Chapter I

INTRODUCTION

I. INTRODUCTION

- Statement of the Problem
- Definitions of the terms used in the title
- Objectives
- Assumptions
- Hypotheses
- limitations
- Scope of the Study
- Significance of the study
- Chapterisation

CHAPTER I
INTRODUCTION

Science has been derived from the Latin word "Scientia" which means knowledge. It is a systematized body of knowledge, which may pertain to any subject or field of life. 'science is a organized commonsense.' ' Science is an interpretation of the natural phenomenon.' 'Science is a heap of truth.' 'Science is a way of investigation'.

"Science is an interconnected series of concepts and conceptual schemes that have developed as a result of experimentation and observation and are fruitful of further experimentation and observations."

(James B. Conant)

Science and technology are playing an important role in our lives. They have become an integral part of our social and cultural life. Various activities are controlled and governed by science. It has helped man to acquire supermacy over nature.

Science is first of all a set of attitudes. It is a disposition to deal with facts rather than with what someone has said about them.

(B.F. Skinner)

" Science is an accumulated and systematized learning, in general usage restricted to natural phenomenon."

(Columbia dictionary)

On the basis of these definitions, we can conclude that

1. Science is study of natural phenomenon.

2. It is an organized and systematized learning.
3. It is a body of cumulative and ordered observations.
4. It is the knowledge based on observation, experiment and inference.
5. Science is a process as well as the product of that process.

The science teaching is generally divided in to two main categories

1. Life sciences or Biological sciences – e.g. Botany and zoology
2. Physical sciences e.g. Physics , Chemistry.

Science grows through processes of science, Scientific knowledge is replicable, holistic, humanistic and tentative in nature.

It provides essential background of knowledge for cultural developments. It helps in developing and fostering the scientific attitude, scientific interest and scientific outlook among children by providing solutions for day to day problems. It helps in training the children for developing scientific temper and scientific creativity. It studies non living things, material and substances. It always remains in search for truth.

Science education is at present undergoing period of change. Life → Social norms → Aims of Education → General objectives of teaching science → Specific objectives of teaching science .

In this modern age, the psychological view point tells that the study of any subject cannot be successful and complete unless it is based on the age, characteristics and needs of the child . Thus in the field of science along with its content, teaching methods play an important role.

Meaningful learning theory

The fundamentals of concept mapping are based on Ausubel's learning theory which in itself "is based on the assumption that meaningful learning occurs when new concepts are linked to familiar concepts existing in the learner's cognitive structure" and can be applied to all subject matter. The connections that concept maps facilitate not only allow students to draw associations amongst the main concepts being presented, but also generate greater retention, application, and understanding. The use of concept maps is becoming more widespread in the areas of science and mathematics education. Researchers have found that the concept map should be recommended "as means of producing meaningful learning in the analysis of scientific articles as well as enhancing the integration of theory and practice" and is also an effective means of "bridging the gap.

"If one has to reduce all of educational psychology to just one principle, I would say this: The most important single factor influencing learning is what the learner already knows."

" In the absence of the correct directions/ true path, a person can not reach his destination, in the same way in the absence of proper method, the student cannot be given correct knowledge."

Selection of proper teaching method helps in achieving the objectives of teaching science, the knowledge of the science teacher of that particular method, the availability of apparatus and materials in the schools.

The experimental nature of method, The class, age and capability of students, Opportunities for catering the needs of individual differences.

Science subject should be taught meaningfully hence, one of the best technique for science teaching is concept mapping.

Meaning and Nature of Concept Mapping

According to Novak (1990), concept mapping is defined as a technique for representing knowledge in diagrams called 'knowledge graphs', which are networks of concepts with relationships between them represented respectively by nodes and links. Concepts and sometimes links are labeled and links can be non-, uni- or bi-directional.

The use of concept maps as a teaching strategy was first developed by J.D. NOVAK in the early 1980s derived Asubel's learning theory which place central emphasis on the influence of student prior knowledge on subsequent meaningful learning. Concept maps are diagrammatic representation which show meaningful relationship between concepts in the form of propositions which are linked together by words, circles and cross-links concepts are arranged hierarchically with the super ordinate concepts at the top of the map and subordinate at the bottom which are less inclusive than higher ones "cross links" are used to connect different segments of the concepts hierarchy which indicate synthesis of related concepts a new interpretation of old ideas and some degree of creative thinking.

In recent years along with the various innovative methods, constructivism in the classrooms as an interpretative process involving individuals constructions of meanings in science is being suggested. New constructions are built through there relations to prior knowledge and it is a pedagogic challenge for teacher to focus on students learning with understanding to learn science from a constructivist philosophy implies direct experience with science as a process of knowledge generation in which prior knowledge is elaborated and changed on the basis of fresh meaning negotiated with peers and teacher. Concept mapping stimulate this process by making it explicit.

Concept mapping is the new method for teaching science and researcher is using this method of concept mapping to check its effect on achievement in physics of XI th standard students.

Concept maps are intended to represent meaningful relationships between concepts in the form of propositions. In it's simplest form, a concept map would be just two concepts connected by a linking word to form a proposition. A concept map is a schematic device for representing a set of concept meanings embedded in a framework of propositions. Concept maps work to make clear to both students and teachers the small number of key ideas they must focus on for any specific learning task has been completed, Concept map provides a schematic summary of what has been learned.

Concept maps Should be hierarchical; that is, the more general, more inclusive concepts should be at the top of the map, with progressively more specific less inclusive concepts arranged below them.

Concept mapping is a technique for externalizing concepts and propositions. We may develop new concept relationship in the process of drawing concept maps, especially if we seek actively to construct propositional relationships between concepts that were not previously recognized as related : students and teachers constructing concept maps often remark that they recognize new relationships and hence new meanings (or at least the meanings they did not consciously hold before making the map) In this sense, concept mapping can be a creative activity and may help to foster activity.

Application of Concept mapping

Concept mapping as a technique widely used in different training programs maps save training time. A good concept map can explain a matter of minute ideas and techniques that would take hours to describe. Information can be presented by art work which tells the story better. The concept maps are inexpensive, they are produced for a definite purpose.

Some topics in science can be demonstrated or experimented upon by students in the laboratory. But there are still left a number of topics which can not be taught by these methods and where verbal description and book learning are the only methods adopted by the teachers. Application of sciences are explained mostly verbally. Thus it becomes necessary for

effective teaching to make up the lack of experimental work by audio-visual devices as concept maps , films etc.

In India because of the shortage of equipment and also because of the highly verbal tradition in teaching experimental work is reduced to minimum. The vast majority of science students are introduced to 'Science' by blackboard, chalk and talk. At this point a concept map may be of great value. If concept maps can be shown they will do something to overcome the highly verbal nature of school science. Concept maps can be used to enrich meaning and extend the syllabus.

The application of concept map approach in science falls in to three groups as contributing to

1. The understanding of processes and relationship;
2. The appreciation of the social significance of science
3. The understanding of industrial and commercial applications.

Today we are facing the problem of school management and class control. By introducing the technique of concept mapping we can control the class of talented as well as average children's. By introducing the students involvement in the teaching learning. If we think of concept mapping technique it is one of the best technique to involve students in teaching learning.

Social scientists have developed a number of methods and processes that might be useful in helping you to formulate a research project. I would include among these at least the following -- brainstorming, brain

writing, nominal group techniques, focus groups, affinity mapping, Delphi techniques, facet theory, and qualitative text analysis. Here, I'll show you a method that I have developed, called concept mapping, which is especially useful for research problem formulation.

Concept mapping is a general method that can be used to help any individual or group to describe their ideas about some topic in a pictorial form. There are several different types of methods that all currently go by names like "concept mapping", "mental mapping" or "concept webbing." All of them are similar in that they result in a picture of someone's ideas. But the kind of concept mapping I want to describe here is different in a number of important ways. First, it is primarily a group process and so it is especially well-suited for situations where teams or groups of stakeholders have to work together. The other methods work primarily with individuals. Second, it uses a very structured facilitated approach. There are specific steps that are followed by a trained facilitator in helping a group to articulate its ideas and understand them more clearly. Third, the core of concept mapping consists of several state-of-the-art multivariate statistical methods that analyze the input from all of the individuals and yields an aggregate group product. And fourth, the method requires the use of specialized computer programs that can handle the data from this type of process and accomplish the correct analysis and mapping procedures.

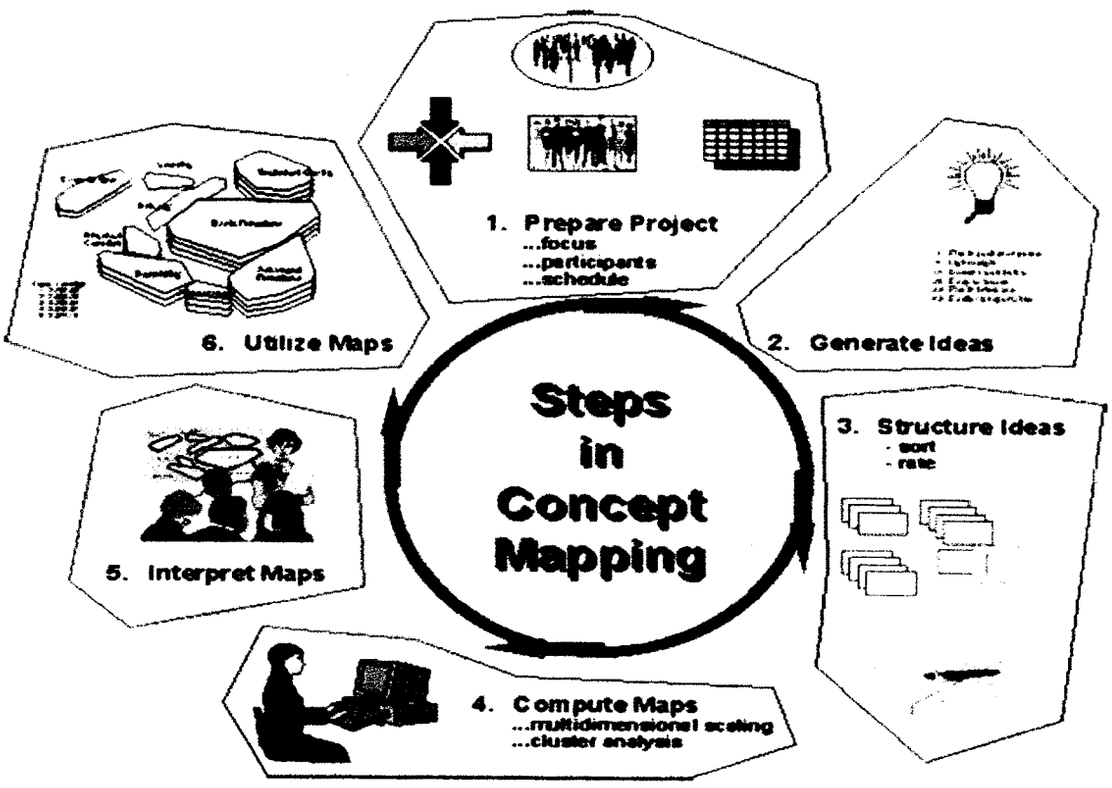
Although concept mapping is a general method, it is particularly useful for helping social researchers and research teams develop and detail ideas for research. And, it is especially valuable when researchers want to involve relevant stakeholder groups in the act of creating the research project. Although concept mapping is used for many purposes -- strategic

planning, product development, market analysis, decision making, measurement development -- we concentrate here on it's potential for helping researchers formulate their projects.

So what is concept mapping? Essentially, concept mapping is a structured process, focused on a topic or construct of interest, involving input from one or more participants, that produces an interpretable pictorial view (concept map) of their ideas and concepts and how these are interrelated. Concept mapping helps people to think more effectively as a group without losing their individuality. It helps groups to manage the complexity of their ideas without trivializing them or losing detail.

Procedure for Concept Mapping

Fig. No. 1



A concept mapping process involves six steps that can take place in a single day or can be spread out over weeks or months depending on the situation. The first step is the **Preparation Step**. There are three things done here. The facilitator of the mapping process works with the initiator(s) (i.e., whoever requests the process initially) to identify who the participants will be. A mapping process can have hundreds or even thousands of stakeholders participating, although we usually have a relatively small group of between 10 and 20 stakeholders involved. Second, the initiator works with the stakeholders to develop the focus for the project. For instance, the group might decide to focus on defining a program or treatment. Or, they might choose to map all of the outcomes they might expect to see as a result. Finally, the group decides on an appropriate schedule for the mapping. In the **Generation Step** the stakeholders develop a large set of statements that address the focus. For instance, they might generate statements that describe all of the specific activities that will constitute a specific social program. Or, they might generate statements describing specific outcomes that might occur as a result of participating in a program. A wide variety of methods can be used to accomplish this including traditional brainstorming, brain writing, nominal group techniques, focus groups, qualitative text analysis, and so on. The group can generate up to 200 statements in a concept mapping project. In the **Structuring Step** the participants do two things. First, each participant sorts the statements into piles of similar ones. Most times they do this by sorting a deck of cards that has one statement on each card. But they can also do this directly on a computer by dragging the statements into piles that they create. They can have as few or as many piles as they want. Each participant names each pile with a short descriptive label. Second, each participant rates each of the statements on some scale. Usually

the statements are rated on a 1-to-5 scale for their relative importance, where a 1 means the statement is relatively unimportant compared to all the rest, a 3 means that it is moderately important, and a 5 means that it is extremely important. The **Representation Step** is where the analysis is done -- this is the process of taking the sort and rating input and "representing" it in map form. There are two major statistical analyses that are used. The first -- multidimensional scaling -- takes the sort data across all participants and develops the basic map where each statement is a point on the map and statements that were piled together by more people are closer to each other on the map. The second analysis -- cluster analysis -- takes the output of the multidimensional scaling (the point map) and partitions the map into groups of statements or ideas, into clusters. If the statements describe activities of a program, the clusters show how these can be grouped into logical groups of activities. If the statements are specific outcomes, the clusters might be viewed as outcome constructs or concepts. In the fifth step -- the **Interpretation Step** -- the facilitator works with the stakeholder group to help them develop their own labels and interpretations for the various maps. Finally, the **Utilization Step** involves using the maps to help address the original focus. On the program side, the maps can be used as a visual framework for operationalizing the program. on the outcome side, they can be used as the basis for developing measures and displaying results.

This is only a very basic introduction to concept mapping and its uses. If you want to find out more about this method, you might look at some of the articles I've written about concept mapping, including An Introduction to Concept Mapping, Concept Mapping: Soft Science or Hard Art?, or the article entitled Using Concept Mapping to Develop a Conceptual

Framework of Staff's Views of a Supported Employment Program for Persons with Severe Mental Illness.

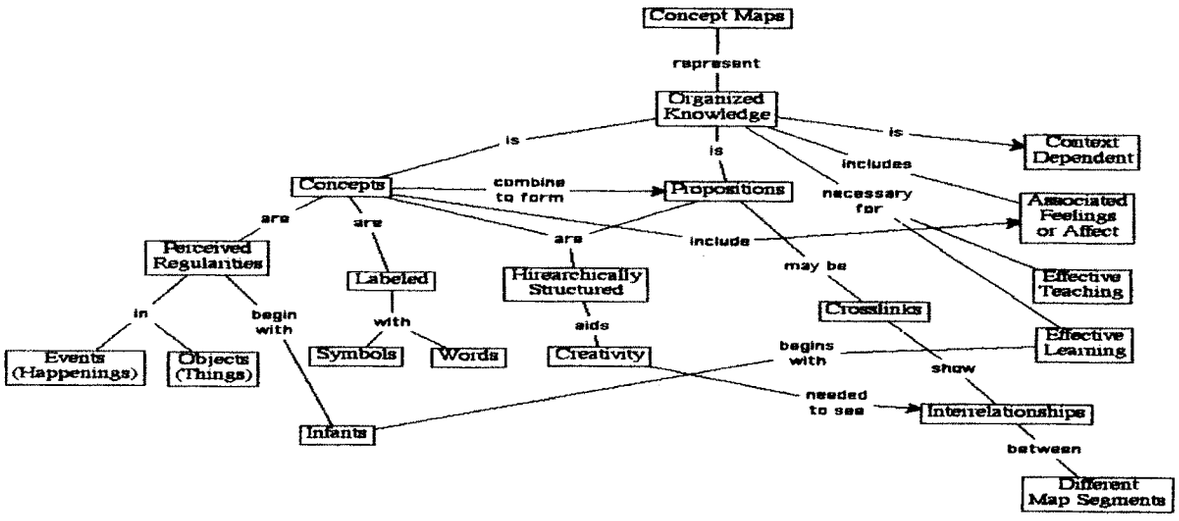
Concept maps are tools for organizing and representing knowledge. They include concepts, usually enclosed in circles or boxes of some type, and relationships between concepts or propositions, (indicated by a connecting line and linking word) between two concepts. Linking words on the line specify the relationship between the two concepts. Joe Novak defines "concept" as a perceived regularity in events or objects, or records of events or objects, designated by a label. Think of the concept "Dog" in your mind, what do you see? You might see a prototype shape (head, four legs etc) and typical examples (terrier, collie, sheepdog) and even be able to explain it (give a definition) in words. The label for most concepts is a word, although sometimes we use symbols such as + or %. Propositions are statements about some object or event in the universe, either naturally occurring or constructed. Propositions contain two or more concepts connected with other words to form a meaningful statement. Sometimes these are called semantic units, or units of meaning. Figure 1 shows an example of a concept map that describes the structure of concept maps and illustrates the above characteristics.

There are two features of concept maps that are important in the facilitation of creative thinking: the hierarchical structure that is represented in a good map and the ability to search for and characterize cross-links. In a concept map the concepts should be represented in a hierarchical fashion with the most inclusive, most general concepts at the top of the map and the more specific, less general concepts arranged hierarchically below. The hierarchical structure for a particular domain of knowledge also depends on

the context in which that knowledge is being applied or considered. Therefore, it is best to construct concept maps with reference to some particular question we seek to answer or some situation or event that we are trying to understand through the organization of knowledge in the form of a concept map. Another important characteristic of concept maps is the inclusion of "cross-links." These are relationships (propositions =linking lines with linking words) between concepts in different domains of the concept map. Cross-links help us to see how some domains of knowledge represented on the map are related to each other. In the creation of new knowledge, cross-links often represent creative leaps on the part of the knowledge producer. A final features that may be added to concept maps are specific examples or actual images of events or objects that help to clarify the meaning of a given concept.

Fig. No. 2

A Concept map about Concept mapping



As defined above, concepts and propositions are the building blocks for knowledge in any domain. We can use the analogy that concepts are like the atoms of matter and propositions are like the molecules of matter. There are now about 460,000 words in the English language, and these can be combined to form an infinite number of propositions; albeit most combinations of words might be nonsense, there is still the possibility of creating an infinite number of valid propositions. We shall never run out of opportunities to create new knowledge! As people create and observe new or existing objects or events, we will continue to create new knowledge.

STATEMENT OF THE PROBLEM

Effect of Concept Mapping in Science on Achievement in Physics for XI standard students – A Study

DEFINITIONS OF THE TERMS USED IN TITLE

Concept-

Conceptual Definition

An idea or representation of the common element or attribute by which groups or classes may be distinguished, a thought, an opinion, an idea or a mental image. (Good C. V.)

Operational definition

For the purpose of this study concept is an idea, rule, formula, units, conversions and experiments involved in Physics syllabus of XI standard prescribed by the state government of Maharashtra. i.e. Measurement, Unit

and system of Units, Dimensions, Errors in measurements, Displacement; Motion, Types of force and Law of conservation of Momentum with moment of Force and couple and properties of couple are the selected concepts for this study.

Mapping

Conceptual definition

A correspondence established between the members of one set and the members of another usually synonymous with function and transformation; for some writers, the term mapping carries a geometric connotation in contrast to any algebraic description which might be given for the correspondence. (Good C. V.)

Operational definition

For the purpose of this study mapping is diagrammatic and Geometric arrangement of selected key concepts and interrelated concepts included in syllabus of XIth standard Physics subject.

Achievement

Conceptual definition

Accomplishment or proficiency of performance in a given skill or body of knowledge. Knowledge attained or skills developed in the school subjects usually designated by test scores or by marks assigned by teachers or by both. (Good C. V.)

Operational definition

For the purpose of this study achievement is nothing but the Scores of XIth standard students in the achievement tests prepared by Researcher

Physics

Conceptual definition

The branch of physical science that is concerned with matter and energy, including the study of phenomenon associated with mechanics, heat, wave motion, sound, electricity, magnetism, light and atomic and nuclear structure. (Good C.V.)

Operational definition

For the purpose of this study it is Subject involved at the Higher secondary school level specially in the syllabus prescribed by state government of Maharashtra for XIth standard of Science stream.

Concept Mapping

Conceptual definition

Concept mapping is defined as a teaching strategy for representing knowledge in diagrams called 'knowledge graphs', which are networks of concepts with relationships between them represented respectively by nodes and links. Concepts and sometimes links are labeled and links can be non-, uni - or bi-directional.

Operational definition

For the purpose of this study concept mapping as a teaching strategy was used by the researcher to teach concepts included in the physics syllabus prescribed by state government of Maharashtra.

OBJECTIVES

1. To analyze the Physics syllabus for the selection of XI standard units for concept mapping
2. To implement concept mapping as a strategy for teaching selected units in the physics at XI standard.
3. To design concept maps on selected concepts in physics of XI standard.
4. To study the effectiveness of concept mapping as a teaching strategy in science on achievement in physics.

ASSUMPTION

1. Concept mapping as a teaching strategy can be used in science teaching.
2. Concept mapping as a teaching strategy is useful to increase students achievement.
3. Concept maps can be developed on certain units in physics.

HYPOTHESES

Null Hypotheses

1.There is no significant difference in the achievement scores of pretest of experimental and control group.

2. . There is no significant difference in the achievement scores of pretest and posttest of control group.

3. There is no significant difference in the achievement scores of pretest and posttest of experimental group.

4. There is no significant difference in the achievement scores of posttest of experimental and control group.

5. There is no significant difference in the achievement scores of pretest of Boys and Girls.

6.There is no significant difference in the achievement scores of posttest of Boys and Girls.

Research Hypothesis

1.Concept Mapping is an effective teaching strategy for teaching science.

LIMITATIONS

The study is limited to

1. XIth standard Physics syllabus prescribed by the state Government of Maharashtra.

2. XIth standard students which have Marathi as mother tongue.

3. present study is limited for academic year 2007-08

4.certain concepts included in physics syllabus of XIth standard.
5. two junior colleges attached to secondary schools.

SCOPE OF THE STUDY

In support of scope of the study Whitney says- "It will provide information concerning, who, what, where and how many. To define a problem means to put a fence around it to separate it, by careful distinction from like questions, found in related situations of need."

The study will cover institutions conducting higher secondary schools and junior colleges in kolhapur city of Kolhapur district.

In this researcher will deal with the selected concepts such as Measurement, Unit and system of Units, Dimensions, Errors in measurements, Displacement; Motion, Types of force and Law of conservation of Momentum with moment of Force and couple and properties of couple are the selected concepts for this study from XIth standard physics syllabus.

SIGNIFICANCE OF THE RESEARCH

Science is a foundation of higher education hence it is obvious that the teaching of science at secondary level has beyond doubt importance. If no significant plans are taken to ensure the perfection in teaching science it will create problems for the students in the future education. Since secondary education is base of higher education it carries great importance.

By conducting experiments In the secondary education system if positive results are achieved. It will be useful in the future curriculum setting as well as the text setting with use of concept mapping. While appointing the

science teacher the management may think of making concept mapping knowledge as an essential factor. This will encourage the student in self learning process. It will help student to get rid of unwanted fear of the subject in his mind and mis concepts about the subject.

The teacher also face different problems in selection and use of proper teaching aid, teaching tools and teaching methods for different topics in physics. So this is an attempt to make a comparative study to find the effectiveness of teaching physics by concept mapping and traditional method.

Result of this study will be useful to the teachers of XI standard, B.Ed. trainees, Teacher educators, parents, authors and educationist.

CHAPTERISATION

I. INTRODUCTION

It includes Statement of the problem and specific theories and variables with which the study is related, Significance of the problem, Important assumptions and limitations; Definition and explanation of important terms, Purpose and hypothesis of the study.

II. REVIEW OF THE RELATED LITERATURE

In this chapter reviews of related literature and researches are given.

III. PLAN AND PROCEDURE

In this chapter researcher deals with Samples, experimental design and Research method used; Descriptions of Data gathering instruments, Tools and Techniques of Data Collection.

IV. ANALYSIS AND INTERPRETATION OF DATA

Result and analysis is represented with the help of following points Classification and tabulation; Pictorial representation, Critical discussion and interpretation; and results are drawn.

V. SUMMARY, SUGGESTIONS AND CONCLUSIONS

Statement of the Problem, Description of Designs and Procedures Used; Main Findings and Conclusions, Recommendations for further Research are included in this chapter.