CHAPTER III

REVIEW OF RELATED LITERATURE

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REVIEW OF RELATED LITERATURE

3.0 INTRODUCTION

The study of the related literature implies locating, reading and evaluating reports of research as well as reports of casual observations and opinions that related to the individual's planned research project (Aggarwal, 1996). According to Good (1972), a systematic canvas of related literature is the means of determining whether the proposed study necessarily duplicate earlier investigations.

The present study aims to find out the effectiveness of 5E Learning Cycle Model on Scientific Creativity, Scientific Interest and Achievement in Physics of students at secondary level. Since 5E Learning Cycle Model is related to Learning style, effectiveness was found out based on learning style. The related literatures reviewed are arranged under the following major heads.

3.1 Studies on Creativity

3.2 Studies on Interest

3.3 Studies on Learning Style

3.4 Studies on Learning Cycle

3.5 Studies on 5E Learning Cycle Model

The details of the studies are given below.

3.1 STUDIES ON CREATIVITY

Hu et al. (2013) developed the “Learn to Think” (LTT) Intervention Program for raising thinking abilities of primary and secondary school students. The study describes the influence and the delayed effects of LTT on the scientific creativity of secondary school students. The Scientific Creativity Test for secondary school students was used four times from pre-test to
delayed post-test. The results indicated that the LTT did promote the development of scientific creativity of secondary school students, and the effects on the scientific creativity were not necessarily immediate, but tended to be long-lasting.

In a study, Rajasree (2013) found that the science creativity of students taught using McCormack and Yager Taxonomy is significantly higher than that of those taught using Bloom’s Taxonomy. It can be concluded that the McCormack and Yager Taxonomy based teaching helped the students to attain more science creativity.

Asaf (2012) conducted a study to find out the effectiveness of Inquiry Based Learning on scientific creativity and process skills in science. Test of significance for the difference between the means of the pre-test and post-test scores of scientific creativity showed that Inquiry Based Learning promotes scientific creativity.

Shaheen (2011) in his study found that children have the ability to produce ideas which are original. But they appear to be weaker in areas such as being able to produce abstract titles, and remaining open to going beyond the ordinary in their thinking. This is due to the fact that much of the teaching is only geared towards knowledge acquisition. This research has reinforced the need for systems of creativity, in order to provide a more holistic and less distorted scientific experiences.

Sanjayan (2011) conducted a study on the impact of knowledge management practices for improving creativity of teachers at the undergraduate level. The study revealed that there exist a positive relationship between knowledge management process, knowledge socialization, knowledge externalization and internalization with creativity of college teachers.

Pravithalakshmi (2010) conducted a study on effectiveness of constructivist approach on creativity in Hindi at secondary level. The study showed that constructivist learning provides enormous opportunities for each and every student in the process of developing the creative potentialities.
Claire-Marie & Martina (2009) in their study explored three creative activities designed to teach students about earth, space science and to allow them to explore and express their understanding in imaginative and subjective ways. The study revealed that creativity is an important quality in science with the hope that this would broaden their perceptions of the practice and learning of science.

Vijayalakshmi (2008) conducted a study on relationship between level of aspiration and creativity of students at secondary level. The study reveals that there is significant relationship between level of aspiration and creativity of average aspired group of students and there is no significant relationship between level of aspiration and creativity of high and low aspired groups.

Rajesh (2008) conducted a study on relationship between creativity and self-concept on academic achievement among higher secondary school students. The study showed that there exists significant relationship between creativity and self-concept on academic achievement among higher secondary school students. The study revealed that there is no significant relationship between creativity and academic achievement and a significant relationship between creativity and self-concept.

Netto (2008) conducted a study on reflective thinking strategy of teaching on certain cognitive and affective variables among secondary school students. The study revealed that gain scores of the three groups of pupils with high, average and low levels of creativity shows no significant difference between the groups with regard to their achievement. This study confirmed that the reflective thinking strategy is equally effective for pupils irrespective of their creativity.

Aldous (2007) made a study named “Creativity, problem solving and innovative science: Insights from history, cognitive psychology and neuroscience”. The study would do well to attend to the non-cognitive as well as the cognitive elements in science and mathematics learning, problem solving and innovative science and teaching. Results of the study pointed the gap between the non-cognitive elements of feeling and intuition and its role in
learning and teaching and the role of emotion in cognition holds the potential for important innovations in the science learning and the practice of teaching.

Philip (2007) conducted a study to find the relationship between intelligence, science creativity, achievement motivation, home environment and achievement in science of higher secondary school pupils of Kerala. Investigator used normative survey method for the collection of data. The study revealed the interactive effect among the variables - intelligence, scientific creativity, achievement motivation, home environment and achievement in science.

Barry & Kanematsu (2006) conducted a study named “Science Fair Competition Generates Excitement and Promotes Creative Thinking in Japan.” They provided the Japanese children with enjoyable and productive learning experiences in science through science fair teaching approach. It also gave children an opportunity to design and display their creative posters. The result showed that out of the 40 participants, 98% of them enjoyed it very much. In addition, the parents, teachers, principals, and members of the media were impressed with the great event.

Seo, Lee & Kim (2005) conducted a study named “Korean Science Teachers’ Understanding of Creativity in Gifted Education”. The finding of the study showed that the science teachers had a thorough understanding of the cognitive component and the strong association of creativity with intellectual ability. To enable their understanding to a more balanced view, personality and environmental components, should be emphasized.

Sindhu (2005) conducted a study on relationship among creativity, classroom adjustment and academic achievement of students at higher secondary level. The values of coefficient of correlation revealed that there was significant relationship between creativity, classroom adjustment and academic achievement taken in pairs. It was also concluded that the combined effect of variables of creativity and class room adjustment on academic achievement will be significant.
Haneeshia (2001) conducted a comparative study of Scientific Creativity of pupils in DPEP and non DPEP schools in Kerala state. The study found that the two groups differ significantly with respect to fluency, flexibility, originality, and total creativity.

Anilkumar (1992) studied the relationship between creativity in science and certain demographic variables of secondary school students. The study showed that there exists a significant relationship between each component of creativity in science and total creativity in science with each of the demographic variables, viz, sex, locale and socio-economic status.

Datta (1989) studied the differences in scientific creativity among high school students and reported that sex difference exist in scientific creativity. Scientific Creativity depends on intelligence, academic achievement and socio-economic status. Dominant factors of Scientific Creativity selected for the study were fluency, flexibility and originality.

Sukla and Sharma (1987) administered a Scientific Creativity Scale in 330 urban, tribal, rural and refugee students in the middle schools to test for fluency, flexibility and originality. The results indicated that the lowest score came from tribal pupils and the rural pupils scored higher in fluency than the refugees.

Raina (1986) conducted a study named “psycho-social correlates of Scientific Creativity among high school students”, and found that achievement in science was significantly related with Scientific Creativity and the problem solving ability was significantly related to the three components of Scientific Creativity viz, fluency, flexibility, and originality. Again it was found that the missionary school students were more creative than those of private and government school students.

3.2 STUDIES ON INTEREST

Rajasree (2013) conducted a study on “Effectiveness of McCormack and Yager Taxonomy on teaching Physics at Secondary level”. The results of the study revealed that experimental group taught through McCormack and
Yager Taxonomy showed more interest in Physics than the control group, taught using Bloom’s Taxonomy.

Gafoor & Narayan (2012) in his study explores experiences that significantly contribute to interest in science on a sample of upper primary school students from Kerala, India. The results of study revealed that biology related experiences and chemistry experiments influence interest in science of girls than boys. The physics activity and biology experimentation influenced interest in science of boys than girls. Urban school student showed enhanced interest in science over their rural counterparts.

Glowinski & Bayrhuber (2011) made a study named “Student labs on a university campus as a type of out-of-school learning environment: Assessing the potential to promote students’ interest in science”. Student labs are out-of-school learning environments that are assumed to promote students interest in science. The major aspects of labs such as situated and authentic for learning, a prominence of application contexts presented by scientists, and a place of high amount of practical work were studied. The study revealed that these aspects can be shown to be separately effective on student’s interest even when applied jointly to the learning environment.

Sandhu et al. (2011) conducted a study on educational interest of 10th grade students in relation to their socio-economic status. The findings of the study showed that male students have significantly higher level of educational interest in agriculture and commerce as compared to female students of high, low, and average socio-economic status groups. Female students have been significantly higher level of educational interest in fine arts and home science as compared to male students of high, low and average socio-economic status groups.

Bulunuz & Jarret (2010) explored the connections between pre-service elementary teachers’ background science experiences and interest in science. Sample for the study was 53 pre-service teachers in two sections of a science method courses. The data were collected by administering a self-report named Science Background Experience Survey. Students with low and
high initial interest in science were significantly different on remembering their elementary school science and involvement in non-school science activities including science related field trips play and exploration.

Mathai (2010) conducted a study on vocational interest, career maturity and interest in Commerce education of Commerce students at higher secondary level. The major findings of the study showed that there is negative and non significant relationship between vocational interest and interest in commerce for the total sample and in the case of demographic variables. Also the study gave the result that there is negative and no significant relationship between career maturity and interest in commerce.

McWilliam et al. (2008) discusses how the interest shown by pupils on science courses in recent years can be addressed by a change in pedagogy. They suggest that planning creative activities into science lessons will engage pupils more and thus increase the interest in science.

Whiteleg & Murphy (2006) conducted a study that has been undertaken to look into reasons why more boys than girls choose to study Physics. This is quite a serious problem, since there is a general decline in the number of students who wish to study Physics. The authors discuss differences in interest, motivation and aspiration between the sexes, ‘teacher effects’ such as question technique and feedback, and they recommend certain strategies for schools and teachers to overcome the imbalance.

3.3 STUDIES ON LEARNING STYLE

Manolis et al. (2013) conducted a study named “Assessing Experiential Learning Styles: A Methodological Reconstruction and Validation of the Kolb Learning Style Inventory (LSI)”. This study transforms the LSI from a categorical measure to continuous measure of learning style that not only more parsimonious but also easier to use than the existing LSI. Two separate studies using samples of engineering and computer science graduate students (Study 1) and undergraduate and graduate students (Study 2) were conducted. The analysis of the study includes a corroborative multi-sample validation producing a methodologically sound option to the existing LSI.
Kamarulzaman (2012) intended to review the effect of personality on learning styles. He explored Costa and McCrae's Five-Factor Model of Personality (The Big 5) against Kolb Learning Styles. The Big 5 factors are extraversion, neuroticism, openness, agreeableness and conscientiousness, whereas Kolb Learning Styles are divergers, assimilators, convergers, and accommodators. The study concluded that the personality does have an affect towards learning styles when it comes to the Big 5 factors and Kolb Learning Styles.

Sywelem et al. (2012) conducted a study named Learning Style Preferences of Student Teachers: A Cross-Cultural Perspective. The study revealed that all students learn, but not all learn in the same way. Educational researchers postulate that everyone has a learning style and the study examines how cultural variability is reflected in the learning style of students in Egypt, Saudi Arabia and United States.

Yenice (2012) conducted a review on learning styles and critically thinking disposition of pre-service science teachers in terms of miscellaneous variables such as sex, grade and age, and to address the relationship between their learning styles and critical thinking disposition. It used Kolb's Inventory of Learning Styles and California Scale of Critical Thinking Disposition. The study found that total scores of learning styles and critical thinking disposition of pre-service science teachers were not significantly different in terms of their sex, grade and age groups. It was determined that there was a low level of positive relationship between learning styles and critical thinking disposition for the pre-service science teachers.

Solvie & Sungur (2012) conducted a study, using mixed methods design research. The study examined the achievement of third level pre-service teachers when they provided instructions based on their learning styles. In this study, Kolb's learning style inventory was used to identify students' preferred learning style preferences. An online module was developed for the completion of course tasks to particular learning styles. Data analysis indicated positive effects of instructions linked to learning style preferences on student achievement.
Speece (2012) conducted a study named learning style, culture and delivery mode in online distance education. This study revealed that adapting online courses to learning style is important for competitiveness and the study discuss how cultural dimensions can be related to the preferred learning styles. The study strongly recommended that the adult-learners require asynchronous modes for online distance education, but synchronous technologies can be embedded within basically asynchronous formats to increase appeal to some learning styles.

Ozgen & Alkan (2012) examined the potential relationship between 1st and 5th year secondary school pre-service mathematics teachers' skills in understanding, method, modelling, verification, and extension dimensions of problem solving and their learning style characteristics. The results suggested that 5th year pre-service teachers were better in representing the skills pertaining to type 1 and type 2 learning styles, while 1st year pre-service teachers were better in representing the skills pertaining to type 1 learning style only.

Alias & Siraj (2012) designed and developed a Physics module based on learning style and appropriate technology in secondary educational setting by employing Isman Instructional Design Model and to test the effectiveness of the module. The pre and post-test designed to identify students' achievement score and Felder Silverman's Learning Style Inventory to measure students' learning style. Findings from evaluation of the module conducted among 120 participants involving 30 participants of each learning style (visual/verbal, active/reflective) suggested that the module is effective for visual, active, reflective but not for the verbal learners.

Mohr, Holtbrugge & Berg (2012) gathered data from 953 students to investigate how far individuals' preferences for a particular learning style are associated with the perceived usefulness of e-learning. The findings reveal the effect of individuals' learning styles as well as their gender and professional experience on the perceived usefulness of different forms of e-learning. The study contributes to the empirical basis on the relevance of learning styles in the design of virtual learning environments.
Bolliger & Supanakorn (2011) examined the effects of learning styles on learner perceptions on the use of interactive online tutorials. Learners were categorized into five learning style categories and four learning modalities. The responses to a questionnaire with four survey dimensions were analyzed in order to ascertain differences based on learning styles, gender and class. Researchers found significant main effects for both gender and learning style, and gender and the perception of usefulness. The relationship between learning styles and gender was statistically significant.

Sriphai, Damrongpanit & Sakulku (2011) conducted a study and the study aims to investigate the effect of learning styles, as well as to compare the effect of two different variable structure models of learning styles on factors influencing mathematics achievement. The research sample was made up of 508 seventh-grade students. The findings were that the model including learning styles as factors influencing mathematics achievement had a greater coefficient of determination than the one without learning styles. The effect of learning styles treated as exogenous variables and had a greater coefficient of determination than learning styles treated as endogenous variables. The changes in the regression coefficient (b) as well as changes in relations between factors influencing mathematics achievement showed that learning style was a moderator variable.

Cekiso (2011) conducted a study and the purpose of the study was to identify the preferred learning styles of students and to plan instruction and course design accordingly. In addition, a comparative analysis was made to ascertain gender differences in learning style preferences. The VAK Learning Style Inventory was administered to 147 B.Ed. students. The results indicated that the majority of students preferred the auditory learning style. When data were compared by gender, the results indicated that there was no statistical significance between male and female students in their choice of learning style preferences.

Amran et al. (2011) conducted a study among students with some or no background in science and technology subjects (non S & T students). It aims to identify students' learning styles on technical courses in order to
provide inputs to instructors' design for a curriculum to suit students' learning styles. Findings of the study indicated that Visual is the most preferred while Kinesthetic is the least preferred learning style. This result applies to both male and female students in all programs of studies and at different levels of academic achievements.

Clarke et al. (2010) investigated the relationship between two intellectual styles approaches: Sternberg's thinking styles of teachers and Felder and Silverman's learning styles. Ninety-five graduate students majoring in special education, reading, educational leadership and curriculum, and elementary education completed the Thinking Styles in Teaching Inventory (TSTI) and the Index of Learning Styles Questionnaire (ILS). Participants differed in their thinking styles in teaching and in their learning styles, based on their educational major.

Landrum & McDuffie (2010) conducted a study to find the overlapping concepts of individualized instruction and differentiated instruction, reviewing the evidences for learning styles. The findings of the study argue that instruction should indeed be individualized and differentiated. The study conclude that there is insufficient evidence, to support learning styles as an instructionally useful concept when planning and delivering appropriately individualized and differentiated instruction.

Vaughn et al. (2010) examined the relationship between specific learning styles, stress and coping in a sample of female college students (N = 246). Participants in the study were assessed on the three variables by completing several self-report instruments measuring learning styles, life stress level, and coping skills. There were significant relationships between specific learning styles, stress level and between specific learning styles and coping skills.

Papadopoulos et al. (2010) explored the impact of question prompts on student learning in relation to their learning styles. The context of the study is technology-enhanced learning in an ill-structured domain. Student learning style was the independent variable, while students' attitudes and task
performance were the dependent variables of the study. Students studied in a web-based learning environment during treatment. The integration of question prompts as student supporting tool in technology-enhanced learning environments might not improve learning for all students alike independent of their learning styles.

Cheriyan (2010) studied the effectiveness of Kolb’s experimental learning model on achievement in Mathematics of students at secondary level. The study revealed that the students belong to different learning styles understand concepts differently. The study found that activities based on experiential learning model can improve the achievement in mathematics at secondary level.

Cagiltay (2008) measured 285 students' learning styles using a learning style assessment tool. Four years after the engineering education, their performance in the programme was compared with their individual learning styles. This study showed that most of the students are assimilators. The relationship between engineering students' learning styles and their performance is found, assimilators and convergers performed better than the divergers and accommodators. The performance difference between assimilators and divergers is statistically significant.

Thomas (2007) conducted a study on effectiveness of Co-operative learning on learning style and academic performance in mathematics learning at the upper primary level. The study revealed that learning style of an individual has considerable impact on his achievement in mathematics. The study revealed that the Theorists and Reflectors perform better in mathematics than Pragmatists and Activists who are weaker in tackling abstract ideas.

Yenilez (2007) studied the relationship among the learning style, Math anxieties and math attitudes of the secondary school teacher trainees. The results revealed that the math anxiety and math attitude are efficient in predicting preferred learning style of secondary school teacher trainees in learning Mathematics.
Ishiyama & Hartlaub (2003) conducted a comparative study of student learning styles into two different political science curricular models at two universities. The result indicated that while there was no statistically significant relationship between student learning styles in under-class students. But there was a significant difference in mean scores among upper-class students between different universities.

Oughton & Reed (2000) measured the relationship between graduate students’ learning styles and performance outcome in a hypermedia environment in which students were required to structurally map out their acquired knowledge and grasp the interrelationships among various ideas and concepts. The results showed that Assimilating & Diverging learners were the most productive on their concept maps.

3.4 STUDIES ON LEARNING CYCLES

Madu (2012) explored the efficacy of four-step (4-E) learning cycle approach on students understanding of concepts related to Simple Harmonic Motion (SHM). 124 students (63 for experimental group and 61 for control group) participated in the study. It was found that the four-step learning cycle was statistically significant on teaching most of the concepts involving SHM but not on teaching amplitude and frequency.

Broderick (2011) focused on how educators could design professional development to empower the learning of individuals. The samples of the study responded to a version of teaching and learning cycle. The teaching and learning cycle served to link multiple learning designs to add depth and consistency to a shared dialogue grounded in student learning.

Dogru-Atay & Tekkaya (2008) investigated the comparative effect of the learning cycle and expository instruction on 8th grade students' achievement in genetics. The experimental group (N = 104) received learning cycle instruction, and the control group (N = 109) received expository instruction. The 2-way analysis of covariance indicated a statistically significant post-treatment difference between the experimental and control groups in favor of the experimental group after instruction. Results also
revealed that students’ logical thinking ability and meaningful learning orientation are significant in genetics achievement.

Turkmen (2006) studied the concepts of technology and educational technology including a rationale for the use of technology in education. The study examined what relationship between "Learning Cycle approach" and educational technology in science education. The study revealed that how to create technology-based curriculum using learning cycle approach.

McCarthy (2005) demonstrated how Newton’s first law of motion applies to students’ everyday lives. The author developed a learning cycle series of activities on inertia. On analysis, it is revealed that these activities promote critical thinking and help bring an abstract concept to life.

Lindgren & Bleicher (2005) examined the difficulties and factors that led to understanding the learning cycle teaching strategy. Participants included 83 pre-service elementary teachers (PTs) enrolled in multiple sections of a science methods. Analysis revealed that there were four categories of PTs, ranging from Enthusiastic to Fearful students, distinguished by their science content background and attitudes to science. High achieving students, successful in science courses, felt confused by the learning cycle that was so different from their previous science learning experiences and formed mindsets against learning it. Average students who expressed disinterest or even fear of science embraced it as their first successful science learning experience. Multiple exposures to the learning cycle were necessary to overcome these mindsets. Most PTs in all categories increased in their understanding of the learning cycle and perceived it as an effective method for allowing students to construct their understanding of science.

3.5 STUDIES ON 5E LEARNING CYCLE MODEL

Tuna & Kascar (2013) conducted a study on “The effect of 5E Learning Cycle Model in teaching trigonometry in 10th grade students of elementary mathematics education on the students’ academic achievement and on the permanence of their trigonometry knowledge”. The students in the experimental group were taught by the researcher in an environment where
the 5E learning model was used. The students in the control group took the same course from their mathematics teacher in an environment where the activities of official mathematics curriculum were used. The statistical findings of the research showed that the scores of the experimental group students on academic achievement and permanence of trigonometric knowledge are higher than that of the control group.

Hanuscin, Garderen, Hill & Presley (2013) on their study evidenced for the favorable impact of the professional development program on teachers’ understanding and ability to apply the 5E Learning Cycle to K-6 science. The findings of the study are significant, even though the experiment is conducted for relatively short duration.

Kinqir & Akqemer (2013) conducted a study named “Using the Learning Cycle Method to Improve College Students’ Understanding on Gases Concepts”. The students claimed that the activities based on 5E Learning Cycle Model helped them to learn the gaseous concepts deeply. Thus 5E learning cycle instruction was found effective on understanding the gaseous concept among college students and helped in the development of favorable attitudes toward chemistry.

Akçay (2013) designed an imaginary insect model to help the fourth grade students to identify basic insect features as a means of promoting student creativity. The 5Es (Engage, Explore, Explain, Extend [or Elaborate], and Evaluate) learning cycle teaching model is used. The 5Es approach allows students to work in small groups. It gives students an opportunity to think more creatively about different insects as they demonstrate their creativity in developing an original insect model.

Walia (2012) conducted a study to examine the effect of 5E instructional model on mathematical creativity of 8th grade students. The control group was taught by traditional approach and the experimental group was taught by the teaching approach based on 5E instructional model. Mann's Whitney Test indicated that experimental group has higher post-test scores
than control group. The results of the study indicate the effectiveness of 5E instructional model on mathematical creativity.

Zhao et al. (2012) had done a study named “Transformative professional development: Inquiry Based College Science Teaching initiatives”. The goal of the study was to promote learning and practice of inquiry-based college science teaching. For that a collaborative and active learning format for participants that involved all phases of the 5E Learning Cycle Model was introduced. Post institute responses and practices showed the effectiveness of 5E Learning Cycle Model of teaching in changing participant’s pedagogy and practice.

The major purpose of the study done by Osawaru & Erewoke (2012) was to determine the effects of 5E Learning Cycle as an instructional strategy on biology and chemistry on student’s achievement. It was found that Learning Cycle had a significant effect on student’s achievement in biology and chemistry. The result of the study includes non-significant difference in posttest scores between male and female students taught through Learning Cycle and a significant higher retention of biology and chemistry knowledge by students taught with Learning Cycle than those taught with lecture method.

Aydin & Hanuscin (2011) on a study named “Secret in the margins: Rutherford’s gold foil experiment”. The authors used a lesson that uses 5E learning cycle, and it helped the students to not only understand the atomic model but also how Rutherford helped to develop it.

Duran et al. (2011) published an article as “A learning cycle for all students”. In this article they reported that the national science education standards are designed to provide a vision of ‘scientific literacy for all’ students regardless of age, race etc. and the most powerful strategies in science instruction which align with the standards- is the use of learning cycle and instructional models. This article suggested modifying the 5E - Engage, Explore, Explain, Elaborate and Evaluate- instructional model by inserting an
“Express’ phase to assess and ensure that all students are progressing adequately through the early phases of the cycle.

Hokkanen (2011) investigated whether the implementation of the 5E learning cycle model in lesson planning and lesson presentation could improve student academics, interest and confidence in science. Within this research project, it was determined that the 5E model has the potential to improve student academics, interest and confidence in science, when implemented properly with dedication and fidelity.

Su, Chiu & Wang (2010) conducted a study on the development of SCORM-Conformant learning content based on the learning cycle using participatory design. This study incorporates the 5E learning cycle strategy to design and develop Shareable Content Object Reference Model (SCORM) - Conformant materials for elementary education. The results of this study provided concrete recommendation for how to incorporate the 5E Learning Cycle and how to develop effective e-learning materials for elementary science instructions.

Sorey, Willard & Kim (2010) published an article “Make your own digital thermometer”. In the hands-on, guided-inquiry lesson presented in this article is to build a homemade integrated circuit (IC) digital thermometer, and to apply a math’s model to calibrate the instrument. This activity used the 5E learning cycle and it helped the physical science students to discover the many connections between math and science.

The study done by Budprom, Suksringam & Singsriwo (2010) aimed to investigate and compare the effects of learning environmental education using the 5E learning cycle with multiple intelligences. The study aimed to find the teacher’s handbook approaches using 5E learning cycle on learning achievement, basic science process skills and critical thinking of grade 9 students. The major substantive findings revealed that the whole students, the male students and the female students in the experimental group showed considerable learning achievement in basic science process skills and critical thinking.
Naab, Henry & David (2009) done a study named “Why static clings”. In which they planned and designed an electricity investigation to address the common student’s misconception about static electricity using 5E Learning Cycle Model, in which students were encouraged to make predictions throughout the investigation. It was found that through the application of this learning cycle, students were more likely to recognize and change their misconceptions.

Ceylan & Geban (2009) conducted a study named “Facilitating conceptual change in understanding the states of matter and solubility concept by using 5E Learning Cycle Model”. The main purpose of the study was to find the effectiveness of 5E learning cycle based instruction on understanding the states of matter and solubility concepts of 10th grade students. After the experimentation, the results revealed that 5E Learning Cycle Model helped significantly in acquiring the scientific conception related to the concerned topic.

Kaynar et al. (2009) has done a study that investigated the effectiveness of 5E learning cycle on achievement of cell concepts, and their scientific epistemological beliefs of 6th grade students. Experimental groups received instruction based on 5E learning cycle and control groups received traditional instruction. The result of the study revealed that higher achievement of cell concepts and epistemological beliefs in favor of experimental group.

Vincent, Cassel & Milligan (2008) in a scientific investigation named “Will it float? - A learning cycle investigation of mass and volume”. The study is based on the 5E learning model designed to focus the attention on the concepts of mass, volume and density. After the session, the students answered the questions and made prediction based on their observation. The study revealed that the 5E Learning Cycle Model is effective in getting better understanding of the concepts and scientific achievement.

Hanuscin & Lee (2008) done a study named “Using the Learning Cycle as a Model for Teaching to Pre-service Elementary Teachers”. This paper,
describes an approach in which the 5E learning cycle is used as a model for instruction to assist pre-service elementary teachers in developing ‘conceptual storylines’ through carefully sequenced activities. The activities developed for learning cycle, function together as a conceptual storyline that helps students to develop a deeper understanding of powerful ways to select and sequence learning activities. These activities are helpful in addressing students’ preconceptions about the “redundancy” of providing multiple learning experiences about one concept.

Taylor, Scother & Coulson (2007) conducted a study named “Bridging research on learning and student achievement: The role of instructional materials”. The report says that for decades the National Science Foundation has been funding for the development of instructional materials. The recommendations of the study include the idea that learning be sequenced and organized using learning cycle or an instructional model such as BSCS 5E instructional model. This article addressed the issue by exploring data collected in two BSCS research studies and it recommended for 5E instruction model.

Schlenker, Blanke & Mecca (2007) used the 5E learning cycle (engage, explore, explain, extend, and evaluate) and a pulmonary carbon dioxide mystery to introduce eighth grade students to the study of chemistry. The activity engages students in measurement, data collection, data analysis, media and internet research, research design, and report writing as they search for answers to questions that develop as a result of the engagement activities they conduct.

Martin, Aden & Quenzer (2006) in an innovative project named “Forces & Motion Lesson Study: What is gravity?”, the students are requested to employ the 5E Learning Cycle Model on investigating the phenomenon of gravity and the factors influencing gravity. The project report revealed the effectiveness of the model on eliminating misconceptions among students regarding gravity.
Amann (2005) published a study named Exploring physics in the classroom. In this study it is considered that the key to learning is student involvement. Here two teaching techniques that are proven to increase student involvement in the classroom were selected. The teaching techniques selected for the study were provided by the American Association of Physics teachers Manuel. The results of the study revealed that in learning based on 5E model, the student involvement is superior to that of other methods.

Wilder & Shuttleworth (2004) done a study named “Cell Inquiry: A 5E Learning Cycle Lesson”. One dilemma science teachers face every day is balancing the content demands of state and federal testing requirements while providing opportunities for inquiry. Using the 5E learning cycle is a realistic, constructivist way to address this dilemma. The 5E learning cycle leads students through a sequence of learning in which they become engaged in a topic, explore that topic, given an explanation for their experiences, elaborate on their learning, and are evaluated. This article outlines a 5E learning cycle introducing middle/high school students to the cell.

Mc-Glinn (2003) used experiential learning cycle in a teacher education program, emphasizing the reflective components of the cycle to overcome students’ lack of reflection on their teaching. The study concludes learning cycle model is effective in promoting change and developments in students’ self-knowledge about their teaching practices by providing time for reflection.

Tinnin (2001) conducted a study on 5E Learning Cycle model, and the results of the study concludes that elementary school teachers who taught science with 5E approach experienced significant positive changes in attitudes of students towards science. It also revealed the greater evidences for increased interest.

Campbell (2000) conducted a study to find the effects of 5E Learning Cycle Model on students understanding of Force and Motion concepts. In order to find the effectiveness of the model pre-test and post-test scores were used. Additionally, a review of lab activity sheets, other classroom-based
assessments, and filmed interviews are used to draw conclusions from the study. Findings of the study showed that understanding of the concepts increases when the students are taught through 5E learning Cycle Model.

Hill et al. (2000) conducted a study on “Chemicals, the Environment and you: Exploration in science and Human Supplement services 7-8 NIH Curriculum Supplement series using BSCS 5E Learning Cycle Model”. This study enabled the teacher to facilitate learning and stimulate student interest by applying scientific concepts to real-life scenario.

3.6 CONCLUSION

The review on previous studies enlightens the significance of Scientific Creativity, Scientific Interest, Learning Style and different Learning Cycle Models on student achievement. It helped the investigator to know the application of 5E Learning Cycle Model on various disciplines and on Scientific Creativity (Akcay, 2013; Walia, 2013), Scientific Interest (Tinnin, 2001; Hill et al., 2000) and Achievement in Physics (Osawaru & Eravwoke, 2012; Vincent, Cassel & Miligan, 2008) and also based on learning style (Landrum & McDuffie, 2010) and other similar variables. The reviews collected were enabled the investigator to form the objectives, methods, design and different methods of analysis for the study.