EFFECT OF CONCEPTUAL CHANGE APPROACH ON ACADEMIC ACHIEVEMENT OF SECONDARY SCHOOL STUDENTS AND ON TEACHING OF PHYSICS IN RAWALPINDI

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APPROVAL SHEET

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AUTHOR’S DECLARATION

I, **Muhammad Ramzan Sajid Registration No: 392-FSS/ MSEDU/F20** as a student of Master Studies in Education at International Islamic University, Islamabad do hereby declare that the thesis entitled **" Effect of Conceptual Change Approach on academic achievement of secondary school students and on teaching of physics in Rawalpindi "** submitted for the partial fulfilment of Master Studies in Education is my original work, except where otherwise acknowledge in the text and has not submitted or published earlier, be submitted by researchers for obtaining degree from this or any University or institutions.

Signature: _________

Muhammad Ramzan Sajid

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ABSTRACT

This study's primary goal was to assess secondary school students studying physics conceptual change approach. It was an experimental study based on how the conceptual change Approach affected students' performance? The purpose of the study was to investigate the effects of instruction using a conceptual change approach and a traditional approach on academic results of students. Evaluating the effectiveness of traditional approach versus guidance based on conceptual change approach supported by real-world activities. For sampling District Rawalpindi's public secondary schools students studying in science group made up the study's population. A self-created instrument, the Subject Achievement Physics Test (SAT), was employed for the study. The SAT consisted of 15 multiple-choice problems. The experimental group was given instructions using the conceptual change Approach whereas the control group was given instructions using traditional approach. Quantitative data analysis methods were employed in this investigation. Data was analyzed and percentages were calculated. For the purpose of descriptive statistics, the raw data is examined using the social sciences statistical software (SPSS-24).The findings of this study support that the expansion of knowledge sources is equivalent to the expansion of knowledge theories. This process enhances awareness about the conceptual change of learning. It also approves the theories evolving from the proposed hypothetical agenda.It is recommended that these approachess may be introduced through training to the teachers in formal education system. It is also recommended that guidelines for conceptual teaching approach may be developed for the teachers.

CHAPTER 1

INTRODUCTION

1.1Background of Study

The process of replacing a misconception with an accepted idea is known as conceptual change. Learning about science is a task that involves acquiring information reorganizing existing knowledge and sometimes letting go of cherished ideas. Analyzing how people learn about science has been fruitful by examining the parallel between learning and conceptual development in several domains. The approach of viewing learning as change examines the circumstances under which individuals with their set of ideas about natural phenomena either retain their beliefs largely unchanged when confronted with new experiences or need to replace them due to their inadequacy. This approach emphasizes the significance of addressing an individual's existing conceptions. Acknowledges how personal philosophical beliefs can influence learning (Hewson & Gertzog 1982).

Conceptual change is a concept in contemporary theories of learning. It refers to a learning process where learners go beyond accumulating knowledge and instead undergo a restructuring of their understanding transitioning from common sense beliefs to scientifically informed conceptions within a specific domain. Conceptual change is investigative topic. It was developed because of various perspectives on cognitive and psychological processes. Understanding conceptual change is a research paradigm; however, conceptual change is poorly applied because there is a lack of understanding of it and an inadequate description of how cognitive mechanisms process information.

1.2 Conceptual Change, Inclusive or Exclusive

The increasing understanding of the variety and coherence of students' viewpoints on natural occurrences/phenomena is one of the explanations for conceptual transformation. It is crucial to take this into account when examining the student learning concepts that make up the goals of a specific curriculum because there is consensus in the research that the processes by which students switch one thought for another is known as conceptual change. Specifically, one must consider whether students will need to abandon, reject, or downplay their goal to achieve the goals. A key idea in many modern approaches on learning is conceptual shift. It describes the learning process in which students not only increase their knowledge but also change their views of phenomena in a particular topic from common sense to scientific concepts. With its connections to theoretical and empirical research on conceptual development, conceptual learning and conceptual evolution in psychology, philosophy and cognitive science, the conceptual change approach to learning has the potential to improve science education. For some, this is purely a means of conceptual change. As a result, it is a term that refers to the challenging aspect of learning exchanging one thought for another but, implicitly, does not refer to learning that is problem-free. To put it another way, for some, conceptual transformation simply refers to a conceptual exchange. Others, on the other hand, believe that problem and non-problem learning share enough commonalities to warrant a conceptual revision to account for various forms of learning.

For instance, a person advances from ignorance to knowledge of a notion in both scenarios. Here, the metaphor of vast transformation can be used to think about effortless learning. When their existing beliefs can be reconciled with what they have learned, it is not a difficulty for students to learn what they don't know by connecting with what they already know. Consider existing knowledge as the "grasp" of new knowledge as an alternative perspective (Hewson, 1981).

Change is a broad concept that covers both growth and exchange. Different perspectives on the nature of knowledge, such as awareness in physics, lead to some distinct interpretations of conceptual change. Some individuals think that the context in which a set of concepts, such as Newton's laws of motion, is employed determines how comprehensive the set is. Although many phenomena, such as planetary motion, bridge construction and Brownian motion, are clearly described by Newton's laws, they are insufficient when applied very small (as quantum mechanics does)and they give explanations for common place events like the throwing of a ball or a table supporting a book that are counterintuitive to most people. This implies that the context of knowledge use must be considered. To put it another way, science uncovers truths about the world. As a result, it is always feasible to determine in theory whether a certain interpretation of an event or phenomena is correct or incorrect. Additionally, this point of view places more emphasis on the findings of science ("the facts") than on the process by which this knowledge was developed. This implies that ideas that are contrary to what is right should be categorized as misconceptions and that proper conceptions should be used to replace misconceptions through conceptual reform.

The third category of conceptual change justifications centers on the connection between teaching and learning. Since the idea of teaching is meaningless without the idea of learning, it seems natural that issues concerning teaching will be raised while thinking about learning. I think it's important to distinguish between learning activities and learning outcomes in the next section.

According to one perspective, teaching cannot take place without learning. The line between teaching and learning may become more ambiguous as a result; some teachers, for instance, may combine the two words. For instance, when it comes to teaching and learning, there is a tendency to priorities teaching techniques over learning activities under the implicit presumption that "if I teach well, my students will learn what I want, let alone they will learn." Another Perspective (Hewson & Hewson, 1988) takes a new approach to the connection between teaching and learning.

Although professors/teachers might assign learning tasks in the hopes that their completion would result in learning outcomes, it is crucial that students are aware of these objectives. Therefore, from this viewpoint, teaching does not result in learning outcomes; rather, it supports learning outcomes. Consequently, learning cannot occur without teaching and vice versa. Conceptual change can be challenging, particularly in science education where many of the concepts are complex, divisive or nonsensical. To successfully address and study conceptual change, however, science educators and scientific education researchers need models (Broughton et al., 2010). This is because conceptual change is essential to science learning. When current research and existing models of conceptual change are considered, a complete, comprehensive and dynamic model of conceptual change is necessary.

Students frequently have misconceptions or naive ideas about physics, chemistry, astronomy, engineering and other scientific phenomena that conflict with what they learn in school, which has led to extensive research on conceptual change, or the restructuring of existing knowledge, in science education (Sinatra, 2005).

1.2 Statement of the Problem

New approaches to educational thinking and teaching processes are necessary considering our changing world. According to study, once teachers started using standard teaching approaches, they frequently struggled to address the fundamental problems that kept students from learning as much as they might. The learning process, however, is limited to rote memorization of scientific principles. Ignorance ultimately took control of the way their thoughts were organized. The researcher tried to investigate the Effect of Conceptual Change Approach on academic achievement of secondary school students and on teaching of physics in Rawalpindi to close the gap between optimal learning and actual learning. Students from secondary classes participated in this research.

1.3 Objectives of the Study

1) To examine the student’s achievement based on conceptual change Approach on teaching of physics on secondary school students studying physics.
2) To examine student’s achievement based on the Traditional approach on teaching of physics on secondary school students studying physics.
3) To compare the results based on Conceptual change and Traditional approach on student’s academic achievement of secondary school students studying physics.

1.4 The study's Hypotheses

Hypothesis #1: There can be no substantial variation of students/learners average scores of conceptual change approach and traditional approach.

Hypothesis #2: There can be considerable change in students mean scores of conceptual change approach and traditional lecturing approach.

1.5 Significance of the Study

Research on the conceptual change approach in science education holds significant importance for students and the broader field of education. Here are some key reasons why this research is significant.

1.5.1 Improving Science Learning

Conceptual change research aims to enhance how students learn and understand scientific concepts. This is crucial because science education is fundamental in fostering critical thinking problem solving skills and scientific literacy. By improving how students grasp and retain scientific knowledge, we can potentially create a more informed and scientifically literate society.

1.5.2 Addressing Misconceptions

Many students hold misconceptions about scientific concepts. The conceptual change approach helps identify and correct these misconceptions. It's vital because misconceptions can hinder students' ability to understand more advanced scientific ideas. By addressing these misconceptions, we pave the way for a deeper and more accurate understanding of science.

1.5.3 Promoting Active Learning

The conceptual change approach often involves active learning strategies, such as hands-on experiments, discussions and concept mapping. This engagement in the learning process can make science education more interesting and relevant to students. Active learning methods can also improve retention and application of knowledge.

1.5.4 Customizing Instruction

Research on conceptual change allows educators to tailor their teaching methods to individual students' needs. It recognizes that learners come with their own prior knowledge and misconceptions and teachers can adapt their instruction accordingly. This personalized approach can lead to more effective learning outcomes.

1.5.5 Supporting Inclusivity

By recognizing and addressing misconceptions the conceptual change approach can help to reduce achievement gaps among students. It ensures that all students have the opportunity to learn and succeed in science, regardless of their prior knowledge or background.

1.5.6 Aligning with Modern Pedagogy

The conceptual change approach aligns with contemporary pedagogical trends that emphasize student-centered, inquiry based and constructivist learning. As education evolves, research on conceptual change provides valuable insights into effective teaching practices.

1.5.7 Curriculum Development

Findings from research on conceptual change can upgrade the improvement of science curricula and instructional stuff. By incorporating effective strategies for conceptual change, educators can create more robust and impactful educational resources.

1.5.8 Contributing to Educational Theory

Research on conceptual change aids in developing a theoretical and practical framework for learning. It can help refine and expand educational theories and provide insights into the cognitive processes involved in acquiring and revising knowledge.

1.5.9 Preparing Future Scientists

Students who experience effective conceptual change instruction are not only better equipped for success in science but also potentially more inclined to search jobs in technology, science, mathematics and engineering fields. This can have long-term implications for the scientific workforce and innovation.

1. 6 Assumptions of the Study

While conducting research on the conceptual change approach for science learning students, researchers made certain assumptions few of them were

a. Cognitive Conflict
b. Active Engagement
c. Individual differences
d. Thinking about one's thinking
e. Real-world Relevance
f. Interactions with Peers

It is essential to recognize that these assumptions can vary depending on the specific focus and goals of a particular study on conceptual change in science education. The current study was an experimental study that focused on people such as students and teachers, all of whom were quirky in their behavior.

1.7 Delimitation of the Study

This study was delimited to 9^{th} class male students were included in the study. Two chapters of secondary school physics were included in the component of the course that was examined. Chapter.1 kinematics and chapter.2 dynamics. Two student groups were made for this purpose such as a control experimental group and traditional group.

1.8 Frame work of Conceptual Change Approach

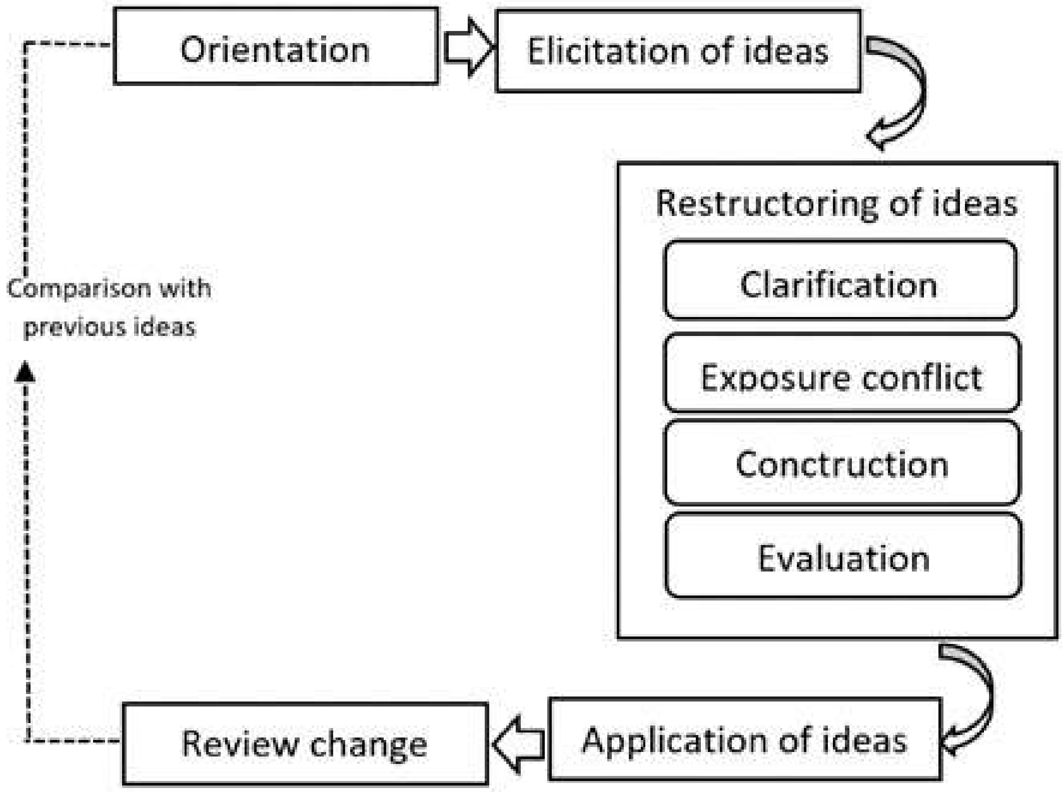

Figure 1.1 The steps of conceptual change learning approach.

This framework was presented by Aminatul Munawaroh,Insih Wilujeng and Zul Hidayatullah in paper "Physics Learning Instruction based on the Conceptual Change Model for Senior High Schools"

1.9 Components of Conceptual Change Approach

The original conceptual change approach research is focused on following main components.

1.9.1 Building Consciousness

At this point you are considering your objectives and decide which objectives students can understand.

1.9.2 Outlining Beliefs

At this stage you consider your advantages and disadvantages while acknowledging the gap between where you are and where you want to be. Although you can name and describe the three dimensions, you have not given them much thought or used them frequently in your lessons.

1.9.3 Confronting Beliefs

You are putting into practice a tried-and-true professional development strategy to help you progress towards your goal stage in terms of the three aspects. This entails creating a systematic schedule for attending conferences, reading for pleasure, researching online, participating in PLCs with other teachers, attending workshops, participating in twitter chats etc. You are pushing yourself by putting some of the three aspects into practice, commenting on how well the lessons worked and making the necessary adjustments to ensure that the three dimensions are applied rigorously.

1.9.4 Reinterpreting Beliefs

With continuous reflection, you are picking up new tactics and enhancing your teaching. You feel at ease asking for help when you need it and are willing to share ideas with others. Your lessons are becoming more and more three dimensional. Instead of being the exclusive source of knowledge, you are actively handing learning over to your pupils and evolving into a co-learner and a guide on the side.

1.9.5 Integration

You are trying to fully integrate three-dimensional learning in your classroom. You approach all instruction with the assumption that science and engineering practices, cross-cutting ideas and discipline central concepts are intertwined. You have a variety of instructional techniques at your disposal, including easy access to every dimension. You have a network of coworkers who can help you continue to advance professionally.

1.9.6 Invention

You are now engaged in ongoing in-depth professional growth related to the three dimensions. You are coming up with innovative ways to grow your practice and through dialogue, presentations, the creation of materials and other means. You are consciously sowing the seeds for others.

1.10 Procedure and Method of Research

The experimental group in this study received instructions by using the Conceptual Change Approach, while the control group received instructions using the Traditional approach. Two distinct treatment patterns were used during the experiment. The researcher instructs the control group using the traditional approach and he also instructs the experimental group using the conceptual change approach.

1.10.1 Traditional Instructional Method

In the Traditional Instructional approach, the topics were taught and learned through scheduled lectures well-prepared notes and a textbook for 9th-grade physics. Here giving detailed lectures was the main goal, making professors the active party and pupils the passive one. The pupils carefully observed the professors as they described the ideas in front of them and took notes on the facts and pictures. The pupils were expected to act as passive listeners, carefully consider the teacher's instructions and maintain silence throughout class.

1.10.2 Procedure and Activities of Conceptual change Approach

To assist in displaying videos, a projector and computer simulations are employed. This method's primary goal is to increase pupils' conceptual comprehension of "Physics concept." The pupils gained expertise on how to relate new circumstances to prior understanding. The pupils were allowed to assess their conceptual knowledge in several subjects.

The following steps were included in the study's procedure.

1. School Selection

The researcher went to the selected school to speak with the principal about the significance of education and to obtain permission to carry out their investigation.

2. Groups Allocation

The researcher announced the purpose of the study and invited students to gather in the hallway. The sample of 60 students is given a self-prepared pre-test. Through paired random sampling, students are divided into experimental and control groups according to their performance on the pre-test. Each group had 30 students.

3. Administration of the Post-Test

After the session, both the experimental group and the control group were checked by self-developed post-test to assess the subjects' progress in an atmosphere identical to that used for the pre-test.

4. Instrument

A self-made Subject Achievement Test checked by professor for Physics (SAT) was the measurement tool employed in this investigation. The bloom taxonomy employed in the analysis served as the foundation for a Subject Achievement Test (SAT) with 15 multiple-choice objectives (MCQs).

CHAPTER 2

LITERATURE REVIEW

2.1 Literature related to the Conceptual Change Approach

Interpreting students' answers based on alternative ideas suggests that learning involves changing a person's ideas and adding new knowledge to existing knowledge. This view was developed in the “learning as conceptual change” approach by Posner, Strike, Hewsonand Gertzog (1982) and expanded by Hewson (1981, 1982).

According to this viewpoint, learning entails the interplay of fresh and established ideas and the outcome relies on the type of contact. There are two primary parts to it. The first of these elements focus on the prerequisites that must exist or do not exist for a person to undergo conceptual change. A person's state of conception refers to how closely a conception satisfies these three criteria. The more requirements that a project fulfils the more important it is. The second component is the individual's conceptual ecology, which provides the framework for conceptual change to take place, affecting and giving the shift significance. The most significant types of knowledge that fall under the umbrella of conceptual ecology may be epistemological commitments (such as coherence or generalizability), metaphysical world views and analogies and metaphors that can be used to organize new information. The students assess whether various criteria are met, including H. whether the new concept is intelligible, trustworthy and fruitful, using their prior knowledge (for example, conceptual ecology).

The new notion will be simple to learn if it includes all three. The change as expansion metaphor, which emphasizes the necessity for new additions to fit cogently into the broader plan, is useful in comprehending this. The extended concept is enhanced by thoughtful additions that are compatible with the existing architecture, just like an expanded house is. As an illustration, the idea of acceleration, which includes the definition of the rate of change of velocity, has been broadened to include acceleration measurement techniques, examples and the significance of acceleration in Newton's 2^{nd} law of motion, among other things.

The pupil must be unhappy with the current concepts for the new concept to be credible or useful if it opposes them. In this instance, monetization necessitates reorganizing current notions or possibly completely swapping them out for new ones. The change as exchange metaphor's status changes give us a method to think about this procedure. Effects of Conceptual Changes on Teaching Science In light of the above there are at least four different ways to think about conceptual shifts in science education.

2.1.1 Learning Science

According to research (Pfundt & Duit, 1991; Carmichael, et al., 1990), students enter their science classes with a variety of distinct ideas about the natural world around them. In terms of qualities like clarity, breadth, coherence, ambiguity and tenacity, these conceptions differ substantially. Many of these notions, in particular, conflict with the generally accepted scientific theory. This research is important since these are the ideas that students use when they are introduced to common scientific subjects. Therefore, the way they learn this new information is influenced by their current views, which may or may not be for the better. Therefore, it makes sense to consider learning the intended outcomes as a conceptual transformation process that incorporates both extension and interchange.

2.1.2 Teaching Science

Believing that pupils have varying concepts that may need to change is one thing; concluding that it is the teacher's duty to use educational strategies that might help conceptual transformation occur is another. While some would support a division of labour where teachers teach the material and students absorb it, this is not a stance I support. Instead, I believe it is the responsibility of the instructor to be aware of the students' preconceptions and to teach in a way that will likely stimulate conceptual growth on the part of the students. Research on students' perceptions of natural occurrences has been incorporated into several instructional studies in recent years. From these investigations, a variety of distinct traits have started to stand out as essential elements of what might be referred to as conceptual shift teaching (Hewson, 1991).

2.2 Stages of Conceptual Development

Teaching conceptual transformation has several levels. These consist of

2.2.1 Diagnosis or Elicitation

Does the teacher examine students' preexisting ideas and the reasons behind them using diagnostic techniques?

2.2.2 Status change

Is the outcome supported by any evidence? Is there any proof that a student's learning outcomes may be influenced by what they already know? On the other hand, due to conceptual shifts, there are certain anomalies in the various sections of the lesson.

Does the teacher assist pupils in elevating other competing ideas above problematic existing knowledge? Are students able or encouraged to "break away" from one or more of their own or others' ideas to reflect on them and share their own opinions?

2.2.3 Meta cognition

Can students "step back" from one or more concepts, either on their own or with others, to consider them and voice their opinions? Do both the teacher and the pupils accept other people's opinions, even when they conflict with their own?

2.2.3 Teacher's role

Is the instructor able to give learners the freedom to communicate themselves without concern of ostracism and to make sure that he or she is not the only one who decides what constitutes a valid thought in the classroom?

2.2.4 Learner's role

Are students prepared to be accountable for their own learning, to respect the opinions of others and to alter their opinions when another one appeals to them more? Can pupils keep track of their own education?

2.3 Conceptual Change Approach in Science Teacher Education

A core assumption of the Conceptual Change Approach is that in order for learners to understand a new idea, they must first have access to the appropriate modes of conception representation. Only then can they examine the plausibility or usefulness of the new conception. In this essay, we investigate how to apply this theory to the challenging issue of teachers' conceptual learning and teaching. Intelligibility, plausibility, fruitfulness, the nature of conceptual change instruction and learning as conceptual change are the five essential notions that have been singled out for investigation. A framework originally created for describing scientific conceptions in terms of verbal and symbolic definitions, images and metaphors has served as the organizing principle for representations of these conceptions, which have been mostly pulled from the literature on conceptual change. The variety of meanings that have been assigned to these representations of fundamental concepts has been highlighted by grouping them together. Both science teachers and teacher educators can benefit from the effects of conceptions into various representational modes to plan how to make important conceptions easier for students to understand. The representational framework's potential as a tool for reflection by both students and teachers on their own understandings is further highlighted by this evaluation of it.

2.3.1 Teaching for conceptual change

An analysis of tactics Children's learning in Science Research Group (P. H. Scott, H. M. Asokoand R. H. Driver) Leeds University in the UK. This essay offers a survey of the pedagogical approaches mentioned in the literature that, in general, are founded on the idea that learning involves conceptual shift. The alternative conceptions research program has so far only had a little influence on instructional strategies. This review was developed to identify the variety of tactics being presented and to analyze the various presumptions on which they are founded. We are currently considering how its conclusions may be applied to enhance scientific instruction more broadly at Leeds.

Four elements may need to be considered while choosing the best teaching strategies,

1. Students/learners' previous conceptions and attitudes: The literature has widely recorded students' preconceptions in a wide range of science areas, but it is now necessary to think about how this literature will influence teaching.

2. The nature of the intended learning outcomes: The effect of learning outcomes through science has traditionally been the main emphasis of lesson planning.

3. This investigation emphases on the nature of the logical journey needed by the student to get from prevailing conceptions to the proposed learning result. It examines the intellectual challenges involved for students in developing or altering their conceptions.

4. An analysis of the educational strategies that might be used to lead students from their present worldviews to the scientific viewpoint. In reviewing the research on conceptual shift teaching methodologies, the fourth of these variables is addressed in this work. Following a description of several recorded tactics, we identify and evaluate several theoretical queries that have arisen from the review.

A discussion of the practical issues in teaching for conceptual development follows this. JSTOR, an online library with links to more than 10 million journal papers, books and primary materials across 75 disciplines, started by conducting a general internet search as well as an online search for peer-reviewed articles.

The following four publications listed in no order have been hailed as the most recent, top publications in education and technology.

1. Elsevier's International Journal of Computers & Education

2. The British Journal of Educational Technology, published by John Wiley & Sons

3. The International Forum of Educational Technology and Society's Journal of Educational Technology and Society Elsevier, the Internet and Higher Education.

4. Using the search phrases "critical thinking,""information development," and "student engagement," those research articles provided more searches within the category of "educational technology."

5. A Google Scholar search was then used as a last resort. A complete references list from this review of literature can be provided, albeit only a few of these research works are quoted in this white paper. New ideas in scientific education and teacher preparation University of Wisconsin-Madison Peter W. Hewson Wisconsin's Madison is in the United States. A was cited, expanding knowledge.

2.4 Conceptual Change from the Epistemological Perspective

Philosophical concepts of knowledge and the learning process are known as epistemological beliefs. An intriguing area for investigation is how students' perceptions of or management of their knowledge are affected by their epistemological views during classroom instruction in various subject areas. Epistemological views research demonstrates that students' naive ideas about the nature of learning and knowledge are greatly influenced by their less sophisticated learning strategies, poorer levels of cognitive functioning and lack of flexibility in their thought processes.

The most well-known conceptual change model in science education was developed and improved by Posner, Strike, Hewsonand Gertzog in 1982 and used in classroom instruction. It is based on students' epistemologies. According to Posner et al., classical conceptual transformation is comparable to Piaget's ideas of assimilation, accommodation and disequilibrium as well as Kuhn's concept of a paradigm shift. According to this theory, learning entails the interplay of fresh and established ideas, with the outcome depending on the type of interaction. The CCA is made up of two main parts. The first of these elements consists of the requirements that must be met (or are no longer met) for a person to undergo conceptual change. The second aspect is the person's conceptual ecology, which provides the context, in which the conceptual shift occurs, influences the change and gives it significance. Epistemological commitments, metaphysical worldviews and analogies and metaphors that can be utilized to arrange new information are some of the knowledge categories that make up the conceptual ecosystem.

Asgari et al., (2018) who concluded that the development and understanding of education has increased with conceptual change teaching besides that it is more effective in removing and modifying student misconceptions.

Redhana et al., (2017) found learning problems viewed from conceptual change approach and showed the problems that related to the aspect of conceptual change by Posner which are necessity, intelligible and fruitful in learning science activities, by knowing the learning problems especially problems related to the students' misconception, the teacher can prepare effective model lesson plans to improve students' thinking and understanding to redefine the students' misconceptions.

Pebriyanti, Sahidu & Sutrio (2015) found that the conceptual change learning was effective in overcoming student's misconceptions of physics. This shows that CCA is superior to traditional teaching in teaching and learning physics concepts to detect and correcting student misconceptions.

The more sophisticated and presumably more developed epistemological viewpoints, in the opinion of Driver, Leach, Millar and Scott (1996), are characterized by "model-based reasoning." Students must comprehend that scientific inquiry requires assessing hypotheses considering new knowledge and that there might be several descriptive models that include theoretical objects that cannot be seen. There is also a distinct difference between description and explanation. Finally, several research stress that context has a significant impact on students' perceptions of the nature of scientific knowledge (Elby & Hammer, 2001).

Constructivist epistemology term is referred to a group of epistemic principles that have roughly the circumstantial, evaluative and constructivist features mentioned above. This is due to our conviction that across-context generalizations about the nature of knowledge and knowing are challenged by the context-dependence of epistemological beliefs. Skills and attitudes necessary for learning are positively correlated with a constructivist personal epistemology. Previous research has shown how the construct is related to understanding, learning, academic performance and conceptual transformation. For instance, Ryan (1984), building on and extending Perry's (1998) research, investigated the impact of epistemological growth on understanding and Meta comprehension. He discovered that students who hold relativist views of knowledge that is, those who believe that knowledge depends on the context perform better in comprehension monitoring tasks and are more likely to employ sophisticated comprehension techniques than dualists, who believe that knowledge is factual and either correct or incorrect. The latter group is more likely to study textual fact recall. In fields like the social and physical sciences, beliefs about the organization of information—that is, viewing knowledge as a collection of discrete, concrete, knowable facts—have been linked to poor text comprehension. Additionally, they have been shown to have a detrimental impact on the understanding and associated problem-solving of statistical text (Schommer et al., 1992). According to research by Kardash and Scholes (1996) and Schmommer (1990), beliefs about the stability/certainty of information that is considering knowledge as unchanging and approaching/achieving absolute truth have been shown to have a negative impact on how well evidence is interpreted.

The following are significant research projects and theoretical viewpoints relating to the conceptual change approach.

2.5 Theoretical Foundations of Conceptual Change

The conceptual change approach is grounded in constructivist theories of learning, which emphasize the active construction of knowledge by the learner. Piaget's theory of cognitive development and Vygotsky's socio-cultural theory provide foundations for understanding the role of misconceptions and the importance of social interactions in conceptual change.

2.5.1 Identification of Misconceptions

A significant aspect of the conceptual change approach is the identification and elicitation of students' prior knowledge and misconceptions. Studies have shown that misconceptions often persist despite explicit instruction and can hinder learning. Diagnostic tools, such as concept inventories, interviews and concept maps, have been utilized to uncover and address misconceptions effectively.

2.5.2 Conceptual Conflict and Cognitive Dissonance

Conceptual conflict, or cognitive dissonance, is a central mechanism in the conceptual change approach. Studies have highlighted the importance of creating situations that challenge students' pre-existing beliefs and create a sense of cognitive conflict. The resolution of this conflict through the revision of misconceptions is considered crucial for conceptual change to occur.

2.5.3 Learning Strategies and Instructional Methods

Numerous learning strategies and instructional methods have been employed within the conceptual change approach. These include peer instruction, concept mapping, problem based learning, reflective writing and guided inquiry. These approaches encourage active student engagement, promote reflection and facilitate the restructuring of conceptual frameworks.

2.5.4 Role of Meta cognition and Reflection

Meta cognition, including self-questioning and self-explanation, plays a significant role in the conceptual change approach. Encouraging students to reflect on their own thinking processes and monitor their understanding aids in identifying and revising misconceptions. Meta cognitive strategies are effective in promoting conceptual change and developing a deeper understanding of concepts.

2.5.5 Teacher Facilitation

The role of the teacher is crucial in facilitating conceptual change. Research suggests that effective teacher facilitation involves diagnostic assessment, scaffolding, and questioning techniques and providing feedback. Skilled teachers create an environment that supports students' conceptual change by addressing misconceptions, guiding inquiry and fostering discussion.

2.5.6 Assessment and Evaluation

Assessment and evaluation within the conceptual change approach focus on formative assessment techniques that provide feedback for learning. Pre and post tests and classroom observations are commonly used to measure the effectiveness of instructional intervention and students' conceptual understanding.

2.5.7 Challenges and Future Directions

In spite of the potential of the conceptual change approach, several challenges exist. Students' resistance to change, the complexity of cognitive restructuring and the influence of affective factors can hinder conceptual change. Future research should explore ways to address these challenges, refine instructional methods and examine the long-term effects of conceptual change on students' learning outcomes.

2.6 Retention of Conceptual Change

The extent to which the revised understanding of concepts is maintained with time follow up assessment conducted at intervals after the instructional intervention to measure the persistence of the conceptual changes observed in individuals.

These operational definitions help researchers to objectively measure and study the various components of the conceptual change approach in a systematic and replicable manner.

According to Smith (1991), there must be four factors in place for conceptual transformation to occur

i. The learner must be discontented with the existing knowledge.

ii. The learner must have an accessible, understandable alternative.

iii. The alternative must seem reasonable to the learner.

iv. The alternative must seem productive to the learner.

2.7 Important Instructional/Teaching Techniques Based on the Conceptual Change Approach

A significant gap exists among our theoretical and empirical understanding and classroom practices even though research on conceptual change has begun to be used in instructional practice. Duit et al. (2008) claim that teacher's lack conceptual understanding and don't use the recommended instructional strategies to promote conceptual transformation in the classroom.

When preparing to teach conceptual transformation, pedagogical decisions should be taken at three levels, according to Scott et al. (1992). To assist conceptual change learning, teachers must first create a supportive learning environment. This may be accomplished by offering chances for debate and the evaluation of other arguments and points of view. The choice of teaching tactics is another level of decision making. Finally, the choice of certain learning tasks needs to be considered. The learning challenge must consider the requirements of the specific science topic in question. Four things may need to be considered while choosing specific teaching strategies:

1. Prior beliefs and attitudes of students.

2. The type of desired learning results.

3. The learner's intellectual capacity or demand.

4. Potential instructive techniques, two different sets of tactics encourage conceptual shift.

The first group is built on the resolution of cognitive conflict and divergent viewpoints. The second group of tactics is based on the concepts already held by the students.

2.7.1 Techniques based on cognitive conflict

Many instructional methodologies have been developed with cognitive conflict as their foundation. Such tactics encourage the creation of scenarios that contradict students' preexisting beliefs about a phenomenon to generate cognitive conflict.

2.7.2 Techniques based on Piaget's theory of concept learning

The instructional sequence proposed by Nussbaum and Novick (1982) makes use of the Piaget concept of accommodation. There are four basic components to it.

1. Early exposure of student/learners' preconceptions through their reactions to an expose an event.
2. Improving student/learners' perception of own and other students' frameworks.
3. Constructing conceptual disagreement by trying to describe a contradictory event.

4. Promoting and directing adaptation and invention of new conceptual approaches consistent with the expected science view.

2.7.3 Disagreement among concepts

Two different ways of framing a disagreement between concepts are highlighted by Stavy (1991).

i) A discrepancy between a child's cognitive frameworks for one type of physical reality and that reality itself.

ii) A disagreement between two opposing cognitive models of the same world. For creating a teaching strategy, they used the second kind of conflict.

2.7.4 Dialogue based approach

The dialogue-based method, also known as ideational confrontation (Champagne, Gunstoneand Klopfer, 1985), is intended to change students' declarative knowledge in a given subject. Students make their explanations or forecasts for typical physical circumstances explicit. Each student creates an analysis to back up their predictions and then they each present it to the class. Each student becomes clearly aware of his or her thoughts in that material as a result of the students' attempts to persuade one another of the truth of their arguments, conversations and ideas. The lecturer offers a theoretical explanation based on scientific principles after demonstrating the physical situation. Students might contrast their analyses with the scientific one through further debate.

2.7.5 Analogy based teaching Approach

There are four steps in the analogical teaching technique (Clement, Brown, & Zietsman, 1989).

a. A target question is used to make the student's misconception about the subject at hand clear.
b. b. The instructor offers an example that, in his or her opinion, is comparable and will appeal to the students' intuitions. This situation is known as an anchoring example.
c. To establish the analogous relation, the instructor requests that the student make an explicit comparison between the anchor and target situations.
d. The instructor/teacher then tries to discover a bridge analogy or a set of bridging analogies if the student rejects the analogy.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Research Design

The foremost objective of this study was to ascertain the impact of the conceptual transformation approach on secondary school students' academic performance. Consequently, an experimental research methodology was employed. Pre-experimental, actual experimental and quasi experimental research designs are the three main types used in experimental studies.True experimental research designs are best used when the treatment's internal validity is substantially guaranteed and its results may be broadly generalised. Each design has its own specifications, limits and restraints. Data collection consequently follows the pre-test post-test similar group experimental research design.

The design's metaphorical representation is given below.

Table 3.1*True -Experimental Design*

Pre- and post-test Design	Test score	Status	Test score
Selected control Group	Pre-test	No Treatment	Post-test
Selected traditional Group	Pre-test	Experiment Treatment	Post-test

Table 3.2 *Research Strategy and Instruments*

Groupings	Pre-tests	Treatments	Post-test
Experimental Group	SAT	Conceptual change approach supported group	SAT
Control Group	SAT	Traditional approach group	SAT

3.2. Study's Population

The study's population consists of 60,9th class students enrolled in Government Boys Higher Secondary School Muslim No. 1 in Rawalpindi.

30 students were included in control experimental group while

30 students were included in traditional approach group.

3.3 Sample of the Study

A sample of the study included 9th-grade secondary students at Government Boys Higher Secondary School Muslim No. 1 in Rawalpindi. 60 students in the 9th grade are chosen as the study's sample and based on their pre-test results they were divided into 2 groups, the experimental and the control group. There were30 students in each group.

Table 2.5 *Study's sample*

School Type	Experimental group	Control Group	Total
Government	30	30	60

3.4 Development of Pre and Post-tests

Following the supervisor's explicit direction and input, the investigator pre and post-tests were created using selected secondary level Physics course materials. The pre and post-tests were built from the chosen 2 units (Kinematics and Dynamics) of class 9th physics text book while considering the updated Bloom taxonomy. The given pre test and post test was designed for experimental study for MS research .The purpose of the study was to explore the effect of Conceptual change approach on the academic achievement of students at secondary level. The pre-test post-test equivalent group experimental research design was used for data collection.

3.5 Pre and Post-tests validation and Reliability

Professors having experience in the field of Physics and education were contacted to improve the test questions for the pre and post-test. For the pilot test, which was not a part of the study, 10 secondary-level Physics students were preferred. The Spearmen-Brown Prophecy formula, which also looked at the pre-test's correlation coefficient, was used to determine the reliability of the pilot pre-test. Prior to the post-test, the same pre-test was given, with a few sequential modifications but at the same level of difficulty.

3.6 Variables

Given that the study was experimental, the various types of variables involved in it were as follows

3.6.1 Independent variables

The traditional teaching approach and the conceptual change approach were the independent variables employed in this study. These were the factors that were changed in the research to compare their efficacy.

3.6.2 Dependent variables

The academic success of the study's participants in the topic of physics served as the dependent variable. Before and after the treatment, the students' performance on this variable was graded.

3.6.3 Controlled Variables

Administrative controls and sample selection were used to regulate controlled variables such as time, treatment length, technique modification, instruction circumstances, use of teaching aids and sample size etc.

3.6.4 Uncontrolled Variables

Many variables were out of our control because of a few limitations, even if they might have had a big impact on the dependent variables. These variables are motivation, anxiety, student’s interest, socio-economic status, home environment of students, their prior experience with a particular teaching method and their parents' educational levels etc. Throughout the course of treatment, these variables persisted.

3.6.5 External Variables

The influence of external factors was kept to a minimum.

1) During the treatments, the instructor did not treat the traditional Groups and Experimental Groups equally or in a biased manner.

2) There is no interaction during the session because the two classes were divided.

3) The study's surroundings were the same for both groups.

3.7 Operational Definitions

3.7.1 Conceptual change Approach

Conceptual change is the process of replacing misconceptions with ideas that are accepted by science.

In the context of the conceptual change approach, which is often used in education and cognitive psychology can be used to describe how individuals revise or reorganize their understanding of a concept.

3.7.2 Pre-assessment Performance

Initial level of understanding of a learner on a specific concept before instruction. Scores obtained from pre-assessment tests, quizzes, or concept mapping activities that measure the baseline understanding of the targeted concept.

3.7.3 Instructional Intervention

The specific educational strategies, methods, or materials designed to facilitate conceptual change. Description and detailed documentation of instructional activities, including lesson plans, teaching materials and techniques employed to foster conceptual change.

3.7.4 Conceptual Change

The observable shift or modification in an individual's mental representation or framework of particular concepts which changes in responses, explanations, or problem solving approaches demonstrated by individuals through post assessment tests, interviews, or concept maps, indicating a revised conceptual understanding.

3.7.5 Misconceptions

Inaccurate or incomplete beliefs held by individuals about a specific concept. Recognition and documentation of specific misconceptions demonstrated by individuals through pre and post test responses.

3.7.6 Meta cognitive Awareness

The degree to which individuals are conscious of their own thinking processes and strategies during the conceptual change process.

3.8 Instructional Strategies for Conceptual Change Teaching Approach

3.8.1 Idea development

The concepts that the students believe to be pertinent to the issue are established.

3.8.2 Writing ideas

Discussions and participants' ideas are saved in a "paper memory" for future reference.

3.8.3 Introduction of concepts

Students were told that major concepts of physics are taught to them which may solve their problems and can help them in construction and later in evaluation of the alternatives they have proposed through discussions.

3.8.4 Teaching new theory

The new theory is explained by relating it to the class's existing foundational knowledge.

3.8.5 Applying new theory

Students use the new theory to solve problems to demonstrate how individuals created it. Written assignments must be included in this process to provide each student with a second paper memory.

3.8.6 Examining ideas

Each student evaluates the quality of the concepts and compares their memory from steps 1 and 5

.

3.8.7 Traditional Instructional approach

In the Traditional teaching approach, the topics were taught and learned through scheduled lectures, well-prepared notes and a textbook for 9th-grade physics. Here, giving detailed lectures was the main goal, making instructor the active party and pupils the passive one. The pupils carefully observed the instructor as he described the ideas in front of them and took notes on the facts and pictures. The pupils were expected to act as passive listeners, carefully consider the teacher's instructions and maintain silence throughout class.

3.9 Procedure and Method of Research

The experimental group in this study received instructions by using the Conceptual Change Approach, while the control group received instructions using the Traditional approach. Two distinct treatment patterns were used during the experiment. The researcher instructed the traditional group by using the traditional approach and he instructed the experimental group using the conceptual change approach.

The following steps were included in the study's procedure.

3.9.1 School Selection

The researcher went to the selected school to speak with the principal about the significance of education and to obtain permission to carry out their investigation.

3.9.2 Groups Allocation

The researcher announced the purpose of the study and invited students to gather in the hall. The sample of 30 students is given a self-prepared pre-test. Through paired random sampling, students are divided into experimental and control groups according to their performance on the pre-test. Each group had 30 students.

3.9.3 Administration of the Post-Test

After the session, both the experimental group and the control group were checked by self-developed post-test to assess the subjects' progress in an atmosphere identical to that used for the pre-test.

3.10 Instruments

A self-made Subject Achievement Test checked by professor of Physics (SAT) was the measurement tool employed in this investigation. The bloom taxonomy employed in the analysis served as the foundation for a Subject Achievement Test (SAT) with 15 multiple-choice objectives (MCQs). SAT is used as a testing tool for pre and post-testing purpose.

The investigator can address the rationality concerns pertaining to the instruments by using the identical pre and post assessments (Schalich,2015). To ensure the accuracy of the image, material and construct, three teachers and three scientific education specialists contributed their expertise. They also evaluated the value of the instructor-made Subject Achievement Test (SAT). The necessary revisions are made considering their invaluable suggestions.

3.10.1 Subject Achievement Test (SAT)

During the study, a teacher-made Subject Achievement Test (SAT) with 15 multiple-choice items was employed.

3.10.2. Reliability and Validity of the Instrument

The instrument was checked by the professionals and university teachers whereas according to the instructions of professionals, the questionnaire was altered and adapted with required changes. Item analysis revealed that the average difficulty of the questions was evaluated to be 0.38, indicating a moderate degree of complexity. The average distinctiveness of the questions is calculated to be 0.38and it can be shown that the questions have good distinctiveness. The estimated value of the Kuder Richardson-20 reliability coefficient following the questions' exclusion is 0,763. The investigation led to the creation of a useful and trustworthy achievement test for the "Matter Changing" unit that includes 15 multiple choice questions of a medium level of difficulty and good distinction strength.

CHAPTER 4

DATA ANALYSIS AND RESULTS

In this chapter analysis and interpretation of data from experiment and pre post tests is included. Descriptive statistics was used to summarize the responses of the respondents to test.

This section represents the data analysis from the data collection techniques described in Chapter three to answer the research questions. Pre-test experimental approach results are presented first, followed by pre-test traditional approach respectively. These results include a summary of findings from conceptual change approach on academic achievement of secondary school students and on teaching of physics in district Rawalpindi, Punjab, Pakistan. The hypotheses were statistically tested and validated at a significant level of 0.05 via T-test since it is the most used tool/technique in educational findings.

4.1 Pre-test Experimental Approach Group

In pre-test experimental approach three different groups of students were observed represented as A*= Number of students attempted correct option, B*= Number of students attempted partially correct option and C*= Number of students attempted incorrect option. The maximum number of students belonged to group C, which was the number of students attempted incorrect option (18.33), followed by group B (8.66) and C (3.00) respectively.

Maximum lower confidence interval was also observed in group of students belonging to C (16.87), followed by group B (7.47) and A (2.30) respectively. A lower confidence interval provides a range within which we can reasonably be confident that the true population mean of our data lies.

Same results were observed for upper confidence interval which was 19.79 for C, followed by B (9.86) and A (3.69) respectively. This interval also provides a range within which the true population mean likely to be (Table 3.1). T-value was calculated based on the difference between the hypothesized population mean and sample mean, divided by the standard error (SE) of the mean. Maximum t-value was also observed for C (26.86), followed by B (15.45) and A (9.11) respectively. Their confidence Interval was 95%. The data is statistically significant at $p \leq 0.05$.

Table 4.1: *Response of secondary school students to pre-test experimental approach based on T-test analysis*

S. No.	Variable	Mean	SE	Lower	Upper	T	DF
1	A*	03	0.32	2.30	3.69	9.11	14
2	B*	09	0.55	7.47	9.86	15.45	14
3	C*	18	0.68	16.87	19.79	26.86	14

S. No. =Serial number, A*=Number of students attempted correct option; B*= Number of students attempted partially correct option; C*= Number of students attempted incorrect option, SE=Standard error, DF= degrees of freedom, T= t-test value.

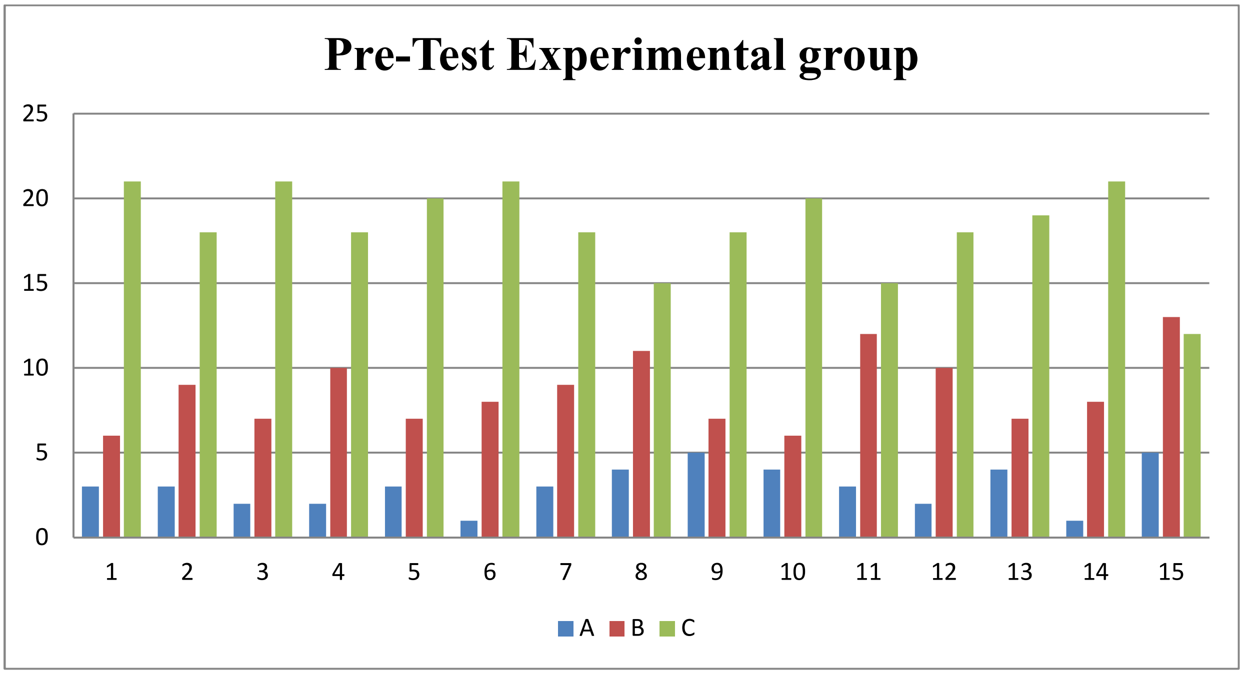

***Figure 4.1*:** Bar graph representing number of student's response to pre-test experimental approach.

A*=Number of students attempted correct option; B*= Number of students attempted partially correct option; C*= Number of students attempted incorrect options.

4.2 Pre-test Traditional Approach Group

In pre-test traditional approach three different groups of students were observed represented as A*= Number of students attempted correct option, B*= Number of students attempted partially correct option and C*= Number of students attempted incorrect option. The findings of pre-test traditional approach group are also in similar pattern like pre-test experimental approach group. The maximum number of students belonged to group C having mean value 18.73, which was the number of student's attempted incorrect option, followed by group B (8.66) and C (2.66) respectively.

The lower confidence interval was higher in group of students belonging to C (17.55), followed by group B (7.60) and A (1.98) respectively. A lower confidence interval provides a range within which we can reasonably be confident that the true population mean of our data lies. The values of lower confidence interval were low as compared to pre-test experimental approach group.

The values of upper confidence interval were also higher in C group of students (19.90), followed by B (9.59) and A (3.35) respectively. The values of upper confidence interval in pre-test traditional approach group were low as compared to pre-test experimental approach group (Table 3.2). T-value was higher in group C (34.13), followed by B (18.35) and A (8.21) respectively. Their confidence Interval was also 95%. The data is statistically significant at $p \leq 0.05$

Table 4.2: *Response of secondary school students to pre-test traditional approach based on T-test analysis*

S. No.	Variable	Mean	SE	Lower	Upper	T	DF
1	A*	02	0.31	1.98	3.35	8.21	14
2	B*	07	0.46	7.60	9.59	18.35	14
3	C*	19	0.54	17.55	19.90	34.13	14

S. No. =Serial number, A*=Number of students attempted correct option; B*= Number of students attempted partially correct option; C*= Number of students attempted incorrect option, SE=Standard error, DF= degrees of freedom, T= t-test value.

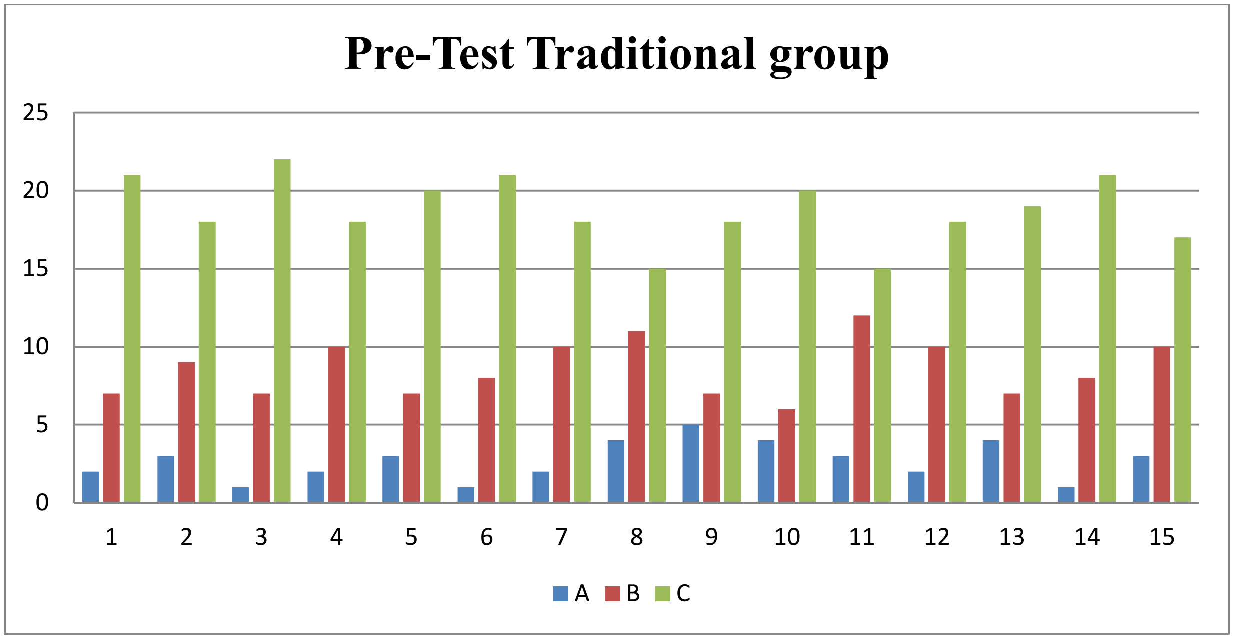

Figure 4.2: *Bar graph representing number of student's response to pre-test traditional approach.*

A*=Number of students attempted correct option; B*= Number of students attempted partially correct option; C*= Number of students attempted incorrect options.

4.3 Post-test Experimental Approach Group

In post-test experimental approach total of 30 students were selected in Physics subject at secondary level. Maximum number of students belonged to group A (22.06), followed by group C (4.26) and B (3.66) respectively. Higher lower confidence interval was observed in group A, which was 20.59, followed by group C (3.00) and B (2.39) respectively.

Maximum upper confidence interval was observed in A (23.53), followed by C (5.53) and B (4.93) respectively (Table 3.3). Maximum "T" test values were observed for A (32.08), followed by C (7.16) and B (6.12) respectively. Their confidence Interval was

95%. The data is statistically significant at $p \leq 0.05$. Their confidence Interval was also 95% (Table 3.3).

These results indicate that experimental group in post-test students performed best as compared to pre-test both groups such as pre-test experimental approach and pre-test traditional approach group. On the basis of these findings we can conclude that post-test students responded well as compared to the above mentioned set of groups and students.

Table 4.3: *Response of secondary school students to post-test experimental approach based on T-test analysis*

S.No.	Variable	Mean	SE	Lower	Upper	T	DF
1	A*	22	0.68	20.59	23.53	32.08	14
2	B*	04	0.59	2.39	4.93	6.12	14
3	C*	04	0.58	3.00	5.53	7.16	14

S. No. =Serial number, A*=Number of students attempted correct option; B*= Number of students attempted partially correct option; C*= Number of students attempted incorrect option, SE=Standard error, DF= degrees of freedom, T= t-test value.

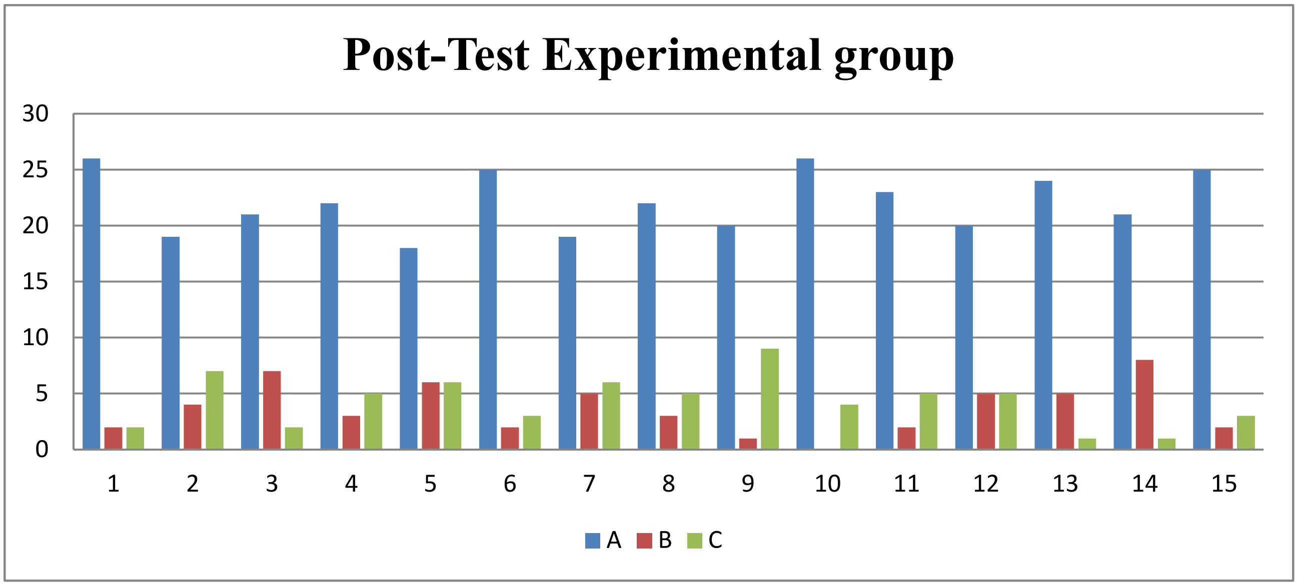

Figure 4.3: *Bar graph representing number of student's response to post-test experimental approach*

A*=Number of students attempted correct option; B*= Number of students attempted partially correct option; C*= Number of students attempted incorrect option.

4.4 Post-test Traditional Approach Group

In post-test traditional approach total of fifteen students were selected in Physics subject at secondary school level. Maximum number of students belonged to group A (13.60), followed by group C (9.86) and B (6.53) respectively. Higher lower confidence interval was observed in group A, which was 12.38, followed by group C 8.57 and B (5.78) respectively.

Maximum upper confidence interval was observed in A (14.81), followed by C (11.15) and B (7.28) respectively (Table 3.4). Maximum "T" test values were observed for A (23.88), followed by B (18.52) and C (16.35) respectively. Their confidence

Interval was 95%. The data is statistically significant at $p \leq 0.05$. Their confidence Interval was also 95% (Table 3.4).

These results indicate that experimental group in post-test students performed best as compared to post-test traditional approach group. Based on these findings, it is concluded that post-test students responded well as compared to traditional approach group.

Table 4.4: *Response of secondary school students to post-test traditional approach based on T-test analysis*

S.No.	Variable	Mean	SE	Lower	Upper	T	DF
1	A*	14	0.56	12.38	14.81	23.88	14
2	B*	07	0.35	5.78	7.28	18.52	14
3	C*	09	0.60	8.57	11.15	16.35	14

S. No. =Serial number, A*=Number of students attempted correct option; B*= Number of students attempted partially correct option; C*= Number of students attempted incorrect option, SE=Standard error, DF= degrees of freedom, T= t-test value.

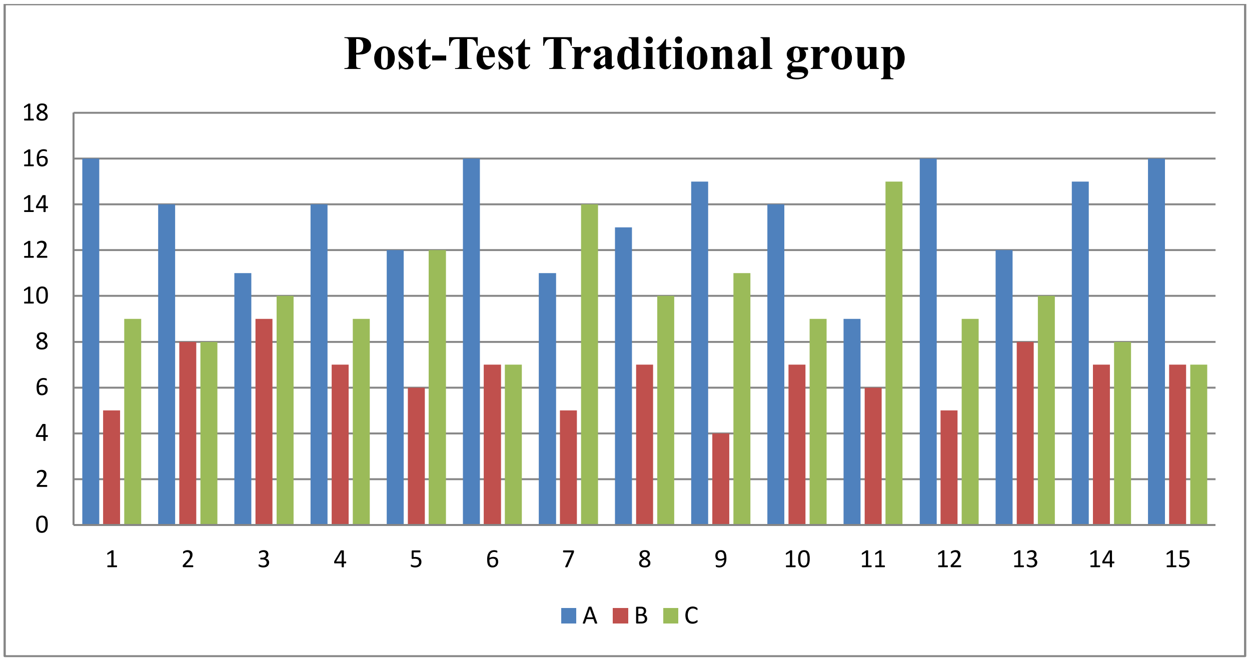

Figure 4.4: *Bar graph representing number of student's response to post-test traditional approach.*

A*=Number of students attempted correct option; B*= Number of students attempted partially correct option; C*= Number of students attempted incorrect option.

CHAPTER 5

SUMMARY, FINDINGS, DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary

This research was designed to assess the traditional and effect on conceptual change approach on the academic achievement of students at secondary level students and on teaching of physics in Rawalpindi, Pakistan.

The major objectives of this research were,

(a) To examine the results of instructions based on conceptual change approach on students' academic achievement.

(b) To examine the results of instructions based on the traditional approach on student academic achievement.

(c) To compare the results of instructions based on conceptual change and traditional approach on student's academic achievement.

This Study offered preliminary evidence that the chosen learning strategy and ensuing choice of study tactics may affect the link among epistemic convictions and conceptual change. A total of thirty (60) learners were examined, 30 who were in control group of learning physics and had accomplished reasonable change in concepts, embraced a profound way to deal with learning and considering. They were completely arranged to individual importance making through the choice of profound review techniques. This interaction resembled a rising theoretical familiarity with how they might interpret physical science such as physics. The remaining 15 students, on the other hand, demonstrated evidence of a superficial approach to learning and studying physics. They had less constructive physics epistemologies and a traditional approach to physics and were far from having a deep conceptual understanding of dynamics. They were execution arranged and favored the choice of shallow review procedures, while no proof of significant reasonable mindfulness was found.

5.2 Findings

Major findings of the study include,

1. For Pre test both experimental group students and traditional group students attempted 57% incorrect option 27% partially correct and 16% attempted correct options.

2. After applying the traditional approach students understanding of concepts was low. They were passive.

3. About 52% students attempted incorrect option 33% partially correct and 15% correct option.

4. But students of experimental group showed better results who learnt by conceptual change approach

5. About 74% students attempted correct options while 14% partially incorrect and 12% totally incorrect option.

6. Students of experimental group achieved better grades due to conceptual change approach.

7. Students having good pervious knowledge related to kinematics and dynamics performed better.

8. By traditional approach only bright minded students may learn better while by conceptual change approach all students learn better about taught topic.

The findings of this study support the expansion of knowledge sources is equivalent to the expansion of knowledge theories. This process enhances awareness about the conceptual approach of learning. They also approve with the theories evolving from the proposed hypothetical agenda according to which epistemic opinions may either ease or oblige the awareness attainment progression unswervingly, together through controlling consideration to certain material and through manipulating intents concerning knowledge building, as well as ramblingly through certain arbitrating rational and motivational features. It was found that teaching science by the conceptual change approach is a good way of helping students to learn science.

Results show that students' conceptual understanding and their character is very different between students who learn with conceptual change learning approach and traditional learning approaches. The conceptual understanding and character of students who learn with conceptual change learning approaches are significantly higher than students who learn with direct learning methods. So that the effect of the conceptual change learning approach is much greater than the traditional learning method. Traditional learning fails to enhance students' conceptual understanding.

Physical science knowledge is a haphazard gathering of material, relatively than a multifaceted structure of interconnected notions, could make them more liable to premature foreclose their serious intellectual thinking in the educational progression.

It is also found that learners with such ability may be prohibited from innate knowledge managing and from arising effective realistic expertise. They would consequently be imagined using superficial tactics such as cramming of evidence and formularies as a replacement for multilayered approaches such as structure and amalgamation-based notions. Such methodologies lead to submissive learning and stop efficient transfer of knowledge.

Findings of this study also advocate that epistemic principles may be reliable prognosticator of intangible changes in physics than marks in the physics subject. As we observed, the two groups of students such as traditional and experimental approach groups at secondary school level, who assisted as samples in this research, were very diverse in terms of their individual physics concepts, but both achieved very good marks in physics subject at school.

5.3 Discussion

The conceptual change approach is an intellectual theory of learning that focuses on how students' prior ideas and fallacies impact their ability to learn new theories/concepts. It speculates that effective learning involves not just the acquisition of new information, but also the restructuring of existing mental frameworks to accommodate the new information. When applied to the teaching of physics at secondary schools level, this methodology intends to address students' misconceptions and advance extreme interpretation of physics models/ideas (Chinn & Malhotra, 2002).

It could be argued that this may be the case in relation to the discovery that pupils' views in unchangeable physics information are also associated to a shallow physics understanding since such a belief may limit the assessment and screen the explanation of faltering and contentious material that doesn't agree with current information (Schommer–Aikins, 2002). Students who think their understanding of physics is static would prefer to steer clear of 'dangerous' new material rather than questioning and revising their preconceptions. In the literature, similar justifications have been put out to explain how students react to anomalous evidence when there is cognitive conflict. (Chinn & Brewer, 1993; Mason, 2000).

Literature study have also indicated that approximately half of students might not give response in the technically recognized way all the queries regarding the 3 Newton's laws , even though they took challenging entering investigations and were nominated on the basis of their high marks in physics subject in their school (Stathopoulou and Vosniadou, 2006). This might be the situation, since high grades can result from inside and out physical science understanding as well as from such factors as proficient utilization of rules, formalistic and algorithmic way to deal with critical thinking, transformation to the instructor's favored procedures, repetition learning, or what could be known as a 'essential way to deal with' learning and contemplating (Entwistle and Tait, 2000). Consequently, it seems objective to show that an understudy with a profound reasonable realizing in material science would be supposed to have high grades in school physical science, yet the inverse may not basically be the situation. To finish up, apparently epistemological convictions impact theoretical change in a wide range of ways. Understanding these ways includes more than a way to deal with reasonable change as a clearly objective cycle (Gregoire, 2003).The contention between what is now known and the new, to-be-procured data makes a learning circumstance in which full of feeling and persuasive factors can assume a significant part (Sinatra, 2005; Vosniadou, 2003).The relationship of epistemic beliefs to conceptual change is, to a large extent, a two-way street (Pintrich (2002)). Since personal beliefs about epistemological knowledge and knowledge are subject to change in physics, it is reasonable to hypothesize that a deeper understanding of physics can provide feedback that affects epistemic beliefs (Bell & Linn (2002), Carey & Smith (1993), Roth (1994), Rothand Smith et al. (2000)). Several researchers have emphasized the need for constructivist training to facilitate the development of a personal epistemology. As mentioned above, the conceptualization of epistemological belief as a theory-like structure can help us gain a better understanding of the mechanisms of epistemological change by referring to various cognitive mechanisms as well as those that play a role in the conceptual change model (Dole & Sinatra (1998), Gregoire (2003), Pintrich (2003), Sinatra (2005) and Vousniadou (2003).

A new concept is often unbelievable to replace deep-rooted one, except a new logical and initially reasonable idea is if settles the problems are fixed with the old one. This means that before a person seriously contemplates a new conception, he or she must first see an old conception with some dissatisfaction. Few new concepts are developed that may be incorporated by teachers into their existing information, or changes in assumptions and misconceptions about scientific idea occur in extremely small quantities. (Santyasa, 2017). Students' misconceptions are stable or consistent because they adopt beliefs on the basis of their absorbing practices even when those beliefs are not systematically reliable. This can prevent students from studying physics because they will struggle when they encounter learning material that contains scientific fundamentals (Zulfikar et al., 2019).

It is stated that the aspects that can influence the students' misconceptions are their daily experiences, teachers and books/articles (Widiyatmoko and Kinya, 2018). The other cause is learners were relying heavily on the net to resolve their problems as they were very lethargic to discover the solution in the public library to overcome their misunderstanding in physics (Trisniarti, Aminah & Sarwanto, 2020).

Rebuilding of apprentice misapprehensions could be carried out in learning process that simplify intangible transformation, so that educators as knowledge providers play key part in inspiring intangible change as reconstruction of student misconceptions of a particular subject (Zulfikar et al., 2019). The low point of conceptual understanding is that since educators studying approach emphases on giving scientific explanations noticeably than the intangible problem, thus forcing learners to not understand their subject i.e., physics in this case. Moreover, to lower learner's misunderstanding is that instructors must understand the level of their learner's conceptual considerate. Instructors must also be competent to demonstrate an assessment of studying accomplishment (Ratnasari and Suparni, 2017). Studies investigated that demonstrating is not just to update or to exhibit the use of information to apprentices, they must motivate their pupils to generate a meaning (Chen and Wang, 2016).

Instructors have a very key responsibility in the learning process, specifically in deciding the reasonable approaches in changing of student's perceptions into systematic ideas. An important model that can be applied in the learning process is conceptual changing model/techniques. On the basis of the investigations carried out, it was learned that apprentices in the conceptual approach group could encounter an elevated conceptual change as compared to the learners in the traditional approach cluster. The findings of the pre-test, post-test and analysis of each dimension of conceptual understanding showed that learners in the conceptual approach group have a greater understanding. Findings of this research are in accordance with the earlier study carried out by Lee in the year 2015, indicates that demonstrating science knowledge via the conceptual change approach and its modern models are good way of teaching science. The improvement in science education have risen with conceptual change approach besides that it is more operative in eliminating and revising apprentice mistaken belief (Asgari et al., 2018).

Learning issues were discovered by Redhana et al. (2017) and were shown to be related to the aspects of Posner's conceptual change model, such as inevitableness, clarity and productivity in learning activities. The instructor can create effective lesson plans to increase students' knowledge and correct their misconceptions by being aware of the learning issues, particularly issues relating to the students' preconceptions. According to Pebriyanti, Sahiduand Sutrio (2015), the conceptual change approach proved successful in eradicating students' misunderstandings about physics. This demonstrates that the conceptual change approach (CCA) is a more effective alternative to the conventional technique in recognizing and correcting student misconceptions while teaching and learning physics ideas.

According to Santyasa et al. (2018), children who study via conceptual change learning or direct learning methods have highly diverse conceptual understandings and personalities. Students who learn using conceptual change learning approach have significantly greater conceptual knowledge and character than students who study using direct learning teachings, both collectively and individually. For students to achieve conceptual knowledge and character while studying physics, the conceptual change learning approach impact must be greater than that of the direct learning approach.

Survey based research displayed that old-style culture flops to progress students' conceptual understanding because the teacher has not twisted his consideration to the reputation of his method, so that it does not try to examine students' predeterminations (Syuhendri, 2017). Syuhendri, (2017), findings provided that conventional programs do not get improvement after training, this fortifies that to change students' concepts can only be done by applying advance methods such as conceptual learning method.

Some of this research suggests that to increase students' conceptual grasp of physics, misconceptions need to be cleared outand one way to do this is by using the CCA (conceptual change model). Students' scientific knowledge will be rebuilt using this model, allowing for the remediation of any misconceptions they may have and the potential for conceptual shifts from misconceptions to scientific conceptions. A key element in helping students learn physics conceptually, conceptual learning method is the best alternative.

The direct learning approach does not offer the advantages of the conceptual change learning paradigm (Santyasa et al., 2018). The conceptual change technique is a far better alternative to traditional ways when it comes to addressing misperception issues in science courses, particularly physics (Ozkan & Selcuk, 2012). According to Sari, Faranieand Winarso (2017), traditional science instruction is ineffective at improving students' comprehension and argumentation abilities when studying scientific concepts.

The traditional learning paradigm, in disparity to the conceptual change education approach, very infrequently provides cognitive conflicts relating to the notion being taught, allowing students to absorb the subject by rote memory with little potential to expand their knowledge. The results of this study have ramifications, including the fact that the learning models are used in the classroom and the learning process can have a different effect on students' ability to understand physics concepts. The conceptual change model (CCM) can be seen as an alternative way of learning to help students understand physics concepts better. This model can lead to cognitive conflicts that help students transition their understanding from preconceived concepts to scientific ones. Conceptual change activities in the CCA application include experiments, demonstration and conferences that are guided by the CCA worksheets. These worksheets are designed to help students in the process of conceptual change. Teachers can use the conceptual change knowledge as a mediator and facilitator to help students in their learning activities. The CCA application is supported using conceptual change text, which are designed to present context and conceptual problems. Cognitive conflict disclaimers can help students to understand cognitive conflict. Contextual examples can help students understand related concepts.

5.4 Conclusion

On the findings of this study, it can be concluded that there is a big difference in the students' conceptual understanding of physics between students who learn using CCA (conceptual change approach.) and students who learn using DIM (direct instruction method/model) in secondary school. The students' conceptual understanding of physics of students who learn using the CCA shows relatively superior results compared to the students who learn using the DIM. To improve the physics learning process that optimally accommodates student conceptual changes, it can be done by using the conceptual change approach.

The use of conceptual teaching in science teaching is efficient in improving Physics students' intellectual accomplishment and curiosity. This is because the students achieved considerably improved in post-test results, when imparted physics using conceptual education tactic than when taught same concepts using traditional teaching approach. These results have made reasonable impact to the existing data investigating conceptual teaching approach in students. The present findings have made substantial addition to the information neighboring conceptual teaching approach in students, who can thrive despite adversities. This process enhances awareness about the conceptual change of learning. It also approves the theories evolving from the proposed hypothetical agenda.

5.5 Recommendations

From the findings of the study, the following recommendations are made,

1) Students may be taught by conceptual change approach for better understanding and learning of different concepts of physics because it deals to misunderstood concepts in daily life.
2) By teaching with Conceptual change approach students may achieve better grades not only in school exams but in all type of exams related to curriculum and other professional exams.
3) Students may learn different life skills through conceptual change teaching approach.
4) Conceptual change teaching approach may enhance use of laboratory in schools.
5) By teaching with this approach teachers may enhance their teaching skills.
6) Teacher may use Av-aids, activities in teaching process by this approach which is discouraged in traditional approach.
7) Teacher in secondary schools may be persistent in preparing different physics lessons to acquire appropriate skills and competence needed for a conceptual change approach.
8) Conceptual education for best instructional methods may be adopted in the secondary school physics curriculum.
9) As conceptual change approaches are aimed at making science, especially Physics learning more exciting which in turn increases educational accomplishment.
10) Teacher training program creators may comprise in their syllabus activities on the conceptual Change approach, while working instructors should be trained in this

approach via conferences, workshops and refresher courses.

11) National curriculum may be assessed by the syllabus developers to manifest the tactic while textbook writers may be promoted to integrate this approach in Physics text-books.

12) Government may provide proper all sources and facilities for conceptual teaching and should start training of all level teachers to learn conceptual change approach.

13) Based on the research findings, teachers do not ask for student opinion or input in their teaching approaches. So, it is better if the teachers share their concept and students input in order to make conceptual teaching approach enjoyable. Then, teachers should look for new innovation in the learning process through conceptual teaching approach.

14) This approach may lead to new techniques to be introduced for the conceptual understanding to create fresh learning.

15) Teaching learning facilities may be improved by this approach.

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Appendix-1

MS RESEARCH THESIS

"THE EFFECT OF CONCEPTUAL CHANGE APPROACH ON ACADEMIC ACHIEVEMENT OF SECONDARY SCHOOL STUDENTS AND ON TEACHING OF PHYSICS IN RAWALPINDI"

The given pre test and post test was designed for experimental study for MS research .The purpose of the study was to explore the effect of Conceptual change approach on the academic achievement of students at secondary level on teaching of Physics. Therefore experimental research design was used. The pre-test post-test equivalent group experimental research design was used for data collection.

Validation and Reliability of pre-test and post test checked by

1. Prof. DR. Mustaq Ahmed (Department of education university of Sargodha)

Population of study Class 9th students' total 60.

Experimental group 30 and traditional group 30

Of public school GHSS MUSLIM NO.1 Rawalpindi.

Pre test

Name of student.________________

Class.________________________

Note. Following are given multiple choice questions. Choose the correct answer given below.

1. The_____________distance between two points is called displacement.

a) Total b) shortest c) longest d) curved

2. Distance and displacement ate ______________terms.

a) Different b) same c) opposite d) none of these

3. Change in position is called _____________.

a) Displacement b) distance c) speed d) velocity

4. The passengers in a moving bus are___________________

a) At rest b) in motion c) both with respect to observer d) none

5. Change in ______________with respect to time is called velocity.

a) Displacement b) distance c) length d) height

6. When we drive a motorcycle or car its meter shows_____________

a) Displacement b) distance c) speed d) velocity

7. Motion of fan is ______________.

a) Circular b) vibratory c) rotatory d) random

8. In the absence of air or any resistive force all the objects (heavy or liter) fall down freely from any height with__________________velocity.

a) Different b) same c) opposite d) none of these

9. A book at rest on a table has_______________no.of forces acting on it.

a) One b) two c) three d) no force

10. When you buy 5kg sugar from shop 5kg is______________.

a) Mass b) weight c) both d) none of these

11. Mass is measured in _____________________.

a) Meter b) Kilogram c) Newton d) none of these

12. If you lift very heavy object for 30 minutes work is ____________.

a) Maximum b) unit c) Zero work d) No work done

13. _______________is necessary for work to be done.

a) Power b) Energy c) Force d) Time

14.______________Can neither be created nor finished.

a) Power b) Energy c) Force d) Time

15. If a body has mass at rest it posse's energy.

a) Yes b) No Energy c) May or may not d) None of these

Post test

Name of student.________________

Class.__________________

Note. Following are given multiple choice questions. Choose the correct answer given below.

1. The_____________distance between two points is called displacement.

   a) Total b) shortest c) longest d) curved

2. Distance and displacement ate ______________terms.

   a) Different b) same c) opposite d) none of these

3. Change in position is called _____________.

   a) Displacement b) distance c) speed d) velocity

4. The passengers in a moving bus are___________________

   a) At rest b) in motion c) both with respect to observer d) none

5. Change in ______________with respect to time is called velocity.

   a) Displacement b) distance c) length d) height

6. When we drive a motorcycle or car its meter shows_____________

   a) Displacement b) distance c) speed d) velocity

7. Motion of fan is ______________.

   a) Circular b) vibratory c) rotatory d) random

8. In the absence of air or any resistive force all the objects (heavy or liter) fall down freely from any height with__________________velocity.

a) Different b) same c) opposite d) none of these

9. A book at rest on a table has_______________no.of forces acting on it.

a) One b) two c) three d) no force

10. When you buy 5kg sugar from shop 5kg is______________.

a) Mass b) weight c) both d) none of these

11. Mass is measured in _____________________.

a) Meter b) Kilogram c) Newton d) none of these

12. If you lift very heavy object for 30 minutes work is ____________.

a) Maximum b) unit c) Zero work d) No work done

13. _______________is necessary for work to be done.

a) Power b) Energy c) Force d) Time

14.______________Can neither be created nor finished.

a) Power b) Energy c) Force d) Time

15. If a body has mass at rest it posse's energy.

a) Yes b) No Energy c) May or may not d) None of these

Appendix-2

Lesson plans

For the purpose of research thesis "Effect of Conceptual Change Approach on academic achievement of secondary school students and on teaching of physics in Rawalpindi"

Subject-Physics

Teacher Name- Muhammad Ramzan Sajid

Total students 60. Experimental group 30 and Traditional group 30.

Level-Class 9Th in a secondary school.

Units –Kinematics and Dynamics.

Lesson plan-1

Sr.No	Topic	Conceptual Change Approach Lesson plan	Traditional Teaching Approach Lesson plan
1	**Differentiate between Distance and Displacement**	**Introduction-**Definition of distance and displacement was written on white board and explained to students. **Elicitation of Topic-**Topic was explained to students by discussion and drawing a diagram on white board. **Clarification of Conception-**Students miss concept about distance and displacement was clarified by using classroom activity and a map chart. **Reconstruction of Topic-**A short video about distance and displacement was shown to students by using laptop and their different questions were answered. **Evaluation-**Evaluation was done by taking 5mints Mcq test on spot and result was shared. **Application of Topic-**By giving daily life example and giving students a home activity about distance and displacement. **Review-**Review was done by sharing test result and correcting mistakes from Mcq test conducted.	**Introduction-**Definition of distance and displacement was written on white board and explained to students. **Explanation-**Topic was explained to students by reading definitions and examples from book. **Assessment-**A short answer questions session was done about what they have learn only few students answered the questions. **Review-**Topic was revised by asking two three students to read from book and write it on note book.

Lesson plan-2

Sr.No	Topic	Conceptual Change Approach Lesson plan	Traditional Teaching Approach Lesson plan
2	**Rest and Motion**	**Introduction-**Definition of Rest and Motion was written on white board and explained to students. **Elicitation of Topic-**Topic was elicitated to students by discussion and drawing a diagram of rest objects and moving objects on white board. **Clarification of Conception-Stud**ents concept about Rest and Motion was clarified by using classroom activities like toy vehicles etc. **Reconstruction of Topic-**An activity was conducted in a class by two students as model activity and students question were answered. **Evaluation-**Evaluation was done by taking 5mints Mcq test on spot and result was shared later. **Application of Topic**- A home activity about rest and motion was given to students to observe different things and make list. **Review-**Review was done by sharing test result and correcting mistakes from Mcq test conducted.	**Introduction-**Definition of Rest and motion was written on white board and explained to students. **Explanation-**Topic was explained to students by reading definitions and examples from book. **Assessment-**A short answer questions session was done about what they have learnt only few students answered the questions. **Review-**Topic was revised by asking two three students to read from book and write it on note book from home.

Lesson plan-3

Sr.No	Topic	Conceptual Change Approach Lesson plan	Traditional Teaching Approach Lesson plan
3	**Circulatory and Rotational Motion**	**Introduction-**Topic was introduced by writing definitions and examples of circulatory and Rotational motion on white board and explained. **Elicitation of Topic-**Topic was elicitated to students by discussion and drawing a diagram of circulating objects and rotating objects on white board. **Clarification of Misconception-S**tudents miss concept about circulatory motion and vibratory motion was clarified by using classroom activities like toys, vehicles etc. **Reconstruction of Topic-**A model of moon circulating around the earth and top toy rotating was shown in a class an activity and students question were answered. **Evaluation-**Evaluation was done asking students few questions about the topic. **Applications of Topic-** Students were directed to observe different circulating and rotating objects make list and share to class next day. **Review-**Review was done by sharing all observations to the class and question answer session.	**Introduction-**Definition of circulatory and Rotational motion was written on white board and explained to students. **Explanation-**Topic was explained to students by reading definitions and examples from book. **Assessment-**A short answer questions session was done about what they have learnt only few students answered the questions. **Review-**Topic was revised by asking few students to read from book and write it on note book from home.

Lesson plan-4

Sr.No	Topic	Conceptual Change Approach Lesson plan	Traditional Teaching Approach Lesson plan
4	**Velocity and Acceleration**	**Introduction-**Topic was introduced by writing definitions and examples of Velocity and Acceleration on white board and explained to students. **Elicitation of Topic-**Topic was explained to students by explaining velocity and acceleration by writing formulas on white board an drawing graphs showing difference between velocity and acceleration. **Clarification of Misconception-S**tudents miss concept about velocity and acceleration were clarified by using classroom activities using different Av aids. **Reconstruction of Topic-**A Speed meter of different vehicles was shown in a class as an activity and students question were answered. **Evaluation-**Evaluation was done asking students few questions about the topic. **Application of Topic-** Students were directed to measure velocity and acceleration of different moving objects by using formulas and share to class next day. **Review-**Review was done by sharing students measured results to the class and questions were answered.	**Introduction-**Definition of velocity and acceleration was written on white board and explained to students. **Explanation-**Topic was explained to students by reading definitions and examples from book. **Assessment-**A short answer questions session was done about what they have learn only few students answered the questions. **Review-**Topic was revised by asking few students to read from book and write it on note book from home.

Lesson plan-5

Sr.No	Topic	Conceptual Change Approach Lesson plan	Traditional Teaching Approach Lesson plan
5	**Gravitational acceleration**	**Introduction-**Gravitational acceleration was introduced by falling different material from height on ground and writing definition on white board and explaining to students. **Elicitation of Topic-**Topic was elicitated by telling students to observe falling objects and see whether they fall on ground at same time or not. **Clarification of Misconception-S**tudents miss concept about gravitational acceleration was clarified by using classroom activities using different Av aids. **Reconstruction of Topic-**A video was shown to students where in a vacuum chamber different objects fall to ground at same time and students questions were answered. **Evaluation-**Evaluation was done asking students few questions about the topic. **Applications of Topic-**Students were directed to observe different free falling objects and share to class next day. **Review-**Review was done by sharing all observations to the class and questions were answered.	**Introduction-**Definition of Gravitational acceleration was written on white board and explained to students. **Explanation-**Topic was explained to students by reading definitions and examples from book. **Assessment-**A short answer questions session was done about what they have learn only few students answered the questions. **Review-**Topic was revised by asking few students to read from book and write it on note book from home.