CHAPTER II

REVIEW OF RELATED LITERETURE

2.0.0 INTRODUCTION

In any research review of related studies is of vital importance. It gives the researcher information about where he/she stands, what methods would be reliable and what are the other things to be found out apart from his/her objectives. Hence, for conducting research, it becomes imperative to make an in-depth survey and study of all the related literature and find gaps in the existence knowledge, sample size, tools used, how data is collected and what statistical analysis has been done. It is to avoid duplication.

The study of related literature implies reading, locating, and evaluating reports of research as well as reports of causal observation and opinion that are related to the individual's planned research project.

2.1.0 IMPORTANCE OF REVIEW OF RELATED LITERATURE

The review of the related literature enables the researchers to define the limit of their fields. They can select only those areas in which positive findings are very likely to yield result and add to knowledge in a meaningful way. Through the related literature, researcher can avoid unintentional duplication of the established findings. It helps the researcher to know about the tools and instruments, which proved to be useful and promising in the previous study. Another purpose of review literature is to know about the recommendations of previous researchers for further research, which they have listed in their studies. This helps the researcher in selection of the problem. It helps in speculating useful hypotheses and provides helpful suggestion for significant investigation. The existing knowledge in the problem area provides background of the research project and makes the research aware of the status of the problem. By reviewing the related literature, the research is able to formulate an appropriate research design.

1. It becomes the basis for the present study.
2. It gives the exact picture about the related work done by the scholars.
3. It indicates the extent to which it has been done by others and their findings
4. It helps in planning in such a way that the contemplated research does not become a fertile exercise of repetition.

2.2.0 STUDIES RELATED TO LEARNING PROGRESSION

Alicia c. Alonzo & jeffrey t. Steedle (2008). Learning progressions are ordered descriptions of students' understanding of a given concept. In this paper, we describe the iterative process of developing a force and motion learning progression and associated assessment items. We report on a pair of studies designed to explore the diagnosis of students' learning progression levels. First, we compare the use of ordered multiple-choice (OMC) and open-ended (OE) items for assessing students relative to the learning progression. OMC items appear to provide more precise diagnoses of students' learning progression levels and to be more valid, eliciting students' conceptions more similarly to cognitive interviews. Second, we explore evidence bearing on two challenges concerning reliability and validity of level diagnoses: the consistency with which students respond to items set in different contexts and the ways in which students interpret and use language in responding to items. As predicted, students do not respond consistently to similar problems set in different contexts. Although the language used in OMC items generally seems to reflect student thinking, misinterpretation of the language in items may lead to inaccurate diagnoses for a subset of students. Both issues are less problematic for classroom applications than for use of learning progressions in large-scale testing.

Alonzo, A. C., & Steedle, J. t. (2009). *Developing and accessing a force and motion learning progression*. Science Education states that Learning progressions are ordered descriptions of students' understanding of a given concept. In this paper, we describe the iterative process of developing a force and motion learning progression and associated assessment items. We report on a pair of studies designed to explore the diagnosis of students' learning progression levels. First, we compare the use of ordered multiple-choice (OMC) and open-ended (OE) items for assessing students relative to the learning progression. OMC items appear to provide more precise diagnoses of students' learning progression levels and to be more valid, eliciting students' conceptions more similarly to cognitive interviews. Second, we explore evidence bearing on two challenges concerning reliability and validity of level diagnoses: the consistency with which students respond to items set in different contexts and the ways in which students interpret and use language in responding to items. As predicted, students do not respond consistently to similar problems set in different contexts. Although the language used in OMC items generally seems to reflect student thinking, misinterpretation of the language in items may lead to inaccurate diagnoses for a subset of students. Both issues are less problematic for classroom applications than for use of learning progressions in large-scale testing. © 2008 Wiley Periodicals, Inc. Sci Ed93: 389–421, 2009

Duncan, R. G., Rogat, A., & Yarden, A. (2007) *Learning Progression in Genetics.* In his study learning progression describes progressive levels of understanding for core concepts in modern genetics. The progression extends from 5th to 10th grade. We have organized the core ideas in this learning progression around two questions in the discipline: (a) how do genes influence how we, and other organisms, look and function? And (b) Why do we vary in how we, and other organisms, look and function? We identified eight big ideas that are needed to successfully reason about these questions. The target performances of this progression thus involve generating several types of mechanistic explanations: explanations that link our genotype to our phenotype; explanations of the processes by which our genes are passed on from generation to generation and how they contribute to genetic variation; and explanations of the sources of variation in phenotype (including environmental interactions with our genes). The learning progression describes three levels of understandings that allow the progressive construction of the explanations described above. Associated with the big ideas are learning performances that range in their complexity and can help determine a student's level of understanding.

Fensham, P. (1994). progression in school science curriculum: A rational prospect or a chimera-*Research in Science Education,* states that, Science in schooling has for the first time been recently considered as a verified whole for the 10 or 12 of its compulsory years, rather than for a limited sector of schooling or for a particular group of students. This has also been occurring as part of a wider review and plan for the whole curriculum of schooling. A framework has been provided consisting of a matrix of strands of intended content for learning across a number of levels approximating the years of schooling. There is a sense and expectation of continuous progression in the learning of science. Earlier notions of progression in science curricula are explored and compared with what has now appeared in the national curricula in England and Wales, New Zealand and Australia. The notions of curriculum opportunity and curriculum purpose for science education are introduced as factors that would lead to a shift in the sense of progression from a focus on science itself to an emphasis on the learners' changing need of science as they progress through the years of schooling.

Jennifer L. Kobrin Pearson, Sarah Larson, Ashley Cromwell, Patricia Garza (2015) in their study, ''*A Framework for Evaluating Learning Progressions on Features Related to Their Intended Uses*'' found that, in recent years, learning progressions (LPs) have captured the interest of educators and policy makers. There have been numerous efforts to develop LPs aligned to college and career readiness standards, to unpack these standards, and to provide more clarity on the pathway's students follow to reach them. There is great variation, however, in the structure, content, and features of LPs, and these have implications for the LP's most appropriate use. The purpose of this research was to devise a framework to understand and evaluate key features of an LP, including its structure, content, usability, and validity evidence. We maintain that educators and other stakeholders should understand these key features so they can evaluate whether an LP is appropriate for an intended use.

John T. Avella, Mansureh Kebritchi, Sandra G. Nunn, Therese Kanai, in their study, "*Learning Analytics Methods, Benefits, and Challenges in Higher Education: A Systematic Literature Review*'' found that Higher education for the 21st century continues to promote discoveries in the field through learning analytics (LA). The problem is that the rapid embrace of of LA diverts educators' attention from clearly identifying requirements and implications of using LA in higher education. LA is a promising emerging field, yet higher education stakeholders need to become further familiar with issues related to the use of LA in higher education. Few studies have synthesized previous studies to provide an overview of LA issues in higher education. To address the problem, a systemic literature review was conducted to provide an overview of methods, benefits, and challenges of using LA in higher education. The literature review revealed that LA uses various methods including visual data analysis techniques, social network analysis, semantic, and educational data mining including prediction, clustering, relationship mining, discovery with models, and separation of data for human judgment to analyse data. The benefits include targeted course offerings, curriculum development, student learning outcomes, behaviour and process, personalized learning, improved instructor performance, post-educational employment opportunities, and enhanced research in the field of education. Challenges include issues related to data tracking, collection, evaluation, analysis; lack of connection to learning sciences; optimizing learning environments, and ethical and privacy issues. Such a comprehensive overview provides an integrative report for faculty, course developers, and administrators about methods, benefits, and challenges of LA so that they may apply LA more effectively to improve teaching and learning in higher education.

Julia Svoboda Gouvea, in her study, "*Recent Progress in Learning Progressions Research*" found that, learning progressions (LPs) are hypothetical models that describe how learning in a domain may unfold over time. Over the past decade, LPs have grown in popularity. At the same time, there have been advances in LP research. In this instalment of Current Insights, I bring together three recent articles that examine the validity and utility of LPs as models to guide research and instruction. In this instalment of Current Insights, I bring together three articles that capture some of the recent progress in LP research. The first article, by Jin and colleagues, presents a conceptual framework outlining the validity considerations that arise as researchers develop, evaluate, and ultimately attempt to use LPs in instructional contexts. The second and third articles offer extended treatments of one or more considerations of LP validity and use. Sikorski questions the validity of assumptions that underlie how sophistication is defined during initial LP development. Alonzo and Elby explore the intersection of LP evaluation and use, arguing that despite their limited empirical validity, LPs may still be useful for instructors.

Krajcik, J, Shin, N., Stevens, S. Y., & Short, H. (2009) *Using Learning Progressions to Inform the Design of Coherent Science Curriculum Materials*. Paper presented at the Annual Meeting of the American Education Research Association, San Diego, CA. Science standards and pre-packaged curricula often focus on numerous disconnected topics that are treated with equal priority. Topics that receive broad coverage with little integration provide a fragile foundation for integrated knowledge growth. In order to support integrated understanding in science, coherent curricula should be developed to emphasize not only the learning of individual topics, but also the connections between ideas and across topics and disciplines, and how these ideas develop over time. Empirically tested learning progressions should be fully articulated for curriculum developers to use as a ready-made artifact in developing coherent curricula. Well-developed coherent curriculum materials should be designed, implemented, and tested for the development of empirically tested learning progressions as well. In this paper, we discuss the requirements needed for learning progressions to inform the development of coherent curricula over the span of K-12 science education based on our experience and what we have learned from the literature. We report how these requirements are used to develop learning progressions and a coherent curriculum. We conclude by stating major challenges for the development of a coherent curriculum based on LPs.

Merrit, J. D., Krajcik, J., Shwartz, Y. (2008) *Development of a Learning Progression for the Particle Model of Matter*. In his study he states that, Prior research indicates that one of the most difficult concepts for students to understand is that of the particle nature of matter. The How can I smell things from a distance? chemistry unit takes the approach of building students' ideas through the construction and revision of models. The purpose of this study is to describe the changes in students' understanding of the particle nature of matter as they were engaged in an eight-week model-based curriculum. One teacher and her two 6 th-grade classes in a midwestern school district were the focus of the study. Data sources include pre- and posttests, students' artifacts, and video recordings of the curriculum enactment, including students' creation of models of various phenomena. Results from this study were used to help develop a learning progression for the particle nature of matter.

Mohan, L., Chen, J., Anderson, C. W. *Developing a Multi-year Learning Progression for Carbon Cycling in Socio-Ecological Systems.* This study reports on our steps toward achieving a conceptually coherent and empirically validated learning progression for carbon cycling in socio-ecological systems. It describes an iterative process of designing and analyzing assessment and interview data from students in upper elementary through high school. The product of our development process—the learning progression itself—is a story about how learners from upper elementary grades through high school develop understanding in an important and complex domain: biogeochemical processes that transform carbon in socio-ecological systems at multiple scales. These processes: (a) generate organic carbon (photosynthesis), (b) transform organic carbon (biosynthesis, digestion, food webs, carbon sequestration), and (c) oxidize organic carbon (cellular respiration, combustion). The primary cause of global climate change is the current worldwide imbalance among these processes. We identified Levels of Achievement, which described patterns in the way students made progress toward more sophisticated reasoning about these processes. Younger learners perceived a world where events occurred at a macroscopic scale and carbon sources, such as foods and fuels, were treated as enablers of life processes and combustion rather than sources of matter transformed by those processes. Students at the transitional levels—levels 2 and 3—traced matter in terms of materials changed by hidden mechanisms (level 2) or changed by chemical processes (level 3). More advanced students (level 4) used chemical models to trace matter through hierarchically organized systems that connected organisms and inanimate matter. Although level 4 reasoning is consistent with current national standards, few high school students reasoned this way consistently. We discuss further plans for conceptual and empirical validation of the learning progression.

Plummer, J. D., & Maynard, L. (2014). *Building a learning progression for celestial motion: An exploration of students' reasoning about the seasons. Journal of Research in Science Teaching*, states in his study that the development of a construct map addressing the reason for the seasons, as a subset of a larger learning progression on celestial motion. Five classes of 8th grade students ($N = 38$) participated in a 10-day curriculum on the seasons. We revised a hypothetical season construct map using a Rasch model analysis of students' pre/post-assessments followed by a closer examination of individual student explanations. Our proposed construct map is consistent with the *Framework for K-12 Science Education* [National Research Council. (2012). *Framework for K-12 Science Education.* Washington, DC: National Academy Press] but includes a more nuanced discussion of critical conceptual and spatial connections. Movement up the construct map begins with learning foundational concepts about the Earth's motion in space and how observational patterns of the Sun relate to temperature changes. Movement into the upper levels of the seasons construct map occurs as instruction supports students in making sense of how the space-based perspective of their location on a spherical Earth can be used to account for observable patterns of change.

Tom Gallacher and Martin Johnson, in their study *"Learning Progression" A Theoretical and Historical Discussion*, found that that the theory of learning that is inherent to the LP approach is unhelpfully simplistic. this is because the theory does not reflect the inconsistencies and complexities of the actual process of change that learner go through, or how inconsistently they can demonstrate their learning. therefore, implementation of a theory based on the ladder analogy, replacing other approaches and models of learning, is likely to be counterproductive for learning since learners are never on one rung of a ladder at a time. this is not to say that no learner makes progression, or that simplifications cannot be useful in some contexts (such as for creating a scheme of work from a curriculum), but that the theory described by "Learning progressions" authors, if implemented with no extra consideration of curriculum and learning, would not lead to positive educational outcomes. From the perspective of a subject expert who has made the learning journey through a subject, it may seem that the journey was smooth in retrospect, but this is unlikely to have been the case. Learners develop cognitively as well as neurologically, with performance on solving problems being at best inconsistent during intermediate phases of the journey. the highest demonstrated level of performance from a learner might not be maintained across different contexts, and should not be expected to indicate mastery of activities learned previously, since forgetting can occur independently of the order of presentation. Our consideration of the simplifications in the underlying learning theory of the LP approach suggests that the three aims of the approach (i.e., to support teaching and learning, assessment, and curriculum design) are unlikely to be met.

2.3.0 STUDIES RELATED TO CONSTRUCTIVISM

Ojha, N.C., Arya, R. & Shekhar, R. (2015) in their study Constructive approach and traditional approach of teaching english to class vi in terms of achievement: a comparative study. *Pedagogy of Learning,*The objectives of the study were to find the "*effectiveness of the constructivist approach in terms of the achievement in English*". The two independent variables were the treatment and the Learning Style of the individual learner. A sample 80 students were taken for the study from Bhopal city, Madhya Pradesh. Post-test control group design was employed for the study. The findings of the study were constructivist approach is effective in terms of the students' achievement in English , gender did not produce significant differential effect on the students' achievement in English , there was no significant interactional effect of Treatment and Gender students' achievement in English , there was no significant effect of Style of Learning on students' achievement in English , there was no significant interactional effect of Treatment and Style of Learning on the achievement in English.

Dogra, B. (2015). *Constructivist classroom activities for Biology learning.* In his study he states that - Constructivism is buzz word widely used in paradigm of teaching-learning. Constructivism emphasises how the learner constructs knowledge from experience, which is unique to each individual. In the present paper the areas of discussion are 1) historical background of constructivism and its importance. 2) Role of mentor and learner in constructivist science classroom. 3) An attempt is made to prepare a lesson plan for science teachers based on 5E's model (one of the models of constructivism) on the topic 'Images formed by concave lenses. This sample lesson plan will facilitate the science teachers in the implementation of constructivism in their classroom.

Kadem, S. (2013). *Effectiveness of constructivist approach on the achievement in science of IX standard students.* The major findings of the article are the Constructivist Approach has a positive effect on the achievement of students in science. It is evident from the analysis that the students taught by constructivist approach scored higher than those taught by conventional method in the control group. It has equally effective for both boys and girls in improving their achievement towards science.

Khan, S. H. (2014). *Constructivism: An Innovative Teaching method in Science Teaching.* This article reveals that constructivist pedagogy is a very effective means of science-teaching. However, the success of this pedagogy presupposes that the teachers should not only be well trained in a constructive approach, but they should also be dedicated enough to follow its requirements patiently. This strategy is time consuming and requires lot of patience on the part of teachers and administrators. Teachers should also be trained in the use of relevant technologies. This all implies massive support from administration and the government. The Objectives of the study were i) To explain the constructivist philosophy and to know its major exponents. ii)To identify important features of constructivist philosophy having relevance in science classrooms, and to know the related pedagogies which can be applied in teaching science.iii) To find out how far Constructivist strategies have been successfully employed in schools, both in India and abroad, and why it has had only a limited success elsewhere, especially in developing countries. iv)To present a few suggestions to improve the chances of success for a constructivist science classroom including better training of teachers and more financial and moral support from the administration and government. The findings of the study were i) Constructivist pedagogy is a very effective means of science teaching. However, the success of this pedagogy presupposes that the teachers should not only be well-trained in a constructivist approach, but they should also be dedicated enough to follow its requirements patiently. ii) This strategy is time consuming and requires lot of patience on the part of teachers and administrators. The teachers should also be trained in the use of relevant technologies. This is all implies massive support from administrator and the government.

Ramulu, A. (2015) has conducted a study on *Enhancement of student learning in Biology using Constructivism.* The result of this study did support the value of constructivist learning. Constructivist class has a higher average biweekly quiz grades, better outlook on science and greater effort to attend lab on a regular basis. Students were willing to answer or ask questions of the instructor and discuss in which they were involved.

Ross, A. A. (2006). *The Effects of Constructivist Teaching Approaches on Middle School Students'* The results from the final structural equation model revealed a significant Correlation at the within level for the variables of student procedural knowledge and student conceptual understanding. At the between level, each of the indicators had significant paths from the latent factor of constructivist teaching approaches. The latent factor of constructivist teaching approaches significantly predicted both procedural knowledge and conceptual understanding. Lastly, the correlation between both types of learning at the between level (classroom level) was significant. The results thus revealed that the latent factor of constructivist teaching approaches, with six indicators, had significant effects on both types of student learning. Constant comparison revealed similar findings concerning correlations among the indicators, as well as effects on student engagement and understanding. Constructivist approaches were found to have a positive effect on both types of student learning in middle school mathematics.

Singh, S., et al., (2015) has conducted a study on *"Constructivism in Science classroom: Why and How?* In this article the author reveals that Constructivism emphasizes how the learner constructs knowledge from experience, which is unique to each individual. In this model emphasis is shifted from "teacher" to the "students. Teacher is no longer behaving as a stage on stage but has to act as "facilitator" of learning. Students are not just a passive gainer of knowledge but become active learner who themselves construct knowledge through experience, observation, documentation, analysis and reflection.

This article reveals that from a constructivist perspective, Science is not the search for truth. It is a process that assists us to make sense of our world. Using a constructivist perspective, teaching biology becomes more like the biology that biologists do. It is an active, social process of making sense of experiences, it is an enjoyable activity and the role of the teacher is very challenging. Learning in classrooms is facilitated by well-designed activities. Through different classroom actives, students get an opportunity to reflect and build on and consolidate existing knowledge. Students get an opportunity to construct knowledge.

2.4.0 STUDIES RELATED TO SCIENTIFIC ATTITUDE

Lamar (2014) had conducted a study on "*Attitude of higher secondary students in shillong towards mathematics*". The study was conducted on a sample of 308 higher secondary students of schools in Shillong of class twelve levels from the science stream having mathematics as one of the subjects. The findings of the study reveal that there is no significant difference between the male and female higher secondary students. Majority of the students had high attitude towards mathematics.

Kounsar (2016) had conducted a study on "*Attitude towards teaching of arts and science teachers*". The present study is a modest effort to compare male and female secondary school teachers on various dimensions of attitude.

Tamboli (2014) had conducted "*A study of religiosity, modernization, science attitude among educated mothers of secondary school children*". A total of 315 educated mothers and their children were selected purposefully. The investigator among other things in this study finds that educational level of mothers is not essentially a dominant factor in religiosity and that as the educational level of the mothers increases their modernization also increases. The educational level of mothers is not a dominant factor in science attitude. The educational levels of mothers did not play a dominant role in the development of science attitude of their children.

Trivedi and Sharma (2013) had conducted "*A study of student's attitude towards physics practical at senior secondary level*". 80 senior secondary students were taken as sample of the study. The results of the study reveal that there is significant difference in the attitude of boys and girls towards practical work at senior secondary level and that the attitude of girls is significantly more positive than that of boys.

Sekar and Mani (2013) had conducted a study entitled "*Scientific attitude of higher secondary students*". The findings of the study reveal that there is significant in scientific attitude of higher secondary students with respect to the location of permanent residence. It is supported to the findings of Maruthi (2009); Aezum and Ahmed (2013); and Jancirani (2012). As far as location of permanent residence is concerned, the present study reveals that urban students significantly differ with the rural students. With regard to the type of management of school, significant difference is noted in scientific attitude of higher secondary students. The higher secondary students of unaided school students got more science attitude than the students of aided schools and government schools. This fact is supported by the findings of syed (2007); Jancirani (2012); Aezum and Nisar (2013); Surekha and Kishore (2013). This study showed the scientific attitude remains more or less the same for boys and girls of biology and computer group students. However, the reasoning ability for boys and girls of computer and biology group students significantly differed.

Freeman (1997) investigates the relationship of Attitude towards Science with Achievement in Science. The analyses of the data express that there was a significant positive correlation of student Attitude towards Science with their Achievement. It was concluded that Achievement in Science was affected by Attitude towards Science.

Kharkongor.Y. (1980) did a study on *Attitude of high school students towards science subject. The study was conducted in English Medium School in Nagaland*. The result reveals that the attitude score of the entire students shows favourable attitude towards science. The attitude score of both boys and girls is also favourable. The mean achievement of girls is slightly higher than that of boys.

Mandila Shaym Singh (1988) studies on the *Attitudes of secondary stages students towards science curriculum and its relationship with achievement motivation*. Result shows that students from rural as well as urban school as well as male and female had favourable attitude towards science curriculum. There were significant different in some aspects such as science temper and teaching methods. Students from urban scores highest in achievement test. Female scores higher than their Male counterparts.

Williams, Kumari Shanta, Sarah (1983) did a study of the *Attitude of high school pupils towards General Science and its relationship with achievement in subject*. The result reveals that pupils 'achievement was poor in general science. The attitude of high school pupils towards science and science education in Tamil Nadu was generally favourable but there was a wide disparity.

2.5.0 CONCLUSION

After reviewing the related literature, the investigator found that a number of studies have conducted in abroad on the learning progression and its impact on secondary education. In Indian context majority of the researcher conduct study on the less related topic to learning progression in-school education. Many of the researchers conducted research on effects of different teaching method indirectly emphasises learning progression. Researcher also found that, there is no research conducted related to the topic in India yet and a research gap has been found. Realising the current scenario researcher decided to conduct this research.