

A COMPILATION OF POSTGRADUATE THESES WRITTEN IN TURKEY ON COMPUTER ASSISTED INSTRUCTION IN CHEMISTRY EDUCATION

Aykut Emre Bozdoğan¹, Murat Demirbaş²

¹Giresun University, Faculty of Education, Turkey, aykut.bozdogan@giresun.edu.tr

²Kirikkale University, Faculty of Education, Turkey, mdemirbas@kku.edu.tr

Abstract

The purpose of the study conducted is to present in-depth information about the postgraduate theses written within the context of Computer Assisted Instruction in Chemistry Education in Turkey. The theses collected in National Thesis Centre of Turkish Council of Higher Education were examined. As a result of an examination, it was found that about forty theses were written between 1992 and 2011 and out of these 40 thesis, 19 master's theses and 6 doctoral dissertations (PhD) were included in the study. When the studies conducted were analysed, what drew attention was that all of them were experimental studies. The researchers frequently explored the effects of computer assisted instruction (CAI) on students' academic achievements and attitudes towards chemistry in their research. Moreover, it was found that the completed theses were at secondary education level. In addition, the studies were conducted on the following subjects: Gases (2), Solutions (2), Atom and Atom Models (2), Radioactivity (2), Chemical Equation (2), Acid-Base and pH (2), Phase Changes, Liquids, Speed of Chemical Reactions, Oxidation-Reduction Reactions and Chemical Bonds.

Key Words: Computer Assisted Instruction, Chemistry Education, Master and PhD Theses.

1. Introduction

The current developments in science and technology affect our daily life and they appear not only as new means of communication and transportation but also they are responsible for the new materials to be used in education-training process. One of these materials is computers. Computer technology has easily made communication materials such as text, music, motion pictures and video functional and offered them to the user's service [1, 2, 3, 4, 5]. With these rapid developments in computer world, methods based on traditional rote learning are replaced by Computer Assisted Instruction (CAI) [3]. CAI refers to instruction by means of computers to teach a subject or a concept to the students via courses programmed in the system or to reinforce the previously gained behaviours [6]. As in many education fields, computers have recently been benefited from to design effective learning environments in chemistry. Interactive computer assisted instruction using improvisations and simulations have been introduced as a choice in place of chemistry education with traditional (classical) methods [7, 8]. Computers help students to compose models in their minds about chemical events and also build stronger relations between macroscopic, molecular, and symbolical levels of chemistry [8, 9, 10].

There are many studies which explored the effectiveness of computers in chemistry education in literature in Turkey and in the world. This study investigated the master's theses and doctoral dissertations written in Turkey within the context of Computer Assisted Instruction in Chemistry Education. Therefore, the study aimed at presenting in-depth investigation about the content of postgraduate theses in Turkey.

2. Method

The study was carried out with document analysis, one of qualitative research methods. Thus, master's theses and doctoral dissertations collected in National Thesis Centre of Turkish Council of Higher Education were examined. As a result of an examination, it was found that about forty

postgraduate theses were written between 1992 and 2011 and out of these 40 thesis, 19 master's theses and 6 doctoral dissertations (PhD) were included in the study and presented below.

3. Results

The first thesis encountered within the context of Computer Assisted Instruction (CAI) is a master's thesis written by Say in 1992 [11]. In this study, chemistry education course software was developed in order to eliminate deficiencies in teaching chemistry course. Yalçınalp [12] in his study explored the effect of CAI on secondary school students' achievement in chemistry and their attitudes towards chemistry course. As a result of the study, it was discovered that CAI promoted students' achievement in chemistry and attitudes towards chemistry course. Another study compared and examined the effects of CAI on high school students' achievement in chemistry and attitudes towards chemistry with a method which benefited from work sheets. 119 high school students participated in the study and as a result of the study, it was found that students who were exposed to CAI had more positive chemistry achievement and attitudes towards chemistry [13]. Kadayıfçı [14] also examined the effect of CAI on students' performance in chemistry which was used in line with traditional teaching methods and instruction. As a result of the study which was carried out with 49 2nd grade high school students revealed that the students who benefited from CAI, besides the traditional teaching methods, were more successful and their attitudes towards chemistry enhanced positively. In another study, Sezen [15] investigated the effects of CAI on high schools students' performance in chemistry and their scientific process skills development. Within the context of the study, a computer assisted teaching program called "Phase Changes" was developed. As a result of the study, it was found that while most of the students in CAI group completed teaching program, the students in individualised teaching group of computer assisted instruction usually did not understand the materials and they were less successful.

The study conducted by Feyzioglu [16] explored the effects of Internet Based Learning on student achievement. For that purpose, a web-based instruction was prepared by using the animations and simulations for 2nd grade high school Chemistry teaching curriculum subject called "Solutions". As a result of the research, it was revealed that students in the experiment group had positive attitudes towards chemistry, computer, Internet and simulation. Still another study examined the effects of multimedia materials developed for chemistry experiments in science course on students' academic achievement and attitudes towards science. The results of the experimental study carried out with 37 8th grade students revealed that both demonstration experiments conducted in science laboratory and experiments carried out in computer lab by using multimedia chemistry experiment materials enhanced students' achievement and attitudes towards science course and science [17]. Durmaz [18] in his study aimed at teaching computer assisted analytical chemistry to the students in University Chemistry Department. Thus, two teaching software were used to teach acid-base titration graphics. It was discovered in the study that CAI in experimental groups was more effective than the control group where traditional teaching was given and there was a significant difference in the attitudes of experimental groups towards Analytical Chemistry course. Uçar [19] in his thesis explored teaching "Radioactivity" subject in 10th grade high school curriculum with Computer Assisted Instruction and the effects of this method on students' achievement and attitudes. The results of the study indicated that the performance and attitudes of experiment groups taught with CAI towards chemistry course enhanced.

Oskay [5] in his research investigated the factors which affected student performance during the CAI carried out in Chemistry Education Internet class in Education Faculty. The results of the study indicated that students' spatial visualization abilities depending on learning styles, attitudes towards computer and achievement differed. In another study, the effect of CAI on students' academic achievements and attitudes towards chemistry for the subject called "Atom and Atom Models" in 1st grade high school curriculum. The results of the study revealed that students in the experiment group had developed positive performance and attitudes towards chemistry course and computers

[20]. The aim of another study was to compare the activities of CAI and traditional teaching methods while teaching "Chemical Equation" unit in secondary education and general (introductory) chemistry course in university. High school students in their final year and the first year university students participated in the study. After the comparisons it was revealed that experiment groups were more successful than control groups [21]. In addition, Yalçın [22] conducted a study to compare CAI and traditional lecture-based teaching to promote student performance. The results of the study conducted on "Solutions" indicated that the performance of the students who were taught with CAI method increased.

Çevik [23] conducted a research study to compare and explore the views of high schools students and teachers about Computer Assisted Instruction and their roles in CAI. As a result of the research, it was found that the environment of the students, types of schools and education classes, economic situations, their interest in technological devices and other factors affected their interest in computer assisted instruction. Most of the teachers agreed with the fact that technology must be benefited in education and the use of technological devices had positive impact. İbri [24], in his experimental study, determined that CAI promoted students' achievement and attitudes towards chemistry. Sırabaşı [25] conducted a study to compare CAI and traditional lecture-based method to promote students' academic achievements in acid-base and pH subjects. The results of the study revealed that there was a significant difference between the attitude scores of control group taught through the traditional lecture-based method and experiment group taught through CAI towards chemistry and although the academic achievement of the students became more favourable towards experimental group, a significant difference between the scores were not identified. Demirci [3] examined how presentations prepared by portable and stationary materials had an impact on students' achievement in chemistry course. 99 second year students in Mathematics Teaching participated in the study and while "Crystal Structures and Liquids" were told to the students in experimental group through portable PowerPoint presentations, stationary power point presentations were used with the control group students. The results of the study revealed that the experiment group had reached a higher acquisition level than the control group. Demirer [26] conducted a study with 10th grade high school students and taught "Gases" subjects through Laboratory Based Instruction (LBI), Computer Assisted Instruction (CAI), and Traditional Teaching (TT) methods and explored the impact of these methods on students' academic achievements, the level of removing misconceptions and their attitudes towards chemistry. It was revealed in the study that the academic achievements and the level of removing misconceptions of CAI and LBI differed significantly when compared to TT groups. There were not significant differences in terms of students' attitudes towards chemistry between the groups. Daldal [27] found that teaching materials prepared according to CAI within the context of General Chemistry course enhanced students' academic achievement in "Gases".

Sarıçayır [28] conducted a study with 180 high school students and explored the impact of CAI, Laboratory Based Instruction (LBI) and Traditional Teaching (TT) methods within the context of "Equilibrium in Chemical Reactions" on students' academic achievement, knowledge retention level, and students' attitudes towards chemistry. According to the results of the study, the students' academic achievement and retention level scores became more favourable towards the experimental group students who were taught through CAI and LBI applications and TT. There was not a significant difference between the students' attitudes towards chemistry. Kolomuç [29], in his study, identified the alternative concepts in a chemistry unit called "Chemical Reactions Rate" in 11th grade chemistry education curriculum and compared the effects of animation assisted instruction in line with 5E model on students' achievement with traditional teaching method. The results of the study revealed that significant differences in favour of the experimental group were obtained between the experimental and control groups in the post tests and the delayed tests. Bilgi [30] conducted a study on 11th grade chemistry unit called "Oxidation-Reduction Reactions" in the chemistry course curriculum and examined whether CAI, LAI and traditional teaching methods had

an effect on students' academic achievement, retention level, and attitudes towards chemistry course. The results of the study indicated significant differences with the academic achievement and retention level of the students taught through CAI application when compared to the students who were taught through traditional teaching methods and LAI. Kahraman [31] aimed at investigating the effects of CAI method used while teaching the subject called "Structure of Atom and Orbitals", on the first year Science Teaching students' academic achievement, attitudes towards chemistry course and CAI. The results of the study indicated statistically significant differences between the experimental and control groups with regard to students' achievement in chemistry and attitudes towards computer assisted instruction. However, the results revealed that there was not a statistically significant difference between the experimental and control groups with regard to students' attitudes towards chemistry. In addition, it was reported that CAI was quite an effective method to eliminate the misconceptions identified in the pre-test. Ulusoy [32] examined the effects of CAI and traditional teaching methods on students' academic achievement, retention level, and attitudes towards chemistry course within the context of "Chemical Bonds" in 12th grade secondary education chemistry course curriculum. The results of the study indicated that CAI became more favourable with regard to students' academic achievement, retention level, and attitudes towards chemistry course between the groups who were taught through CAI and traditional teaching methods. Usta [33] investigated the development of a CAI material about the concepts in "Nuclear Chemistry (Radioactivity)" unit based on a four-stage model of constructivist theory and the effects of this material on students' attitudes, conceptual understanding, and achievement. The results of the study revealed that the CAI material developed had positive effects on students' attitudes, conceptual understanding, and achievement.

4. Discussion and Conclusion

When the research studies conducted are analysed, what draws attention is that nearly all of them are experimental studies. The researchers mostly examined the effects of CAI on students' academic achievement and attitudes towards chemistry course. Nearly most of the findings indicated that CAI has a positive effect on students' academic achievement and attitudes towards chemistry. These results reveal that CAI is an effective teaching method in Chemistry education. Moreover, when the education level of completed dissertations are examined, they are frequently at secondary education (n=15). In addition to this, there are studies conducted at primary education level (n=2) and university level (n=6). When the subjects of the studies conducted on chemistry are investigated, the subjects are "Gases" (n=2), "Solutions" (n=2), "Atom and Atom Models" (n=2), "Radioactivity" (n=2), "Chemical Equation" (n=2), "Acid-Base" and "pH" (n=2), "Phase Changes", "Liquids", "Chemical Reaction Rates", "Oxidation-Reduction Reactions" and "Chemical Bonds". In conclusion, placing particular importance to CAI and popularising its use in physical sciences will have positive effects on students' academic achievement and attitudes towards physical sciences.

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