive impact on students learning empowerment. The findings of the study are consistent with other studies in the literature Lee & Song, (2010), You et al. (2014) that revealed the benefits of concept maps in the academic domain. In addition, learning empowerment had a significant mediating effect on the relationship between concept maps and engagement. The study showed a positive effect on the meaningfulness subscale of learning empowerment. It was also supported by the study (Ningrum & Nandi, 2021). The technique of concept mapping can be used in meaningful learning processes in the geography subject for senior high school students. It also helps in the process of constructive thinking can be observed visually through a mind-map. Concept mapping in teaching and learning can fix the students' confidence level in the learning environment. It also helps in rapid learning and increases students' success rate. This is what the traditional approaches lack, for it depends on the teacher. Concept mapping values the learner's awareness in searching and discussing skills in the learning process. Students gain control of their learning which makes them self-directed learners. Fang, (2018) reported a positive attitude toward engineering courses, while negative responses were observed as concept mapping as exhaustive work.

Concept maps significantly increase the competence level of the students, and it was also supported by the study (Sultan, 2014). The study observed the same findings that concept maps enable students to self-control and self-learning. For constructing concept maps students require reading ability, comprehension, organizing, and reorganizing their thoughts. The application of this technique contributes to the acquisition of the learning to learn competence, autonomy, and personal initiative, thus promoting improvements in the

students' teaching-learning process, rendering it more effective (Ledo et al., 2007). Concept maps play an important role in the process of competence building. Students feel more competent when they use concept mapping in their learning. The progress of the transition from unempowered to empowerment university students can be smoothed by providing them with opportunities and training in conceptual maps.

Concept mapping has made a considerable contribution to the success of education. The affective component of concept mapping strategy is that it deeply involves students in the learning domain. This element of concept mapping enhances the retention power of the students. The statistical values in the analysis of the present study showed an improvement in the post-treatment measurement. The same finding has been also reported by another study (Collins & Nyenhuis, 2021). The predictive value of concept maps for learning empowerment suggests its educational significance. Concept maps are useful for a broad range of educational purposes. Due to its feature of learner engagement, learners become active participants. Students engaged in meaningful connections between known and unknown. Connections are a must while working with concept maps. Connections are based on the constructive integration of thinking and acting and leading them to empowerment. Self-confidence and a sense of responsibility are the results of concept maps. It provides learners with self-confidence and a positive feeling of learning through which new materials become related to prior knowledge and lead to knowledge transfer and development of learning skills. The results of this study extend the findings of Hall and O'Donnell (1996), Bilesanmi-Aworderu (2002), Ahlberg and Ahoranta (2004), Malik (2009), Khawaldeh and Al-Olimat (2010), Snead and Young (2003), Czerniak and Haney (1998). The major reason is that concept mapping provides an opportunity for active

involvement of students in their learning process and hence enhances their thinking ability while cross-questioning and thinking for seeking solutions. Moreover, a positive impact on students' achievement, self-regulation, and self-efficacy is enhanced when students attend to the tasks, focus on important features, organize material, and maintain a productive psychological climate for learning.

5.6 Conclusions

1. Concept mapping has a significant effect on students' learning empowerment
2. The score of learning empowerment showed improvement in the learning empowerment of the learners.
3. A significant difference was found in every succeeded observation. So it showed that concept mapping has positive effect on students' learning empowerment.
4. The score of impact and competence increased throughout the intervention of concept mapping.
5. The score on impact increased throughout the intervention of concept mapping.
6. The score on meaningfulness remained the same before and mid of the intervention, while it showed a decrease at the end of the intervention. At the time of retention, the score of meaningfulness increases.
7. It was observed that the competence domain of learning empowerment showed improvement throughout the intervention.
8. Intervention through concept mapping showed slight progress from before the intervention to mid of the intervention. The comparison of learning empowerment of subscale impact, meaningfulness, and competence before and mid of interaction concluded that the students' learning empowerment improved till the mid of the

intervention. There was a significant difference in subscale impact before intervention and mid of intervention. There was very little dispersion of marks from the mean value. It was concluded that the sample significantly improved in the scores of meaningfulness before and mid of the intervention.

9. It was concluded that at the end of the instruction, students achieved scores in the three subscales of learning empowerment "impact", "meaningfulness" and "competence". Impact scores were maximum, and meaningfulness was minimum.

10. It was concluded that the comparison of mean scores "subscale impact" before and mid of intervention showed that, the students significantly achieved subscale impact before the intervention and final intervention.

11. The subcategory of meaningfulness before intervention and final intervention improved significantly. Scores more deviated from the mean scores before the intervention than the final intervention.

12. It was concluded that the comparison of mean scores "subscale impact" mid of intervention and final intervention showed that, the students significantly achieved in subscale impact mid and final intervention. It was also concluded that the students' learning empowerment improved significantly in meaningfulness for mid of intervention and final intervention. The score dispersion in mid remained more than the final.

13. It was concluded from the students' responses from qualitative data that students support the use of concept mappin in their learning process. It was concluded that there is tgere was improvement in the learning empowerment subvariable after instruction with concept mappin.

5.7 Implications of the Study

Findings found that concept mapping teaching strategy helps students to enhance learning empowerment. Results found that teaching with concept mapping enhances the students' sense of meaningfulness which may lead to increased motivation, deeper understanding, and better retention of the subject matter.

Besides this, it was also observed that students felt that the content was more impactful, so incorporating concept mapping into teaching practices could create a more meaningful and impactful learning environment for students.

Teacher programs may include concept mapping as a pedagogical strategy, equipping educators with the skills to facilitate students' learning empowerment through visual representations of knowledge.

5.8 Limitations of the Study

Following were the limitations of the study:

1. Time series design was used in the study because of the sample size, and formation of groups was absent from the study, comparison was made among different observation of the group, if there was controlled group, the result of the study and effect of teacing strartegy may be observed more clearly.
2. The study was conducted during Covid-19. Educational activities were running unusual mode at that time. Most of the universities stopped their teaching learning activities while some of them were a combination of face-to-face and online modes of learning. Due to the said situation, the study was conducted with a limited number of students and data was based on students' perceptions. Study results may be more accurate with a larger sample size. A researcher was restricted to conduct

the experiments with the available sample size where the formation of groups for comparison purposes was not possible.

5.9 Recommendations

As findings of the study showed that concept mapping has significant effect on prospective teachers' learning empowerment and htey showed interest in learning through concept mapping therefore it is recommended:

1. Concept mapping teaching strategy may be adopted as part of instruction by teachers educators at BS level.
2. Curriculum developers of teachers' education programe may include concept mapping in the pedagogical courses of teachers education curriculum.
3. Teachers education institutions may arrange workshops for effective utilization of concept mapping tecniques in propective teachers trainings.
4. Teachers may be trained to use concept mapping through Continious Professional Development Prorammes (CPD,s) by teachers education institutions.

5.9.1 Recommendations for Future Researchers

1. The same study having a different population may be repeated to verify the findings of the present study.
2. Other type of experimental design may be planned for future studies to verify the findings of the present study.

References

Adeniran, S. A., Ochu, A. N., & Atoo, S. F. (2018). Effects of concept mapping strategy on students' retention in basic science in benue state, nigeria. *International Journal of Research and Review, 5*(5), 193-200.

Ahmad, M. I. (2017). Enough Quantity: Time to Focus on Quality of Researchers in Pakistan. *International Higher Education*, 24-25.

Ahmed, M. A., Shittu, F. A., Yahaya, L., & Dada, A. O. (2021). Effects of concept-mapping instructional strategy on senior school students' achievement in biology. *Malaysian Online Journal of Educational Sciences*, *26*(1), 2289-3024.

Allan, A. G. (2003). Cooperative chemistry – Concept mapping in the organic chemistry lab. *Journal of College Science Teaching, 32*(5), 311-315.

Ameyaw, Y., & Okyer, M. (2018). Concept mapping instruction as an activator of students' performance in the teaching and learning of excretion. *Annuals of Review and Research, 1*(4), 93-102.

Anohina-Naumeca, A. (2019). *Concept map-Based formative assessment of students' Structural Knowledge: Theory and Practice.* Newcastle upon Tyne: Cambridge Scholars Publishing.

Ausubel, D. P. (1963). *The Psychology of Meaningful Verbal Learning*. New York, NY: Grune& Stratton.

Ausubel, D. (1968). Facilitating meaningful verbal learning in the classroom. *The Arithmetic Teacher*, *15*(2), 126-132. http://www.jstor.org/stable/41187349.

Awodun, A. O. (2017). Effects of Concept mapping teaching strategy on Students' academic performance and retention in senior secondary school Physics in Ekiti state, Nigeria. *International Journal of Research in Educational Studies, 3*(6), 10-18.

Bahr, G. S. & Dansereau, D. F. (2005). Bilingual Knowledge maps (BiK maps) as a presentation format: Delayed recall and training effects. *The Journal of Experimental Education, 73*(2), 101-11.

Bailey, D. (1992). Using participatory research in community consortia development and evaluation: lessons from the beginning of a story. *American Sociologist, 23*(4), 71- 82.

Baker, T. L. (1994), *Doing Social research (2nd Edn.),* New York: McGraw-Hill Inc.

Barlow, D. H. (1984). Single case experimental designs Strategies for studying behavior change. New York: Pergamon Press.

Bhandari, J. S. (2021). Technology and education -prospects of a future classroom. *International Journal of Education, 9*(3), 149-154.

Baumann, J. F., & Bergeron, B. S. (1993). Story map instruction using children's literature: Effects on first graders' comprehension of central narrative elements. *Journal of Reading Behavior, 25*(1*)*, 407-437.

Bawaneh, A. K. (2019). The effectiveness of using mind mapping on tenth-grade students' immediate achievement and retention of electric energy concepts. *Journal of Turkish Science Education, 16*(1), 123-137.

Benson, A., & Blackman, D. (2003). Can research methods ever be interesting?. *Active Learning in Higher Education, 4*(1), 5-7.

Benson, P. & Voller, P. (2014). *Autonomy and independence in language learning* (E-edition). Routledge. London.

Bii, K., & Chris, M. (2020). Effect of Collaborative Concept Mapping Teaching Strategy on Students Achievements and Attitudes Towards Mathematics in Selected Secondary Schools in Kenya. *European Journal of Education Studies. 2194*(1), 135-161.

Blaschke, L. M. (2012). Heutagogy and lifelong learning: A review of hauntological practice and self-determined learning. *International Review of Research in Open and Distance Learning, 13*(1). http:// www.irrodl.org/index.php/irrodl/article/view/1076/2113

Brown, A. L. (1987). Metacognition, executive control, self-regulation, and other more mysterious mechanisms. *Metacognition, motivation, and understanding, 2*(8), 65-116.

Bruner, J. S. (1966). *Toward a theory of instruction* (Vol. 59). Cambridge, MA: Harvard University Press.

Burant, P.A. (1999). *Students' perceptions of teacher's communication and its effects on students' learning.*[A Dissertation Thesis]. West Virginia University, United States.

Carretero-Dios, H., & Pérez, C. (2007). Standards for the development and review of instrumental studies: Considerations about test selection in psychological research. *International Journal of Clinical and Health Psychology, 7*(3), 863-882.

Cakır, S. G., & Erdogan, M. (2014). The adaptation of the learner empowerment scale: Validity and reliability studies. *Mustafa Kemal Universitesi Sosyal Bilimler Enstitüsü Dergisi, 11*(25), 297-307

Castillo-Martínez, I. M., & Ramirez-Montoya, M. S. (2021). Research competencies to develop academic reading and writing: a systematic literature review. *Frontiers in Education*, *5*, https://doi.org/10.3389/feduc.2020.576961

Chen, J. (2017). Design of a Three-Dimensional Cognitive Mapping Approach to Support Inquiry Learning. *Journal of Educational Technology & Society*, *20*(4),191-204.

Clark, J. M., & Paivio, A. (1991). Dual coding theory and education. *Educational Psychology Review, 3(*3), 149-170

Cleary, T.J., & Zimmerman, B.J. (2004). Self-regulation empowerment program: A school based program to enhance self-regulated and self-motivated cycles of student learning. *Psychology in the Schools*, *41*(5), 537-550.

Cohen, L., Manion, L. & Morrison, K. (2007). *Research methods in education.* Routledge

Collins, B., & Nyenhuis, R. (2021) The Effectiveness of Concept Maps for Students' Learning and Retention. *Journal of Political Science Education, 17*(1), 897-909.

Conger, J. A., & Kanungo, R. N. (1988). The empowerment process: Integrating theory and practice. *Academy of Management Review*, *13*(3), 471-482.

Cox, M., Steegen, A., & De Cock, M. (2016). How aware are teachers of students' misconceptions in astronomy? A qualitative analysis in Belgium. *Science Education International,* 27 (2), 277-300.

Cronin, H., Meadows, D., & Sinatra, R. (1990). Integrating computers, reading and writing across the curriculum. *Educational Leadership, 48*(1), 57-62.

Czuba, C. E. (1999). Empowerment: What Is It? *Journal of Extension*. *37*(5). https://archives.joe.org/joe/1999october/comm1.php

Conger,J. & Kanungo, R. (1988). The Empowerment Process: Connecting Theory and Practice. *Academy of Management Review, 13*(1), 471-482.

Daggol, G. (2020). Perceived Academic Motivation and Learner Empowerment Levels of EFL Students in Turkish Context . *Participatory Educational Research, 7*(3), 21-37.

DeChenne, D. (1993). Schema theory, educational applications, and a model for teaching labor history. *The History Teacher, 26*(2), 175-189.

Donald, S., & Barbara, Y. (2003). Using concept mapping to aid African American students' understanding in middle-grade science. *The Journal of Negro Education, 72*(3), 333- 337.

Driscoll, M. (2023). *Education in the 21st Century*. thinkstrategicforschools.com: https://thinkstrategicforschools.com/education-21st-century/

Driscoll, P. (2014). *Psychology of learning for instruction: Pearson new international edition*. Harlow, England: Pearson Education Ltd.

Elmore, R. (2019). The challenges of learning and design. *Review of Education*, 2(3), 160–195.

Fang, N. (2018). An Analysis of Student Experiences with Concept Mapping in a Foundational Undergraduate Engineering Course. *International Journal of Engineering Education, 34*(2A), 294-303.

Field, A. (2018). *Discovering statistics using IBM SPSS statistics*. Los Angeles, Sage.

Frymier, A. B. (1996). Students' classroom communication Effectiveness. *Communication Quarterly, 53*(1), 197-212.

Gagné, R. M., & Briggs, L. J. (1974). *Principles of instructional design*. New York City: Holt, Rinehart & Winston.

Georghiades, P. (2000). Beyond conceptual change learning in science education: focusing on transfer, durability, and metacognition. *Educational Research, 42*(2), 119-139. 38

Gerlach, V. S., Ely, D. P., & Melnick, R. (1971). *Teaching and media: A systematic approach.* Englewood Cliffs, NJ: Prentice-Hall.

Gomez-Zwiep, S. (2008). Elementary teachers' understanding of students' science misconceptions: Implications for practice and teacher education. *Journal of Science Teacher Education, 19*(5), 437-454.

Gureckis, T. M., & Goldstone, R. L. (2010). *Schema. The percepts and concepts laboratory at Indiana University*, 725-727.

Guzeldereli, A. (2019). *A Survey Study on Students' Sense of Empowerment in an English Preparatory Program at a State University*. (Master Thesis, Middle East Technical University).

Hall, R. H., & O'Donnell, A. (1996). Cognitive and affective outcomes of learning from knowledge maps. *Contemporary Educational Psychology, 27(1),* 94-101

Harrington, J., & Booth, C. (2003). Research methods modules and undergraduate business research: an investigation. *International Journal of Management Education, 3*(3*),* 19-31.

Hassan, S. U. (2016). Research landscape of Pakistan. MIT Technology Review, Pakistan. *Journal of Learned Publishing, 30*(3), 233-236. Retrieved from http://www. technologyreview. pk/research-land-scape-of-Pakistan/

Hendry, G. D., & King, R. C. (1994) On the theory of learning and knowledge: Educational implications of advances in neuroscience. *Science Education, 78*(3), 223-253.

Hillsdale, N.J., Canning, N., & Callan, S. (2010). Heutagogy: Spirals of reflection to empower learners in higher education. *Reflective Practice, 11*(1), 71–82.

Ifenthaler, Dirk, Ria, & Hanewald (2014). *Digital knowledge mapping in an educational context.* New York: *Springer.*

Inhelder, B., & Piaget, J. (1958). *The growth of logical thinking from childhood to adolescence: An essay on the construction of formal operational structures* (Vol. 22). East Sussex, UK: Psychology Press.

Joshi, R., Hadley, D., & Nuthikattu, S. (2022). Concept Mapping as a Metacognition Tool in a Problem-Solving-Based BME Course During In-Person and Online Instruction. *Biomedical Engineering Education,* 22-26.

Kabeer, N. (1999). Resources, agency, achievement: Reflections on the measurement of women's empowerment. *Development and Change, 30*(3), 435-464.

Kirby, J.R., Knapper, C., Lamon, P., & Egnatoff, W.J. (2010). Development of a scale to measure lifelong learning. *International Journal of Lifelong Education, 29*(3), 291-302.

Kumari, R. (n.d.) Review of Research Performance in Higher Education Sector in the Last Decade. https://www.hec.gov.pk/english/universities/projects/TESP/Documents/ e.pdf

Laszlo, S., Grantham, K., Oskay, E., & Zhang, T. (2017). *Grappling with the Challenges of Measuring Women's Economic Empowerment.* Technical report. McGill University.

Lips, H. (1991). *Women, men and power.* Mountain View, CA: Mayfeld Co.

Litwin, M. (1995). *How to Measure Survey Reliability and Validity*. Thousand Oaks, CA: Sage Publications.

Longworth, N. (2003). *Lifelong learning in action: Transforming education in the 21st century.* United States of America: Kogan Page.

Mailloux, C.G. (2006). The extent to which students' perceptions of faculties' teaching strategies, students' context, and perceptions of learner empowerment predict perceptions of autonomy in BSN students. *Nurse Education Today*, *26*(7), 578-85.

Maiorano, D., Shrimankar, D., Thapar-Björkert, S., & Blomkvist, H. (2021). Measuring empowerment: Choices, values, and norms. *Elsevier*, *138*, 1-8.

Malhotra, A., Schuler, S. R., & Boender, C. (2002). Measuring women's empowerment as a variable in international development. In background paper prepared for the World Bank Workshop on Poverty and Gender: New Perspectives, *28(1).*

Mayo, J. A. (2010). Graphing organizers as learning and assessment tools. *American Psychological Association,* 93-111.

Michelsen, C. (2021) Empowerment for Participation: Measuring Motivation, Stress, Defense Routines, and Engagement. *Psychology*, *4*(12), 511-535

Mickelson, J. J., Kaplan, W. E., & MacNeily, A. E. (2013). Active learning: a resident's reflection on the impact of a student-centered curriculum. *Canadian Urological Association Journal*, *3*(5), 399–402. https://doi.org/10.5489/cuaj.1154

Mintzes, J., Wandersee, J., & Novak, J. (2000). *Assessing science understanding. San Diego, CA: Academic Press*.

Mitra, D. (2008). *Amplifying student voice. Educational Leadership.* ASCD. 66.

Mok, J. (2006). Student empowerment in an english language enrichment program: an action research program in Hong Kong. *Educational Action Research*, 5(1), 305-320.

Munna, S., & Kalam, A. M. (2021). Teaching and learning process to enhance teaching effectiveness: a literature review. *International Journal of Humanities and Innovation (IJHI)*, *4*(1), 1-4.

McAleese, R. (1998). *Coming to know: The role of the concept map – Mirror, assistant, master?* ED429968.

Mythry, R., Manish, T., & Debkumar, P. (2024). Role of Self-Directed Learning in Pedagogy – Current Scenario of Competency-Based Medical Education. *Current Medical Issues*, *22*(1), 56-59.

Nauman, S. (2017). Lack of critical thinking skills leading to research crisis in developing Countries: A Case of Pakistan. *The Association of Learned and Professional Society Publishers. 30(3).* 10.1002/leap.1091

Nirel.R, & Lickman. H. (2009). *Handbook of Statistics.* Elsevier

Novak, J. D., & Musonda, D. (1991). A twelve-year longitudinal study of science concept learning. *American Educational Research Journal, 28*(1), 117-153.

Novak, J. D., & Gowin, D. B. (1984). *Learning how to learn. Cambridge*, UK: Cambridge University press.

Novak, J. D. (1998). *Learning, Creating, and Using Knowledge: Concept Maps TM as Facilitative Tools in Schools and Corporations.* Mahwah, NJ: Lawrence Erlbaum Associates, Publishers.

Novak, J. D., & Cañas, A. J. (2008). *The theory underlying concept maps and how to construct and use them (Technical Report IHMC CmapTools 2006-01 Rev 2008-01).* Pensacola: FL: Institute for Human and Machine Cognition.

Novak, J.D. (2013). Empowering learners and educators. *Journal for Educators, Teachers, and Trainers, 4*(1), 14-24.

OECD. (2018). *The Future of Education and Skill.* Organization of Economic Development and Cooperation.

Oluikpe, E. N. (2014). Effect of concept mapping on students' retention in English grammar. *International Journal of Educational Science and Research, 4*(5), *73-*80.

Phye, (2002). *Handbook of academic learning: Construction of Knowledge,* San Diego: Academic Press

Pond, K., & Rehan, U. (1997). Learning to assess students using peer review. *Studies in Educational Evaluation, 24*(4), 331–348.

Ponton, M. K., Derrick, M. G., & Carr, P. B. (2005). The relationship between resourcefulness and persistence in adult autonomous learning. *Adult Education Quarterly: A Journal of Research and Theory, 55*(2), 116-128.

Rapport, J. (1984). Studies in empowerment: Introduction to the issue. *Prevention in Human Services, 3*(1), 1-7.

Robbins, S. P., Chatterjee, P. & Canda, E. R. (1999). Ideology, Scientific Theory, and Social Work Practice. *Families in Society*, *80*(4), 374–384. https://doi.org/10.1606/1044-3894.1217

Roini, D., & Sundari. (2019). Empowering critical thinking ability of genetic students of education study biology university of Khairun University using mind map media direct learning. *Proceeding of the AIP Conference Proceedings 2194, 020106 (2019); https://doi.org/10.1063/1.5139838*

Rosendahl, J., Kisyova, H., Gawlytta, R., & Scherag, A. (2019). Comparative validation of three screening instruments for posttraumatic stress disorder after intensive care. *Journal of Critical Care, 53*(1). 149-154.

Ross, K., Dennis, B., & Li, P. (2017). Exploring Graduate Students' Understanding of Research: Links Between Identity and Research Conceptions. *International Journal of Teaching and Learning in Higher Education, 29*(1). 73-86.

Schaffer, H. R. (1986). Child psychology: The future. *Journal of Child Psychology and Psychiatry*, *27*(6), 761-779.

Schultz, J. M. (1991). Mapping and cognitive development in the teaching of foreign language writing. *The French Review*, *64*(6), 978-988.

Schunk, D. H. (2004). *Learning theories: An educational perspective* (4th ed.). Saddle River, NJ: Pearson Education.

Seo, K., Park, S., & Choi, A. (2017). Science teachers' perceptions of and approaches towards students' misconceptions on photosynthesis: A comparison study between US and Korea. *Eurasia Journal of Mathematics, Science & Technology Education*, *13*(1), 269-296

Sheikh, A., Malik, A., & Mahmood, K. (2021). Research practices of LIS professionals in Pakistan: A study of attitudes, involvement, and competencies. *Journal of Information Science*, *1*(1),1-13.

Siegler, R. S., & Richards, D. D. (1979). Development of time, speed, and distance concepts. *Developmental Psychology*, *15*(3), 288.

Silver, N. (2013). *Reflective pedagogies and the metacognitive turn in college teaching.* IL: University of Chicago Press.

Soika, K., Reiska, P., & Rain, M. (2014). Concept Mapping as an Assessment Tool in Science Education. *Journal of Baltic Science Education*, *13*(5).

Spencer, J. (2019). *Making the Shift from Student Engagement to Student Empowerment.* http://www.spencerauthor.com/empowerment-shifts/

Spreitzer, Gretchen M., & Quinn, Robert E. 2001. *A Company of Leaders: Five Disciplines for Unleashing the Power in your Workforce*. San Francisco: Jossey-Bass.

Sultan, M. (2014). *The Effect of Using the Conceptual Maps on the Achievement of the Intermediate First Class Students for the English Language and their Attitudes towards It in Mosul-Iraq.* Iraq: Middle East University for Graduate Studies.

Swaminathan, H., & Algina, J. (2010). Analysis Of Quasi-Experimental Time-Series. *The Journal of B Behavioral Research, 3*(2), 1532-1546.

Swatevacharkul, R. (2009). An investigation on readiness for learner autonomy, approaches to learning of tertiary students, and the roles of English language teachers in enhancing learner autonomy in higher education. *Unpublished research report*, Bangkok: Dhurakij Pundit University

Sewagegn, A., & Diale, M. (2019). Empowering Learners Using Active Learning in Higher Education Institutions. *Active Learning- beyond the future, 14*(1), 1244-1366.

Sweet, C. (2017). *Mind Mapping: A Technique for Metacognition.*

https://www.improvewithmetacognition.com/wpcontent/uploads/2017/08/Sweet_Blythe_Carpenter.TwM_.Aug2017.pdf

Thomas, K. W., & Velthouse, B. A. (1990). Cognitive elements of empowerment: An "interpretive" model of intrinsic task motivation. *The Academy of Management Review*, 15(4), 666–681. https://doi.org/10.2307/258687

Tibbles, D., Richmond, V., McCroskey, J., & Weber, K. (2008). Organizational orientations in an instructional setting, *Communication Education, 57*(3), 389-407.

Tidd, J., & Bessant, J. (2018). *Managing Innovation: Integrating Technological, Market and Organizational Change*. John Wiley and Sons.

Vygotsky, L. S. (1978). Interaction between learning and development. *Readings on the development of children, 23*(3), 34-41.

Wandersee, J.H., & Novak, J.D. (1997). *Meaningful learning in science: The human constructivist perspective.* San Diego: Academic Press

Weber, M. (1946). *From Max Weber: Essay in Sociology.* New York: Oxford University Press.

Wilson, B. G. (1996). *Constructivist learning environments: Case studies in instructional design*. Englewood Cliffs, NJ: Educational Technology Publication.

Zimmerman, M.A. (1984). Aiming at empowerment research: On the distinction between individual and psychological conceptions. *American Journal of Community Psychology*, *18*(1), 169-177.

APPENDICES

APPENDIX A

Learning Empowerment Scale

Instruction: Please read each statement then check the response that best shows your feelings and experience toward tutorials through the marketing course. Circle the number that best represents your opinion – 0 indicates, "Never happen at All", 1 ''rarely, 2'sometimes'', 3'often'' and 4 indicates "happen very often".

S. No	Items	Never	Rarely	Sometimes	Often	Very often
Impact						
1	I have the power to make a difference in how things are done in my class					
2	I have a choice in the methods I can use to perform my work.					
3	My participation is important to the success of the class					
4	I have the freedom to choose among options in this class.					
5	I can make an impact on the way things are run in my class					
6	Alternative approaches to learning are encouraged in this class					
7	I have the power to make a difference in how things are done in my class					
8	I have a choice in the methods I can use to perform my work.					
9	I cannot influence what happens in this class					
10	I have the power to create a supportive learning environment in this class					
11	My contribution to this class makes no difference					
12	I can determine how tasks can be performed.					

13	I make a difference in the learning that goes on in this class.					
14	I have no freedom to choose in this class					
15	The tasks required in my class are personally meaningful.					
Meaningfulness						
16	I can influence the instructor.					
17	I feel appreciated in this class					
18	I look forward to going to my class.					
19	This class is exciting					
20	This class is boring.					
21	This class is interesting.					
22	The tasks required in my class are valuable to me.					
23	The information in this class is useful.					
24	This course will help me to achieve my future goals.					
25	The tasks required in my class are a waste of my time					
26	This class is not important to me.					
Competence						
27	I feel confident that I can adequately perform my duties.					
28	I feel intimidated by what is required of me in my class.					
29	I possess the necessary skills to perform successfully in class.					
30	I feel unable to do the work in this class.					
31	I believe that I am capable of achieving my goals in this class.					
32	I have faith in my ability to do well in this class.					
33	I have studied before to succeed in this class					
34	I lack confidence in my ability to perform the tasks in this class.					
35	I feel very competent in this course.					
36	I feel comfortable challenging with my lectures in the class					
37	I feel comfortable challenging my peers in the class					
38	I feel comfortable answering questions in the class					

APPENDIX B

Revised Learning Empowerment Scale for Second-Time Administration

Instruction: Please read each statement then check the response that best shows your feelings and experience toward tutorials through the marketing course. Circle the number that best represents your opinion – 0 indicates, "Never happen at All", 1 ''rarely, 2'sometimes'', 3'often'' and 4 indicates "happen very often".

S. No	Items	Never	Rarely	sometimes	Often	Very often
Meaningfulness						
1.	This class is interesting.					
2.	I look forward to going to my class.					
3.	This class is exciting					
4.	I feel appreciated in this class					
5.	I can influence the instructor.					
6.	The tasks required in my class are valuable to me.					
7.	This course will help me to achieve my future goals.					
8.	The tasks required in my class are a waste of my time					
9.	This class is not important to me.					
10.	I can influence the instructor.					
11.	I feel appreciated in this class					
12.	I look forward to going to my class.					
13.	This class is exciting					
14.	This class is boring.					
Competence						
15.	I feel confident that I can adequately perform my duties.					
16.	I feel intimidated by what is required of me in my class.					

17.	I possess the necessary skills to perform successfully in class.					
18.	I feel unable to do the work in this class.					
19.	I believe that I am capable of achieving my goals in this class.					
20.	I have faith in my ability to do well in this class.					
21.	I have studied before to succeed in this class					
22.	I lack confidence in my ability to perform the tasks in this class.					
23.	I feel very competent in this course.					
24.	I feel comfortable challenging with my lectures in the class					
25.	I feel comfortable challenging my peers in the class					
26.	I feel comfortable answering questions in the class					
Impact						
27.	I have the power to make a difference in how things are done in my class					
28.	I have a choice in the methods I can use to perform my work.					
29.	My participation is important to the success of the class					
30.	I have the freedom to choose among options in this class.					
31.	I can make an impact on the way things are run in my class					
32.	Alternative approaches to learning are encouraged in this class					
33.	I have the power to make a difference in how things are done in my class					
34.	I have a choice in the methods I can use to perform my work.					
35.	I cannot influence what happens in this class					
36.	I have the power to create a supportive learning environment in this class					
37.	My contribution to this class makes no difference					

APPENDIX C

Model Lesson Plans

Lesson Plan No. 1 **Nature of Educational Research**

Objectives:- After attending the class the students will be able to:-

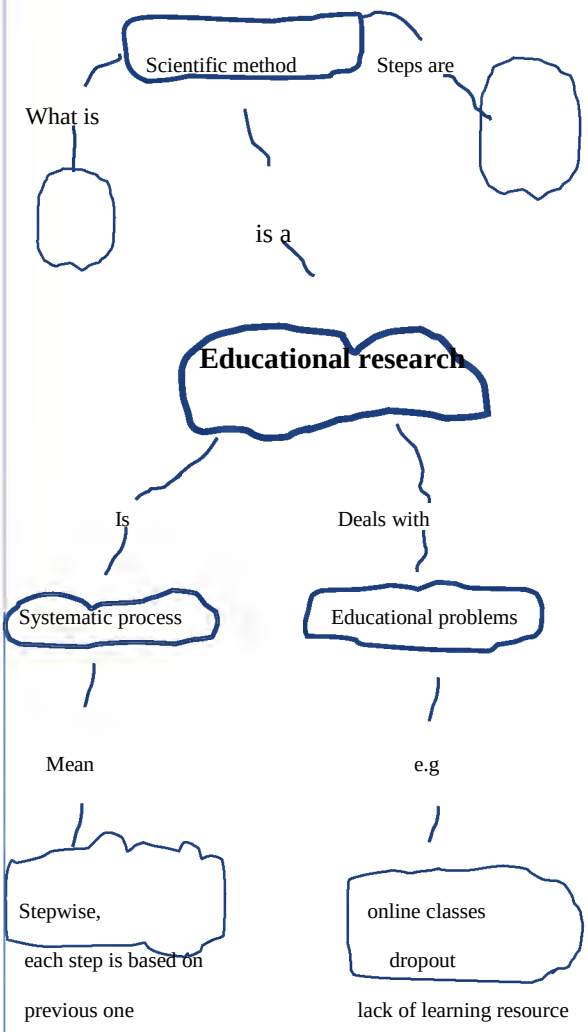
1. Define educational research.
2. Describe the importance of educational research.
3. Explain different steps of the scientific method.

Instructional Materials:- Mobile app (Mindomo), whiteboard

Method:- Concept Mapping

Time: 90 Minutes

CONTENTS	METHODOLOGY	BOARD WORK
Preparation	To prepare students for learning I will ask questions. This will help me to know their experiential background Q1. What do you know about education? Q2. Have you felt any kind of situation in which you want to be changed or improved? Q3. How?	
Presentation	I will announce the topic "Today we are going to discuss educational research, its definitions, importance, and steps of the scientific method."	Topic:- **<u>Nature of Educational Research</u>**
Activity	With the help of concept mapping, I will explain the concept of educational research.	Definition:- Research, Educational research

	Concept mapping  	Key terms:- Educational Research, educational problems, systematic process, Scientific Method, Mindomo
	I will explain the key terms in definition with examples. With the help of Mindomo, I will explain educational research	
Practice	I will assign a task to students to create their concept maps with the help of digital mapping apps.	
Product	To know how much students learn I will repeat and extend the practice activity	
Home Work	To create a concept map of what was discussed in the class.	

Lesson Plan No. 2 **Research Problem**

Objectives:- After attending the class the students will be able to:-

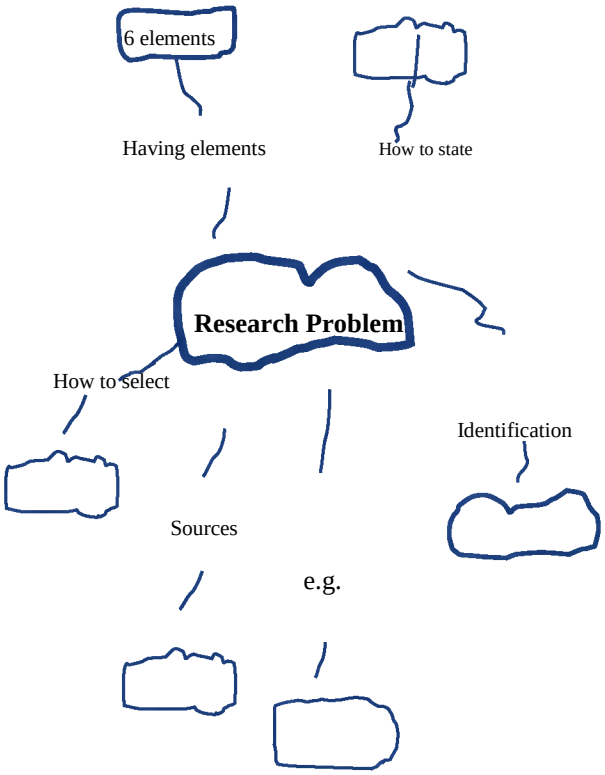
1. Understand the research problem.
2. Tell the characteristics of the research problem.
3. State research problem in education.

Instructional Materials:- Mobile app (Mindomo), whiteboard

Method:- Concept Mapping

Time: 90 Minutes

CONTENTS	METHODOLOGY	BOARD WORK
Preparation	To prepare students for learning I will ask questions. This will help me to know their experiential background Q1. What do you know about education? Q2. Have you felt any kind of situation in which you want to be changed or improved? Q3. How?	
Presentation	I will announce the topic "Today we are going to discuss educational research, its definitions, importance, and steps of the scientific method."	Topic:- **Nature of Educational Research**
Activity	With the help of concept mapping, I will explain the concept of educational research. Concept mapping	Definition:- Research, Educational research

	 I will explain related topics of research problem With the help of Mindoro.	Key terms:- Research Problem
Practice	I will assign a task to students to create their concept maps on one of the topics mentioned in the nodes of the concept map. with the help of digital mapping apps.	
Product	Students will discuss their created maps in the class	
Home Work	To create concept maps of the topics mentioned in the nodes of the concept map.	

Lesson Plan No. 3 Types of Educational Research

Objectives: - After attending the class the students will be able to: -

1. List types of educational research.
2. Differentiate between historical, experimental, and descriptive research.

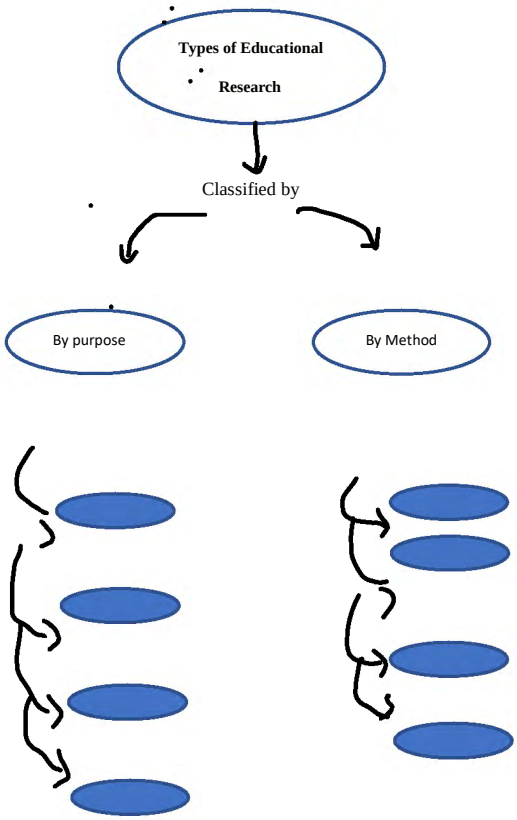
Instructional Materials: - Mobile app (Mindomo), whiteboard

Method: - Concept Mapping

Time: 90 Minutes

CONTENTS	METHODOLOGY	BOARD WORK
Preparation	I will ask questions in the previous lecture. Q1. What do you know about education? Q2. Have you felt any kind of situation in which you want to be changed or improved? Q3. How?	
Presentation	I will announce the topic "Today we are going to discuss educational research, its definitions, importance, and steps of the scientific method."	Topic:- **Types of Educational Research**
Activity	With the help of concept mapping, I will explain the concept of educational research.	

Concept mapping



Key terms:-

Historical Research,

Descriptive research,

Experimental Research

I will explain related topics of research problem

With the help of Mindoro.

Practice	I will assign a task to students to create their concept maps on one of the topics mentioned in the nodes of the concept map. with the help of digital mapping apps.
Product	Students will discuss their created maps in the class
Home Work	To create concept maps of the topics mentioned in the nodes of the concept map.

Lesson Plan No.4 Historical Research

Objectives: - After attending the class the students will be able to: -

1. Understand the nature of historical research.

Instructional Materials: - Mobile app (Mindomo), whiteboard

Method: - Concept Mapping

Time: 90 Minutes

CONTENTS	METHODOLOGY	BOARD WORK
Preparation	I will ask questions in the previous lecture. Q1. What do you know about education? Q2. Have you felt any kind of situation in which you want to be changed or improved? Q3. How?	
Presentation	I will announce the topic "Today we are going to discuss educational research, its definitions, importance, and steps of the scientific method."	Topic:- **Historical Research**
Activity	With the help of concept mapping, I will explain the concept of educational research. Concept mapping	Key terms:- Historical Research, Descriptive research, Experimental Research

I will explain related topics of research problem

With the help of Mindoro.

Practice	I will assign a task to students to create their concept maps on one of the topics mentioned in the nodes of the concept map. with the help of digital mapping apps.
Product	Students will discuss their created maps in the class
Home Work	To create concept maps of the topics mentioned in the nodes of the concept map.

Le

sson Plan No.4 Experimental Research

Objectives: - After attending the class the students will be able to: -

1. Understand the nature of experimental research.

Instructional Materials: - Mobile app (Mindomo), whiteboard

Method: - Concept Mapping

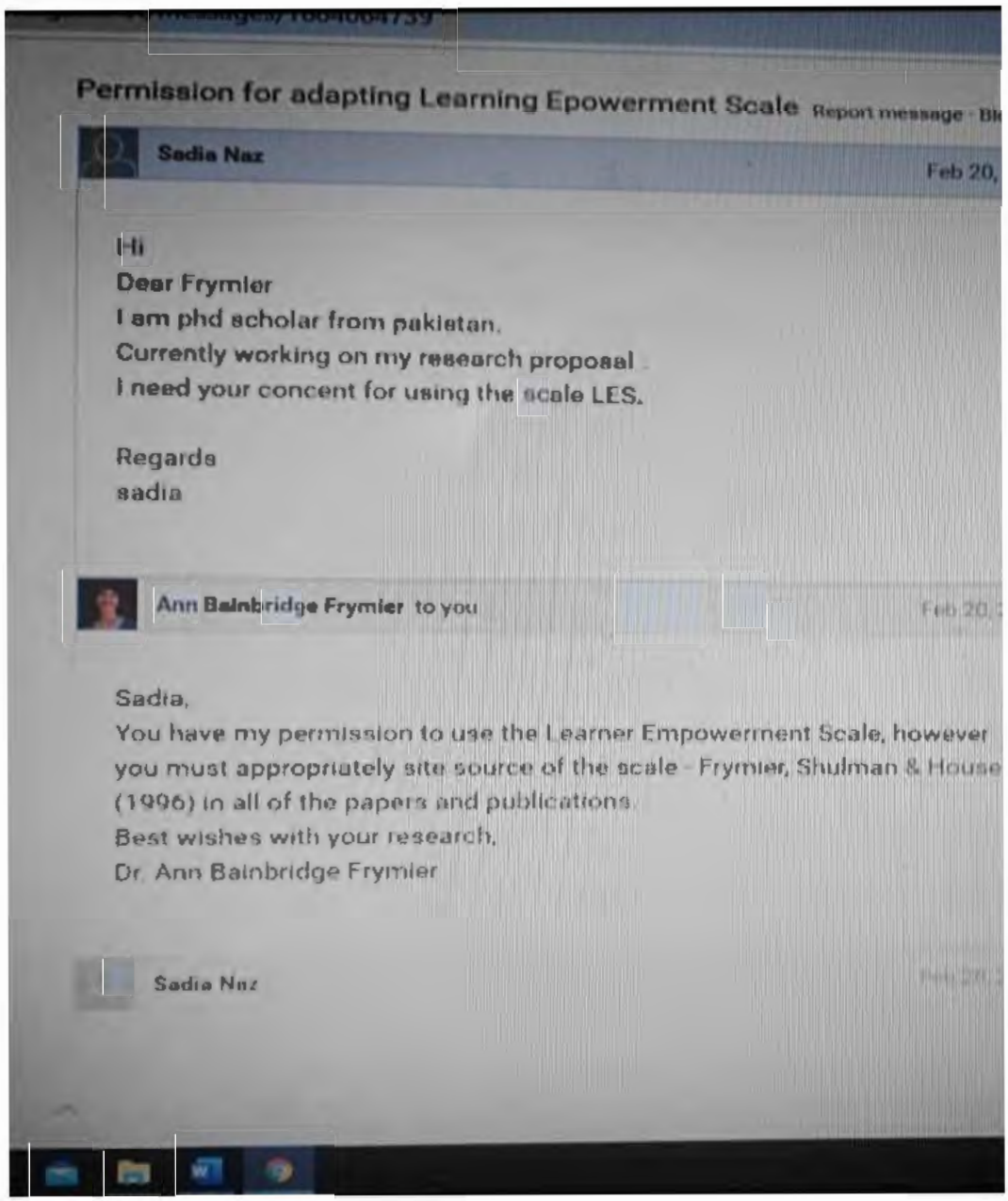
Time: 90 Minutes

CONTENTS	METHODOLOGY	BOARD WORK
Preparation	I will ask questions in the previous lecture. Q1. How many types of educational research? Q2. What is historical research?	
Presentation	I will announce the topic "Today we are going to discuss experimental research, its nature, types, and steps of scientific method."	Topic:- **Experimental Research**
Activity	With the help of concept mapping. I will explain the concept of experimental research. Concept mapping	
		Key terms:- Experimental Research

	I will explain related topics of research problem With the help of Mindoro.
Practice	I will assign a task to students to create their concept maps on one of the topics mentioned in the nodes of the concept map. with the help of digital mapping apps.
Product	Students will discuss their created maps in the class
Home Work	To create concept maps of the topics mentioned in the nodes of the concept map.

APPENDIX D

Permission for Using Learning Empowerment Scale



Permission for adapting Learning Epowerment Scale Report message · Bl

Sadia Naz Feb 20,

Hi
Dear Frymier
I am phd scholar from pakistan.
Currently working on my research proposal
I need your concent for using the scale LES.

Regards
sadia

Ann Bainbridge Frymier to you

Sadia,
You have my permission to use the Learner Empowerment Scale, however you must appropriately site source of the scale - Frymier, Shulman & House (1996) in all of the papers and publications.
Best wishes with your research,
Dr. Ann Bainbridge Frymier

Sadia Naz

APPENDIX E

Students' Concept Mapping Work

Figure 1A

Concept Map 1 by students

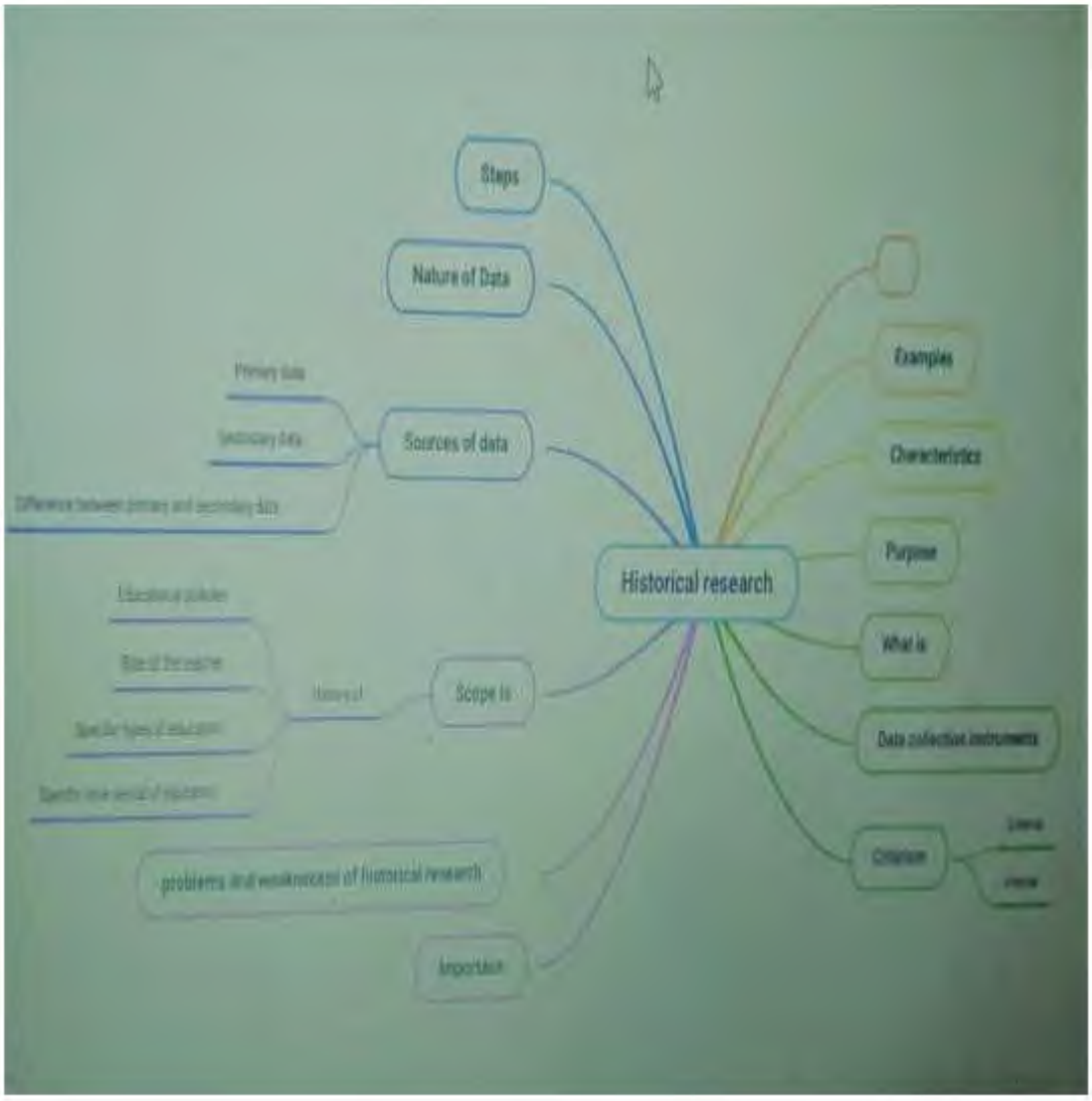


Figure 2A

Concept Map 2 by Student

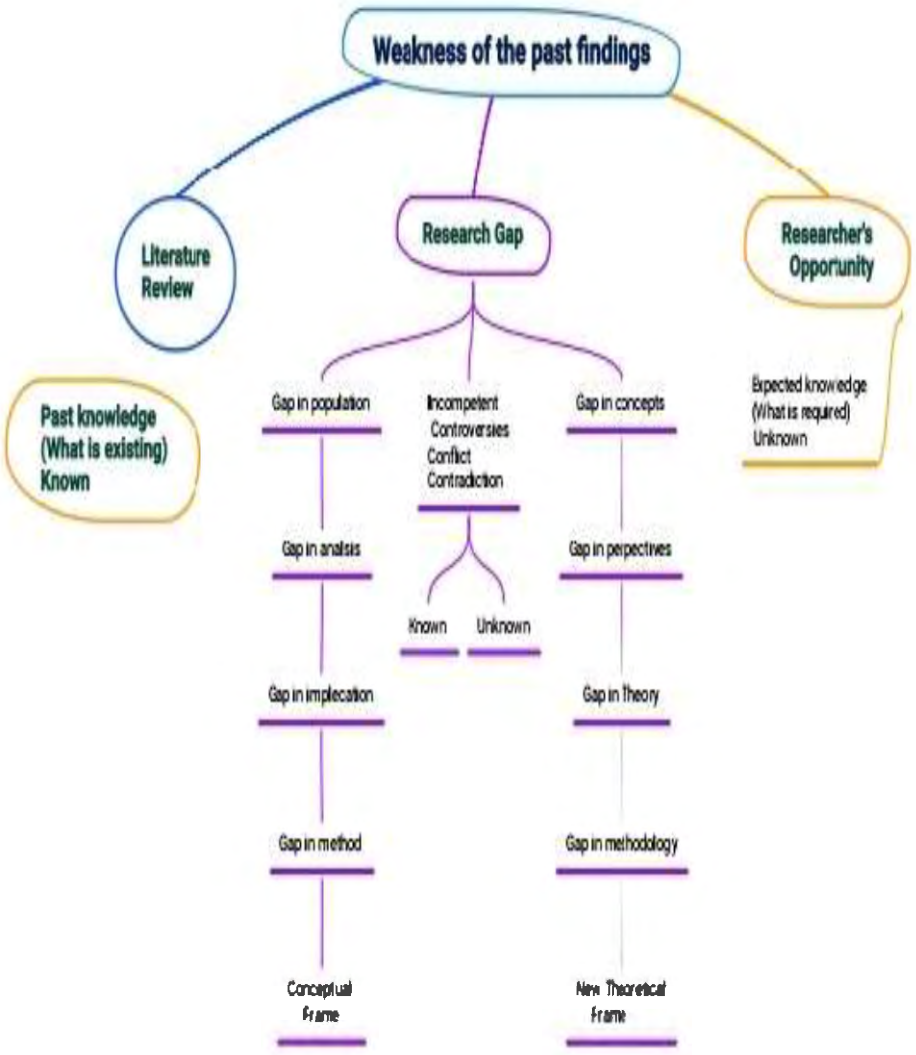


Figure 3A

Concept Map 3 by Student

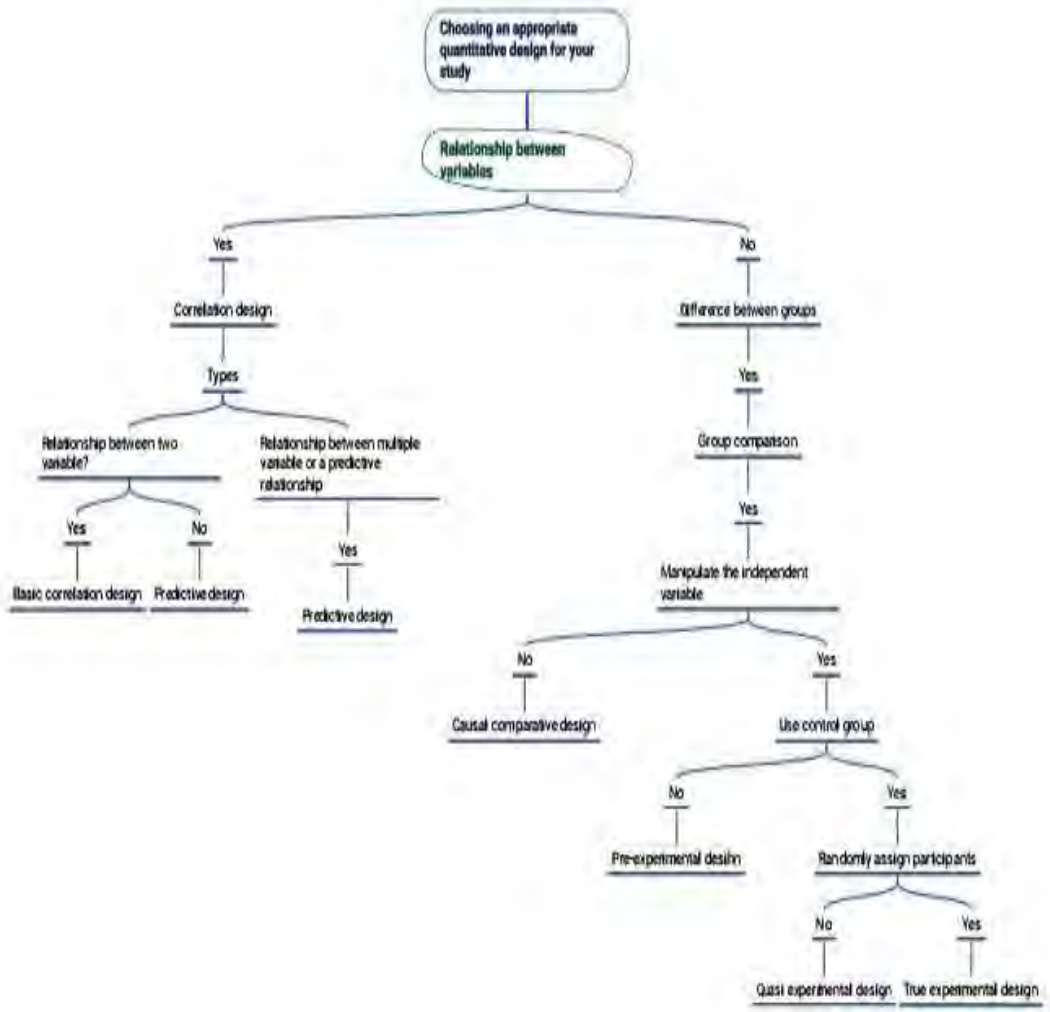


Figure 4A

Concept Map 4 by Students

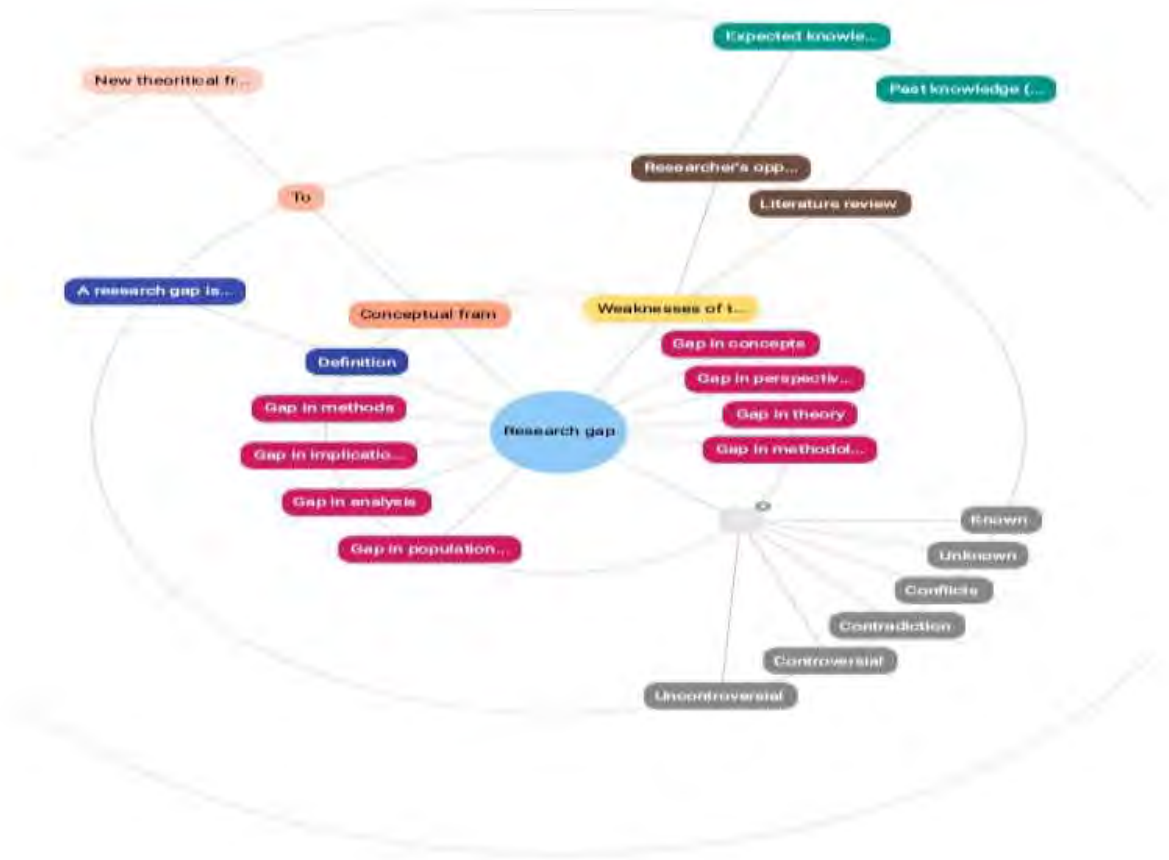


Figure 5A

Concept Map 5 by Students

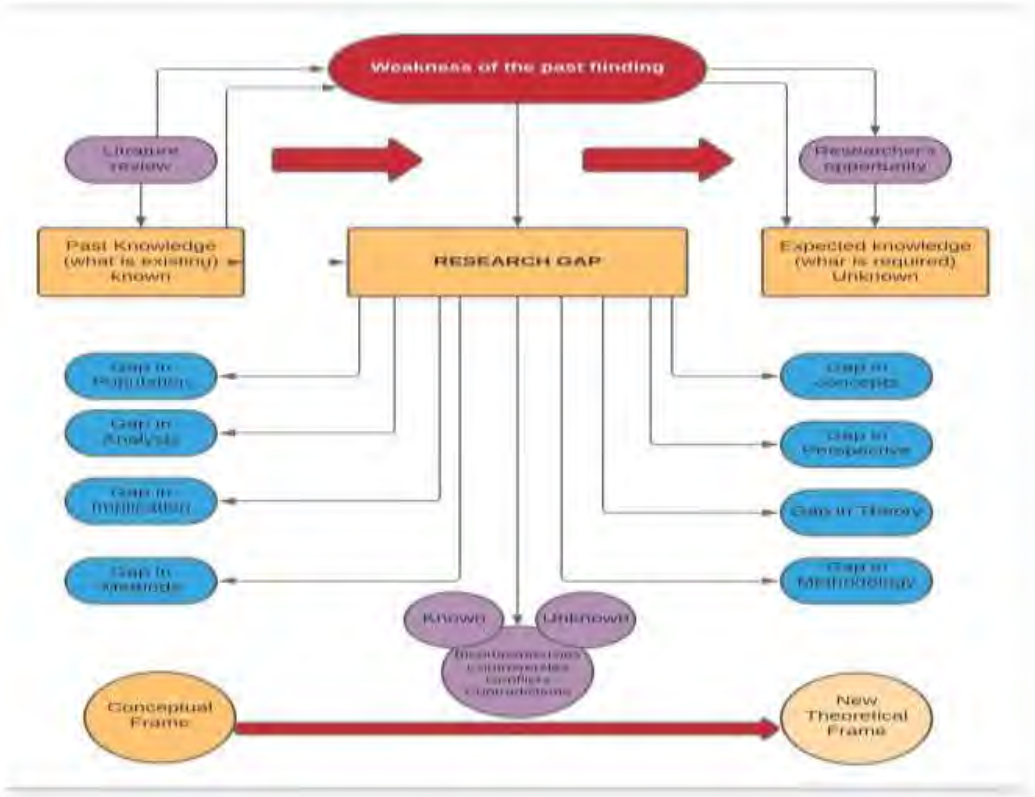


Figure 6A

Concept Map by Students

APPENDIX F

Concept Mapping Tutorial

What are concept maps?

Concept mapping is an emerging learning tool. Students utilized in visualizing and organizing ideas, and concepts. It enables them to draw meaningful connections among the concepts. It helps students to connect previous knowledge with new knowledge. In graphical representations, concepts are placed in nodes connected by arrows and prepositions show a relationship between the concepts. The formation of concept maps takes various forms. It may be in the form of a hierarchy or a circular form spread like a spider. The main idea remains on the top or in the center and emerging ideas are connected with the main idea via prepositions and arrows. They are thought to reflect, and deepen, a person's understanding of a subject because it is necessary to not only list concepts but to link them by their relationships and show connectedness of ideas.

What are concepts, links, and propositions?

A concept is defined as "a regularity in events or objects designated by some label" (Novak & Gowin, 1984, p. 4). That is, the mental image that emerges when you hear a word is considered a concept. Examples include chair, dog, weather, mathematics, studying, thinking, and eating.

A link is a word or phrase that connects two or more concepts to form a proposition about the concepts. Examples include: is, is not, by, with, requires, determines, leads to, can be, made of, for example.

A **proposition** represents a meaningful relationship between concepts. Examples include: cats are animals, dogs can be long-haired, water is made of molecules, mathematics has many branches, and studying requires concentration.

Other characteristics and components of concept maps

Concept maps are represented graphically, or visually, with the concepts placed in circles or boxes and the linking words or phrases placed on lines that connect the concepts.

Concept maps are organized hierarchically with the most inclusive and general concepts at the top and the more specific and less general concepts below. Concept maps may include cross-links: "links between concepts in different segments or domains of the concept map" (Novak & Cañas, 2008, p. 2). Crosslinks show how a concept in one area of the map is related to a concept in another area of the map. These relationships often symbolize the creation of new knowledge or integration of a new idea into existing knowledge by the learner. Concept maps may include specific examples of a given concept. These items are generally not encased in a circle or box in order to differentiate them as specific examples rather than concepts.

APPENDIX G

Experts Details

Subject Expert

Dr. Munazza Mahmood

Assistant Professor

Department of Education

International Islamic University Islamabad

Dr. Farah Khan

Assistant Professor

Institute of Education and Research

Women University Mardan

APPENDIX H

PROOFREADING CERTIFICATE

Dated: 14th May 2024

CERTIFICATE OF PROOFREADING

This is to certify that I have proofread the thesis titled Effect of Concept Mapping on the Learning Empowerment of the Learners by Ms. Sadia Naz. I have ensured that the writing is academic, concise, and error-free. I have corrected grammatical and typographical mistakes, improved the flow and structure of writing, and suggested modifications to enhance the coherence of arguments. Throughout this process, I have maintained high standards of confidentiality and professionalism.

I am confident that my improvements to the thesis will contribute to its overall quality and help ensure its success. I would readily provide further information or clarification on my work if required.

Sincerely yours,

Q Saher,

Lecturer in English,

Women University Mardan

E2 WS

APPENDIX I

ITEM WISE ANALYSIS

No	Items	Before		Mid		End		After	
		mean	Std.d	mean	Std.d	mean	Std.d	mean	Std.d
	Meaningfulness								
1	I have the power to make a difference in how things are done in my class	2.71	.258	2.65	.67	2.12	1.35	4.89	.414
2	I have a choice in the methods I can use to perform my work.	2.6	.834	2.21	1.40	2.20	.414	4.21	.258
3	My participation is important to the success of the class	3.0	1.03	3.13	.46	2.6	.258	4.12	.834
4	I have the freedom to choose among options in this class.	2.13	1.16	2.13	1.43	2.13	.834	3.99	.414
5	I can make an impact on the way things are run in my class	2.27	1.10	2.26	1.20	2.21	1.03	4.28	.258
6	Alternative approaches to learning are encouraged in this class	2.23	1.16	2.24	1.63	3.93	1.16	4.59	.834
7	I have the power to make a difference in how things are done in my class	2.23	1.17	2.23	.72	2.17	1.1	4.56	1.03
8	I have a choice in the methods I can use to perform my work.	3.87	1.22	3.91	.89	3.21	1.16	4.45	1.16
9	I cannot influence what happens in this class	4.45	.258	4.42	.96	4.33	1.17	2.21	1.1
10	I have the power to create a supportive learning environment in this class	2.56	.258	2.56	.96	3.87	1.22	4.54	1.16
11	My contribution to this class makes no difference	2.40	.834	2.41	.36	3.27	1.16	4.00	1.17
12	I can determine how tasks can be performed.	1.96	1.03	1.94	1.03	4.27	.4	4.56	1.22
13	I make a difference in learning that goes on in this class.	1.22	1.16	1.22	1.03	4.27	.45	2.43	1.16
14	I have no freedom to choose in this class	4.32	1.30	4.10	1.16	4.40	.50	4.56	.414
15	The tasks required in my class are personally meaningful.	1.56	1.16	1.57	1.16	3.53	.516	4.21	.258
	Competence								
16	I can influence the instructor.	1.13	.258	2.83	.96	3.37	.96	3.72	1.03

17	I feel appreciated in this class	2.27	.834	3.11	.36	3.72	.36	4.76	1.16
18	I look forward to my class.	2.23	1.03	2.78	1.03	2.27	1.03	2.89	1.1
19	This class is exciting	1.23	1.16	2.32	1.03	3.27	1.03	4.87	1.16
20	This class is boring.	3.87	1.10	4.23	1.16	4.83	1.16	4.55	1.17
21	This class is interesting.	3.87	1.16	4.01	1.16	4.42	1.16	4.49	1.22
22	The tasks required in my class are valuable to me.	1.56	1.17	2.87	1.16	3.52	1.16	3.99	1.16
23	The information in this class is useful.	2.40	1.22	2.82	.96	3.07	1.52	4.65	.414
24	This course will help me to achieve my future goals.	1.96	.258	2.67	.36	2.89	1.49	3.98	.258
25	The tasks required in my class are a waste of my time	3.22	.834	2.44	1.03	2.53	1.50	0.44	.834
26	This class is important to me.	1.13	1.03	2.45	1.03	3.80	1.14	4.40	1.03
	Impact								
27	I feel confident that I can adequately perform my duties.	1.71	1.10	2.75	1.16	3.00	.676	3.78	1.16
28	I feel intimidated by what is required of me in my class.	2.6	1.16	3.23	1.16	3.86	1.40	4.89	.414
29	I possess necessary skills to perform successfully in class.	2.0	1.17	2.37	.96	4.71	.468	4.80	.258
30	I feel unable to do the work in this class.	3.13	1.22	2.65	.36	3.33	1.49	3.78	.834
31	I believe that I am capable of achieving my goals in this class.	2.27	.258	2.76	.96	3.26	1.22	3.99	1.16
32	I have faith in my ability to do well in this class.	2.23	.834	2.84	.36	3.60	1.68	4.45	.834
33	I have studied before to succeed in this class	1.23	1.03	2.12	1.03	3.33	.723	4.21	1.03
34	I lack confidence in my ability to perform the tasks in this class.	4.87	1.16	3.04	1.03	3.33	30.8	2.89	1.16
35	I feel very competent in this course.	1.87	1.10	2.11	1.16	3.87	5.96	4.56	1.10
36	I feel comfortable challenging with my lectures in the class	1.13	1.16	1.87	1.16	4.73	6.19	4.77	1.16
37	I feel comfortable challenging with my peers in the class	1.27	.258	1.65	3.00	3.13	1.35	3.79	.258
38	I feel comfortable answering questions in the class	1.32	.834	1.88	1.26	4.20	.414	4.87	.83