TEACHERS' OPINIONS ON COMPUTER-ASSISTED CHEMISTRY TEACHING

KIMYA ÖĞRETMENLERININ BILGISAYAR DESTEKLI KIMYA ÖĞRETIMINE ILIŞKIN GÖRÜŞLERI

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Abstract

Every era has its own requirements. Education takes the most prominent place among all these requirements. The developing and diversifying technology saddles various responsibilities to the individuals to teach or acquire the knowledge as well as facilitating the learning of new knowledge. The diversity of fields under education increases the need for well-equipped individuals in terms of knowledge. Today, the amount of knowledge is increasing rapidly. The utilization of computers in transferring knowledge to new generations brought forward a new concept called computer-assisted teaching. In recent studies comparing computer-assisted teaching to the traditional teaching, it has been observed that computer-assisted teaching resulted with higher rates of achievement. In addition, computer technology enables individuals to store knowledge in their minds both in graphics and symbols. This facilitates the multi-dimensional storage of knowledge. In this way, not only learning becomes more meaningful, but also knowledge is stored in longer terms. Besides its utilization in knowledge attainment and storing, computer-assisted teaching improves students' advanced skills and affects their achievement levels positively.

This study aimed to determine the opinions of chemistry teachers on the utilization of computers and the effects of some independent variables on these opinions. The sampling of the study consisted of 40 chemistry teachers teaching at secondary level educational institutions. The evaluation of the responses of the teachers to the assessment tool enabled the revealing of some suggestions for overcoming the problems related to computer-assisted teaching and education.

As a result, the roles of teachers have changed with the utilization of computers in educational studies as well as computer-assisted teaching practices. The most important responsibility of a teacher within this process is to be aware of the software related to all levels of education and to reach the level of education that enables the teacher to utilize the software. Therefore, in order to keep up with the modern systems, teachers ought to improve themselves and follow the technological improvements closely.

Keywords: Computer-Assisted teaching, Computer-Assisted Chemistry teaching, Teacher Opinions.

Öz

 Günümüzde bilgi birikimi hızla artmaktadır. Bilginin yeni nesillere aktarılmasında bilgisayarın kullanılması fikri, bilgisayar destekli eğitim adi verilen yeni bir kavramı ortaya çıkarmıştır. Bilgisayar destekli öğretim, bilgi depolanması ve aktarılmasında kullanıldığı gibi ayni zamanda öğrencilerin üst düzey becerilerini de arttırmakta ve başarı artışı yönünde de olumlu etkiler ortaya çıkarmaktadır.

Çalışmada, kimya öğretmenlerinin bilgisayar kullanımlarına yönelik düşüncelerinin saptanması ve bu düşünceler üzerine bazı bağımsız değişkenlerin etkisi incelenmiştir. Araştırmanın örneklemini, ortaöğretim kurumlarında görev yapmakta olan 40 kimya öğretmeni oluşturmuştur. Öğretmenlerin ölçüm aracına verdikleri cevapların değerlendirilmesi sonucunda ortaya çıkan bulgulardan yola çıkılarak, bilgisayar destekli öğretimdeki aksaklıkların giderilmesi için öneriler geliştirilmiştir.

Sonuç olarak, eğitim-öğretim uygulamalarında bilgisayarların kullanılması ve bilgisayar destekli öğretim çalışmalarının sonucunda öğretmenin rolleri de değişmiştir. Öğretmene bu süreçte düşen en önemli görev, eğitimin her aşamasına uygun nitelikteki yazılımlardan haberdar olması, hatta o programları kullanacak eğitim düzeyine ulaşmasıdır. Bu sebeple öğretmenlerin yeni sistemlere uyum sağlayabilmek için hem kendilerini iyi bir şekilde yetiştirmeleri hem de teknolojiyi yakından takip etmeleri gerekmektedir.

Anahtar Sözcükler: Bilgisayar Destekli Öğretim, Bilgisayar Destekli Kimya Öğretimi, Öğretmen Görüşleri

1. INTRODUCTION

The communication technologies of today are tools that play the key roles in management and sharing of knowledge (Mercader, 2006). Although technology does not address all the educational problems by itself, it has become a part of required teaching tools nowadays (Kirschner & Selinger, 2003). However, according to Leh (1998), it has become an essential issue that technological changes affect functions expected from teachers. Related behaviors of teachers are important variables in the utilization of computers as teaching tools. The time teachers spend using computers, their skills regarding the utilization of computers and their openness to changes provide essential information about how they would utilize computers as teaching tools (Vannata & Fordham, 2004). It is not enough for the teachers to know how to utilize computers by itself. In order teachers to supplement learning effectively would require them to know how to utilize technology effectively (Kruger, Hansen & Smaldino, 2000).

As computers allow the organization of learning environments appropriate to the levels of students, it has become an obligation for teachers to learn the new information technologies. The traits of teachers that belong to the age of information are listed below:

- **Individual competency:** Being able to utilize special information and communication technology tools.

- **Subject field competency:** Being able to integrate educational technologies into their own fields.

- **Learning competency:** Being able to plan, prepare, teach and evaluate the lesson using educational technologies (McNair and Galanouli 2002).

Research have proved that teachers construct their own principles, ideas and beliefs about the utilization of information communication tools in classrooms and these affect their practices (Cope and Ward, 2002; Velle, McFarlene, Brawn, 2003; Galanouli, Murphy, Gardner, 2004; Jedeskog & Nissen, 2004).

Chang (2002), Hacker and Sova (1998), Yalcinalp, Geban and Ozkan (1995) reported that computer-assisted teaching, when compared to traditional education technique, resulted in higher achievement rates. Additionally, computer technology enables individuals to store the knowledge in their minds both in graphics and in symbolic presentation styles. This facilitates the two-dimensional and directional storage of knowledge, which leads to more meaningful learning as well as long term knowledge storing (Cekbas v. d. 2003). According

to Renshaw and Taylor (2000), in addition to increasing the achievement rates, computer-assisted teaching enhanced advanced thinking skill development in students, which enabled students to comprehend rather than memorize (Cekbas v.d. 2003).

In a study by Aytun (2007), the attitudes of primary school teachers towards computer-assisted teaching and their computer utilization skills were investigated in terms of age, gender, experience, education received and attendance to in-service training programs. The findings showed that 48.9% of teachers applied computer-assisted teaching in their classrooms. Information technology class was available in 90.7% of schools and 63% of schools had Internet connection (ADSL) available. On the other hand, the available teaching software was limited to 47.8%. Significant differences were found between the computer utilization skills of teachers and their applying computer-assisted teaching. Variables such as age, gender, education level, having received training on computers or possessing computers were found to affect their computer utilization skills. Their attendance to the in-service training programs of Ministry of National Education did not result in any significant difference. The attitudes of teachers towards computer-assisted teaching did not create any significant difference in terms of their ages, education levels, genders, experiences or their attendance to the courses provided by the Ministry of National Education.

Celik and Bindak (2005) concluded in their study on primary school teachers towards computers that the attitudes of teachers towards computers did not differ according to their genders, subject fields and location of teaching Moreover, it was observed that teachers possessing computers had significantly more positive attitudes towards computers than those who did not possess. Additionally, positive and significant relationships were found between self-competence in computers, frequency of computer utilization and positive attitudes towards computers.

Erkan (2004) tried to determine the attitudes of kindergarten teachers towards computers and whether these attitudes changed according to gender, previous computer experience and possession of computers at home. He concluded that younger teachers had more positive attitudes than older teachers as well as teachers with more experience with computers having more positive attitudes than those who did not. On the other hand, there was not a significant difference found between the attitudes of teachers possessing computers at home and those who did not.

A descriptive research was made by Seferoglu**,** Akbiyik and Bulut (2008) on the views of primary school teachers and student teachers, the utilization of computers, the role of computers and the utilization of computers in education with 51 teachers and 56 student teachers. Two different surveys were made use of as data collection tools. It was concluded that while teachers learnt how to use computers by receiving in-service training, student teachers learnt it by themselves or by receiving help from their environments. The findings showed that student teachers made use of information technologies at more advanced levels when compared to teachers.

İmer and Ozkilic (2009) aimed in their study to determine the self-competence of student teachers studying at computer and teaching technologies departments about creating education software. The study concluded that the self-competence levels of student teachers about creating education software were at intermediate level in general. The gender variable did not display any significant difference in terms of project management, teaching design, graphic design or programming among education software development self-competencies, whereas there was a significant difference observed for animation, audio-video design dimensions favoring the male student teachers. Student teachers possessing computers were found to have higher competency levels in developing education software at all dimensions than non-possessing student teachers.

The data obtained from this study suggests that as computer utilization skills requires a great amount of practice, education faculties as well as other related institutions and organizations should provide as much opportunity and support as possible.

The Purpose of the Study

This study aims to determine the opinions of chemistry teachers on the utilization of computers. Moreover, some independent variables that were thought to have impacts on the utilization of computers by teachers were also examined.

The Importance of the Study

Computer-assisted teaching could only serve its aim when administered through competent teachers. Therefore, the determining the attitudes of teachers from all subject fields towards computers and technology becomes a must to enable the computer-assisted teaching function within that subject field, which would contribute to computer-assisted teaching in general. In this study, it was aimed to determine the opinions of chemistry teachers on computer-assisted teaching in chemistry education.

Problem

"What are the opinions of chemistry teachers on computer-assisted teaching and what are the conditions affecting their utilization of computers?"

2. METHOD

Universe & Sampling

The universe of the study consisted of chemistry teachers teaching at secondary level educational institutions. The sampling involved 40 chemistry teachers teaching at secondary schools in Ankara.

Limitations

The assessment tool of the study was the three-choice opinion survey prepared by the researcher in order to determine the opinions of teachers on utilizing computers. The survey consisted of 26 questions prepared for teachers. Also, the survey sought for some variables such as gender, teaching experiences of chemistry teachers. A possible significance was examined between the responses of teachers to the survey questions and these variables.

Data Collection Tool

The survey of the study was prepared by the researcher considering the findings of the related literature. The teacher Opinions on Computer-Assisted Chemistry Teaching Survey consists of two sections. The first section addresses personal information such as genders and experiences of teachers. The second section contains questions on teachers' utilization of computers and their utilization of computers in chemistry classes. In terms of content validity of the survey, some modifications were made upon expert views; by removing or changing some questions the survey took its final version. The total number of questions in the survey is 26. The questions of the second section were three-point scaled as "yes, partly, no". Statistical techniques such as frequency (f) and percentage (%) were made use of in the analysis of the data obtained.

3. FINDINGS

The percentages and frequencies of data obtained from the three-point opinion survey on teacher opinions aiming to analyze views on computer-assisted chemistry teaching in terms of various variables were evaluated for some questions as follows:

Table 1: The percentage (%) and frequency (f) values of teachers' interest in computer technologies in terms of gender and experience variables.

Question		Gender				Experience					
		Male		Female		0-10		11-20		21-30	
		%	f	%	f	%	f	%	f	%	f
3.Are you interested in computer technology?	Yes	83,3	15	56,5	13	70	7	71	17	57,1	4
	Partly	16,7	3	43,5	10	30	3	29	7	42,9	3
	No										

Looking at Table 1, the analysis of the responses to the question "Are you interested in computer technology?" in terms of gender concluded that %83.3% of male and 56.5% of female teachers were interested in computer technology. None of the teachers indicated that they were not interested in computer technology. Moreover, in terms of experiences, teachers with experiences between 0 to 20 years (70%) were determined to be interested in computer technology. The rate for teachers with 21 to 30 years of experience was as low as 57%.

Table 2: The percentage (%) and frequency (f) values of teachers' responses to the question on the available computer-assisted teaching at their schools in terms of gender and experience variables.

Question		Gender				Experience					
		Male		Female		0-10		11-20		21-30	
		%	f	%	f	%	f	%	f	%	f
5. İs computer-assisted teaching available at your school?	Yes	11,1	2	21,7	5	30	3	8,3	2	28,6	2
	Partly	22,2	4	13	3	10	1	21	5	14,3	1
	No	66,7	12	65,2	15	60	6	71	17	57,1	4

Table 2 displays that male and female teachers, with rates of 66.7% and 65.2%, indicated there was not computer-assisted teaching available at their schools. Moreover, 60% of participating teachers with 0 to 10 years of experience indicated that there was not computer-assisted teaching available at their schools. This rate was 71% for teachers with 11 to 20 years of experience and 57.1% for teachers with 21 to 30 years of experience.

Table 3: The percentage (%) and frequency (f) values of teachers' responses to the question on whether computer-assisted teaching would create negative attitudes towards school in terms of gender and experience variables.

Question		Gender				Experience					
		Male		Female		0-10		11-20		21-30	
		%	f	%	f	%	f	%	f	%	f
6.would computer-assisted teaching create negative attitudes towards school?	Yes	5,6	1	8,7	2	10	1	8,3	2		
	Partly			4,3	1			4,2	1		
	No	94,4	17	87	20	90	9	88	21	100	7

According to Table 3, most of the male teachers (94.4%) and a great number of female teachers (87%) assumed that computer-assisted teaching would not create negative attitudes towards school. Regardless of experience level all teachers changing between 87.5% and 100% indicated that computer-assisted teaching would not create negative attitudes towards school.

Table 4: The percentage (%) and frequency (f) values of teachers' responses to the question on their willingness to work at a school where computer-assisted teaching is available in terms of gender and experience variables.

Question		Gender				Experience					
		Male		Female		0-10		11-20		21-30	
		%	f	%	f	%	f	%	f	%	f
7. Would you like to work at a school where computer-assisted teaching is available?	Yes	88,9	16	73,9	17	100	10	75	18	71,4	5
	Partly	5,6	1	17,4	4			17	4	14,3	1
	No	5,6	1	8,7	2			8,3	2	14,3	1

Among male teachers 88.9% and 73.9% of female teachers were observed to be willing to teach at a school where computer-assisted teaching is available in Table 4. A hundred percent of teachers with 0 to 10 years of experience, 75% of teachers with 11 to 20 years of experience and 71.4% of teachers with 21 to 30 years of experience indicated that they would like to work at a school where computer-assisted teaching was available.

Table 5: The percentage (%) and frequency (f) values of teachers' opinions on the effects of utilization of computers in chemistry classes on the relationship between the teacher and the student in terms of gender and experience variables.

Question		Gender				Experience					
		Male		Female		0-10		11-20		21-30	
		%	f	%	f	%	f	%	f	%	f
10. Would the utilization of computers in chemistry classes decrease the level of relationship between the student and the teacher?	Yes	5,6	1	4,3	1			8,3	2		
	Partly	16,7	3	34,8	8	20	2	38	9		
	No	77,8	14	60,9	14	80	8	54	13	100	7

Table 5 presents that according to 77.8% of male and 60.9% of female teachers; utilization of computers in chemistry classes would not decrease the level of relationship

between the teacher and the student. Eighty percent of teachers with 0 to 10 years of experience, 54.2% of teachers with 11 to 20 years of experience and 100% of teachers with 21 to 30 years of experience assumed that utilization of computers in chemistry classes would not reduce the level of relationship between teacher and student.

Table 6: The percentage (%) and frequency (f) values of teachers' responses to the question on whether learning chemistry would me made easier through computer-assisted teaching in terms of gender and experience variables.

Question		Gender				Experience					
		Male		Female		0-10		11-20		21-30	
		%	f	%	f	%	f	%	f	%	f
12. Could learning chemistry be made easier through computer-assisted teaching?	Yes	61,1	11	39,1	9	50	5	37,5	9	85,7	6
	Partly	33,3	6	56,5	13	50	5	54	13	14,3	1
	No	5,6	1	4,3	1			8,3	2		

As Table 6 shows, 61.1% of male teachers and 39.1% of female teachers assumed that learning chemistry would be easier through computer-assisted teaching. The idea that computer-assisted teaching would facilitate learning chemistry dominated as the years of experience increased. Fifty percent of teachers with 0 to 10 years of experience, 37.5% of teachers with 11 to 20 years of experience and 85.7% of teachers with 21 to 30 years of experience assumed that with the help of computers and computer-assisted teaching, learning chemistry would be made easier.

Table 7: The percentage (%) and frequency (f) values of teachers' responses to the question on whether utilization of computers in teaching chemistry by teachers would increase achievement in terms of gender and experience variables.

Question		Gender				Experience					
		Male		Female		0-10		11-20		21-30	
		%	f	%	f	%	f	%	f	%	f
13. Would utilization of computers in chemistry classes increase achievement?	Yes	66,7	12	43,5	10	70	7	42	10	71,4	5
	Partly	27,8	5	52,2	12	30	3	54	13	14,3	1
	No	5,6	1	4,3	1			4,2	1	14,3	1

According to Table 7, 66.7% of the male teachers and 43.5% of female teachers agreed that utilization of computers in chemistry classes would increase achievement. Regardless of experience level all teachers changing between 87.5% and 100% indicated that computer-assisted teaching would not create negative attitudes towards school.

Additionally, 70% of teachers with 0 to 10 years of experience, 42% of teachers with 11 to 20 years of experience and 71.4% of teachers with 21 to 30 years of experience assumed that utilization of computers in chemistry classes would increase achievement.

Table 8: The percentage (%) and frequency (f) values of teachers' opinions on whether lessons would become more enjoyable as graphics, audio and visual facilities were available in computer-assisted chemistry teaching in terms of gender and experience variables.

Question		Gender				Experience					
		Male		Female		0-10		11-20		21-30	
		%	f	%	f	%	f	%	f	%	f
14. Would lessons be more enjoyable as graphics and audio-visual facilities are available in computer-assisted chemistry education?	Yes	83,3	15	91,3	21	90	9	87,5	21	85,7	6
	Partly	16,7	3	8,7	2	10	1	13	3	14,3	1
	No										

Table 8 presents that according to 83.3% of male and 91,3% of female teachers; computer-assisted chemistry teaching would make lessons more enjoyable as graphics and audio-visual aids are available. Ninety percent of teachers with 0 to 10 years of experience, 87.5% of teachers with 11 to 20 years of experience and 85.7% of teachers with 21 to 30 years of experience agreed that computer-assisted chemistry teaching would make lessons more enjoyable as graphics and audio-visual aids are available.

Table 9: The percentage (%) and frequency (f) values of teachers' opinions on whether some experiences in laboratories could be made more interesting through computers in terms of gender and experience variables.

Question		Gender				Experience					
		Male		Female		0-10		11-20		21-30	
		%	f	%	f	%	f	%	f	%	f
15.Could some experiments in laboratories be made more interesting through computers?	Yes	83,3	15	60,9	14	60	6	71	17	85,7	6
	Partly	11,1	2	17,4	4	30	3	13	3		
	No	5,6	1	21,7	5	10	1	17	4	14,3	1

According to Table 9, 83.3% of the male teachers and 60.9% of female teachers assumed some experiments could be made more interesting through computers. Sixty percent of teachers with 0 to 10 years of experience, 71% of teachers with 11 to 20 years of

experience and 85.7% of teachers with 21 to 30 years of experience indicated that some experiments could be made more interesting through computers.

Table 10: The percentage (%) and frequency (f) values of teachers' opinions on whether management and evaluation of students could be easier with computer-assisted chemistry teaching in terms of gender and experience variables.

Question		Gender				Experience					
		Male		Female		0-10		11-20		21-30	
		%	f	%	f	%	f	%	f	%	f
19.Could student management and evaluation be made easier through computer-assisted chemistry teaching?	Yes	38,9	7	39,1	9	40	4	29,2	7	71,4	5
	Partly	44,4	8	47,8	11	50	5	50	12	28,6	2
	No	16,7	3	13	3	10	1	20,8	5		

As Table 10 shows, 38.9% of male teachers and 39.1% of female teachers agreed that student management and evaluation could be made easier through computer-assisted chemistry teaching, whereas 16.7% of male teachers and 13% of female teachers disagreed. Forty percent of teachers with 0 to 10 years of experience, 29.2% of teachers with 11 to 20 years of experience and 71.4% of teachers with 21 to 30 years of experience stated that student management and evaluation could be made easier through computer-assisted chemistry teaching. Ten percent of teachers with 0 to 10 years of experience and 20.8% of teachers with 11 to 20 years of experience rejected that student management and evaluation could be made easier through computer-assisted chemistry teaching.

Table 11: The percentage (%) and frequency (f) values of teachers' opinions on teaching chemistry through computer-assisted teaching technique in terms of gender and experience variables.

Question		Gender				Experience					
		Male		Female		0-10		11-20		21-30	
		%	f	%	f	%	f	%	f	%	f
23. Should chemistry classes be taught with the help of computers?	Yes	55,6	10	47,8	11	60	6	46	11	57,1	4
	Partly	44,4	8	43,5	10	40	4	46	11	42,9	3
	No			8,7	2			8,3	2		

Table 11 displays that more than half of the male teachers (55.6%) and nearly half of the female teachers (47.8%) believed that chemistry classes should be taught with the help of computers. Additionally, 43.5% of female teachers responded to this question as partly, whereas 8.7% disagreed. Sixty percent of teachers with 0 to 10 years of experience, 46% of

teachers with 11 to 20 years of experience and 57.1% of teachers with 21 to 30 years of experience suggested that chemistry classes should be taught with the help of computers. Only 8.3% of teachers with 11 to 20 years of experience rejected the idea that chemistry classes should be taught with the help of computers.

Table 12: The percentage (%) and frequency (f) values of teachers' opinions on attending in-service training programs on computer-assisted chemistry teaching in terms of gender and experience variables.

Question		Gender				Experience					
		Male		Female		0-10		11-20		21-30	
		%	f	%	f	%	f	%	f	%	f
26. Have you ever attended an in-service training program on computer-assisted chemistry teaching organized by the ministry?	Yes	11,1	2	4,3	1	10	1	8,3	2		
	Partly										
	No	88,9	16	95,7	22	90	9	92	22	100	7

Table 12 shows that 88.9% of male teachers and 95.7% of female teachers had never participated in such in-service training programs. Moreover, ninety percent of teachers with 0 to 10 years of experience, 92% of teachers with 11 to 20 years of experience and all of teachers with 21 to 30 years of experience mentioned that they had never attended such in-service training programs.

4. DISCUSSION and SUGGESTIONS

The greatest role in the effective utilization of computers in education belongs to teachers (Gooler, Kautzer & Knuth, 2000). The roles of teachers have changed as a result of utilization of computers in educational applications and computer-assisted teaching studies. The primary responsibility of a teacher within this process is to become aware of software appropriate to all levels of education and reach the educational level to be able to utilize the software. Therefore, in order to keep up with the modern systems, teachers should educate themselves and follow the technological developments closely. Jacoby (2005) explained the benefits of computer-assisted teaching as follows:

- İt is in line with the life-long learning perception at all times and places and enables practices in and out of the classroom.
- Each student could work at his/her own speed. İn crowded classrooms, the learning difficulties and time problems of students at different levels would be avoided.

- The exam results of students being taught through computer-assisted teaching are recorded on a database. This makes it easier for the teacher to follow students' achievement and progress.

- Computer-assisted teaching decreases the demand for more teachers at various school levels and organizations.

- In traditional classroom environments, knowledge is learnt by students with different learning types at different amounts and styles. Therefore, the same knowledge is not learnt by all students. However, in computer-assisted teaching, all students learn the same knowledge in the same way.

- Computer-assisted teaching programs allow students to revise the subjects that are not well-understood by them.

- Since the software used in computer-assisted teaching are interactive and fun, students are better motivated to the lesson and higher student attendance to the class is obtained.

- In order to address the problems and lacking points in computer-assisted teaching, we make the following suggestions to student teachers, professional teachers and educational institutions:

- In order to have teachers with the knowledge that modern technologies require, teachers should firstly be able to acquire information technologies easily and economically. Teachers, therefore, should be provided with long-term economical loan opportunities. The opportunities provided by National Ministry of education in 2005 in order teachers to possess their own computers should be continued.

- Computer literacy training should be available to the teachers who do not know how to use computers.

- Teachers and administrators should follow the related contents of National Ministry of Education regarding computer-assisted teaching.

- Teachers and administrators should cooperate with institutions and publishers that provide information technologies, exchange knowledge with them and guide their students towards these publications. The knowledge obtained from these institutions and published materials should be transferred to students by educators quickly and easily.

- Teachers should prepare their teaching and educational materials such as yearly and daily plans, club activities as well as their teaching materials in computer environments.

- Students should be encouraged to use computers by preparing written exams, homework and projects in computer environments.

- Student files, exam results, teacher notes should be carried to the computer environment where knowledge could be stored. By receiving feedback, the personal and professional capacity of teachers could be enhanced.

- Teachers should consider that utilization of computers, which addresses multiple senses, would increase the achievement levels in chemistry classes and make the lessons more enjoyable as well. Classroom environments should be organized accordingly.

- Teachers should make use of package software for the chemistry lessons in and out of the classroom so that students could have the chance to practice and revise more.

- Teacher-student communication could be carried outside the classroom by using the internet web, which would also facilitate the control of students outside the classroom.

- It should be considered that teachers could save time by providing extra knowledge, transferring the clarified knowledge to students, initiating homework and project activities outside the classroom.

- Teachers should consider the failure in and disadvantages of teacher-student relationship within the traditional system, where teacher is the instructor, and create teacher-student connections on the Internet. This would enable the teacher to know the student better and determine what to teach more easily.

- Chemistry teachers should be eager to utilize computer labs in their schools for their teaching. Therefore, chemistry teachers should be in close contact with school administration and IT teachers.

- Teachers should be sensitive to the problems that may occur during the utilization of computers and communicate the issues to the authorities immediately.

We strongly believe that sensitivity towards these suggestions listed would contribute to educational environments positively. Students with lack of knowledge progress step by step in computer-assisted teaching under the control of the teacher or according to their own learning speeds. Students could discover the knowledge by themselves. As a teacher once mentioned that his/her students were interested in how much s/he knew how to

utilize computers; on the other hand, s/he was not at the top of his/her knowledge; and that increased his/her reliability at that point (Wexler 2000).

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