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CHEMISTRY STUDENTS' OPINIONS ABOUT TAKING CHEMISTRY EDUCATION AS DISTANCE EDUCATION

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Abstract:
The aim of this study is to determine the opinions of the students studying in chemical and chemical processing technologies departments on take chemistry education in the form of distance education. The research sample consists of students studying in chemistry and petrochemical technology programs in Kocaeli Vocational School. It was applied to students studying in related departments in the fall semester of 2018-2019. The sample consists of 149 students. The mixed method has been adopted in the research. Scale and interview questions were prepared with the literature review. The reliability coefficient of the Chemistry Distance Education Scale was 0.945. There was a high correlation between the dimensions of the scale consisting of three dimensions. In quantitative research; a relationship was found between income and chemistry distance education. It was found that students with low income level were eligible for distance education in chemistry. Distance education diminish students' costs of housing and transportation. In addition, there is no relationship between the gender of the students, the type of education, the level of education of the parents, the department and the class. The qualitative research findings are: a large part of the students indicate that the distance education infrastructure is not sufficient. According to the students, chemistry education is considered to be sufficient for theoretical knowledge only as distance education. Students do not want to take laboratory applications as distance education. Distance education cannot eliminate the need to touch materials while adding visuality. It is determined that students are not ready to take chemistry education from distance education as cultural and cognitive.

Keywords: chemistry, chemistry education, distance education

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1. Introduction

Learning; the knowledge of the outside world can be characterized by concrete terms that are transmitted from the teacher to the student, irrespective of reason. The basic ideas and information to be conveyed to the student should be expressed in a way that students can understand, and more complex concepts should be given step by step (Sammons, 2003). Complex concepts can be simplified and better understood by computer technology.

Distance education; the courses offer advantages such as continuing education without being connected to the place, appealing to a wide audience, making free use of educational opportunities without age restrictions, and being able to watch course records repeatedly. In addition to the listed advantages, it is known that there are adverse conditions. The aim of this study is to question whether the chemistry education is distance education and whether the virtual laboratory applications are at the current level in education.

2. Literature Review

Developments in information technology have become a part of daily life and have led to changes in the field of education. Information technologies benefit from lifelong learning by ignoring constraints such as "*place, time, age in accessing information*". One of these changes is the spread of the concept of distance education that contributes to the lifelong learning of the individual by eliminating obstacles such as place, time and age in accessing information (Fidan, 2016). This system is distance education.

The history of distance education dates back to ancient times (Guri-Rosenblit, 2009). Distance education was first used in 1892 by the University of Wisconsin. Then Germany and France were introduced and applied respectively. Developmental process of distance education; letter, (Kaya, 2002), followed the use of telephone, television and internet systems and is based on interactive communication (Goksel-Canbek, 2015).

Distance education is provided through computer technology;

- It allows the transfer of complex information to students using more simple and visual materials.
- Difficult concepts are provided to be understood more easily (Tüysüz, 2010).

There is an increase in educational institutions in the US with online programs based on distance education and e-learning, and 460,000 students receive online courses in the fall 2005 period. Even doctoral programs are offered as distance education. Moreover, the proportion of those who think that the outcomes of distance education are superior to face-to-face education is increasing (Simonson et al., 2015).

In chemistry teaching, effective learning is carried out in the laboratory with practice. Laboratory applications provide the opportunity to make observations while improving the ability to record, report and interpret. Gains cognitive skills in reasoning, hypothesis building and testing hypothesis. Increases the ability to use the existing equipment in the laboratory environment (Dalgarno et al., 2009).

However, the use of laboratories for chemistry education in Turkey are inadequate for the following reasons (Altun et al., 2009):

- Inadequate infrastructure of schools' chemistry laboratories,
- Sharing laboratories with other courses,
- Insecurity in laboratories due to hazardous chemicals,
- Crowded classes,
- Not having enough time,
- Lack of material,
- Costs of materials required for chemistry course,
- Inability to use laboratories effectively,
- Negative attitude of students towards laboratory practices.

These problems related to chemistry laboratories can be solved by distance education. At Charles Sturt University, chemistry courses are offered as distance education (Dalgarno et al., 2009).

In distance education and virtual laboratory applications, students do not experience lack of confidence and experience anxiety (Sammons, 2003). At the same time, more students can be provided with the opportunity to learn compared to the face-to-face classroom environment.

In fact, it was found that virtual laboratory applications are equivalent to face-to-face learning and virtual laboratory applications give positive results on students' success and attitudes compared to face-to-face laboratory applications (Tuysuz, 2010). In a similar conclusion, Coates et al. (2004) in the study of face-to-face and distance learning is that there is no significant difference between (as cited in Atik, 2008). In addition, Rutten et al. (2012) emphasized that as a result of their study, laboratory applications should be replaced with computer-aided virtual laboratories and determined the positive contribution of virtual laboratories to learning.

Cai et al. (2014) were interested in improving traditional methods and tools for learning. In their study on the development of virtual laboratory applications for chemistry course, they stated that virtual laboratory has complementary learning effect based on inquiry. Learning environments in which information technology is used increases the interest, curiosity and motivation of the student. Limniou et al. (2008) found that students better understand the molecular structure and changes in chemical reactions through the program they have developed to facilitate chemistry teaching.

Bennett et al. (2012) stated that web technologies have an effect on learning in their research conducted in different departments and classrooms by using information and communication technologies to support students' learning. Bennett et al. (2012), it provides a broad framework for the educational use of voice and video sharing on social media, where information technology is widely used in higher education in Australia. The use of information technologies is considered to be the right choice in terms of learning effectiveness.

3. Material and Methods

In the research, mixed method was adopted, chemistry distance education scale was used for quantitative research and interview questions were formed for qualitative research. While quantitative research reveals the relationships between concepts, qualitative research seeks answers to how and why questions related to concepts (Berg & Lune, 2015).

The quantitative research was applied to the students studying chemistry technology and refinery and petrochemical technology programs in Kocaeli Vocational School. The sample of the study, in which easy sampling method is preferred, consists of 149 students. The qualitative research included 14 volunteer students from the same sample group.

The questions used for both quantitative and qualitative research were prepared as a result of literature review and in line with expert opinions. In the quantitative study, a five-point Likert scale was used which was scored as “strongly disagree” “1” and “strongly agree” “5”. Validity and reliability analyzes of the scale were performed.

A live course was created in the distance education system and a topic related to chemistry course was presented to the students in the form of distance education. They were then asked to answer questions about distance education in chemistry. Qualitative research using interview method was conducted with a 15-minute face-to-face interview. In order to measure students' attitudes towards distance education in chemistry, questionnaires were distributed to students studying in chemistry and petro-chemistry programs in 2018-2019 fall term by face-to-face method. After obtaining the findings of the quantitative research, four questions were asked about the qualitative research. Interview questions are given below:

- What do you think about taking all the courses you take in formal education in the form of distance education?
- What are your positive opinions about the provision of chemistry education as distance education?
- What are your negative thoughts about the provision of chemistry education as distance education?
- How can laboratory applications be performed in distance education?

Data were analyzed using SPSS 21 program. In the analyzes, the degree of significance was accepted as 0.05. The first part of the study, where the quantitative and qualitative methods were used together, was composed of the questions in which the attitude of distance education in chemistry education was measured and the semi-structured interview questions in the second part of the research. Four questions were prepared, and the students were asked to answer these questions. Content and significance analysis were applied to the data obtained from the interview.

4. Results and Discussion

In the first part of the research, the quantitative method was adopted, and the scale formed in this direction; according to the results of factor analysis, it was concluded that the sample volume was sufficient. Kaiser-Meyer-Olkin (KMO) coefficient and Barlett Sphericity test results show that the data are suitable for factor analysis. KMO value was 0.924 and Bartlett test (sd = 253, p = 0,000) was significant.

According to the results of the factor analysis, the eigenvalue ratio is 1, 2, 3 and 10,717-1,520-1,214 respectively. The explained variance ratio is 58,599.

As a result of the factor analysis, the scale items were scattered in three dimensions. As a result of repeated factor analysis, factor loads, mean values, variance values are shown in the table below.

Table 1: Repeated factor analysis matrix of rotated components

Scale items	**1. Factor**	**2. Factor**	**3. Factor**	$\bar{x}$
CUE4	,729			2,89
CUE6	,722			2,79
CUE8	,675			2,93
CUE7	,674			2,79
CUE9	,664			2,97
CUE5	,663			2,97
CUE3	,661			2,82
CUE1	,620			2,59
CUE2	,561			2,63
CUE22		,783		2,74
CUE20		,757		2,54
CUE23		,702		2,84
CUE19		,656		2,23
CUE21		,570		2,69
CUE11		,505		2,53
CUE12		,472		2,82
CUE13			,774	2,61
CUE17			,766	2,96
CUE18			,730	2,64
CUE16			,636	2,85
CUE14			,602	2,73
CUE15			,551	2,82
Eigenvalues	10,279	1,498	1,196	
Total variants explained	23,498	17,859	17,614	
Total	58,972			

According to the repeated factor analysis, the variance ratio increased to 58,972. A factor load value of up to 0.30 may be considered to be sufficiently large (Buyukozturk, 2002).

Table 2: Scale reliability coefficients

Factor	Items	Cronbach Alfa
Chemistry distance education	22	0,945
Compliance with education and training	9	0,897
Program compliance	7	0,878
Visual competence	6	0,877

The results of the reliability analysis of the scale and its sub-dimensions are shown in the table below. The reliability of the scale is quite high.

Table 3: The correlation coefficients between chemistry distance education scale and its sub-factors

	Compliance with education and training	Program compliance	Visual competence	Chemistry distance education
Chemistry distance education (CUE)	0,860**	0,886*	0,826**	1

The correlation coefficients related to the scale and its sub-dimensions are shown in Table 3. It is possible to state that there is a direct and high-level relationship between the sub-dimensions of the scale.

The frequency values related to the demographic variables of the students are shown in the table below.

62.4% of the students are women. 81.2% of the students are 1. Education students. It was seen that 39.1% of the mothers 'education level and 53% of the fathers' education level were at primary level. It was determined that 43.6% of the students had family income level of 2001-3000 TL. It was determined that 85.9% of the students were studying in the chemistry department and 62.4% of them were studying in the first grade.

As a result of the tests conducted on the normal distribution of the data, it was seen that the data were not distributed normally, and non-parametric tests were applied in the analyzes. According to the test results related to scale dimensions with variables, no significant results were obtained from demographic variables related to gender, type of education, department, class, parent education status, and chemistry distance education and its sub-dimensions. The results of the analysis of variables related to income are given in the table below.

Table 4: Income with chemistry distance education

		N	Mean Rank	X^2	p
Chemistry distance education	≤2000 TL	44	76,88		
	2001-3000TL	65	78,95		
	3001-4000TL	25	72,50	4,01	0,54
	4001-5000TL	7	47,79		
	5001-6000TL	4	62,38		
	6001-7000TL	4	66,00		
Compliance	≤2000 TL	44	77,48		
	2001-3000TL	65	**82,28**		

with	3001-4000TL	25	69,70	11,43	**0,04**
education	4001-5000TL	7	**30,71**		
and	5001-6000TL	4	48,50		
training	6001-7000TL	4	66,50		
	≤2000 TL	44	81,41		
Visual	2001-3000TL	65	74,49		
competence	3001-4000TL	25	74,86	3,48	0,62
	4001-5000TL	7	53,64		
	5001-6000TL	4	69,00		
	6001-7000TL	4	57,00		
	≤2000 TL	44	76,64		
Program	2001-3000TL	65	77,27		
compliance	3001-4000TL	25	70,18	1,86	0,86
	4001-5000TL	7	58,36		
	5001-6000TL	4	84,63		
	6001-7000TL	4	69,75		

A significant relationship was found between the family income of the students and the sub-dimension of chemistry distance education scale for education and training (0.04<0.05). Accordingly, the highest level of eligibility for education and training of students with an income of 2001-3000 TL (82.28), the lowest level of eligibility for higher education and training of students with income level of 4001-5000 TL (30.71) is seen to be formed.

When the students (S) were asked about their thoughts about taking all the courses you took in formal education in the form of distance education; S1, S2, S3, S4 replied that there is no difference between distance and formal education in terms of quality of education. S12 stated that they do not have a computer and therefore have difficulty in accessing the courses.

When the students were asked about their positive thoughts about giving chemistry education as distance education; S3, S4, S5 stated that it provides ease of reaching larger masses. The other students did not express a positive opinion.

When students were asked about their negative thoughts about giving chemistry education as distance education; S6 said that materials will be inadequate. S1, S2, S3, S12, S13 said that cannot be given as distance education and cannot be a useful form of education. S10 said that class environment is the best environment they cannot be enough. S8 said that the opportunity to experiment cannot be in distance education. The other students stated that technical problems such as sound, connection and video are encountered.

How can laboratory applications be performed in distance education? S11 said that I would like to touch the materials with my hands while experimenting. S14 said that practice cannot be done. S6, S7, S8 said that learning in the virtual environment can be balanced with practice at work. S12 said that application is important, the application should be face-to-face.

5. Recommendations

Distance education programs are available in various departments and universities in Turkey. At Kocaeli Vocational School, students take general culture courses in the form of distance education. This study was conducted in order to get the opinions of the students about the distance education of the courses that should be carried out in the laboratory. Improvements can be provided as long as deficiencies in education are identified.

According to the results of quantitative research; low-income students find chemistry distance education suitable for education and training. Providing all courses in the form of distance education, students will be established from costs such as housing, transportation. However, with chemistry distance education, there was no relationship between gender, type of education, parental education level, department and class.

The research consists of two parts, quantitative and qualitative. According to the qualitative research findings; most students stated that the distance education infrastructure was not sufficient. When they took chemistry education as distance education, they stated that this would be enough for theoretical knowledge. However, they did not find it appropriate to provide laboratory applications in the form of distance education. Students want to complete learning with touch as well as visual sense. In a cultural and cognitive context, students are skeptical about taking chemistry education as distance education. In addition, it was obtained from qualitative research that there are still students who do not have a computer even if all the conditions are in place. This deficiency is sufficient to prevent student access to courses.

Similarly, Uzoğlu (2017) found that the majority of the participants did not benefit from distance education activities. In Kaleli-Yılmaz and Guven (2015) 's study, distance education courses are conducted during the course without breaks, communication with the instructor outside of the course can not be established, technical-infrastructure problems constitute the negative opinions of students about distance education. The negative opinions of the students about chemistry distance education coincide with the findings of Kaleli-Yılmaz and Guven.

According to the results of Fis-Erumit (2013: 100), it was found that the use of web-based educational materials by students and instructors was successful. Satisfaction with material use coincides with the results of this research. According to Kennepohl (2001), the students achieved higher success by completing the experiments in the simulation laboratory in a short time. According to the results of the study, students stated that they wanted to be together with the instructor face to face and that they had the opportunity to ask questions at any time, but they could not find this opportunity in distance education. It is possible to state that success and personal trust based on education and learning differ.

6. Conclusion

Although students spend their daily lives with technological tools, it is determined that they are not yet ready for distance education in chemistry especially in terms of transferring laboratory conditions to virtual environment. Technical problems can be solved easily, but from a socio-cultural perspective, distance learning of chemistry should be adopted.

Acknowledgements
Although this study has been applied to vocational school students, computer aided distance education and virtual laboratory applications can be reduced to secondary level and research can be done on students at this level. In addition to this study on distance education in chemistry, it can be realized to include courses such as science, mathematics, biology and physics.

About the Author(s)
Serpil Ozkurt Sivrikaya completed her graduate, master and PhD studies at Karadeniz Technical University. She is working at Kocaeli University. She has scientific publications in various journals. She is currently working on science and chemistry education.

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