Eurasia Journal of Mathematics, Science & Technology Education, 2014, **10**(6), 537-546

A Research on the Generative Learning Model Supported by Context-Based Learning

Fatma Merve Ulusoy & Aysem Seda Onen
Hacettepe University, TURKEY

Received 12 December 2013; accepted 18 March 2014

This study is based on the generative learning model which involves context-based learning. Using the generative learning model, we taught the topic of Halogens. This topic is covered in the grade 10 chemistry curriculum using activities which are designed in accordance with the generative learning model supported by context-based learning. The purpose of this study was to ascertain the effects of the activities on students' motivation towards context-based chemistry learning, their attitudes towards chemistry lessons and their level of success in understanding the halogen concepts that were taught. The sample of the study consisted of 60 grade 10 students in a high school in Ankara, Turkey. The study was conducted using a pretest – posttest design with a control group of 30 students and a treatment group of 30 students. The Context-Based Chemistry Motivation Scale, the Attitudes towards Chemistry Scale and the Halogens Achievement Test were used as data collection tools in the study. The study concluded that the context-based learning activities improved students' motivation in learning chemistry and their attitudes towards the chemistry course as well as increasing their achievement levels in the test.

Keywords: Context-based learning, generative learning model, context-based chemistry motivation, attitudes towards chemistry.

INTRODUCTION

Gaining understanding of students' experiences in daily life is closely related to the teaching and learning of chemistry in present times. Attempting to teach students the intensive theoretical knowledge of chemistry courses results in students perceiving the subject to be dry and abstract. As a result, there have been changes in the motivation and attitudes of students towards chemistry courses as well as in their in chemistry (Becker, 1983; Gräber, 1992; Osborne & Collins, 2001; Pekdağ, 2010; Todt, 1985; Wanjek, 2000). Therefore, awareness of the need to bridge the gap between students' daily life experiences and the content of chemistry courses has resulted in interpreting chemistry topics around students' daily life events (Huntemann, Paschmann, Parchmann & Ralle 1999; Koçak, 2012). Introducing chemistry topics by relating them to daily life events and increasing the quality of education has highlighted the utilization of the context-based approach in chemistry teaching (Acar & Yaman, 2011; Bennett & Lubben, 2006; Demircioğlu, Demircioğlu, Çalık, 2009; Huntemann, Haarmann & Parchmann, 2000; King & Ritchie, 2013; Ramsden, 1997; Schwartz, 2006; Van Driel, Bulte & Verloop, 2005; Vos, Taconis, Jochems & Pilot, 2011). In the context-based approach contexts are used as the starting points for developing scientific thoughts (Bennett, Lubben & Hogarth, 2006; Ramsden, 1997). The main aim of the context-based approach is to present scientific concepts to students through selected daily life events, and as a result anticipating an increase in their motivation as well as their willingness to learn chemistry (Barker & Millar, 1999; Köse &

Correspondence to: Fatma Merve Ulusoy;
Faculty of Education, Department of Secondary Science and Mathematics Education Chemistry Education Programmes, Hacettepe University, 06800 Beytepe/ Ankara/ TURKEY
E-mail: fmerveulusoy@gmail.com
doi: 10.12973/eurasia.2014.1215a

ISSN: 1305-8223

State of the literature

- Recently, greater importance has been given to the relevance of chemistry education in the events that we face in our daily lives.
- Context-based learning has been supported simultaneously with a model, method and technique in research projects.
- Current researches show that context-based learning generally positively affects students' interests, attitudes, motivation and success in the field of science.

Contribution of this paper to the literature

- In this research, it is aimed to find out the effects of context-based learning on a specified science topic (Halogen). The topic has been taught by relating students' daily life experiences to their chemistry background knowledge.
- Studies conducted related to context-based chemistry teaching in terms of motivation was accomplished using qualitative methods. In this respect, the Context-Based Chemistry Motivation Scale designed to assess context-based chemistry motivation is the first data collection tool that has been documented in the literature.
- It is expected that meeting students' needs and desires to learn a subject using context-based learning activities will make a positive contribution to the research literature in this field.

Tosun, 2011). In this way, it is aimed to positively influence the interests and attitudes of students towards science. Additionally, raising awareness of the relationship between real life issues and science would foster the development of science process skills (Sözbilir, Sadi, Kutu & Yıldırım, 2007). The context-based approach focuses directly on the daily life events and relates these events to chemistry concepts or topics in the form of contexts. Selection of appropriate contexts and teaching through these contexts would help to maintain the students' attention in the lessons (Ünal, 2008).

The integration of the context-based approach into the chemistry course is referred to in the literature as "context-based chemistry". (Huntemann et al., 1999; Parchmann et.al, 2006). The aims of context-based chemistry are to avoid the implementation of a heavy curriculum and to establish a teaching program of events that are connected to the daily life experiences of students. In this way, the chemistry course is related to the daily life events of students with the help of contexts. During the establishment of links and contexts, students' experiments involving materials that are commonly available are utilized (Gilbert, 2006; Karagölge & Ceyhun, 2002; Palmer, 1997). According to the context-based approach, teaching environments are expected to facilitate students' learning through extracts from daily life events and experiences. This would require students to attain skills to perform activities using daily life tools along with their theoretical or experimental knowledge. For instance, starch, hydrochloric acid, tincture of iodine and such substances could be used in determining the iodine content in table salt (Böcher, 2005), alcohol and cough pastilles could be burned to release CO_2 gas (Ledwig & Nick, 2009), the chloride content could be determined in cleaning agents such as bleach or hydrochloric acid (Böcher, 2005), and chocolate could be decomposed using acetone (Wörn, Melle & Bader, 1999). These types of experiments are in line with context-based chemistry and they have positive influences on students' experimental skills and course achievement levels.

The importance of context-based learning is highly emphasized by the constructivist and sociocultural learning theorists. It is suggested that the context-based learning is quite effective in students' constructing, transferring and implementing knowledge through their own experiences (Andrée, 2003; Gilbert, 2006). Therefore, presenting course contents involving context-based chemistry activities according to the methods, models and techniques in line with the constructive approach in learning resulted in positive effects favoring the achievement of context-based chemistry teaching (Choi & Johnson, 2005; Coştu, 2009; Kerber & Akhtar, 1996; Kutu & Sözbilir, 2011; Toroslu, 2011; Ültay & Ültay, 2013). One of these models is the generative learning model (Ayas, 1995; Çalık, 2006; Karplus, 1960, as cited in Ayas, 1995; Osborne & Wittrock, 1983). The generative learning model was first suggested by Osborne and Wittrock in 1983 (Kyle, Abell & Shymansky, 1989) and was translated into Turkish by Ayas (1995). It is defined as the combination of previous knowledge with new knowledge and it consists of four stages, Preliminary, Focus, Challenge and Application. The model requires the active participation of students in their own learning. Having understanding of this model, teachers could plan their own lessons using their students' existing knowledge and the school facilities that are available (Ayas, 1995).

The need and willingness of students towards learning a topic in chemistry education should be considered from two aspects, namely the teacher and the student. Therefore, it is very important to determine the extent to which the generative learning model supported with context-based learning addresses the requirements of the model. In the light of this view, this study aims to determine the effects of teaching Halogens to 10th Grade students using activities in line with the generative learning model supported with context-based activities on students' motivation to learn chemistry together with their attitudes towards chemistry and their achievement in chemistry courses.

METHODOLOGY

This study was conducted using the pre-posttest design involving a control group and a treatment group. The Context-Based Chemistry Motivation Scale (CBCMS) and the Halogens Achievement Test (HAT) developed by the researcher along with the Attitudes Towards Chemistry Scale (ATCS) developed by Kan & Akbaş (2005) were used in the study. All three data collection tools were administered to the control and treatment groups as pre- and posttests. The researcher taught the Halogens topic to the treatment group using the generative learning model supported with the context-based learning activities. The worksheets that were used in the stages of the model consisted of context-based stories, context-based chemistry experiments, and puzzles – matching questions and open-ended questions. The same topic was taught to the control group using a traditional lecture method, Power Point presentations and with questions and answers.

Course of Teaching in the Treatment Group

At the beginning of the lesson, general information on Halogens was briefly described. This group was taught according to the generative learning model within the frameworks of determined context. The model consists of four phases. The generative learning model allows for the integration of laboratory practice to the course (Ayas, 1995; Hand & Treagust, 1991); therefore, context-based experiments were conducted with the students.

Preliminary Phase

Students in the treatment group were handed out worksheets on the topic of the day. A passage from the first part of the worksheet about a daily life event was read along with the students. Relevant contexts were given to students to arouse their curiosity. Students then participated in a discussion where questions about the reasons for the event were asked.

Focus Phase

In the focus phase of the generative learning model, experiments were performed to concretize the perceptions of students that were acquired in at the preliminary phase. Later on, the observations of students during the experiment and their conclusions were discussed. Following the experiments, students' theoretical knowledge about the periodic characteristics of Halogens, their molecular structures and certain reactions were clarified.

Challenge Phase

In the challenge phase of the generative learning model, students completed the activities on the worksheet (puzzles, matching questions, gap filling). They were informed of various examples of the use of Halogens in everyday life. The activities enabled students to achieve their missing knowledge and establish links with their existing knowledge.

Application Phase

In the final phase of the generative learning model, students tried to solve the problems on worksheets selected from daily life events related to Halogens using the knowledge they had attained. A general evaluation together with the students was made about their understanding about halogens. During the evaluation, the main focus was on enabling students to link their existing knowledge with the new knowledge.

Course of Teaching in the Control Group

The control group was taught about Halogens using the traditional learning approach. The topic was introduced according to the lesson plan that was prepared. The researcher made use of traditional instruction, with a question & answer technique and PowerPoint presentations during the lesson.

Data Collection Tools

The Context-based Chemistry Motivation Scale (CBCMS)

A motivation scale was developed for the study to determine the motivation levels of students towards their learning of chemistry using a context-based approach. The reliability and validity of the scale were assessed with 540 high school students. The scale consisted of 20 items within a 3-factor structure. The responses were based on a 5-point Likert-type scale ranging from 1 for 'strongly disagree' to 5 for 'strongly agree'. The overall Cronbach's alpha reliability coefficient was determined to be 0.91, with values of 0.84, 0.80 and 0.81 for each of the three factors. The Kaiser-Meyer Olkin (KMO) coefficient of the scale was found to be 0.93.

Attitudes towards Chemistry Scale (ATCS)

To determine the effects of the generative learning model supported with context-based learning on students' attitudes towards the chemistry course, the ATCS developed by Kan & Akbaş (2005) was used. The scale consisted of 22 items with three factors based on responses with a 5-point Likert-Type ranging from strongly agree (5) to strongly disagree (1) structure with 3 factors. The factors were named by the researchers as Positive Feelings towards Chemistry Course, Negative Feelings towards Chemistry Course and Chemistry Course Related Activities. The Cronbach's alpha coefficient for the whole scale was 0.92, with values of 0.87, 0.87 and 0.78 for each of the three factors. The structural validity of the scale was assessed through a value of 0.94 for the KMO coefficient.

Halogens Achievement Test (HAT)

An achievement test was developed for the study to determine the achievement levels of the 10th Grade students on Halogens. The test consisted of 20 structured questions. As context-based activities were considered in the study, the questions of the achievement test were related to students' daily life experiences. The pilot study of the test was administered to 491 students and the Cronbach's alpha value was calculated to be 0.73. The average difficulty of the test was found to be (p) 0.62 and the average distinctiveness was determined to be (r) 0.56. Each question had a score of five points and the total score ranged from 0 to 100.

The internal and external validity of the study

Data collection tools were administered to the control and treatment groups for obtaining the internal validity. The researchers evaluated data obtained from each group. A pretest was administered four weeks prior to the beginning of the study while the posttest was administered four weeks after the study was completed. Students in the treatment group were interviewed before the study and informed of the procedure of instruction. As the students were aware that they were a part of the experimental group, to avoid the performance change risk, these students were subject to effective communication and motivation provided by the researchers.

This study was conducted with 10th Grade students from an Anatolian High School in Ankara. The conclusions of this study could be generalized for similar research with other similar groups of students.

FINDINGS

Independent samples t-test analyses were conducted using the averages of students' scores obtained from the ATCS, the CBCMS and the HAT with the aim of determining the any potential significant differences. The results are displayed on Table 1.

Table 1 shows that there was no statistically significant difference between the average pretest scores of the control and treatment group achieved in the ATCS, CBCMS and HAT [$t_{(58)}$= -0.85; -1.95; -.56, p>.05]. This finding suggests that students of the two groups were at similar levels in terms of their attitudes towards chemistry, motivation and achievement.

Paired samples t-test analyses were conducted using the averages of students' scores obtained in the ATCS, CBCMS and HAT at the end of instruction with the aim of determining any potential significant differences. The results are displayed on Tables 2, 3 and 4. (Table 2)

Table 2 shows that there is a statistically significant difference between the pre and posttest scores of students in the ATCS [$t_{(29)}$ = -7.03, p<.05]. While the average attitude scores of students before instruction was ($\bar{X}$ = 2.75), it displayed a significant increased and reached up to ($\bar{X}$ = 3.43) after instruction. In other words, the generative learning model supported with context-based learning was found to have contributed to the development of positive attitudes towards the chemistry course. No significant increase was observed between the pre and posttest scores of the control group students regarding their attitudes towards chemistry [$t_{(29)}$= -1.62, p>.05]. (Table 3)

Table 3 indicates that there was a statistically significant difference between the pre and posttest scores of students in the CBCMS [$t_{(29)}$= -5.59, p<.05]. The average scores of treatment group students in the pretest was ($\bar{X}$ = 3.41) while it increased to ($\bar{X}$ = 4.12) in the posttest after instruction. This conclusion shows that the generative learning model supported by context-based learning improved the motivation of students towards their daily life chemistry experiences. Students in the control group did not show any statistically significant differences between their pre and posttest average scores in the CBCMS [$t_{(29)}$= 0.08, p>.05]. (Table 4)

A statistically significant difference was observed between the pre and posttest HAT averages scores of the treatment group students the [$t_{(29)}$= -12.10, p<.05]. While the halogens test average scores of the treatment group students before instruction was ($\bar{X}$ = 63.67), the average increased to ($\bar{X}$ = 91.17) following instruction. There was also a statistically significant difference between the pre and posttest averages of the students in the control group [$t_{(29)}$= -3.97, p<.05].

While the achievement test average score of the students was ($\bar{X}$ = 65.67) in the pretest, it increased to ($\bar{X}$ = 72.83) following instruction. In other words, the achievement levels of control group students were significantly better than they were before instruction.

Table 1. Independent samples t-test results on the averages of students' scores obtained from the pretests of ACBCMS, CBCMS and HAT (N = 60)

	Group	N	$\bar{X}$	SS	SD	*t*	*p*
Attitudes towards chemistry scale	**Treatment**	30	2.75	0.23	58	-0.85	.39
	Control	30	2.80	0.28			
Context-based chemistry motivation scale	**Treatment**	30	3.41	0.69	58	-1.95	.056
	Control	30	3.73	0.57			
Halogens achievement test	**Treatment**	30	63.67	15.97	58	-0.56	.57
	Control	30	65.67	11.12			

Table 2. T-test results on the pre and posttest averages of control and treatment group students' scores obtained from the attitudes towards chemistry scale (N = 60)

Group	Test	N	$\bar{X}$	ss	sd	t	p
Treatment	**ATCS pretest**	30	2.75	.23	29	-7.03	.00
	ATCS posttest	30	3.43	.50			
Control	**ATCS pretest**	30	2.80	.28	29	-1.62	.11
	ATCS posttest	30	3.03	.77			

Table 3. T-test results on the pre and posttest averages of control and **treatment** group students' scores obtained from the context-based chemistry motivation scale (N = 60)

Group	Test	N	$\bar{X}$	ss	sd	t	p
Treatment	**CBCMS pretest**	30	3.41	0.69	29	-5.59	.00
	CBCMS posttest	30	4.12	0.45			
Control	**CBCMS pretest**	30	3.73	0.57	29	.08	.93
	CBCMS posttest	30	3.73	0.43			

Table 4. T-test results on the pre and posttest averages of control and **treatment** group students' scores obtained from the halogens achievement test (N = 60)

Group	Test	N	$\bar{X}$	ss	sd	t	p
Treatment	**HAT pretest**	30	63.67	15.97	29	-12.10	.00
	HAT posttest	30	91.17	8.06			
Control	**HAT pretest**	30	65.67	11.12	29	-3.97	.00
	HAT posttest	30	72.83	9.97			

After instruction, independent samples t-test analyses were conducted using the average scores obtained from the ATCS, CBCMS and HAT with the aim of determining any potential differences. The results are displayed in Table 5. (Table 5)

Table 5 indicates that there is a statistically significant difference between the average scores obtained by students in the control and treatment groups in the posttest of the ATCS in favour of the treatment group [$t_{(58)}$= 2.38, p<.05]. This finding shows that the

Table 5. T-test results of the posttest scores obtained from the attitudes towards chemistry scale, context-based chemistry motivation scale and halogens achievement test (N = 60).

	Group	N	$\bar{X}$	ss	sd	t	p
ATCS	Treatment	30	3.43	0.50	58	2.38	.02
	Control	30	3.03	0.77			
CBCMS	Treatment	30	4.12	0.45	58	3.41	.001
	Control	30	3.73	0.43			
HAT	Treatment	30	91.17	8.06	58	7.83	.00
	Control	30	72.83	9.97			

generative learning model supported by context-based learning affected students' attitudes when compared to the traditional teaching approach.

The posttest average scores of the control and treatment group students in the CBCMS were significantly different [$t_{(58)}$= 3.41, $p<.05$]. The posttest score averages of the treatment group students in the CBCMS ($\bar{X}$=4.12) was higher than that of the control group, which shows that the generative learning model supported by context-based learning positively affected students' motivations towards their daily life experiences in chemistry.

The HAT results showed that there was a statistically significant difference between the posttest scores of the control and treatment group students favoring the treatment group [$t_{(58)}$= 7.83, $p<.05$]. The posttest score averages of the treatment group students in the HAT ($\bar{X}$=91.17) was higher than that of the control group ($\bar{X}$=72.83), which shows that the generative learning model supported by context-based learning increased students' achievement levels about the halogens.

CONCLUSION AND DISCUSSION

Context-based learning is an approach depending on the principle that scientific concepts should be presented through certain methods by establishing contexts and relationships selected from students' daily life events (Barker & Millar, 1999; Gilbert, 2006). In the light of this perspective, it aims to increase students' motivation and attention towards the lesson, while encouraging them to learn about science and develop positive attitudes towards the courses, which in turn would increase their achievement levels (Barker & Millar, 1999; Gilbert, 2006; Köse & Tosun, 2011; Palmer, 1997; Yaman, 2009). In this study, the topic was introduced within the generative learning model with the selection of appropriate contexts for the students to establish links between the halogens and daily life events. The findings of the study indicate that as a result of the context-based learning activities, students' context-based chemistry motivation improved along with their attitudes towards the chemistry course, while their achievement levels in the Halogens test increased.

At the beginning of the study, it was assumed that there was no significant difference between the context-based chemistry motivations of students in the control and treatment groups. After the completion of the study, students in the treatment group, who were taught according to the context-based learning methodology, were observed to have increased levels of context-based chemistry motivation, while those of the control group, who received traditional instruction, were identified to have no significant differences in their context-based chemistry motivations. As the topics were not taught within the contexts in the control group, it is an expected result that there were no significant changes in the students' context-based chemistry motivation. In the treatment group, establishing connections with their daily life experiences using relevant contexts as aimed at creating curiosity among students, which increased their motivation accordingly. There are various studies in the literature indicating that context-based learning increases students' motivation (İlhan, 2010; Kesner, Hoffstein & Ben-Zvi, 1997; Koçak, 2012; Kutu & Sözbilir, 2011; Lubben, Campbell & Dlamini, 1996; Murphy & Whitelegg, 2006). Peşman and Özdemir (2012) examined the effects of context-based physics teaching on the motivation of students towards physics. The study concluded that no significant change was observed in students' motivation towards learning physics.

It was assumed that as there were changes in the context-based chemistry motivation of students, their attitudes towards chemistry would also change. The ATCS that was administered to the students in both groups as a pretest prior to the initiation of the study concluded no statistically significant difference in their attitude scores. After the study was completed, the scale was administered as a posttest and a significant increase was observed in the attitude scores of the students in the treatment group. Meanwhile, no significant changes were observed in the attitude scores of the students in the control group. This conclusion is in line with the outcomes of various studies on context-based learning approach in the literature (Demircioğlu, 2008; Gutwill-Wise, 2001; Henderleiter & Pringle, 1999; İlhan, 2010; Kesner, Hofstein & Ben-Zvi, 1997; King, Bellocchi & Ritchie, 2008; Koçak, 2012). Conclusions of studies on other disciplines other than chemistry also suggest that context-based learning positively affected students' attitudes towards the courses (Barker & Millar, 1999; Çam, 2008; Hırça, 2012; Kim, Yoon, Rae Ji & Song 2012; Ramsden, 1997; Reid, 2000;). However, there are studies in the literature, which have concluded that context-based learning activities did not have significant effects on students' attitudes towards the courses (Kutu & Sözbilir, 2011; Sari, 2010; Ünal, 2008).

The HAT that was administered to the students to determine their achievement levels before the study, showed that there were no significant differences between the achievement test averages of the students in both groups. After the study was completed, an increase was observed in the achievement scores of all students in both control and treatment groups. However, the posttest results indicated that the achievement levels of the students in the treatment group were higher than those of the students in the control group. The literature documents various studies that indicate higher achievement levels as a result of context-based learning approaches similar to this study (Toroslu, 2011; Demircioğlu, 2008; İlhan, 2010; Ramsden, 1997; Steinhoff, 2004; Koçak, 2012; Ünal, 2008).

While society is rapidly changing, individuals should adapt to the developing society and change their attitudes or behaviors, which is one of the most important functions of science education. Additionally, it is very important that the presentation and instruction of course topics should be reasonable, understandable and useful (Ruis, 1988; Yücel, 2007). The context-based chemistry learning approach is recognized as an approach that is in line with the targets of effective chemistry teaching. Accordingly, it could be supported with various methodologies and models that are based on the constructive approach. The study concluded with significant increases in students' achievement levels along with their attitudes towards chemistry. All these significant findings have been related to and interpreted to improvements in students' motivation towards context-based learning. In addition to this, the CBCMS used in the study, has the specifications of a valid and reliable data collection tool assessing motivation towards context-based learning. The studies for assessing motivation carried out up to now, were conducted with qualitative methods. In this sense, this data collection tool designed to assess motivation has the feature of being the first quantitative tool documented in the literature. The findings of the study indicate that the generative learning model supported with the context-based learning approach would make positive contributions to the teaching process and would be a relevant educational model that relates chemistry teaching to the daily life events of students.

ACKNOWLEDGEMENTS

This research, as a part of my master's thesis, was supported by Hacettepe University Scientific Research Projects Coordination Unit.

REFERENCES

Acar, B., & Yaman, M. (2011). The effects of context-based learning on students' levels of knowledge and interest. *Hacettepe University Journal of Education, 40*, 1-10.

Andrée, M. (2003, August 19-23). *Everyday-life in the science classroom: A study on ways of using and referring to everyday-life.* Paper presented at the ESERA Conference, Noordwijkerhout, The Netherlands.

Ayas, A. (1995). Fen bilimlerinde program geliştirme ve uygulama teknikleri üzerine bir çalışma: İki çağdaş yaklaşımın değerlendirilmesi. (A study on curriculum development and application techniques: Evaluation of two modern approaches). *Hacettepe University Journal of Education*, *11*, 149-155.

Barker, V., & Millar, R. (1999). Students' reasoning about basic chemical reactions: What changes occur during a context-based post-16 chemistry course? *International Journal Science Education, 21*(6), 645-665.

Becker, H. J. (1983). Eine empirische untersuchung zur beliebtheit von chemieunterricht. (An empirical investigation on the popularity of chemistry teaching). *Chimica Didactica, 2,* 97-123.

Bennett, J., & Lubben, F. (2006). Context-based chemistry: The Salters approach. *International Journal of Science Education*, *28*(9), 999-1015.

Bennett, J., & Lubben, F. & Hogarth, S. (2006). Bringing science to life: A synthesis of the research evidence on the effects of context-based and sts approaches to science teaching. *Science Education*, *91*(3), 347-370.

Böcher, J. (2005). Halogenverbindungen im alltag. (Halogen compounds in everyday life). Retrieved August 12, 2011, from http://www.chids.de/dachs/expvortr/719Halogenverbindungen_Boecher.pdf

Choi, H. J., & Johnson, S. D. (2005). The effect of context-based video instruction on learning and motivation in online courses. *The American Journal of Distance Education*, *19*(4), 215-227

Coştu, S. (2009). *Teacher experiences from a learning environment based on contextual teaching and learning in mathematics teaching.* Master's Thesis, Karadeniz Technical University, Trabzon, Turkey.

Çalık, M. (2006). Devising and implementing guide materials related to solution chemistry topic in grade 9 based on constructivist learning theory. Doctoral Dissertation, Karadeniz Technical University, Trabzon, Turkey.

Çam, F. (2008). *The effects of context-based learnıng approach in biology lesson.* Master's Thesis, Atatürk University, Erzurum, Turkey.

Demircioğlu, H. (2008). *Developing instructional materials about the topic of states of matter based on the context based approach for primary students teachers and probing their effectiveness.* Doctoral Dissertation, Karadeniz Technical University, Trabzon, Turkey.

Demircioğlu, H., Demircioğlu, G., & Çalık, M. (2009). Investigating effectiveness of storylines embedded within context based approach: A case for the periodic table. *Chemistry Education Research and Practice, 10,* 241-249.

Gilbert, J. K. (2006, September 7-9). *Context-based approaches to the design of science curricula*. Paper presented at the 7.National Sciences and Mathematics Education Conference, Ankara, Turkey.

Gräber, W. (1992). Interesse am unterrichtsfach chemie, an inhalten und tätigkeiten. (Interest in subject chemistry, contents and occupations). *Chemie in der Schule, 39*(10), 354-358.

Gutwill-Wise, J.P. (2001). The impact of active and context-based learning in introductory chemistry courses: An early evaluation of the modular approach. *Journal of Chemical Education*, *78*(5), 684–690.

Hand, B., & Treagust, D. F. (1991). Student achievement and science curriculum development using a constructivist framework. *School Science and Mathematics*, *91*(4), 172-176.

Henderleiter, J., & Pringle, D.L. (1999). Effect of context-based laboratory experiments on attitudes of analytical chemistry students. *Journal of Chemical Education, 76*(1), 100-106.

Hırça, N. (2012). The effects of hands on activities depend on context-based learning approach on understanding of physics and attitudes towards physics course. *Mustafa Kemal University Journal of Social Sciences Institute 9*(17), 313-325.

Huntemann, H., Haarmann, E. M., & Parchmann, I. (2000). Schüleraussagen zur unterrichtsreihe 'treibstoffe in der diskussion': Eine erste untersuchung zur konzeption chemie im kontext. (Students' views about instructional plan 'fuels in the discussion': First investigation about context based learning). *CHEMKON*, *7*(3), 131-136.

Huntemann, H., Paschmann, A., Parchmann, I., & Ralle, B. (1999). Chemie im kontext-ein neues konzept für den chemieunterricht? Darstellung einer kontextorientierten konzeption für den 11. jahrgang. (Is context-based learning a new concept for chemistry lessons? Representation of context-oriented concept for 11. grade). *CHEMKON, 6*(4), 191-196.

İlhan, N. (2010). *The effect of context based approach on the learning of chemical equilibrium.* Doctoral Dissertation, Atatürk University, Erzurum, Turkey.

Kan, A., & Akbaş, A.(2005). A study of developing an attitude scale towards chemistry. *Mersin University Journal of the Faculty of Education*, *1*(2), 227-237.

Karagölge, Z., & Ceyhun, İ. (2002). Öğrencilerin bazı kimyasal kavramları günlük hayatta kullanma becerilerinin tespiti. (Determination of students' using skills of some chemical concept in daily life). *Kastamonu Education Journal*, 10(2), 287-290.

Kerber, R. C., & Akhtar, M. J. (1996). Getting real: A general chemistry laboratory program focusing on 'real world' substances. *Journal of Chemical Education, 73*(11), 1023-1025.

Kesner, M., Hofstein, A., & Ben-Zvi, R. (1997). Student and teacher perceptions of industrial chemistry case studies. *International Journal of Science Education, 19*(6), 725-738.

Kim, M., Yoon, H., Rae Ji, Y., & Song, J. (2012). The dynamics of learning science in everyday contexts: A case study of everyday science class in Korea. *International Journal of Science and Mathematics Education*, *10*(1), 71–97.

King, D., Bellocchi, A., & Ritchie, S. M. (2008). Making connections: Learning and teaching chemistry in context. *Research in Science Education*, *38*, 365-384.

King, D. T., & Ritchie, S.M. (2013). Academic success in context-based chemistry: demonstrating fluid transitions between concepts and context. *International Journal of Science Education, 35(7),* 1159-1182.

Koçak, C. (2012). Evaluation of chemistry topics within the daily life concept. *Hacettepe University Journal of Education, 42,* 262-273.

Köse, E., & Tosun, F. (2011). Effect of context based learning in students' achievement about nervous system. *Journal of Turkish Science Education, 8*(2), 91-106.

Kutu, H., & Sözbilir, M. (2011). Teaching chemistry in our lives unit in the 9th grade chemistry course through context-based ARCS instructional model. *Ondokuz Mayıs University Journal of Education*, *30*(1), 29-62.

Kyle, W. C., Abell, S., & Shymansky, J. A. (1989). Enhancing prospective teachers' conceptions of teaching and science. *Journal of Science Teacher Education*, *1*(1), 10-13.

Ledwig, G., & Nick, S. (2009). Das ende der pharao-schlangen? (The end of the Pharaoh's serpent).*CHEMKON, 16*(1), 38.

Lubben, F., Campbell, B., & Dlamini, B. (1996). Contextualizing science teaching in Swaziland: some student reactions. *International Journal of Science Education*, *18*(3), 311-320.

Murphy, P., & Whitelegg, E. (2006). *Girls in the physics classroom:A review of the research on the participation of girls in physics*. London, UK: Institute of Physics Report.

Osborne, R. J., & Collins, J. (2001). Pupils' views of the role and value of the science curriculum: A focus group study. *International Journal of Science Education, 23*(5), 441-467.

Osborne, R.J., & Wittrock, M.C. (1983). Learning science: A generative process. *Science Education*, 67 (4) 489-508.

Palmer, D. (1997). The effect of context on students' reasoning about forces. *International Journal of Science Education*, *19*(6), 681-696.

Parchmann, I., Graesel, C., Baer, A., Nentwig, P., Demuth, R., & Ralle, B. (2006). Chemie im kontext: A symbiotic implementation of a context-based teaching and learning approach. *International Journal Science Education, 28*(9), 1041-1062.

Pekdağ, B. (2010). Alternative methods in learning chemistry: Learning with animation, simulation, video and multimedia. *Journal of Turkish Science Education, 7*(2), 79-110.

Peşman, H., & Özdemir, Ö. F. (2012). Approach–method interaction: The role of teaching method on the effect of context-based approach in physics instruction. *International Journal of Science Education*, *34*(14), 2127-2145.

Ramsden, M. J. (1997). How does a context-based approach influence understanding of key chemical ideas at 16+?. *International Journal of Science Education*, *19*(6), 697-710.

Reid, N. (2000). The presentation of chemistry logically driven or applications-led?. *Chemistry Education: Research and Practice In Europe*, *1*(3), 381-392.

Ruis, S.P. (1988). Something's wrong with chemistry textbooks. *Journal of Chemical Education, 65*, 720–721.

Sari, Ö. (2010). *Developıng a materıal based on the context based approach on the topıc the earth and the unıverse for the 5th grade prımary students*. Master's Thesis, Gazi University, Ankara, Turkey.

Schwartz, A. T. (2006). Contextualised chemistry education: The American experience. *International Journal of Science Education, 28*(9), 977-998.

Sözbilir, M., Sadi, S., Kutu, H., & Yıldırım, A. (2007, June 20-22). *Kimya eğitiminde içeriğe/bağlama dayalı (context-based) öğretim yaklaşımı ve dünyadaki uygulamaları*. (Context-based learning in chemistry teaching and its applications in the world). Paper presented at I. National Chemistry Education Congress, Istanbul, Turkey.

Steinhoff, B. (2004). *Wissens- und kompetenzerwerb in einem unterricht nach chemistry ım kontext- exemplarische entwicklung eines wissenstests für die unterrichtseinheit (k) ein auto ohnne kunststoffe*. (Knowledge and expertise working in a teaching chemistry in the context of exemplary development of a knowledge tests for the teaching unit (not) a car without plastics). Doctoral Dissertation, Cristian-Albrechts University, Kiel, Germany.

Toroslu, S. (2011). *Effect of 7E learning model integrated with real-life context based instruction on students' conceptual achievement, misconceptions and science process skills about energy*. Doctoral Dissertation, Gazi University, Ankara, Turkey.

Ünal,H. (2008). *Researchıng the effects of conductıng the prımary school scıence and technology lesson accordıng to context based approach on the matter-heat subject*. . Master's Thesis, Atatürk University, Erzurum, Turkey.

Ültay, E., & Ültay, N. (2013). Designing, implementing and evaluating a context-based instructional materials on buoyancy force. *Energy Educatıon Science and Technology Part B: Social and Educational Studies*, *5*(1), 385-394.

Van Driel, J. H., Bulte, A. M. W., & Verloop, N. (2005). The conceptions of chemistry teachers about teaching and learning in the context of a curriculum innovation. *International Journal of Science Education*, *27*(3), 303-322.

Vos, M. A. J., Taconis, R., Jochems, W. M. G., & Pilot, A. (2011). Classroom implementation of context-based chemistry education by teachers: The relation between experiences of teachers and the design of materials. *International Journal of Science Education*, *33*(10), 1407-1432.

Wanjek, J. (2000). *Einflüsse von alltagsorientierung und schülerexperimenten auf den erfolg von chemieunterricht*. (The effects of everyday orientation and student experiments on the performance of chemistry teaching). Doctoral Dissertation, Westfälischen Wilhelms-University, Münster, Germany.

Wörn, A., Melle I., & Bader H. J. (1999). Einfache stofftrennung am beispiel schokolade genussmittel im anfangsunterricht chemie. (Simple separation of substance for example chocolate in teaching elementary chemistry). *CHEMKON*, *6*(1), 25.

Yaman, M. (2009). Context and methods on respiration and energy acquisition interesting for students. *Hacettepe University Journal of Education*, *37,* 215-228.

Yücel, A.S. (2007). An analysis of the factors affecting student achievement in chemistry lessons. *World Applied Sciences Journal*, *2*(S) 712-722.