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WHAT DO JUNIOR SCIENCE TEACHER STUDENTS THINK ABOUT CHEMISTRY?

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ABSTRACT

This study aims to identify the perspectives of junior elementary science teacher students towards chemistry as a science. To accomplish this reason, 51 first year science teacher students studying in one of the governmental universities in the west part of Turkey were included in a survey investigation. Students' habits, daily life concerns, wonders and initial considerations related to chemistry were collected with an instrument developed by the researchers. Descriptive statistics method and content analysis were utilized to analyze data. The findings represent a whole picture of the participants' habits, daily life concerns, wonders and considerations related to chemistry. Based on the findings, a number of suggestions will be provided for science educators which will be beneficial to improve the vision of junior teacher students in terms of chemistry aspect beginning from their first year in the university to increase their academic success and to contribute their future occupational needs.

Key Words: Chemistry, junior science teachers, opinions.

INTRODUCTION

In the worldwide, the year - 2011 was declared as International Year of Chemistry (IYC) by UNESCO and UN with the encouragement of International Union of Pure and Applied Chemistry (IUPAC) in order to trigger awareness about the science of chemistry which influences all parts of life (Sözbilir, 2013). For this purpose, four fundamental goals were determined to address all people who were related to chemistry directly or indirectly. Those goals were:

1. Raising awareness to sense and accept the significance of the chemistry in order to meet the needs of the world
2. Raising the interest of young people towards chemistry
3. Encouraging the generation of creative opinions for the future of chemistry
4. Celebrating the role of ladies and significant historical events in chemistry (Sözbilir, 2013).

As mentioned in the goals above, evoking interest of the youth is also significant for the future of our country because academic success and efficient studies in this area firstly depend on positive tendencies of young people towards chemistry. Unfortunately, the literature reports that students tend to get away from physics and chemistry courses (Woolnough, 1994; Solbes & Vilches, 1996). When the university entrance examination results in Turkey are investigated, it is seen that the results are not good in terms of the number of the net right responses gained from the science test. When the general mean of entrance to higher education examination (abbreviated as *YGS* in Turkish) results are investigated, it is found that the participants have an average of 4.6 net right responses in 2010; 4.1 net right responses in 2011 and 3.6 net right responses in 2012 from 40 questions in the science test (Measurement, Selection and Placement Center, 2012a). It is remarkable

that the mean of the net right response numbers gained from science test remains very low when compared to the other courses such as Turkish, social science and mathematics. The mean of the net number of right responses of all the participants for chemistry course in 2012 undergraduate placement examination (abbreviated as *LYS* in Turkish) is 9.87 from 30 questions (Measurement, Selection and Placement Center, 2012b). Additionally, when decreasing number of students who are selecting chemistry programs is considered, it is highlighted to research the chemistry perceptions of students regarding their success level (Tosun, 2013).

In this paper, mainly chemistry and daily life relations will be addressed. The previous study results indicate that students fail to connect the things they learn in the courses with daily life (Yiğit, Devecioğlu & Ayvacı, 2004). The students should be able to apply their theoretical knowledge practically in daily life. Daily life is a social aspect of science (Koçak & Önen, 2012a). It will be a failure to think of science without daily life. When the rapid changes in our day's conditions are considered, daily life is affected by those changes substantially and we have to be aware of them as scientifically literate people.

Rather than limiting the vision of the students, repeating the clichés and scaring them with difficult questions; the educators should assist them become individuals who enjoy science a lot. Koçak and Önen (2012a) taught 9^{th} grade students chemical changes unit with the help of experiments which connect them with daily life and as a result of their study, they gained increase in students' motivation and success. Also, being chemically literate is important. Students should be developed as people who can access information by themselves (Üce & Şahin, 2001; Bayrakçeken, Canpolat & Çelik, 2011).

The results of the research report that the initial concepts considered as one hears the name of chemistry are laboratory, chemical substances and dangerous exploding experiments (Koçak & Önen, 2012b). This finding is also reflected in the drawings of young children related to scientists which show them with experiment tubes, laboratory coats and glasses (Demirbaş, 2009; Korkmaz & Kavak, 2010). Such results can be acceptable for young aged children. However expectations related to the conceptions about chemistry for those who come to university level by graduating from science branch in the high school and achieving science or chemistry related courses are more.

Encouraging students to make research, to connect theoretical knowledge with daily life can prevent memorization and influence their looks at science positively. The look of teacher candidates at science is significant since they may affect their opinions for their future students. So, this study addresses the opinions of junior science teacher candidates about the science of chemistry.

The Aim and Significance of the Study

In this paper, it is aimed to determine the opinions of junior science teachers in terms of chemistry by finding out their wonders and conceptions about it.

The results of this study will present the profiles of the participants in terms of chemistry subject. The points which are included in and which are excluded from chemistry will be determined by investigating their profiles. Those findings might contribute educators to form the content of "special topics in chemistry" and "elective courses related to chemistry" in addition to helping educators to insert new ideas to the students which will enlarge their vision related to chemistry.

METHOD

Study Design

A survey study was conducted as it was convenient for the purpose of the study. In the literature, survey studies are defined as the studies which are conducted with relatively large samples in order determine the characteristics about the interests, skills and attitudes of the participants related to a subject or event (Büyüköztürk, Çakmak, Akgün, Karadeniz & Demirel, 2010: 231). In the present study, participants' tendency towards the science of chemistry was aimed to figure out.

Study Group

The study group involved 51 first year elementary science education students studying in one of the governmental universities in the west part of Turkey. 43 of the participants were females whereas 8 of them were male students. All of the participants graduated from science branch from their high schools.

Data Collection Instrument

The researchers developed the data collection instrument to meet the purpose of the study (see the instrument in Appendix). This instrument involved two questions which aimed to measure the habits of the participants about chemistry and those questions were rated in three dimensions (never/seldom/frequently). The other questions were prepared as open ended.

Data Analysis

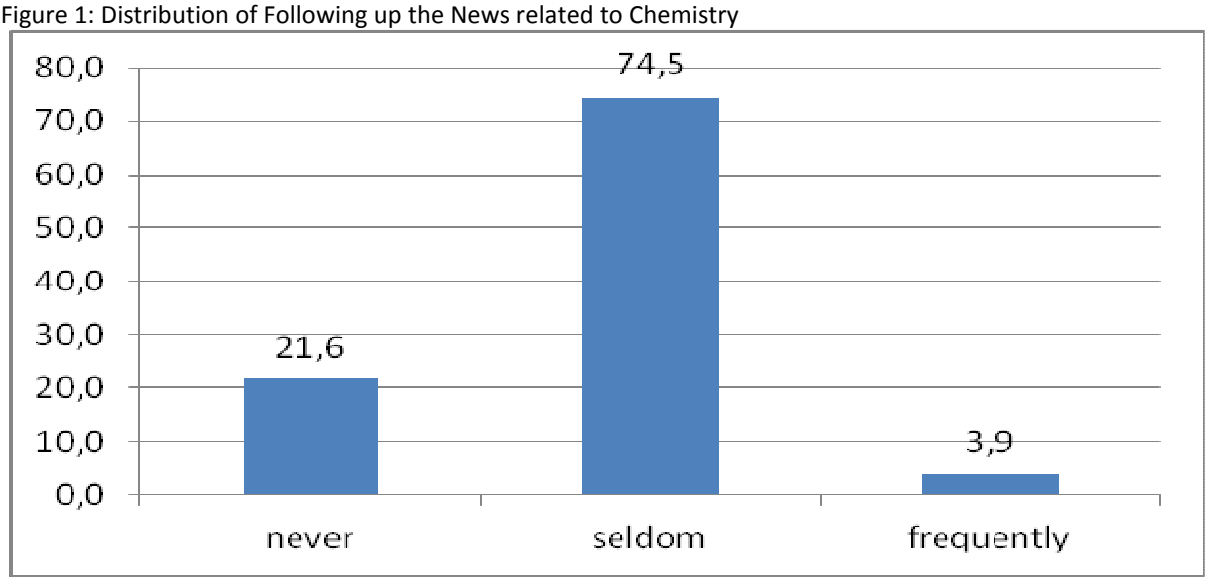
In data analysis, descriptive statistics and content analysis were utilized. In the analysis of open ended questions, content analysis, which aimed to reach concepts and relations to explain collected data, was utilized (Yıldırım & Şimşek, 2008). In the analysis of other questions, descriptive statistics methods were used by presenting the frequency and percentage distribution of the findings in order to quantify the data.

RESULTS

Do You Follow up the News related to Chemistry via Internet/TV/Newspaper?

According to Figure 1, 38 of the participants (74.5 %) *seldom* followed up such news. The students who *frequently* followed up constituted only 2 of them (3.9 %) whereas 11 of them (21.6 %) were *never* interested in following up chemistry related news via internet, newspaper or TV.

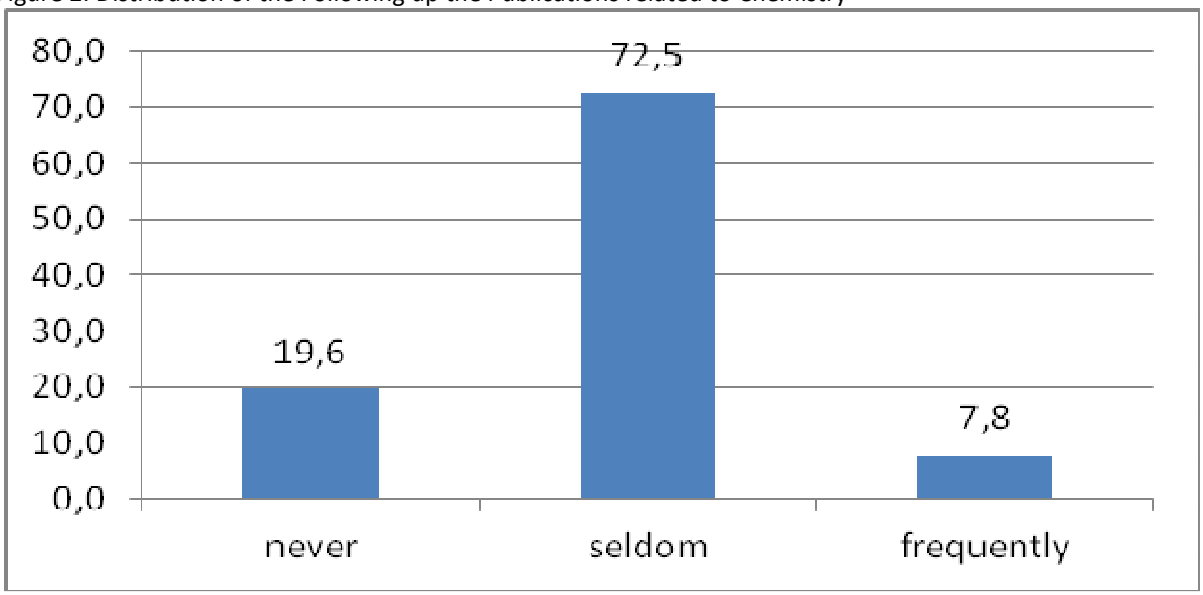
Figure 1: Distribution of Following up the News related to Chemistry



Do You Read any Publications related to Chemistry?

Similar to the results of the previous question, 37 of the participants (72.5 %) *seldom* read publications related to chemistry. 10 of them (19.6 %) *never* read such publications whereas only 4 of them (7.8 %) *frequently* read. The distribution is displayed in Figure 2.

Figure 2: Distribution of the Following up the Publications related to Chemistry



Where Do You Use Chemistry in Your Daily Life?

The responses of the participants related to daily life use areas of chemistry are shown in Table 1. Since each participant could provide more than one opinion, the total number of the opinions exceeded the number of the participants.

Table 1: Distribution of the Opinions related to Daily Use Areas of Chemistry

Daily life utilization	**f (%)**
In wipers	46 (34.8)
In the kitchen	31 (23.5)
In the medicines	16 (12.2)
In cosmetics	13 (9.8)
In dyes	8 (6.1)
In the drinks	8 (6.1)
In the building area	6 (4.5)
In heating	4 (3.0)
Total	**132 (100)**

According to Table 1, participants asserted that mostly, chemistry was utilized in wipers, kitchen, medicines and cosmetics. Other use areas are as shown in Table 1.

What are Your Favourite Questions related to Chemistry?

After the analysis of the questions whose answers were wondered by the participants at most, the questions were collected under eight themes as provided in Table 2. Additionally, example questions to illustrate each theme were placed in Table 2 below.

Table 2: Themes that Involve Students' Questions and Examples for the Questions

Themes	Examples from the questions
Matter and Particle	How was the first particle found? Why was it found? How was the first element discovered?
Chemical Bonds	How do bonds form? How did the first reaction occur?
Matters and Their Properties	Why does "He" element cause a change in the voice? What is the structure of the diamond like?
Structure of Cosmetics	How is the foundation formed? What are the materials used to form it? How was acetone found?
Wipers	How do wipers clean dust and dirt so easily? How does soap foam form?
Structure of Dyes	How are dyes made up? How does the first dye discovered?
Formation of Colours	Why is the flame in the oven blue in the oven? Why are the papers white in colour?
Scientific Process	According to Democritus, atoms can neither be created nor broken up and formed. How did other scientists refute this idea? Would chemistry be so well developed if there were no alchemists?

As can be seen in Table 2, students' questions were related to matter and particles, matters and their properties, chemical bonds, dyes, colours, cosmetics, wipers and scientific process. The frequency and percentage distribution of the questions of the participants related to each theme are demonstrated in Table 3. Since one student could write more than one question, the total number of the questions constructed by the students was more than the number of the students.

Table 3: Distribution of the Questions of the Participants related to Chemistry in Each Theme

Themes	f (%)
Matter and Particle	24 (28.6)
Matters and Their Properties	24 (28.6)
Scientific Process	14 (16.7)
Wipers	7 (8.3)
Formation of Colours	6 (7.1)
Structure of Dyes	4 (4.8)
Structure of Cosmetics	3 (3.6)
Chemical Bonds	2 (2.4)
Total	**84 (100)**

As shown in Table 3, the questions wondered by the students at most belonged to the themes - *matter and particle* and *matters and their properties* with the percentages of 28.6 %. To make the first theme more clear, following questions can be provided from the participants' responses: "How can atom be broken up?", "How can an atom bomb be produced?, "How can an element know to form compounds with particular elements?". To illustrate the second theme, following questions can be added: "How is glass formed from sand?", "What is there inside the chemical weapons?", "How does toothpaste make our teeth whiter?".

When the questions were investigated in general, it was seen that the students were keen on the things done/discovered first (the first particle, first element, first reaction, first dye, and first yoghurt). They questioned the people who made/discovered those and how those things were made/discovered.

The Concepts related to Chemistry

The concepts in Table 4 were found out when the participants were asked to write down the things they considered when they were told the term – chemistry.

Table 4: Distribution of the Concepts of the Participants related to Chemistry

Concepts	f	Concepts	f
Atom	13	Formulas	3
Experiment	12	Ammonia	2
H_2O	9	Cosmetics	2
Element	9	My teacher	2
Matter	6	Kelvin	1
Periodic table	6	Organic chemistry	1
Alchemy	5	Soaps	1
Acid	5	NaCl	1
Laboratory	5	Molecule	1
Compound	4	Inventions	1
Gases	4	Science	1
Bases	4	Problem	1
Mixtures	3	Electron	1
Reactions	3	**Total**	**106**

According to Table 4, the most frequently considered concepts related to chemistry by the participants were "atom", "experiment" and "H_2O". Similar to the most frequently asked questions, most frequently considered other conceptions were "element" and "matter". Since one student could write more than one concept, the total number of the concepts exceeded the total number of the participants.

DISCUSSION AND CONCLUSION

According to the results of the study, most of the students *seldom* follow up chemistry news or *seldom* read publications regarding chemistry. What is more important, the ratio of students who respond to this question as *never* is almost five times than those who respond this question as *frequently.* This result can be accepted as an astonishing consequence when we consider today's technological conditions and when we consider that those participants will be our future science teachers.

It is found that students mostly observe chemistry in "wipers" in their daily life. Those substances can be easily observed in daily life both in the cleaning of body or of home. Hence, this is reflected in the frequency of the responses. Again, other easy to observe themes, "kitchen", "medicines" and "cosmetics" follow it. The reason of the fact that students connect scientific concepts with daily life might be due to the fact that they can easily meet such situations which affect their lives, in their home, in their environment and in their lesson applications (Yiğit, Devecioğlu & Ayvacı, 2002). Also, high proportion of the female students in the participants can be another factor influencing the high frequency of above mentioned themes as they are more interested in those mentioned themes when compared to male students.

Most of the students' favourite questions focus on "matter and particle" and "matters and their properties" themes. However, among those questions, no specific issues such as CERN experiments are encountered. The questions of the students remain mostly superficial. They seem not rising to higher cognitional levels, staying in knowledge and comprehension level. When those determined consequences are considered by the educators, it is expected that four years that will be spent in the university by the students will contribute to their questioning skills. Good questioning capability will be the consequence of receiving inquiry based education beginning from primary level. However, it is seen that this ability was neither gained from the family nor from the school environment. So, the experiences and habits before coming to university are critical for shaping such

characteristics of the students. At this respect, encouraging education faculty students to read magazines, books related to chemistry and to follow up such news via internet/TV/newspaper will be beneficial for their future students also.

Despite the fact that chemistry involves various different themes inside it (such as acids-bases-salts, gases, liquids, solutions...) the level of students' questions generally remains in general chemistry level. This is also an interesting result. From this result, it can be concluded that the students cannot comprehend chemistry from a broad perspective.

Parallel to the previous study results, students consider "atom", "laboratory and "experiment" when they hear the term – chemistry (Ürek, 2012). Additionally, the indispensible of life - "H_2O" keeps its place in top 3 of the responses. The concepts of students related to chemistry match with the themes of the questions they wonder. Matter and particle theme also takes place in a high proportion among the concepts. In this question also, no more different and more creative response was gained. Hence, students can be reported to live a never ending circle.

When the findings are evaluated all together, it can be concluded that the profiles of junior science teachers are very limited in terms of chemistry. They need to be introduced to nanotechnology, CERN and green chemistry which are recently very popular and inter disciplinary research areas of chemistry. For this purpose, science-technology-society relationships should be emphasized during the courses. Construction of the science-technology-society relationship does not only improve students' opinions related to science and raise their interest towards physics and chemistry with its motivating aspect but also those results stem from its contextualization affect on those disciplines (Solbes & Vilche, 1996).

The conceptions of the students related to chemistry in this paper overlap with the previous studies' cliché findings related to science, scientists, chemistry and chemists. Therefore, educators' considerations related to interdisciplinary interactions are significant for the students. Projects can be assigned to the students by considering students' wonders and favourite questions related to chemistry. Their presentation and sharing with peers might be beneficial. Such planning could shape the content of the "Special Topics in Chemistry" and various "Elective Courses" related o chemistry. Also, the points which are never mentioned by the students could be assigned to the students in order to make them investigate those different aspects. With such attempts, the vision of the future teachers can be enlarged and they can be developed as more qualified.

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APPENDIX: Data Gathering Instrument

1. I follow chemistry related news via TV/newspaper/internet. Never O Seldom O Frequently O
2. I read publications related to chemistry. Never O Seldom O Frequently O
3. Where do you use chemistry in your daily life? Give examples.
4. What are the questions that make you wonder most related to chemistry?

- ……
  I wonder the answer of this question because ……
- ……
  I wonder the answer of this question because ……

5. Write down the concepts that you consider when you hear "chemistry".