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An Effective Model to Increase Student Attitude and Achievement: Narrative Including Analogies

Nalan Akkuzu, Husamettin Akcay
University of Dokuz Eylul, Izmir, Turkey

This study describes the analogical models and narratives used to introduce and teach Grade 9 chemical covalent compounds which are relatively abstract and difficult for students. We explained each model's development during the lessons and analyzed understanding students derived from these learning materials. In this context, achievement, chemistry attitude scales and semi-structured interviews were used to analyze the effectiveness of these new learning material based on narratives and models. The lesson and data were subject to independent which analyzes the following outcomes obtained: We planned to use the students' pre-knowledge wherever possible, responded the questions with narratives and extended and enriched analogies. We discussed where each analogy broke down but did not cause misconceptions. The data were drawn for two Grade 9 randomly selected as pre- and post- lesson interviews, CCAT (covalent compounds' achievement test) and CAS (chemistry attitude scale). This experimental research was conducted in the first term of 2009-2010 educational years. The EG (experimental group) was instructed through model and narrative including analogies based method with using sheets, whereas the CG (control group) was utilized by traditional teacher-centered method. The study carried out on 60 high school students in Izmir, Turkey. The differences of CG and EG tests were outlined. According to statistical analyzes of data, there was a significant difference between pre- and post- tests ($p < 0.05$) of EG and CG. The results showed that EG was more successful than CG. Consequently, it was determined that students' interests and attentions may easily attract with using model and analogy assisted by a narrative. Finally, it can be said that models, analogies and narratives are great ways to illustrate teaching, training and science lessons having abstract and complex characters.

Keywords: narrative-based learning, analogy, model, chemistry achievement, chemistry attitude, covalent compounds

Introduction

Narratives are the oldest and most natural and powerful formalism for storing and describing experimental knowledge that is essential to learning science. The studies suggest that, as science teachers, we spontaneously use analogies in narratives to help pupils and students understand. While modeling is being defined with an unknown moving target from available resources to make clear the actions, the model is its resulting product (Harrison & Treagust, 1996). Using models and narratives to teach chemistry at the level of universities and high schools increase its effectiveness and permanence from day to day (Montgomery, 2001). Model, including narratives and analogies, is scientific and mentally activities to make easy to understand and learn complicated

Nalan Akkuzu, Department of Chemistry Education, University of Dokuz Eylul.
Husamettin Akcay, Department of Chemistry Education, University of Dokuz Eylul.

phenomenon (Paton, 1996; Egan, 1999). An event difficult to comprehend may facilitate using another incident described by a model and narratives. In this case, an unfamiliar fact is a target while a familiar phenomenon is a source.

We used narrative because of its potential to be engaging and situate information in familiar contexts (Brown, Collins, & Duguid, 1989; Lave & Wenger, 1991; Polkinghorne, 1988; Young, 1993). Narrative is regarded as one of the most appropriate pedagogical approaches for teaching and learning of science at all levels of education (Bruner, 1990; Clandinin & Connelly, 1996; Eisner, 1994; Oliver, 1998). According to Bruner (1990), narrative promotes a different kind of thinking than didactic information. Narrative thinking involves matching a problem, situation or an idea to the narrative schema. It is a heuristic process, one which requires skill, judgment and experience. While presenting information as facts can lead to logical or paradigmatic modes of thought, it leaves little room for interpretation or imagination (Robinson, John, & Linda, 1986).

Narrative, however, can represent human behavior and events as lived experience in a manner that offers opportunity for interpretation and imagination, prompting learners to infer meanings that are not explicit. In fact, many insist that human beings think in narrative form and that our most memorable experiences are held in mind as narratives (Fisher, 1995; Sarbin, 1986; Spence, 1982; Vitz, 1990). Epistemologically, the use of narrative in instruction relies on a constructivist perspective or the view that knowledge is constructed rather than transmitted. Learners play an active role in their own learning, which many have experience curiosity, mystery and even wonder.

The science teachers use analogies and narratives extensively due to models but with little advance preparation or introducing after explaining the target idea. They recognized that opportunities for students understanding were limited as teachers often did not fully explain the analogy used. A more systematic and planned use of constructivist learning materials as models and narratives in teaching may provide significant help to students in grasping concepts. Raghavan and Glaser (1995) showed that by making models of a central feature of the learning process, students were able to show high levels of conceptual understanding. This qualitative was reasoning by the use of models “concretized” abstract ideas, and gave pupils a greater cognitive understanding, not only of the idea, but also the processes and reasoning by which the concept was modeled. Importantly, they also noted that previous underachievers participated with greater positive contribution. More recent studies have confirmed the learning gains which can be achieved by making models based on analogy and narrative, modeling and their evaluation to the learning process (Lave & Wenger, 1991; Polkinghorne, 1988).

The students enjoy using innovative learning materials like narrative and model which provide an interesting visual and stimulating way of understanding chemical abstract and complex concepts. A lot of researches show that models including analogies connected to daily life can really help and motivate low achievement students (Egan, 1999; Harrison & Treagust, 1996; Jarman, 1996; Haury, 1989). An important constructivist methodology entails the elicitation, analyzes and inclusion of narratives as a primary form of instructional support while learning to chemical abstract concepts.

In this work, the effect of using models, analogies and narratives to make easy to learn abstract chemical subject as covalent compounds was studied. For this purpose, we searched answers to following question: Is there any difference between CG (control group) and EG (experimental group) on the students’ achievements and the attitude in chemistry lesson? While an EG learned using a new learning material supported with models,

analogies and narratives, a second group was taught in a more traditional teacher-centered manner (called the traditional group). Additionally, it was carried out as a qualitative study towards the students' ideas about new learning material.

Method

In this research, the randomized pretest-posttest control group design was used. The measure was carried out on to randomly selected groups. The study was carried out on 60 high school students in Izmir (a province in Aegean Region, Turkey). The research covered a CG consisting of 30 and an EG consisting of 30 students. The research was applied during five weeks in the first semester of 2009-2010 educational years. The CG was learned traditionally while the EG had a model- and narrative- based learning material. A statistical evaluation was made to determine the efficiency of the new learning material.

Research data were collected at different situations as described in the following overview:

(1) Pre- and post- lesson interviews which focused on model- and narrative- based education and attitude towards chemistry lesson;

(2) Achievement pre-test and post-test;

(3) Attitude pre- and post- scales.

Interview Questions

Interviews are the key elements of data collection in quantitative research and together supported findings discussed in data analysis. A qualitative research will be more valuable if it is supported by the quantitative data. In this sense, it should be benefited from qualitative research which can provide support to the quantitative research and measurements. For this, ten students were taken with semi-structured interview questions about model and narrative teaching method. To obstruct taking same ideas, students were randomly selected from EG. This interview approach provided depth information, easy analyzing and more systematic and comparable information from different individuals. In generally, four planned questions were asked. But, the questions were exchanged during the interview. So, it was provided with comfortable environment by using familiar language and open-ended questions. The purpose of the interview was to gather information about what each student thought and understood about model and narratives including analogies and how this method does an impact on the students' attitudes towards chemistry lesson. For the purpose of determining, the opinions of teacher candidates concerning model and narratives including analogies applications and attitudes towards chemistry lesson. The following open-ended questions were inquired:

(1) What do you think about effectiveness of model- and narrative- based learning in covalent compounds? Why?

(2) Do you want that model- and narrative- based learning method will be used for the other subject in chemistry? Why?

(3) Which properties do you like/don't you like in model- and narrative- based learning method? Why?

(4) Did your attitude towards chemistry lesson change after the model- and narrative- based learning implementation? How?

CCAT (Covalent Compounds Achievement Test)

The purpose of this test was to measure the achievement of students on covalent compounds unit. To prepare valid and reliable test, it was not only used objects of Grade 9 class chemistry curriculum program of

Ministry of National Education, but also was added new objects. The objects created by the researchers were formed according to Bloom taxonomy including knowledge, comprehension and application steps. This scale was applied to 140 students who committed this subject in the previous years for reliability analysis. It was used TAP (Test Analyze Program) for reliability of achievement test. Cronbach α-reliability coefficient was measured as 0.80. After the reliability analysis six items were removed and 27 items applied for pre- and post- tests.

ChAS (Chemistry Attitude Scale)

A ChAS of 23 items in a five-point Likert-type scale ("Fully agree", "Agree", "Undecidedly agree", "Disagree" and "Fully disagree") was used. This scale included 12 positive and 11 negative questions. Its α-reliability coefficient was 0, 89. It is used for analyzing the difference between control and experimental groups (Onal, 2006).

Procedure

Firstly, we organized a seminar to meet teachers and EG students on application of the new constructivist analogy- and narrative- based learning material and models on covalent compounds before to teach. An achievement test and attitude scales were applied before beginning to experimental process. Semi-structured interview was conducted with ten students from EG before the implementation. Then, to compare the effectiveness of model- and narrative- based teaching with this regular class (CG) which learned using traditional teacher-centered method with plain language, question and answer technical and demonstrative experiments, an active learning method based on model, analogy and narrative was used for EG. Our learning style allows active participation of students to the courses during the teaching activities. The subject was explained with some guide materials including model and narrative which were developed from researchers who brought the students as active in the field of education.

In this work, a new instructional material using models and narratives for Grade 9 chemistry courses about covalent compounds was prepared as an alternative to traditional written material. These new constructivist materials including models and narratives give opportunity to students to make analogy with their daily life. The new chemistry learning material's benefits were evaluated more precisely on students' motivations and interests.

The narratives were "boy as bonding electrons, girl as protons" and "separated twine" that the language of science, central on how people understand the word in which they live, serves as a means to learn and communicate personal understanding with others.

Here, different models were used for making easy to understand covalent compounds. The idea to create these models was coming from how the electrons make a covalent bond desirable. These models are shown in Figures 1, 2 and 3.

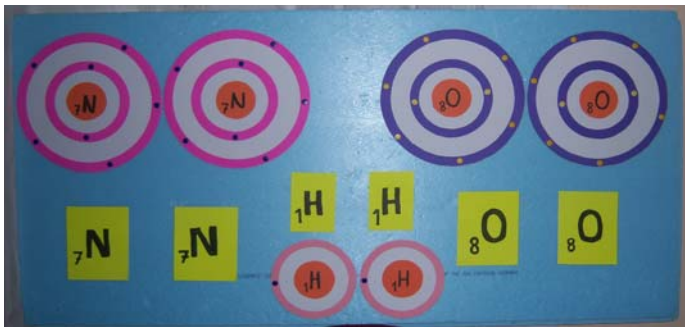

Figure 1. Analogy and models of non-polar covalent compounds.

Figure 1 shows that some non-metals' models are constructed non-polar covalent compounds. During the lesson, these models were indicated to experimental group for teaching non-polar covalent bonds and compounds.

While students had a problem of reading elements in the covalent compounds, the rotating wheel was prepared to make easy reading elements (see Figure 2).

Figure 2. The reading of the element number in the covalent compound.

Figure 3 shows polar and non-polar covalent bonds in H_2O and CO_2 covalent compounds. With these models were tried to find following questions' answers by students: "How does covalent bonds in H_2O and CO_2 compounds occur and how are electrons' movements in compounds?".

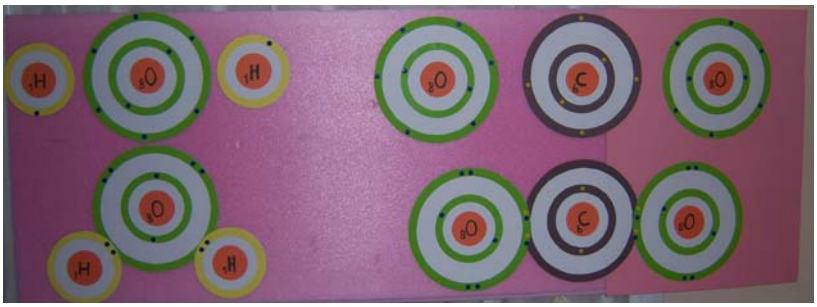

Figure 3. Analogy and models of H_2O and CO_2 covalent compounds.

In a tight cooperation between teachers, all courses applied to the experimental and control groups were conducted by the researchers. In this study, plans, subject of the name, time, equipment and materials, goals and attitudes, course introduction, development and result activities were prepared according to the model- and narrative- based education.

After the experimental implementation, achievement test and attitude scales were applied. The ideas about model and narrative-based education of same ten students were taken with semi-structured interview questions.

Data Analysis

Analyzes for Achievement Test

Achievement test was calculated over 27 full scores. Each question has one score. Achievement test was applied as pre-test and post-test. Firstly, it was used for revealing the equality of CG and EG. After the end of the experimental operation, it was implemented for analyzing significance between pre-test and post-test scores of EG and CG. At the end of the applications, data obtained from correct answers were described as "1" score and incorrect responses as "0" score. It was used SPSS (statistical package for the social sciences), Version

15.0 for Windows program including independent *t*-test and dependent *t*-test to analyze all of the quantitative data was used. So, mean, standard deviation and *t*-values of CG and EG scores were calculated.

Analyzes on Attitude Scale

Attitude scale consisted of 23 items. Scale was both Likert type and had five degrees with the alternatives of "Fully agree", "Agree", "Undecidedly agree", "Disagree" and "Fully disagree". The scores of positive sentences were calculated "5", "4", "3", "2" and "1", respectively. On the contrary, negative sentences were calculated as "1", "2", "3", "4" and "5". Therefore, this scale consisting of 23 items was taken maximum 115 scores and the minimum score was 23. Attitude scale was implemented before and after the experimental processes. Data obtained were entered by using SPSS, Version 15.0 for Windows program. Standard deviation and *t*-values of the scores of EG and CG were calculated.

Analysis on Semi-structured Interview

Semi-structured interview was conducted by ten students at EG. During the interview, four planned questions were asked. The data obtained from the interview was written as a text, and then reliability study of it was implemented. All interviews were recorded with audio-tape. The reliability of the interview was provided with being calculated of percentage agreement of interview transcribed. While percentage agreement of interview was being calculated, the data were transcribed and coded by two researchers. Then, by comparing two texts, percentage agreement of interview between codes was found as 0.88. Firstly, categories were identified from these answers. In the next stage, these categories were counted and transformed into frequency and percentage tables.

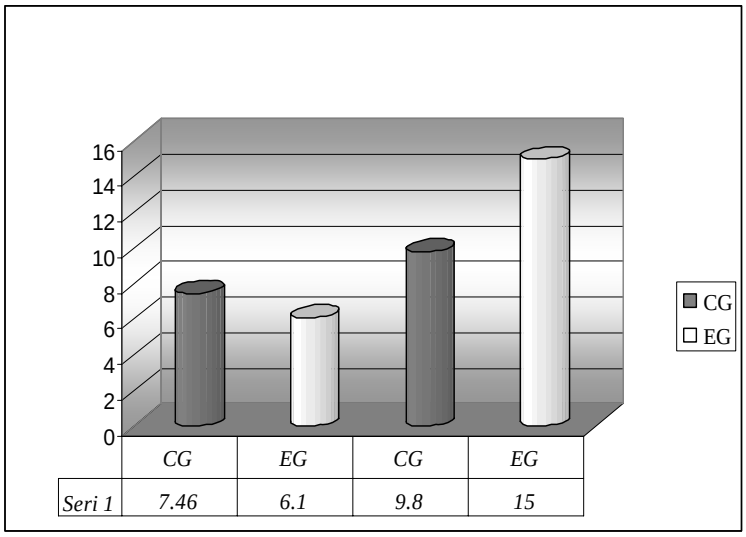

Figure 4. Achievement pre-test and post-test scores of CG and EG.

Achievement and Attitude Findings

The independent *t*-test results for the achievement test (pre- and post-) and the attitude scale (pre- and post-) were presented for each of the outcome variables in this section. The findings were shown that there were no differences between the EG and the CG with respect to the students' academic achievement ($t = 1.85$; $p = 0.68 > 0.05$). However, there was a meaningful difference in favor of the EG after the implementation ($t = -6.44$; $p = 0.00 < 0.05$). According to attitude findings which was obtained from this study, there was

statistically no differences between the EG and the CG (t = 1.47; p = 0.14 > 0.05). However, there was a significant difference between the mean scores in favor of the EG after the instruction based on model and narrative teaching (t = -7.60; p = 0.00 < 0.05). Figures 4 and 5 show the achievement and attitude of pre- and post- tests scores of EG and CG, respectively.

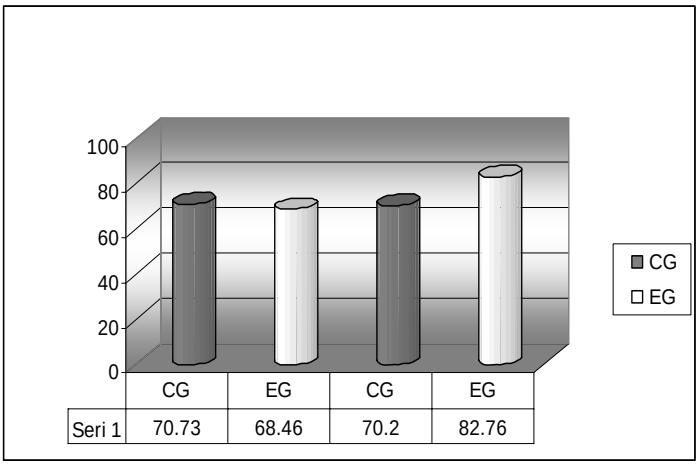

Figure 5. Attitude pre- and post- test scores of CG and EG.

Interview Findings

This part includes the findings of the semi-structured interview. Categories, sample positive and negative expressions, frequency-percent rates relating to answers given to the interview questions by the students were given in Table 1.

Table 1

Opinions of the Students Relating to the Effectiveness of the Model- and Narrative- Based Learning

1. What do you think about effectiveness of model- and narrative- based learning in covalent compounds? Why?						
	Categories	*f*	Percentage (%)	Students' sample expressions	*f*	Percentage (%)
Positive statements effective	Provide the knowledge to be permanent	6	33.3	This learning model was so unforgettable. I do not think so that I will forget non-polar and polar compounds in the future time.(S2)	17	94.4
	Interesting	5	27.7	I had some problem while reading covalent compounds, but rotating wheel was very interesting for learning some covalent compounds given in the lesson. (S5)		
	Enhances understanding chemistry related to daily life	3	16.7	I had a wonderful time in chemistry lesson; it is incredible. Now, I know how chemistry is related to daily life. (S4)		
	Facilitates learning	2	11.1	Especially the analogy of "identical twins" which was presented at the narrative was very instructional. I learned what the differences between nonmetals and metals were and which type bonds have them. (S6)		
	Connecting quality	1	5.6	Any gap did not occur while I was listening narratives. Since the narratives have gripping quality, I understood relationships between concepts well. (S2)		
Negative statements Not effective	Passive role	1	5.6	While I was listening to teacher, I was bored. Because I was only listening, it looks like traditional method. (S1)	1	5.6

While 94.4 frequencies of the students suggested positive statements about effectiveness of model- and narrative- based learning in covalent compounds 5.6 frequencies of the students told negative statements. The most of the students stated that model- and narrative- based learning was effective, because it provided the knowledge to be permanent, had interesting activities, facilitated learning and increased understanding of daily life. On the other hand, only one student stated that narratives were bored and they passivated students while listening.

At the end of the analyses of the second interview, it was determined that all of the students stated that model- and narrative- based learning should be used in different chemistry subjects. As a reason, they stated that with 26.6% frequencies that this learning approach was more understandable; with 20% frequencies that it increased motivation towards chemistry lesson. The other opinions of the students about the question and percent-frequency rates were displayed in Table 2.

Table 2

Opinions of the Students Relating to the Usefulness of Model- and Narrative- Based Learning in Different Subjects of Chemistry Lesson

2. Do you want that model- and narrative- based learning method will be used for the other subject in chemistry? Why?						
	Categories	*f*	Percentage (%)	Students' sample expressions	*f*	Percentage (%)
Positive statement Yes, I want (n = 10) because:	More understandable	8	26.6	While I was following the narrative about covalent compounds, I understood non-polar and polar compounds better. (S2)	30	100
	Provide occurring creative ideas and reasoning	5	16.7	I tried to complete the narrative and learned relationships between non-polar covalent bond and polar covalent bond. (S7)		
	Increases motivation towards chemistry lesson	6	20	I thought myself as an actor. I always asked myself questions related to narrative about covalent compounds and I was excited. I waited the result of the narrative curiously. And doing the models of H_2O and CO_2 compounds was very excited for me. (S4)		
	More enjoyable	6	2	I tried to show how did construct covalent bonds and how were electrons' movements in H_2O. It was really very enjoyable. I would like to do it in the other chemistry subjects similarly. (S9)		
	Developing chemistry concepts	5	16.7	I found and revealed chemical concepts like non-polar covalent bond from the narrative and then implemented this concept in different covalent compounds. And I understood abstract concepts like chemical bond well. (S3)		

For the purpose of determining the opinions of students concerning, the enjoyment of model- and narrative- based learning was given in Table 3. According to the results, while 96.2% frequencies of the students had positive statements 3.8% frequencies of the students had negative statements. With 30.8% frequencies they stated that they liked this learning method because it had an instructive quality. On the other hand, with 3.8% frequencies they stated that they did not like this learning approach because of a limited discussion time. The other results of analysis about their positive statements were given in Table 3.

The analyses of the students' attitude changes towards chemistry lesson were given in Table 4. According to the results, there were general positive opinions about students' attitude. With 40.9% frequencies, they expressed that the narratives- and models- based learning provided raising their interest and motivation. The students stated with 31.8% frequencies that they were able to be stimulated by using narrative and model, they

could share and reflect construction of knowledge and thus they had self-efficacy towards chemistry course. On the other hand, with 9.1% frequencies, they stated that they could not focus on new application easily.

Table 3

Opinions of the Students Relating to the Enjoyment of Model- and Narrative- Based Learning

3. Which properties do you like/don't you like in model- and narrative- based learning method? Why?						
	Categories	*f*	Percentage (%)	Students' sample expressions	*f*	Percentage (%)
Positive statements I like, because	Instructive quality	8	30.8	I had never seen like this teaching before. It was very useful for my learning. For example, I have just known why I_2 molecule does not dissolve in H_2O compound easily. I think these activities were very instructive. (S6)	25	96.2
	Visual quality	4	15.4	The models presented visuality. And analogies presented within narratives provided concrete examples. They increased my learning related to covalent compounds. (S5)		
	Interesting narratives	5	19.2	Especially, the narratives were very interesting. Because I could not think that narrative and chemistry were together. But I learned covalent compounds very well with narratives. (S4)		
	Enjoyable activities	4	15.4	I read P_4O_{10} covalent compound with using rotating wheel. I firstly found the number of elements and showed my friends. I wrote its name on the blackboard. It was very amusing. (S9)		
	Intensifier examples	4	15.4	I liked especially intensifier examples presented with models. I learned how covalent compounds were named with rotating wheel. (S2)		
Negative statements I don't like, because	Limited discussion time	1	3.8	While we were crowded, we had not got enough time to discuss questions related to narratives. I discussed with my desk mate but I could not discuss my other friends who they thought different from me. (S9)	1	3.8

Conclusions

Model and narrative including analogies can be used in different ways to support and improve learning. A reflection on models in science has an important place of any study on the relation between sensible reality and the procedures by which science derives knowledge about it. In this perspective, analogies powered by attractive narratives and models are the tools of scientific thinking. Also, they are vehicles of descriptive analogical thinking which are very useful to make easy to teach many complex and abstract chemical matters. Models and narratives including analogies can be used as exemplars of concepts, principles, or theories being taught by direct instruction. The role of model and narrative in instruction is perhaps the most inviolable principle of instructional material design.

The model- and narrative- based learning materials can also be used as problem cases to be solved by students. In some cases, narrative as problems is the basis for learning in different strategy as constructivist learning, goal based scenarios and a lot of other contemporary models of instruction. On the other hand, correctly designed narratives can be used as advice for the students for helping them learn to solve problems and understand abstract concepts (Jarman, 1996; Schank & Berman, 2002).

We have attempted to make the case for the use of analogy combined with narrative in teaching chemistry as a way of making it meaningful and accessible to by the high school students. For this purpose, firstly, we have built some models including narratives and analogies about covalent bonding in tight cooperation with

high school students. An attractive narrative was adjusted to strength learning, too.

Table 4

Opinions of the Students Relating to the Attitude Towards Chemistry Lesson after Model- and Narrative- Based Learning

4. Did your attitude towards chemistry lesson change after the model- and narrative- based learning implementation? How?						
	Categories	*f*	Percentage (%)	Students' sample expressions	*f*	Percentage (%)
Positive statements	Self-efficacy towards chemistry lesson	7	31.8	Yes, of course. I could not explain something to my friend after chemistry lesson before this implementation. But, I can do it now. This made me more interested in chemistry lesson. (S3)	20	90.9
	Brainstorming	4	18.2	Exactly, it was changed. I shared my opinions about questions within narrative. And I saw different aspects about them. I think I have just better understanding with this application. (S4) Yes. I felt that there was a comfortable environment in the class. Maybe, I was wrong. But, I did not afraid saying something wrong for the first time. I liked to share my opinions with my friends. (S5)		
	Motivational Orientation	9	40.9	Yes, of course. I was being keenly aware of the objectives of topic. I was closely guided in this implementation. And I was very stimulated to learn chemistry with narratives and models. I have not already felt like this. (S4) Yes. This application provided me a change about my studying. I want to study chemistry course a lot. (S2)		
Negative statements	Focus on Assessment	2	9.1	No, I supposed that this new application was an assessment. I was shy about beginning to speak. I was focused on only teacher's assessment not new learning process. So, I missed some concepts. (S1)	2	9.1

Statistical evaluation of experimental data showed that the learning material based on model and narrative helped to improve to understand and constructive covalent bonding having an imaginary character. However, there existed the question that what kind of science was communicated through narrative, or if it was at all possible to figure through narrative how science was practiced by scientists and how scientific knowledge was constructed (Schank & Berman, 2002). The crucial question then became narrative and appropriate tool to enhance apprentice students' understanding of chemistry or science, generally. Rather, we mentioned that the purpose of science education was to provide future generations and appreciation of the cultural value of science and its strengths and weaknesses. In this sense, we argued that using narrative becomes of value in supporting the understanding of scientific concepts and matters by none-experts. This statement had a good agreement with some other researchers (Jarman, 1996; Egan, 1986). Further research in this area is necessary in order to develop appropriate learning materials based on narrative for the other subjects of the introductory chemistry which foster students' successful and meaningful learning of basic chemistry concepts.

Here, there was a pedagogical reason for keeping them wondering that we wanted students to see that our ideas in chemistry were sensible and also we wanted them to like chemistry, as well as we hoped they would find chemistry sympathy and useful. The narrative and model learning used here indicated a high level of reflection and attention to students' interests. According to the results, most of the students found that model- and narrative- based learning was effective. They suggested that narratives and models were instructive and

facilitated learning chemical abstract concepts. They explored role of chemistry in daily life especially with examples of dissolution H_2O, CO_2 and I_2 molecules. They realized what chemical bond and covalent bond were and how covalent compounds were formed. They had permanent knowledge about covalent bond by using this learning approach. However, some comment of interview showed that it was not easy to connect fully to student interest as it was thought. Still, narratives were carefully rehearsed and made conscious effort to merge difficult concepts to everyday experiences that were familiar to most of the students. It was important to remember that interactive explaining and answering of student questions was so complex action and teachers could not always be expected to remember everything. That is the reason why some students declared that narratives were bored and they passivated themselves while listening. Thus, especially, if working analogies in narratives were to promote relational understandings, the shared and unshared attributes could be carefully mapped and conceptualized with the hearers.

The students appreciated narrative- and model- based education as a useful source of learning in different subjects of chemistry lesson. They suggested that this learning approach significantly improved their understanding of covalent compounds and creativity thinking about chemistry. They also stated that it could be appropriate for the other chemistry subjects, because it had enjoyable and interesting activities and helped them become aware of the subject's conceptions. This condition increased motivation towards chemistry lesson. These results were approximately in agreement with other researchers (Barker & Millar, 2000; H. Demircioglu, G. Demircioglu, & Ayas, 2006).

It is worth highlighting that affective features like attitudes were impressed by experimental process. With model and narratives including enjoyable and interesting activities, the students could share and reflect construction of their knowledge and thus they had self-efficacy towards chemistry course. There is a close relationship between self-efficacy and attitudes. If students have low attitudes towards lesson, they do not want to study and they are with low self-efficacy related to course. Individuals with high self-efficacy have positive attitudes towards lesson (Cakir, Kan, & Sunbul, 2006). From this point of view, it could be said that the narrative and model activities were apt to raise students' attitudes and self-efficacies related to chemistry course. Additionally, attitude change did not only arise from self-efficacy, but also brainstorming in comfortable class environment, and motivational orientation have important role.

As negative statements of the students were taken into consideration, it was seen that some students had missing understanding in this kind of learning strategy. They could not focus on the process carefully and understand analogies within narratives. While the class environment crowded, they could not pay attention, so their actual behaviors were not uncommon and they directed unexpected questions in class.

From a learning perspective and basing on the presented findings, it could be seen how the model and narrative surface similarities provide access to deep relational ideas embedded in the mappings. The results showed a majority of students who were attracted to the model and narrative, because they described and everyday situation that they felt were only imaginary useful. Model- and narrative- based education captured students' interests and energies and it channeled them toward meaningful learning goals. The activities engaged students in improving their learning and communication skills, such as understanding the relationships through concepts, brainstorming and sharing ideas with their friends. The findings proved that more structured model and narratives improved learning environment, because systematical, logical and familiar phenomena built relational ideas.

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