CHAPTER - II

REVIEW OF RELATED LITERATURE

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2.0.0 INTRODUCTION

Chapter-I deals with the introduction of the present study along with the concept and its elements. It also deals with the different instructional strategies of CAM. In the chapter – I, need and justification, objectives, hypotheses and the delimitations of the study are presented. In this chapter, some of the relevant researches related to instructional strategies are presented.

2.1.0 STUDIES RELATED TO CONCEPT ATTAINMENT MODEL (CAM)

Aziz (1990) compared the relative effectiveness of inductive thinking model, concept attainment model and traditional models of teaching in developing concepts in chemistry at secondary stage. The result of the analysis showed that the performance of the students taught through different models was superior to the performance of the students taught through traditional approach.

Jamini (1991) investigated the relative effectiveness of Advanced organizer model (AOM) and Concept attainment model (CAM) on conceptual learning efficiency and retention of chemistry concepts in relation to divergent thinking which indicated that although both AOM and CAM were effective in fostering concept learning, AOM was comparatively more beneficial in concept learning to pupil with high divergent thinking while CAM was more beneficial to pupils with low divergent thinking.

Remadevi (1998) achievers on scientific attitude scale taught through IPM were found to have significantly higher achievement has applied information processing models in teaching chemistry at the secondary and higher secondary levels with respect to (a) Knowledge level of cognitive achievement; (b) Comprehension level of cognitive achievement; (c) High Intelligence categories; (d) Low Intelligence Categories; (e) Categories of high achievers on scientific attitude scale; and (f) Categories of low achievers secondary and higher secondary

on scientific attitude scale. The major findings of the study were: (1) The pupils taught through Information processing model(IPM) were found to have significantly higher achievement than those taught through Conventional method(CM) with respect to knowledge level of cognitive achievement, comprehension level of cognitive achievement and application level of cognitive achievement at .01 level. (2) The pupils belong to high intelligence categories taught through IPM were found to have significantly higher achievement than those taught through CM. (3) The pupils belong to low intelligence categories taught through IPM were found to have significantly higher achievement than those taught through CM. (4) The pupils belonging to the categories of high achievers on scientific attitude scale taught through IPM were found to have significantly higher achievement than those taught through CM. (5) The pupils belonging to the categories of low than those taught through CM.

Sreelekha and Nayar (2004) conducted a study to compare the achievement level between traditional method and concept attainment model with respect to knowledge objectives, understanding objectives and application objectives. The major finding was CAM was effective in improving the overall level of achievement in chemistry.

Luckpoteea and Narod (2012) studied the Use of the Concept Attainment Model in teaching the "Periodic Table" at 'O'-Level Through an Action Research. The study was based on the use of the concept attainment model (CAM) in the teaching of the topic "Periodic Table" at the 'O'-level, in an attempt to investigate its impact on students' understanding and on students' motivation and interest during the lessons. The research was carried out in a girls' State Secondary School in a village located in the northern region of Mauritius. The sample consisted of 44 girls of age 14–15 years, who were preparing to sit for the 'O'-level Cambridge International Examinations in November 2009. The study was carried out through an action research involving three cycles. Data were collected through observation checklists, achievement tests, students' questionnaire and a group interview. Results from the study revealed that use of CAM has motivated the students, and increased their level of participation during

the lessons. The findings also show that use of the model had enhanced conceptual understanding and helped to improve students' performance in the topic "Periodic Table". It was also found that students were better able to identify the attributes of the concepts when varied resources and strategies were used to present the exemplars and non exemplars. Thus it was recommended that for successful implementation of the CAM in classroom teaching, educators should continuously vary the ways of presenting the exemplars and non-exemplars.

2.2.0 STUDIES RELATED TO INTEGRATION OF TECHNOLOGY (MULTIMEDIA) FOR BETTER CHEMISTRY TEACHING

Aloraini (2012) studied the impact of using multimedia on students' academic achievement in the College of Education at King Saud University. This study's effort was to answer the following questions:

-What was the impact of using multimedia on students' academic achievement in the "computer & its use in education" curriculum?

-Was there any statistically-significant differences between the average marks of the experimental group & that of the control group in the pre & post measurements of students' academic achievement in the school of Education?

An experiment of two equivalent groups was designed, one of the groups is experimental & the other was control; each of them consists of 20 female students. The lecture was given to the first group using a computer presentation program which uses multimedia treated as an experimental group, while the second group was given the same lecture using the traditional method which uses the dialog & discussion technique treated as a control group. Both groups were subjected to pre & post tests in the subject tackled by the lecture. The analysis result of the pre test showed no statistically-significant differences, which in turn proves the equivalence of the two groups. Meanwhile, the analysis result of the post test showed that there are statistically-significant differences between the experimental group and the control group at a significance level of 0.05 in the favor of the experimental group.

Su (2011) studied ICT-integrated environmental learning strategy for enhancing student performance. The purpose of the study was to design information

communication technology (ICT) courses related to experimental chemistry for junior college freshmen (aged from 16 to 18), entitled "ICT-integrated environmental learning", and to assess the learning performance of these students after completing the courses. The study adopted a quasi-experimental approach to evaluate the learning of two groups of students after completing a nine-week semester syllabus. Aided by ANCOVA data, the researchers probed the processes of the students" chemistry learning, its effectiveness and their attitudes. The result analyses verified that their ICT-integrated environmental learning has a more significant effect on the students" learning performance. The results obtained from this ICT-integrated environmental learning when compared with other chemical experimental results showed the same positive and scientific perspective for academic research.

Oskay and Dinçol (2011) studied the effects of internet-assisted chemistry applications on prospective chemistry teachers' cognitive structures in the topics of bonding and hybridization. The sample of the study consisted of 36 prospective chemistry teachers attending Hacettepe University, Faculty of Education, the Department of Chemistry Education in 2010-2011 academic year and taking Basic Chemistry I lesson. In the study, students were separated into experimental and control groups according to their pre-cognitive structures. Students were requested to answer two open ended questions. Answers by each student were gathered and evaluated by flow map method. "Bonding and hybridization" topics were taught to control group with traditional teaching method and to experimental group besides traditional method internet-assisted applications were conducted. The same open-ended questions were given to both groups and their cognitive structures were examined once more. The differences between control and experimental groups' cognitive structures were examined. A significant difference was identified in favour of experimental group ($p<0,05$). The mean score of the Experimental group was X=19.94, and the mean score of the Control group was X=13.88. In addition, subsequent to internet assisted chemistry applications differences in terms of concepts and descriptions in prospective chemistry teachers' in experimental and control group cognitive structure have been

determined. When post flow maps of prospective chemistry teachers in experimental group, on whom internet assisted chemistry applications were made, are formed, it was determined that there are more statements about hybridization, hybridization types, molecule geometry and bond angles compared to control group.

Morais and Paiva (2007) studied the application of simulations in teaching-learning process in Science. A simulation called "Fusion and Boiling Points" was presented, which aimed to provide pupils with the learning situations that would enable them to learn the concepts of Physics and Chemistry in Level 7, in a more meaningful way. A qualitative study was carried out, based on the observation of the pupils during the interviews. The didactic use of this simulation is additional to the practical and experimental component and never replaces it.

Findings:After using the simulation, all the pupils acknowledged the advantage of having the *roteiro de exploração(title of the simulation)* to hand, said that: they knew what the aim of the task is; it explains the main functionalities of the digital resource being used and favours commitment in the search for the correct answers; it prevents distraction towards less relevant aspects of the activity; it hinders indiscriminate and compulsive clicks; it enables one to reach a conclusion; they learn in a more meaningful way and make the most of the time allowed.

The aspects considered by pupils to be positive in the study of Chemistry using digital resources were: it was less difficult to learn; they understood the content more fully (since the resources can be seen and used again) and the use of images and audio helped them in their understanding and led them to be more attentive. Furthermore, the pupils felt that the teachers should use digital resources more frequently in their teaching practice. According to the pupils, the reasons why this does not happen are due to: a lack of ideas or possibility of using them; the teachers view the "blackboard and chalk" as more efficient means and are what teachers are more accustomed to using.

Su (2007) studied ICT-based Chemistry Approach with Constructivist Instructions. The study aimed at evaluating students' learning effects and attitudes of chemistry with integrated information communication technologies (ICT). The classroom samples in this study included 89 engineering students who took chemistry courses during the academic year. The results indicated that: (a) students acquired a better understanding of targeted chemistry concepts during integrated multimedia representations, (b) students' average performance on the pretests and posttests through our chemistry course indicated a10-point grade growth, and (c) all variants under constructivist instructions, such as F-ratio, p-values, and Cohen's effect sizes of attitudes toward chemistry and learning chemistry were detected in terms of students' gender, major, computer-based multimedia, and disposition toward computerization. A factual and systematic assessment was made in this study to incorporate computer-based multimedia teachings utilizing constructivist design principles to facilitate students' chemistry understanding and learning attitude.

Yakmaci-Guzel and Adadan (2013) studied the use of multiple representations in developing pre-service chemistry teachers' understanding of the structure of matter. The purpose of this study was to examine the changes in 19 pre-service chemistry teachers' understandings of the structure of matter, including the aspects of the physical states of matter, the physical composition of matter, and the chemical composition of matter, before, immediately after, and months after they received a specific instruction. The one-group pre, post, and delayed posttest design was used, and participants' understandings before, immediately after, and months after the instruction were assessed using the "three part particulate drawing" classification question constructed by Sanger (2000). Collected data were analyzed according to both the number of scientifically appropriate classifications, and the types and nature of scientifically inappropriate classifications made by pre-service teachers. The results of these two analyses were quite parallel to each other and showed that this specific instruction promoted the development of participants' scientific understandings of the structure of matter. It should be noticed that while the effect of the instruction

appeared extremely positive based on the results of the statistical analyses which solely compared the number of scientifically appropriate classifications, it was reflected more accurately after the participants' scientifically inappropriate classifications of the structure of matter were analyzed more thoroughly. It was also found that although some scientifically inappropriate classifications were changed to scientifically appropriate ones following the instruction, some of them reverted back to their initial status months after the instruction.

Kozma and Russell (1997) studied the expert and novice responses to different representations of chemical phenomena by multimedia. In two experiments, it was examined how professional chemists (i.e., experts) and undergraduate chemistry students (i.e., novices) respond to a variety of chemistry representations (video segments, graphs, animations, and equations). In the first experiment, we provided subjects with a range of representations and asked them to group them together in any way that made sense to them. Both experts and novices created chemically meaningful groupings. Novices formed smaller groupings and more often used same-media representations. Experts used representations in multiple media to form larger groups. The reasons experts gave for their groupings were judged to be conceptual, while those of novices were judged to be based on surface features. In the second experiment, subjects were asked to transform a range of representations into specified alternative representations (e.g., given an equation and asked to draw a graph).

Experts were better than novices in providing equivalent representations, particularly verbal descriptions for any given representation. The role that surface features of representations play in the understanding of chemistry were discussed and emphasis on the importance of developing representational competence in chemistry students. The implications drawn for the role that multiple representations—particularly linguistic ones—should play in chemistry curriculum, instruction, and assessment.

2.3.0 STUDIES RELATED TO GENDER AS A VARIABLE

Many science education studies have focused on alternative variables that affect students' understanding of science concepts. Moreover, variables external to the classroom such as gender are analyzed to determine their impact on attitudes (Rani, 2000) and on science achievement. In the literature there are contradictory results about gender issue in attitude researches. Dahindsa and Chung (2003) found no significant sex difference in attitudes toward and achievement in science in coeducational schools. However, Barmby et al. (2008) showed that attitudes toward science declined as students progressed through secondary school and this decline was more pronounced for female students. There are also contradictory results about the relationship between gender and understanding chemistry. Some of the researchers concluded that gender difference was affective in understanding chemistry (Chambers & Andre, 1997). However, on the contrary to these findings, some other researchers showed gender difference was not effective (Azizoglu, 2004).

Suneetha et al. (2001) studied age and gender differences as factors affecting academic achievement and revealed that gender was the more important variable than intelligence quotient in deciding high academic performance, girls were among top ranking students; girls were better in interaction and concentration while boys were better than girls in language, reasoning and drilling dimension.

Hatice Belge Can (2012) studied the effect of interaction between gender and grade level in students' attitudes toward school chemistry. The purpose of the study was to investigate the effect of interaction between gender and grade level on secondary school students' attitudes toward chemistry as a school subject. The sample is composed of 197 students across Grades 9 to 11. The Attitude Scale Toward Chemistry, developed by Geban & Ertepinar (1994), was used to collect data. Principal Component Analysis revealed two dimensions of the scale which were labelled as "enjoyment of chemistry" and "importance of chemistry". The Cronbach Alpha reliability coefficient of the whole scale was computed as .93. Two-way MANOVA results indicated that the interaction effect between gender and grade level on students' attitudes toward school chemistry in terms of both enjoyment and importance dimensions was statistically significant.

Demirčloglu and Norman (1999) studied the effects of some variables on chemistry achievements and chemistry related attitudes of high school students. In this research the effects of gender, on chemistry attitudes cumulative secondary school grades and chemistry achievement, effect of father's education on chemistry achievement, and effect of school type on chemistry achievement and chemistry attitude were investigated. The sample of this study consisted of 205 science students from Ayrancı Super Lycee and Ayrancı Curriculum Laboratory School located in the metropolitan region of Ankara. A questionnaire consisting of Chemistry Attitude Scale and questions about students' family, cumulative school grades, chemistry scores was completed by 103 Ayrancı Super Lycee and 102 Ayrancı Curriculum Laboratory School students. Results of this research indicated that there is a significant gender difference of students' cumulative secondary school grades whereas there is no significant effect of gender on chemistry achievement and chemistry attitudes. On the other hand, school type has a significant effect on chemistry achievement and there is no effect of fathers' education on chemistry achievement.

2.4.0 STUDIES RELATED TO EFFECT OF LEARNING STYLE ON ACHIEVEMENT

Yilmaz-soylu and Akkoyunlu(2002) studied the effect of learning styles on achievement in different learning environments. The purpose of this study was to investigate the effect of learning styles on students' achievement in different learning environments which were designed according to principles of Generative Theory of Multimedia Learning. Research was conducted in the framework of single group repeated measures experimental design model and three different learning environments (text based, narration based and computer mediated (narration + music + text + static picture) were planned and study group studied in these environments at different times. The two instruments were used to collect data for this study. The pre-posttest designed to identify students' achievement score and Kolb's Learning Style Inventory to measure students' learning style. As a result, it has been clarified that the type of the learning style was not

significantly effective on students' achievement in different learning environments.

Vaishnav (2013) studied the relation and effect of learning style and academic achievement of secondary school students. This study presented an analysis of learning styles prevalent among secondary school students. It was conducted on three learning styles-visual, auditory and kinesthetic (VAK). It also tried to find out relation and effect of different learning styles on academic achievements of students. A sample of 200 students of class 9th, 10th and 11th standard of Maharashtra state was selected for the study. Findings of the study revealed that, kinesthetic learning style was found to be more prevalent than visual and auditory learning styles among secondary school students. There exist positive high correlation between kinesthetic learning style and academic achievement. The main effects of the three variables - visual, auditory and kinesthetic are significant on academic achievement.

Mary Lynne Wilson (2011) studied relations between matched styles and academic achievement.The purpose of the study was to identify the extent to which learning styles influence the educational process as well as the outcome of students, particularly elementary-age students, in terms of academic achievement. This study examined the potential relationship between the degree of match (as determined by comparing learning style preferences of students with instructional strategies of teachers) and the academic achievement of fourth grade students as shown by Palmetto Assessment of State Standards scores in four academic content areas, namely English language arts, mathematics, science, and social studies. The researcher collected data from a sample of approximately 200 students from three schools in different northwestern South Carolina districts. A quantitative approach utilizing a correlational design was used to analyze the data and produced Pearson *r* values for each content area respectively. These results demonstrate a lack of significant correlation between variables.

Uzuntiryaki (2007) studied learning styles and high school students' chemistry achievement. The aim of the present study was to investigate the effect of students' learning styles on their chemistry achievement and whether matching

between teaching and learning styles also effects students' chemistry achievement.265 tenth grade students enrolled in a chemistry course and seven chemistry teachers participated in the study. Grasha- Riechmann Student Learning Style Scale was used to determine students' learning styles. In order to assess teacher's teaching styles, Teaching Styles Inventory was used. Results showed that there was a statistically significant difference among students with different learning styles with respect to chemistry achievement. But there was no statistically significant effect of matching between students' learning styles and teacher's teaching styles on students' chemistry achievement.

2.5.0 SUMMARY OF REVIEW OF RELATED LITERATURE

The review of related literature shows that concept attainment model (CAM) and teaching through multimedia effect achievement in chemistry. These are effective for introduction of concept, creation of interest and motivation in chemistry.

From the above studies it is not easy to conclude whether gender influences the achievement in chemistry or not. The studies done by Suneetha et al. (2001) , Hatice Belge Can (2012) ,Barmby et al. (2008) and Chambers & Andre(1997) found that gender produced a significant differential effect on academic achievement as well as achievement in chemistry.

But the studies of Dahindsa and Chung (2003), Azizoglu (2004), Demircloglu and Norman (1999) indicate that academic achievement and achievement in chemistry is independent of gender.

Similarly, mixed results were found in studies related to learning styles on academic achievement and achievement in chemistry. The studies done by Yilmaz-soylu and Akkoyunlu(2002) and Mary Lynne Wilson (2011), show that the type of the learning style was not significantly effective on students' achievement. However, the studies of Vaishnav(2013) and Uzuntiryaki (2007) show that there was a statistically significant difference among students with different learning styles with respect to academic achievement and achievement in chemistry.