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Research Article

# Chemistry Teaching Departments' Current Situation from the Perspective of Prospective Chemistry Teachers: A Case Study

# Kimya Öğretmen Adaylarının Perspektifinden Kimya Öğretmenliği Bölümlerinin Güncel Durumu: Bir Durum Çalışması

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## ABSTRACT

This study aims to investigate the opinions of prospective chemistry teachers (PCTs) regarding the chemistry teaching department. In this qualitative research, 47 PCTs participated and the data were collected via an opinion form and focus group interviews. In the end, it was found that the PCTs preferred the department willingly, the intrinsic factors mainly shaped their preferences. Additionally, if they had a second chance they expressed that they would prefer different departments related to health like nursing, and pharmacy. Appointing in the Public Personnel Selection Exam (KPSS in Turkish) is prominent for them in the post-graduation period if not they have different plans. Correspondingly, the most intense feeling about this period they have is fear. In the end, they criticized the current undergraduate chemistry teaching curriculum and complained about it. They anticipated modifications both in the distribution and the context of the courses. In the end it was seen that they emphasized that they wanted more chemistry based professional knowledge courses.

**Keywords:** Chemistry teaching department, prospective chemistry teachers, chemistry teaching program, chemistry teaching, chemistry education.

## ÖZ

Bu çalışma, kimya öğretmen adaylarının kimya öğretmenliği programı ile ilgili görüşlerini incelemeyi amaçlamaktadır. Bu nitel araştırmaya 47 kimya öğretmen adayı katılmış; veriler görüş formu ve odak grup görüşmeleri yoluyla toplanmıştır. Çalışma sonunda kimya öğretmen adaylarının bölümü isteyerek tercih ettikleri, bu tercihleri ağırlıklı olarak içsel faktörlerin şekillendirdiği görülmüştür. Ayrıca ikinci bir şansları olsa hemşirelik, eczacılık gibi sağlık alanındaki farklı bölümleri tercih edeceklerini belirtmişlerdir. Mezuniyet sonrası dönem için kariyer planları incelendiğinde Kamu Personeli Seçme Sınavı'nda (KPSS) atanmanın ilk sırada yer aldığı görülmüştür. Buna bağlı olarak mezuniyet sonrası dönemle ilgili yaşadıkları en yoğun duygunun ise korku olduğu belirlenmiştir. Son olarak kimya öğretmenliği lisans programını eleştirmeleri istendiğinde ise birçok eleştiride bulundukları görülmüştür. Ders dağılımlarında ve ders içeriklerinde değişiklik yapılmasına vurgu yapmışlardır. Özellikle programın içeriğinde yer alan derslerin daha çok kimya odaklı alan eğitimi dersi olmasını arzu ettikleri dikkat çekmiştir.

**Anahtar Kelimeler:** Kimya öğretmenliği bölümü, kimya öğretmen adayları, kimya öğretim programı, kimya öğretimi, kimya eğitimi.

## INTRODUCTION

Teacher quality does encourage or discourage student outcomes (Graham & Flamini, 2023). A qualified teacher is someone good at teaching, is in love with her profession, and cannot give up that profession despite all kinds of difficulties. If a teacher does not take pleasure in teaching she may be unable to make the learning process enjoyable for students. On the contrary, a teacher, working willingly, does not only teach the content but also can contribute to the students' lives. In this way, students may enjoy the course more. The ability of students to be interested in and love a profession is related to the extent to which people who have that profession enjoy their work (Czikszentmihalyi, 1982). After all, it can be said that "a teacher plays a key role in the educational process." (Bulut & Doğar, 2006, p.14).

The quality of a teacher depends on the qualified training of a prospective teacher. After high school, a student decides which profession would offer a wealthy life for the rest of her life. Factors that are effective in choosing a teaching profession can be classified as internal, external, and altruistic reasons (Fokkens-Bruinsma & Canrinus, 2012). An altruistic motivation portrays education as a socially beneficial activity connected to a desire to promote the growth of both the individual and society (e.g., a desire to see children succeed). A person's desire to work with children is an example of an intrinsic motivator. On the other hand, an extrinsic reason is doing that profession because of a good salary, working conditions, holidays, or status (Azman, 2013). Studies in the literature have suggested that the expectations and hopes of prospective teachers who prefer this profession for internal and altruistic reasons are at a higher level (Buldur & Bursal, 2015), while those who prefer this profession for more external reasons have lower expectations and hopes (Beşoluk & Horzum, 2011). Especially when choosing a profession that requires self-sacrifice, such as teaching, for internal and altruistic reasons to be met, it is necessary to satisfy external reasons at first. From a different viewpoint, according to Bastick's (2000) analysis of the factors preferred by teachers in various nations, pre-service teachers in developed nations (such as Canada, the US, the UK, and Australia) were driven by both intrinsic and altruistic factors, whereas in developing nations (such as Jamaica and the Caribbean region, Nigeria, Brunei, Zimbabwe, and Cameroon), extrinsic motivation seemed to be more prominent. Prospective teachers prefer teaching under the influence of intrinsic and altruistic factors in developed countries, while in developing countries prospective teachers prefer teaching under extrinsic factors.

In Turkey, after a twelve-year compulsory education, the students take two main exams; the Core Proficiency Exam (TYT in Turkish) and the Advanced Proficiency Test (AYT in Turkish). Then they make a list of departments and universities according to their exam scores, the context of the departments, personal characteristics, of which they want to be educated. Subsequently, they deserve to enroll in a department of a university. The placement process is conducted by The Measuring, Selection and Placement Center (ÖSYM in Turkish) (The Measuring, Selection and Placement Center, 2023). After covering an undergraduate program, for example, a teaching department in an education faculty, they take the exam Public Personnel Selection Exam (KPSS in Turkish). In the condition of being successful, they have a right to teach in a public school (Kılınç et al., 2012).

After making a decision the critical process starts which is the transformation of a high school student to a prospective teacher and then to an experienced teacher. An eighteen-year-old teenager becomes a candidate in different teaching professions like chemistry. Chemistry may be an example of a challenging course since its macro, sub-micro, and symbolic nature, chemistry is complicated for students (Johnstone, 1982; Talanquer, 2011). As the content of the courses becomes more complex, the teacher's responsibility enlarges. From this perspective, unless a successful chemistry teacher establishes this triplet meaningfully a student's mind can be full of misconceptions. For this reason, a professional chemistry education is needed.

Modern chemistry first entered Turkey, in the early 19th century for only educational purposes. In the beginning, students only in medicine and pharmacy faculties were responsible for a limited chemistry knowledge base. Then, specific chemistry courses were added within the scope of science education, and a chemistry laboratory was established in a science faculty. In the first years, German and French researchers supported the development of chemistry education. They were paid high salaries and appreciated with higher titles compared to their domestic stakeholders at that time, and so as to they were encouraged to stay in Turkey. They were not only transferring their knowledge and experiences to students but also contributing to the training of new Turkish researchers. Regarding the development of chemistry, steps were taken, such as publishing translated books, establishing chemistry laboratories, and bringing necessary laboratory materials from abroad. In 1917, a chemistry diploma was given for the first time in the science faculty. In time, pure chemistry education evolved into chemical engineering education. However, when the basics of chemistry teaching education are examined, a professional education process has yet to be encountered. The focus was mainly on chemistry and chemical engineering rather than chemistry teaching education. In 1981, after the acceptance of the Higher Education Law, the chemistry teaching department was officially embodied. Since then, the responsibility of training chemistry teachers has been given to the faculties of education (Dölen, 2013 a, b). After chemistry teaching departments had become official, deciding to be a chemistry teacher became official as well. From 1982 to 1997, chemistry teaching was a four year with eight semesters department. After that in 1997, the department's duration was prolonged to five years with ten semesters. For the first 3.5 years, the PCTs were responsible only for content-based courses (general chemistry, analytical chemistry, organic chemistry, biochemistry and their laboratory courses, etc.) not for education-based courses. Meantime, they covered these courses in the faculty of science and literature. In the last 1.5 years, the PCTs came back to the faculty of education to cover teaching-based courses. At the end of ten semesters, they graduate also with a master's degree without a thesis. After ten years passed, in 2007 an update was made that the distinction between the first 3.5 years and the last 1.5 years was abolished and the PCTs could take all the courses concurrently no matter whether they were general cultural or field education courses (Council of Higher Education, 2007). In other words, they no longer had to wait for the last 1.5 years for professional knowledge courses. Then in 2015, the time duration of the chemistry teaching program was shortened to four years and the right of graduation with a master's degree without a thesis was withdrawn. Erdoğan and Koçak (2016) analyzed chemistry teaching programs across Turkey and stated that there were differences among universities' chemistry teaching departments concerning the number of courses, names of courses, and credits of courses. This kind of difference was the justification of a new curriculum. In the end, due to the dynamic nature of curriculum development, new problems emerged (Şahin, 2006) and it was decided that a new version of the chemistry teaching program is needed in 2018 to overcome these needs. For example, course credits, course hours and varied across Turkey, and this difference became a challenge in Erasmus, Mevlana, and Farabi or other processes (Council of Higher Education, 2018a). It was strictly emphasized in this version that courses can not be relocated between semesters, course credits can not be manipulated for both elective and compulsory courses (Council of Higher Education, 2018b).

In Turkey, the chemistry teaching undergraduate program was last updated on 12.04.2018 countrywide (Council of Higher Education, 2018c). Since then, a prospective chemistry teacher should pass 66 courses with 159 course hours and 145 credits. In this version of the program, while some courses in the former program were removed, new courses were added. The current course program was organized for eight semesters. In each semester the PCTs are responsible for different courses. The courses in the program are divided into three main groups general cultural, professional knowledge, and field education. Some of the courses under these groups are compulsory, while some are elective. Course categories and courses in these categories are shown below in Table 1 (Council of Higher Education, 2018c).

**Table 1**

*Courses in Chemistry Education Undergraduate Program According To The Course Categories (Council of Higher Education, 2018c)*

| Semester | General Cultural Courses (GCC) | Professional Knowledge Courses (PKC) | Field Education Courses (FEC) |
|---|---|---|---|
| 1st | Foreign Language 1<br>Ataturk s Principles and History of Turkish Revolution 1<br>Turkish Language 1<br>Information Technologies | Introduction to Education<br>Education Sociology | General Chemistry 1<br>Calculus 1<br>Laboratory Safety |
| 2nd | Foreign Language 2<br>Ataturk s Principles and History of Turkish Revolution 2<br>Turkish Language 2 | Education Philosophy<br>Education Psychology | General Chemistry 2<br>Calculus 2<br>General Biology<br>General Physics<br>General Chemistry Laboratory |
| 3rd | GCC Elective 1 | PKC Elective 1<br>Teaching Technologies<br>Teaching Principles and Methods | FEC Elective 1<br>Chemistry Learning and Teaching Approaches<br>Analytical Chemistry 1<br>Analytical Chemistry Laboratory 1<br>Inorganic Chemistry 1 |
| 4th | GCC Elective 2 | PKC Elective 2<br>History of Turkish Education<br>Research Methods in Education | FEC Elective 2<br>Chemistry Teaching Programs<br>Analytical Chemistry 2<br>Analytical Chemistry Laboratory 2<br>Inorganic Chemistry 2 |
| 5th | GCC Elective 3 | PKC Elective 3<br>Classroom Management<br>Ethics in Education | FEC Elective 3<br>Chemistry Teaching 1<br>Organic Chemistry 1<br>Organic Chemistry Laboratory 1<br>Physical Chemistry |
| 6th | GCC Elective 4 | PKC Elective 4<br>Measuremet and Evaluation in Education | FEC Elective 4<br>Chemistry Teaching 2<br>Organic Chemistry 2<br>Organic Chemistry Laboratory 2<br>Biochemistry |
| 7th | Community Service Practices | GCC Elective 5<br>Teaching Practice 1<br>Special Education and Inclusion | FEC Elective 5<br>Laboratory Applications in Chemistry Teaching |
| 8th | - | GCC Elective 6<br>Teaching Practice 2<br>Guidance at Schools<br>Turkish Education System and School Management | FEC Elective 6<br>Chemistry in Everyday Life |

Surprisingly, on 18 August 2020, the Council of Higher Education annihilated the former judgment (12.04.2018) and declared that every faculty can organize their teaching programs in the condition of adhering to important points of the former curriculum (Council of Higher Education, 2020). In the latest version, three main categories still remain, and course hours, course credits, and course types should be prominent on the committees. From that day, some of the chemistry teaching departments in Turkey revised their programs while some of them did not. In the following part, one of the updated chemistry teaching programs is represented by Balıkesir University, Necatibey Faculty of Education (Balıkesir University, 2023) in Table 2. This version of the program has been valid since the 2022-2023 academic year. The course names written in bold mean that these courses were not placed in the former program, and the course names written

in italic means that these courses were placed in the former program but in a different semester. The instructors' experiences and preferences shaped the new program's design. For example, they observed that the PCTs graduate with limited laboratory experience then they paid more importance to the laboratory courses. It can be said that the main structure remained the same, but the program was made more functional with minor changes.

**Table 2**

*An Updated Version of Chemistry Teaching Program Used in Balıkesir University, Necatibey Faculty of Education (Balıkesir University, 2023)*

| Semester | General Cultural Courses (GCC) | Professional Knowledge Courses (PKC) | Field Education Courses (FEC) |
|---|---|---|---|
| 1st | Foreign Language 1<br>Ataturk s Principles and History of Turkish Revolution 1<br>Turkish Language 1<br>Information Technologies | Introduction to Education<br>**History and Social Foundations of Education** | General Chemistry 1<br>Calculus 1<br>Laboratory Safety<br>**General Chemistry Laboratory 1** |
| 2nd | Foreign Language 2<br>Ataturk s Principles and History of Turkish Revolution 2<br>Turkish Language 2 | Education Philosophy<br>Education Psychology | General Chemistry 2<br>Calculus 2<br>General Mathematics<br>General Physics<br>**General Chemistry Laboratory 2** |
| 3rd | GCC Elective 1 | PKC Elective 1<br>*Research Methods in Education*<br>*Ethics in Education* | FEC Elective 1<br>Chemistry Learning and Teaching Approaches<br>Analytical Chemistry 1<br>Analytical Chemistry Laboratory 1<br>Inorganic Chemistry 1<br>**Inorganic Chemistry Laboratory 1** |
| 4th | GCC Elective 2 | PKC Elective 2<br>*Special Education and Inclusion*<br>*Curriculum Development in Education* | FEC Elective 2<br>Chemistry Teaching Programs<br>Analytical Chemistry 2<br>Analytical Chemistry Laboratory 2<br>Inorganic Chemistry 2<br>**Inorganic Chemistry Laboratory 2** |
| 5th | GCC Elective 3 | PKC Elective 3<br>Teaching Technologies<br>Teaching Principles and Methods | FEC Elective 3<br>Chemistry Teaching 1<br>Organic Chemistry 1<br>Organic Chemistry Laboratory 1<br>**Physical Chemistry 1** |
| 6th | - | PKC Elective 4<br>Measuremet and Evaluation in Education<br>*Classroom Management* | FEC Elective 4<br>Chemistry Teaching 2<br>Organic Chemistry 2<br>Organic Chemistry Laboratory 2<br>**Physical Chemistry 2** |
| 7th | Community Service Practices | PKC Elective 5<br>Teaching Practice 1<br>*Turkish Education System and School Management* | FEC Elective 5<br>Laboratory Applications in Chemistry Teaching |
| 8th | *GCC Elective 4* | GCC Elective 6<br>Teaching Practice 2<br>Guidance at Schools | FEC Elective 6<br>Chemistry in Everyday Life |

For a deeper understanding of the two programs (2018 and 2022), a comparison was done and shown in Table 3. It can be seen that laboratory courses were added and some of the courses were relocated or removed.

**Table 3**

*Differences Between Former (2018) and Current (2022) Chemistry Teaching Programs In Terms of Courses and Their Places Used in Balıkesir University, Necatibey Faculty of Education*

| The Courses Removed From The Former Program | The Courses Added To The Current Program | The Courses Still Placed Both In Former and Current Program But In Different Semesters | |
|---|---|---|---|
| | | Name of The Courses | Shift In Semesters Between Former and Current Programs |
| General Chemistry Laboratory | General Chemistry Laboratory 1 | Ethics in Education | 5→3 |
| General Biology | General Chemistry Laboratory 2 | GCC 4 | 6→8 |
| Biochemistry | Inorganic Chemistry Laboratory 1 | Research Methods in Education | 4→3 |
| Physical Chemistry | Inorganic Chemistry Laboratory 2 | Teaching Technologies | 3 →5 |
| Education Sociology | Physical Chemistry 1 | Teaching Principles and Methods | 3→5 |
| History of Turkish Education | Physical Chemistry 2 | Special Education and Inclusion | 7→4 |
| | History and Social Foundations of Education | Classroom Management | 5→6 |
| | | Turkish Education System and School Management | 8→7 |

The alteration in the undergraduate chemistry education program accompanies the question of which qualifications the graduates have and whether they are ready to teach chemistry in a high school. There is a need to examine the current status of the chemistry teaching department. When the literature was examined, it was seen that different studies focused on prospective teachers. For example, all third and fourth-grade prospective teachers in country-wide (Gür Erdoğan & Arsal, 2015), prospective primary education and secondary education teachers (Bursal, 2016), prospective primary education teachers (Deliveli, 2021), prospective history teachers (Kaya, et al., 2013). The study by Boz and Boz (2008) focused on why chemistry and mathematics teacher candidates prefer the teaching profession. According to the findings, the participants' love of teaching, being positively influenced by their previous mathematics or chemistry teachers, and the love for chemistry or mathematics field knowledge are the main reasons for choosing to teach. Derman et al. (2008) examined also PCTs' attitudes towards the teaching profession in terms of the types of high schools they graduated from, parents' education levels, preference ranks of the department, willingness to post-graduation education, and levels of academic success.

In Turkey, eleven universities have chemistry teaching departments, accepting students, for the present, in 2022 shown in Table 4. All of the departments' quotas are twenty, and they have reserved a quota for the top-scoring students of the high school. In country-wide, Boğaziçi University accepts students with the highest ranks of achievements. Atatürk and Van Yüzüncü Yıl University's chemistry teaching departments ceased student acceptance a few years ago but this year started to accept again. Unfortunately, Dicle, Ondokuz Mayıs, and Trabzon Universities put an end to chemistry teaching departments because of not meeting some criteria, although the department is still taking place on websites (Dicle University, 2023; Ondokuz Mayıs University, 2023; Trabzon University, 2023).

**Table 4**

*Numbers and Rankings of Students Settled in Chemistry Teaching Departments in Turkey Between 2020 And 2022 (Higher Education Program Atlas, 2022)*

| University | Year | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2020 | | | 2021 | | | 2022 | | |
| | NOSS | HROA | LROA | NOSS | HROA | LROA | NOSS | HROA | LROA |
| Atatürk | The department did not accept students | | | | | | 10 | 267.608 | 290.293 |
| Balıkesir | 18 | 94.703 | 297.586 | 21 | 227.143 | 278.093 | 21 | 188.411 | 265.393 |
| Boğaziçi | 21 | 36.645 | 60.495 | 21 | 47.569 | 71.499 | 21 | 31.573 | 62.392 |
| Çanakkale Onsekiz Mart | 21 | 236.010 | 283.336 | 21 | 173.129 | 260.874 | 21 | 184.388 | 250.886 |
| Dokuz Eylül | 21 | 140.197 | 235.733 | 21 | 130.257 | 219.110 | 21 | 117.102 | 209.280 |
| Gazi | 21 | 167.996 | 211.477 | 21 | 155.709 | 207.632 | 21 | 106.739 | 174.134 |
| Hacettepe | 21 | 108.249 | 166.806 | 21 | 94.760 | 154.654 | 21 | 77.899 | 138.040 |
| Marmara | 21 | 107.531 | 195.551 | 21 | 167.396 | 200.350 | 21 | 123.157 | 195.358 |
| Necmettin Erbakan | 14 | 188.617 | 297.863 | 21 | 121.780 | 280.082 | 21 | 122.306 | 258.275 |
| Orta Doğu Teknik | 21 | 58.508 | 85.794 | 21 | 52.770 | 88.815 | 21 | 46.164 | 77.455 |
| Van Yüzüncü Yıl | The department did not accept students | | | | | | 14 | 200.845 | 299.207 |

*NOSS: Number of settled students, HROA: Highest rank of achievement, LROA: Lowest rank of achievement

The fact that there are programs that accept students before but are closed over time brings to mind the question of why the chemistry teaching department is less preferred. On the other hand, although it continues to exist in scientific developments and university exams, how is it less preferred? This study aims to uncover the current status of the chemistry teaching department from the perspective of the PCTs. The starting point of this research is the question of why this department is less popular now.

### 1.1. Research Questions

1. What are the PCTs' opinions about their preferences for the chemistry teaching department, whether willingly or not?
2. What are the PCTs' opinions about the factors shaping their preferences for the chemistry teaching department?
3. What are the PCTs' opinions about which department they would prefer if they had a second chance?
4. What are PCTs' career plans for post-graduation?
5. What are the feelings of PCTs about the post-graduation period?
6. What are the PCTs' opinions about possible changes that can be made in the chemistry education undergraduate program?

## METHODOLOGY

### 2.1. Research Design

The case study model is used in this research. A case study, a type of qualitative research, is a detailed analysis of any bordered unit. In a case study, the phenomenon on which the researcher is focused should have explicit and apparent bounds (Merriam & Tisdell, 2015, pp.38-40). The phenomenon should not sound any function. Instead, it should be a noun, a unit about anything else (Stake, 2006, p.1). So, the PCTs' opinions about the chemistry teaching department are specified in current research as a case study.

### 2.2. Participants

The participants of the research were assigned purposefully (Patton, 2002). For a more comprehensive fund of knowledge, it was decided not to focus on a specific point of time in the chemistry teaching program duration (Markic & Eilks, 2013) not only freshman students or seniors. Rather, the researcher's goal was to engage all the PCTs studying in the chemistry teaching department ranging from the first to the fourth year of the program. Nevertheless, in the process, some of them were not present at the appointment place on time. To avoid putting any pressure on them, the researcher did not offer a recovery appointment to those who did not participate in the first one. So participant selection process was actualized through the criterion sampling technique. The criteria were participating willingly and studying in the chemistry teaching department at one of the state universities in the western part of Turkey. The PCTs were enrolled in the same university but were in different semesters. In the end, 47 PCTs met these characteristics and participated in the research. Their ages ranged from 17 to 23 and they were coming from different cities in Turkey to study in the current chemistry teaching program with different backgrounds. All of them enrolled in the program between the years 2018 and 2021. So they were educated according to the chemistry teaching program presented in Table 2. The number of PCTs enrolled in the program and participating in the research according to the year is shown in Table 5.

**Table 5**

*Frequencies of The PCTs Enrolling In The Program and Participating In The Research*

| Year | Frequency of PCTs enrolling in the chemistry teaching department | Frequency of PCTs participating in the research |
|---|---|---|
| First year | 21 | 21 |
| Second year | 19 | 17 |
| Third year | 7 | 6 |
| Fourth year | 3 | 3 |

For a more profound viewpoint, the ranks in TYT/AYT of the PCTs' preferences were asked and presented in Table 6.

**Table 6**

*The Rank Groups of The PCTs' Preferences and Frequencies*

| Rank groups | First-year | | Second year | | Third year | | Fourth-year | |
|---|---|---|---|---|---|---|---|---|
| | PCT1 | f | PCT2 | F | PCT3 | f | PCT4 | f |
| 1-5 | PCT1-3, PCT1-6, PCT1-12, PCT1-13, PCT1-14, PCT1-15, PCT1-18, PCT1-19, PCT1-21 | 9 | PCT2-1, PCT2-4, PCT2-5, PCT2-8, PCT2-10, PCT2-14 | 6 | PCT3-2, PCT3-3, PCT3-6 | 3 | - | - |
| 6-10 | PCT1-1, PCT1-4, PCT1-5, PCT1-8, | 7 | PCT2-6, PCT2-13 | 2 | PCT3-5 | 1 | PCT4-2 | 1 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | PCT1-11, PCT1-16, PCT1-17 | | | | | | | |
| 11-15 | PCT1-2, PCT1-7, PCT1-9 | 3 | PCT2-7, PCT2-11, | 2 | - | - | - | - |
| 16-20 | PCT1-10 | 1 | - | - | PCT3-1, PCT3-4 | 2 | PCT4-1 | 1 |
| 21-24 | - | - | PCT2-2, PCT2-3, PCT2-9, PCT2-12 | 4 | - | - | PCT4-3 | 1 |
| Undergraduate transfer | PCT1-20 | 1 | - | - | - | - | - | - |
| Additional placement | - | - | PCT2-15, PCT2-16, PCT2-17 | 3 | - | - | - | - |

It can be seen in Table 6 that the PCTs enrolled in the chemistry teaching department at different ranks.

### 2.3. Data Collection Tools

Data were collected through an opinion form and a focus group interview. In the opinion form, there were two parts. The first part was towards the PCTs' demographic information and the second part was towards their opinions about the department. For demographic information, they wrote their names, grades, and the rank of this department among their preferences. In the second part, six open-ended questions were placed in the form which the researcher developed. Three independent researchers examined the form in terms of chemistry teaching, ordering of questions, readability, and comprehensibility. After their suggestions, the form got its final version. The answers given to six open-ended questions in the opinion form were analyzed within the scope of this study. The open-ended questions in the opinion form are as follows:

1. Did you settle in the department of chemistry teaching department willingly or not?
2. Why did you choose the department of chemistry teaching?
3. If you had a second chance, which department would you prefer? Why?
4. What is your career plan after graduation?
5. How does the post-graduation period make you feel?
6. What kinds of changes would you like to be made in the chemistry teaching undergraduate program?

During the focus group interviews, the open-ended questions in the opinion form were asked again so their answers could be deepened. The six main questions were probed with some probes.

### 2.4. Data Collection

The researcher met the participants after class hours at the laboratory in their territory, their natural setting for data collection. The researcher preferred meeting in the laboratory to make the focus group interviews less formal and more comfortable for them (Bogdan & Biklen, 2007). The researcher and the participants were familiar with each other before the current research, and the researcher conducted their General Chemistry I-II and General Chemistry Laboratory courses in the past. Therefore, she knew their names, success levels, and characteristics to make sense of their gestures and facial expressions.

The data collection process had two steps, writing the answers to the open-ended questions placed in the opinion form and performing the focus group interviews. Each step of the data collection process took place among the participants' classmates. In brief, eight independent sessions occurred (four sessions for filling out the opinion form and four sessions for the focus group interviews). Each session lasted between 30 and 50 minutes.

At the beginning of the data collection process the participants first filled out the form in written, then after a few days, the interviews were performed. The design of the data collection in this way was planned consciously. The reason for this design is first to urge them to think about their departments' through the opinion form. Then, enable them to talk about additional answers they did not write in the opinion form that came to their minds during the time elapsed until the focus group interview. In the focus group interviews the researcher asked the open-ended questions used in the opinion form with some follow-up questions (Why do you think so?, Can you explain what you mean there?). The focus group interview was used because it may be more advantageous than individual interviews. Participants can beware of talking about their department to a researcher in the same department. Unhappily, students can not criticize the department or the context in front of teachers, instructors, school staff, etc. But, when they hear each other's feelings and critiques, they can get more comfortable and think that she is not alone, and then they can express themselves easily. The participants' opinions may shift after listening to others as well. In sum, data is socially constructed within the interaction of the group (Merriam & Tisdell, 2015, p. 114).

### 2.5. Data Analysis

The data were analyzed through the classical content analysis in which the themes and codes are counted regardless of production before or after the analysis. In this analysis, codes can be produced either inductively, deductively, or both (Leech & Onwuegbuzie, 2011). Classical content analysis is also suitable for this research in terms of data collection tools. For example, talks and documents should be analyzed through classical content analysis (Leech & Onwuegbuzie, 2008). For example, a focus group interview is a kind of talk, and an opinion form is a kind of document, so these data sources need classical content analysis.

Before the analysis, the opinion forms were counted, and organized and the focus group interviews were transcribed verbatim by the researcher. Then the raw data were read many times. The similar and different parts of the data were specified as serving the research questions. These parts were accepted as codes. Within the whole data if these codes were seen as repeating among the participants then a new category was formed representing similar codes. After all, the frequency tables were constituted then the codes and categories were supported with the quotations.

### 2.6. Reliability and Validity

To increase reliability and validity of the research triangulation protocol was used. Denzin (1978 pp.295-304) introduced different types of triangulation and its multi subtypes. In the current research, data, investigator and methodological triangulation were utilized. For data triangulation, data was collected at different points of time. Investigator triangulation was provided with the consultation of the independent researchers' during the development of data collection tools and analysis of data. The research findings were analyzed by another researcher, having a profession in chemistry education. The Miles-Huberman (1994) inter-rater reliability coefficient was 94%. The inconsistencies were fixed after the researchers' agreement. At the end within-methodological triangulation was performed with two types of qualitative data collection methods.

### 2.7. Ethical Principles

In this research, due to ethical principles, committee permissions were obtained. With the Balıkesir University Science and Engineering Ethics Committee's permission, the decision was taken at the meeting of the commission on 14/06/2022 and numbered 2022/4, (E-19928322-302.08.01-152278), and the research was conducted. Moreover, pseudonyms were substituted with their names. They were coded as PCT (the grade number)-1,2,3. In the beginning, the researcher explained the research context and said the data would not be shared with anybody

except the researcher. If they want, they may not join the study and may leave whenever they want.

## RESULTS

In this section, the findings of the research questions are presented in tables and the following quotations. The data presented in the tables were collected through the opinion form and the quotations were collected through the focus group interviews. The quotations were used to assist the data presented in the tables.

### 3.1. The Findings of The PCTs' Opinions About Their Preferences of The Chemistry Teaching Department

The findings gathered from the opinion form about the PCTs' opinions about their preferences for the department can be seen in Table 7.

**Table 7**

*The PCTs' Opinions About Their Preferences For The Chemistry Teaching Department*

| Answer | First-year | | Second year | | Third year | | Fourth-year | |
|---|---|---|---|---|---|---|---|---|
| | **PCTs** | **f** | **PCTs** | **f** | **PCTs** | **f** | **PCTs** | **f** |
| Willingly | PCT1-1, PCT1-2, PCT1-3, PCT1-4, PCT1-5, PCT1-6, PCT1-7, PCT1-8, PCT1-9, PCT1-10, PCT1-11, PCT1-12, PCT1-13, PCT1-14, PCT1-15, PCT1-16, PCT1-17, PCT1-18, PCT1-19, PCT1-20, PCT1-21 | 21 | PCT2-1, PCT2-4, PCT2-5, PCT2-6, PCT2-7, PCT2-8, PCT2-10, PCT2-12, PCT2-13, PCT2-15 PCT2-17 | 11 | PCT3-1, PCT3-2, PCT3-3, PCT3-4, PCT3-5, PCT3-6 | *6* | PCT4-1, PCT4-2, PCT4-3 | 3 |
| Not willingly | - | - | PCT2-9, PCT2-11 | 2 | - | - | - | - |
| Partially | - | - | PCT2-3, PCT2-2, PCT2-14, PCT2-16 | 4 | - | - | - | - |

It is shown in Table 7 that, except for the second-year PCTs, all of them preferred the chemistry teaching department willingly. The answers of the second-year PCTs differed between willingly, not willingly, and partially.

### 3.2. The Findings of The PCTs' Opinions About The Factors That Shaped PCTs' Preferences For The Chemistry Teaching Department

The findings gathered from the opinion form related to the PCTs' opinions about the factors that shaped PCTs' preferences for the chemistry teaching department can be seen in Table 8.

**Table 8**

*The Factors That Shaped PCTs' Preferences For The Chemistry Teaching Department*

| Types of factors | Factors | First year | | Second year | | Third year | | Fourth year | |
|---|---|---|---|---|---|---|---|---|---|
| | | PCTs | f | PCTs | F | PCTs | f | PCTs | f |
| Intrinsic factors | I like chemistry | PCT1-1, PCT1-2, PCT1-5, PCT1-6, PCT1-8, PCT1-10, PCT1-11, PCT1-12, PCT1-14, PCT1-15, PCT1-16, PCT1-17, PCT1-18, PCT1-19, PCT1-20, PCT1-21 | 16 | PCT2-1, PCT2-2 PCT2-3, PCT2-4, PCT2-5, PCT2-6, PCT2-8, PCT2-9, PCT2-10, PCT2-13, PCT2-17 | 11 | PCT3-1, PCT3-2, PCT3-4, PCT3-5, PCT3-6, | 5 | PCT4-1, PCT4-2 | 2 |
| | I wanted to be a teacher | PCT1-13 | 1 | PCT2-1 PCT2-8 | 2 | PCT3-4 | 1 | PCT4-1 | 1 |
| | I believed that I could do | PCT1-5, PCT1-7, | 2 | PCT2-3, PCT2-10 | 2 | - | - | - | - |
| | I liked my chemistry teacher in high school | PCT1-11 | 1 | PCT2-4, PCT2-13, | 2 | PCT3-3 | 1 | | |
| | I did not like my chemistry teacher in high school | - | - | - | - | - | - | PCT4-1 | 1 |
| | I want to work in the laboratory | PCT1-9 | 1 | - | - | - | - | - | - |
| | I wanted to study in this faculty in this city | PCT1-3 | 1 | - | - | - | - | - | - |
| Extrinsic factors | There is a need for chemistry teachers in the private sector | PCT1-4 | 1 | PCT2-3, PCT2-12, PCT2-14 , PCT2-16, | 4 | PCT3-4 | 1 | PCT4-3 | 1 |
| | I preferred according to my rank | - | - | PCT2-2, PCT2-9, PCT2-11, | 3 | - | - | - | - |
| | Because it is a prestigious profession | - | - | PCT2-15 | 1 | - | - | - | - |
| Altruistic factors | I like chemistry, but I like influencing a young person more than it | PCT1-18 | 1 | - | - | - | - | - | - |
| | I like helping people | PCT1-19 | 1 | - | | - | - | - | - |

It can be seen from Table 8 that most of the PCTs preferred this department with intrinsic factors rather than extrinsic and altruistic factors. Among the intrinsic factors, enjoying chemistry takes the first place according to all groups. On the other hand, the need in the private sector is

the most expressed factor in extrinsic factors. At last, the enjoyment of helping people and influencing a young person was enounced only by the first-year PCTs. There was no other altruistic factor from the rest of the participants. The quotations collected through the focus group interviews are presented below.

PCT1-11: *I loved both chemistry and my former chemistry teacher. My chemistry teacher had much influence on me. His approach to the student, lecture, and attitude was very nice. He even broke our prejudices against chemistry.*

PCT1-4: *I was planning to be a science teacher, but the principal of the high school I graduated from in Izmir changed my mind. He said there is a great need for chemistry teachers in İzmir. Then we asked different teachers if there was such a need. We learned that was true, and the number of graduates was low, so I chose chemistry teaching department*.

PCT4-1: *I believe that chemistry was taught wrongly to us when I was in high school. No lesson should be taught in a way that the teacher opens the notebook and writes only questions on the board. After coming here, I asked, should chemistry be taught in another way? I came here to teach chemistry better than my teacher.*

PCT1-18: *I enjoy chemistry, but touching a young person's life and future is much more valuable than chemistry for me. I want to experience this feeling.*

### 3.3. The Findings of The PCTs' Second Department Choices If They Had A Second Chance

The findings gathered through the opinion form about the PCTs' second department choices if they had a second chance can be seen in Table 9.

**Table 9**

*The PCTs' Second Department Choices If They Had A Second Chance*

| Field | Department | First-year | | Second-year | | Third-year | | Fourth-year | |
|---|---|---|---|---|---|---|---|---|---|
| | | PCTs | f | PCTs | f | PCTs | f | PCTs | f |
| Health | Nursing | PCT1-13, PCT1-21 | 2 | PCT2-3, PCT2-15 | 3 | - | - | PCT4-1, PCT4-3 | 2 |
| | Pharmacy | PCT1-1, PCT1-2, PCT1-10, PCT1-12 | 4 | - | - | - | - | - | - |
| | Dietetics | PCT1-4, PCT1-19 | 2 | - | - | | | | |
| | Veterinary medicine | - | - | - | - | PCT3-3 | 1 | - | - |
| | Dentistry | - | - | - | - | PCT3-1 | 1 | - | - |
| | Midwifery | - | - | PCT2-6 | 1 | - | - | - | - |
| Education | Secondary mathematics education | PCT1-3, PCT1-14, PCT1-16, PCT1-18 | 4 | PCT2-1, PCT2-4, PCT2-8 | 3 | PCT3-2 | 1 | - | - |
| | Science education | PCT1-10, PCT1-20 | 2 | PCT2-7, PCT2-10 | 2 | - | - | - | - |
| | Primary mathematics education | PCT1-2 | 1 | - | - | - | - | - | - |
| | Literature education | - | - | PCT2-17 | 1 | - | - | - | - |
| | Primary school education | - | - | PCT2-12 | 1 | - | - | - | - |
| Chemistry | Chemistry education | PCT1-8, | 4 | PCT2-7, PCT2-5, | 4 | PCT3-5 | 1 | - | - |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | PCT1-11, PCT1-15, PCT1-17 | | PCT2-13, PCT2-2 | | | | | |
| | Chemistry | PCT1-5, PCT1-6, PCT1-7 | 3 | - | - | - | - | - | - |
| | Chemical engineering | - | - | PCT2-13 | 1 | - | - | - | - |
| Social sciences | Political sciences | - | - | PCT2-17 | 1 | - | - | - | - |
| | Psychology | - | - | - | - | - | - | PCT4-2 | 1 |
| | Music/Sports | - | | PCT2-11 | 1 | - | - | - | - |
| No field | I do not know | - | - | PCT2-9 | 1 | - | - | - | - |
| | I did not prefer a department. I would go abroad. | - | - | PCT2-16 | 1 | - | - | - | - |
| | I prefer something except teaching. | PCT1-9 | 1 | - | - | - | - | - | - |
| Security | Policing | - | - | - | - | - | - | PCT4-3 | 1 |
| | Military school | - | - | - | - | PCT3-6 | 1 | - | - |

The participants were asked if they had a second chance of which department they would prefer to study. It can be seen in Table 9 that their answers were based on different fields like health, education, chemistry, social sciences, no field, and security. Interestingly the preferences varied according to the easy appointment, being part of their dreams, and their personal characteristics. The quotations collected through the focus group interviews are presented below.

PCT1-5: *I would prefer the chemistry department (a department of the faculty of science and literature not in the faculty of education). This is the department that makes me more excited and curious.*

PCT1-6: *Chemistry but in English because it has more opportunities.*

PCT1-12: *I would choose pharmacy because it is related to chemistry.*

PCT2-3: I *would prefer nursing. It also deals with people, like teaching, and has good appointments.*

PCT2-12: *I would study primary school teaching because of good appointments.*

PCT2-10: *I would like to be a teacher again but I would choose science teaching. The fact that it is related to science and that I have the opportunity to give private courses, and that the number of appointments is high.*

PCT2-6: *Midwifery. It is imposing to be the first to see and hold a newborn baby, to bring a new individual into the world.*

PCT3-3: *Veterinary medicine was my dream.*

### 3.4. The Findings of The PCTs' Career Plans For The Post-Graduation Period

The findings gathered through the opinion form about the PCTs' career plans for the post-graduation period can be seen in Table 10.

**Table 10**

*The PCTs' Career Plans For The Post-Graduation Period*

| Major plans | Minor plans | First-year | | Second-year | | Third-year | | Fourth-year | |
|---|---|---|---|---|---|---|---|---|---|
| | | PCTs | f | PCTs | f | PCTs | f | PCTs | f |
| Working as a teacher | I want to be appointed to a public high school | PCT1-2, PCT1-3, PCT1-5, PCT1-7, PCT1-8, PCT1-10, PCT1-12, PCT1-14, PCT1-15, PCT1-16, PCT1-18, PCT1-19 | 12 | PCT2-1, PCT2-2, PCT2-3, PCT2-4, PCT2-5, PCT2-8, PCT2-9, PCT2-10, PCT2-12, PCT2-13, PCT2-14, PCT2-15, PCT2-16, PCT2-17 | 14 | PCT3-1, PCT3-2, PCT3-4, PCT3-5, | 4 | PCT4-1, PCT4-2, PCT4-3 | 3 |
| | I will work in a private course if I cannot be appointed. | PCT1-4, PCT1-9, PCT1-13 | 3 | PCT2-9, PCT2-10, PCT2-14 | 3 | PCT3-4 | 1 | - | - |
| | I will not try to be appointed. I am going to work on a private course. | PCT1-11, PCT1-20 | 2 | PCT2-3 | 1 | - | - | - | - |
| Doing academic researches | I want to be an academician | PCT1-1, PCT1-10, PCT1-13, PCT1-17 | 4 | PCT2-15, PCT2-17, | 2 | - | - | PCT4-1, PCT4-2, PCT4-3 | 3 |
| | I want to have a master's degree | - | - | PCT2-2, PCT2-3, PCT2-13, PCT2-15 | 4 | - | - | - | - |
| Doing something except teaching | I want to be a chemist in a laboratory | PCT1-6, PCT1-9 | 2 | - | - | - | - | - | - |
| | I have not made a plan yet | PCT1-21 | 1 | PCT2-11 | 1 | - | - | - | - |
| | I want to trade. | - | - | - | - | PCT3-3 | 1 | - | - |
| | I want to work in the military. | - | - | - | - | PCT3-6 | 1 | - | - |
| | I do not intend to be a teacher. | - | - | PCT2-6 | 1 | - | - | - | - |
| | I can live abroad. | PCT1-4 | 1 | - | - | - | - | - | - |

It can be seen in Table 10 that the PCTs' career plans for post-graduation emerged under three main groups working as a teacher, doing academic research, and doing something except teaching. In the first category, nearly half of them pay attention to being appointed to a public high school after the KPSS. In the second category, most of them wanted to be academicians. On the other hand, in the last category, almost a quarter of the participants plan to do something but not about teaching, even if they do not have a plan. The quotations collected through the focus group interviews are presented below.

PCT4-1: *I want to be an academician, but I also take the exam, KPSS. Because life is not easy, we should do whatever we can.*

PCT2-4: *Indeed, my priority right now is to be appointed. Even if I can't get a high score in KPSS, I will start to teach in a private course.*

PCT3-3: *After graduation, I want to do something rather than teaching. I am planning to trade.*

PCT2-15: *After graduation, I want to start a master's degree then, if possible, I want to be an academician.*

### 3.5. The Findings of the PCTs' Feelings About the Post-Graduation Period

The findings gathered through the opinion form related to the PCTs' feelings about the post-graduation period can be seen in Table 11.

**Table 11**

*The PCTs' Feelings About The Post-Graduation Period*

| Major feelings | Minor feelings | First year | | Second year | | Third year | | Fourth year | |
|---|---|---|---|---|---|---|---|---|---|
| | | **PCTs** | **f** | **PCTs** | **f** | **PCTs** | **f** | **PCTs** | **f** |
| Negative | Fear | PCT1-1, PCT1-2, PCT1-4, PCT1-6, PCT1-13, PCT1-11, PCT1-12 | 7 | PCT2-1, PCT2-2, PCT2-4, PCT2-11, PCT2-13, PCT2-14, PCT2-15, | 7 | PCT3-1, PCT3-2, PCT3-5, PCT3-6 | 4 | - | - |
| | Uncertainty | - | - | PCT2-2, PCT2-8, PCT2-16, PCT2-17 | 4 | PCT3-4 | 1 | PCT4-2, PCT4-3 | 2 |
| | Sadness | - | - | - | - | - | - | PCT4-1, PCT4-2 | 2 |
| Positive | Excitement | PCT1-2, PCT1-7, PCT1-8, PCT1-11, PCT1-18, PCT1-16, | 6 | PCT2-14 | 1 | PCT3-3 | 1 | - | - |
| | Hope | PCT1-2, PCT1-15, PCT1-16, PCT1-20, | 4 | - | - | PCT3-3 | 1 | - | - |
| | Happiness | PCT1-5, PCT1-9, PCT1-10, PCT1-14, PCT1-16, PCT1-17 | 6 | PCT2-10 | 1 | - | - | - | - |
| | Comfort | - | - | PCT2-3 | 1 | - | - | - | - |
| | Triumph | PCT1-21 | 1 | - | - | - | - | - | - |
| Other | Answers not adhering to a feeling | PCT1-3 | 1 | PCT2-12, PCT2-6 PCT2-9 PCT2-5 | 4 | - | - | PCT4-3 | 1 |

It can be seen in Table 11 that the PCTs have more negative feelings regarding the post-graduation period. They said this period made them more afraid, sad, and uncertain. However, on the other hand, some have positive vibes, like feeling more excited, hopeful, and happy. The quotations collected through the focus group interviews are presented below.

PCT1-16: *Getting into business life and earning money excites me, and doing this in a profession that I love makes me feel happy.*

PCT1-2: *A small amount of anxiety and fear, but I do not lose hope. In fact, I can achieve anything thanks to my determination.*

PCT2-8: *I feel emptiness. "What am I going to do or what should I do?" I say.*

PCT2-17: *I am still determining what will happen after graduation.*

PCT2-3: *Comfort. I will never be idle, and I am sure I will be a successful and sought-after teacher. The maximum time I will have difficulty in this profession is the first 2 or 3 years.*

### 3.6. The Findings of The PCTs' Opinions About Possible Changes That Can Be Made in The Chemistry Teaching Program

The findings gathered through the opinion form related to the PCTs' opinions about possible changes that can be made in the chemistry teaching program can be seen in Table 12.

**Table 12**

*The PCTs' Opinions About Possible Changes That Can Be Made In The Chemistry Teaching Program*

| Types of changes | Examples of changes | First-year | | Second-year | | Third-year | | Fourth-year | |
|---|---|---|---|---|---|---|---|---|---|
| | | PCTs | f | PCTs | f | PCTs | f | PCTs | f |
| Modification of courses' distribution in the program | There should be more laboratory courses. | PCT1-1, PCT1-2, PCT1-8, PCT1-9, PCT1-11, PCT1-15, PCT1-16, PCT1-17, PCT1-18 | 9 | PCT2-3, PCT2-7, PCT2-8, PCT2-12, PCT2-13, PCT2-14, PCT2-16, PCT2-17 | 8 | PCT3-3 | 1 | PCT4-3 | 1 |
| | More experiments should be done instead of verbal explanations | PCT1-5, PCT1-18, PCT1-19 | 3 | PCT2-1 | 1 | - | - | - | - |
| | I would like to increase the number of field education courses | PCT1-2, PCT1-10 | 2 | PCT2-4, PCT2-5 | 2 | - | - | - | - |
| | I would like to reduce the number of professional konowledge courses. | - | - | - | - | - | - | PCT4-1, PCT4-2, PCT4-3 | 3 |
| | I want the teaching practice courses to start in the earlier semesters of the program | - | - | PCT2-3, PCT2-13, PCT2-17 | 3 | - | - | - | - |
| | I would like to increase elective field education courses | - | - | - | - | PCT3-1, PCT3-2 | 2 | - | - |
| | I would like to abolish the math course | PCT1-6, PCT1-12 | 2 | - | - | - | - | - | - |
| | I want the course hours to be increased | - | - | PCT2-1 | 1 | PCT3-4 | 1 | - | - |
| | I want the course intensity to be reduced. | - | - | - | - | PCT3-6 | 1 | - | - |
| | I want more courses about how to survive in the private sector | - | - | PCT2-3 | 1 | - | - | - | - |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Modification of the context of the courses | Firstly, learning the more simplified version of the courses that the student has difficulty with and then focusing on the more detailed version of the course | - | - | PCT2-3, PCT2-6, PCT2-11, | 3 | - | - | - | - |
| | I want to use more materials during the courses | PCT1-11 | 1 | - | - | - | - | - | - |
| | I would like to be taught how to adapt the knowledge I have learned at the university level to the high school level. | - | - | PCT2-1 | 1 | - | - | - | - |
| | I want compensation for the online courses | - | - | PCT2-4 | 1 | - | - | - | - |
| | Exams of the laboratory courses should be performed through the hands-on activities | - | - | PCT2-15 | 1 | - | - | - | - |

It can be seen in Table 12 that if the PCTs had a chance, they would change the chemistry teaching program in two different dimensions. In the first group, they would change the distribution of courses in the program. They would like to be responsible for more field education courses. The second group wants to alter the context of the courses in the program. The quotations collected through the focus group interviews are presented below.

PCT4-2: *Professional knowledge courses are very tiring and reduce our motivation for our field. When we want to pass these courses, we cannot give enough weight to field education courses. Moreover, it is not right to attend professional knowledge courses with other departments. For example, we are a science-based department, and our brains do not work like the students of social-based departments like social science teaching and preschool teaching. Therefore, we need to take these courses together with similar departments.*

PCT4-1: *We need more field education courses and laboratory-specific courses. The laboratory is vital for the chemistry teaching department.*

PCT4-2: *We need more laboratory experience and field education courses that we could not take. For example, according to the current curriculum, we are not responsible for nuclear chemistry or electrochemistry courses.*

PCT4-3: *Sadly, we will be obliged to teach the "chemistry and electricity" unit in the 10$^{th}$ grade chemistry curriculum in the future, but in the undergraduate chemistry program, we are not responsible for the electrochemistry course. I think we could compensate for the insufficient laboratory experience but could hardly overcome these kinds of missing courses.*

## RESULTS AND DISCUSSION

The PCTs' opinions about the chemistry teaching department were investigated in this research. In the beginning, the main starting point was to see whether they willingly preferred this department. When asked this question, it was seen that almost all of them willingly preferred and this result is in line with the literature (Beşoluk & Horzum, 2011). Settling into a department willingly, even a labored department like chemistry teaching due to the laboratory work, may increase stamina because a PCT can stay in the laboratory for hours and may be in hazardous circumstances. Otherwise, a PCT can hardly endure the laboratory load.

The factors that shaped the PCTs' preferences were also meaningful for interpreting their opinions about the department. They had multiple factors for enrolling in the chemistry teaching department, not a single factor shaped their choices (Sinclair, 2008). Three main types of factors emerged intrinsic, extrinsic, and altruistic, comprising their reasons. Under the intrinsic factors, the participants' answers were related to their inner worlds and feelings. The most frequent answers were enjoying chemistry and dreaming of being a teacher. The participants expressed that they believed themselves in being able to teach efficiently. The PCTs' confidence can help them to get through the early career years with less frustration. In this research, the PCTs were mainly driven by intrinsic factors, which were in line with the literature (Sinclair, 2008; Struyven et al., 2013).

The students generally remember the teachers who positively influenced them, helped their learning process, and paid attention to their unique characteristics (Czikszentmihalyi, 1982). Students may be charmed by their teachers not only in positive ways but also in negative ways. In the first group, students choose to teach with the sympathy of their teachers. The students admire these teachers, and they may imagine being such an effective/admirable teacher in the future. On the contrary, the other group prefers to teach differently than their teachers, which causes bad memories such as punishment and not teaching well. The participants expressed reasons in line with these two categories in this research. Some of them were influenced by their chemistry teachers in positive ways, while some of them were influenced in the opposite. In the second category, the participants were stubborn about surpassing their insufficient chemistry teachers. They had the ambition to do experiments and teach meaningfully, using technology despite all the inadequacies. They motivated themselves to teach chemistry better to overcome the challenges they experienced in their chemistry learning process. This result is compatible with the previous experiences or beliefs that shape the current teaching of prospective teachers (Boz & Uzuntiryaki, 2006; Bryan, 2003; Tsai, 2002; Tünkler, 2021; Uzuntiryaki & Boz, 2007). Right here, the responsibilities of teachers become prominent. Prospective teachers accept good teachers (according to them) as role models in planning their future (Calderhead & Robson, 1991). If the teachers do their job effectively, the students may admire and prefer doing the same job unless a department may not be preferred if the teachers do not teach in such an unlikeable way.

Under the extrinsic factors, three different sub-factors emerged. The need for chemistry teachers in the private sector, settling according to the rank of the university entrance exam, and the prestige of being a teacher in social life were shaping the participants' preferences. Sinclair (2008) and Derman et al. (2008) suggested a title, it was the influence of others. In the current research, the former teachers' advice about the demand for chemistry teachers in the private sector, can be examples of others' influence on the PCTs. Also, the influence of others emerged in another way as the prestige of being a teacher in daily life influences young people's preferences compatible with the literature (Bulut & Doğar, 2006; Musa & Bichi, 2015). These extrinsic factors were more related to the participants' external world, like job opportunities, salary, and other viewpoints. Under the altruistic factors, paying more attention to influencing the students' lives than teaching chemistry and enjoying helping people were seen.In this group, the PCTs were under the thumb of their feelings. In the end, similar to Azman (2013), in this research, it was found that an interplay among these three factors influenced the participants' preferences.

When the participants were asked if they had a second chance and which department they would prefer, their answers varied under the different fields like health, education, chemistry, social sciences, and security. This result is compatible with the literature (Çermik et al., 2010). Interestingly some of them expressed that they would do something except chemistry teaching. It can be said that the PCTs changed their career plans according to sufficient salary, assignment, and enjoyment. Some participants stated that if they had a second chance, they would still prefer something related to chemistry, such as pure chemistry, and chemical engineering. This result can be interpreted as an indication that the PCTs like chemistry.

The PCTs' career plans for post-graduation, working as a teacher, doing academic research, and doing something except teaching themes emerged. Pleasingly working as a teacher is their initial career plan. In this group, appointment to a public high school after KPSS is at first rank, compatible with the literature (Beşoluk & Horzum, 2011). If not, some of them were planning to teach in a private course. Interestingly, some few did not talk about the appointment. They will start to teach in a private course directly, no matter if they can be appointed. Because in Turkey, early-career chemistry teachers settle in the eastern part of the country. Some participants did not want to challenge themselves living far from their families or friends etc. So they may be planning to be close to their hometown or wherever they want to live under the circumstances whatever they are accustomed to. Moreover, like the earlier research, one of the PCTs expressed that they did not intend to work as a teacher after graduation (Beşoluk & Horzum, 2011). Sinclair (2008) linked this possible career change with nonemployment and geographic relocation. At this point, it can be said that the PCTs' preferences, and beliefs are context-bound, and may be like the shadow of economic and sociocultural circumstances, and past educational background (Al-Amoush, et al., 2014).

In the doing academic research category, the PCTs referred to the master's degree. This result may be related to get in touch with academicians during the undergraduate degree. For instance, they may be part of the data collection process of any scientific research and thus they may be inspired from by the researchers. Moreover, completing a scientific research methods course may have made them more sympathetic to a master's degree. So they may plan to work in that way.

In the last group of the alternative career plans category, some participants expressed that they would do something except teaching in the future. Being a chemist, not having a plan yet, trading, working in the military, not being a teacher, and living abroad are among their plans. Therefore, the chemistry teaching program may serve as an intermediate step for their subsequent lives.

The PCTs' feelings about the post-graduation period were different. Most of them had negative feelings like fear, uncertainty, and sadness. It can be said that the low probability of appointment, as stated by Beşoluk and Horzum (2011) in their studies, may be effective in having more negative feelings towards the period after graduation. In order for a chemistry teacher to be appointed to a public school, she must get high scores from KPSS, otherwise she may have to work in private schools with low salaries and high performance. On the other hand, some of them had positive feelings like excitement, hope, happiness, comfort, and triumph. In this category, they may focus on the feeling of having accomplished something after four years. Therefore, they are more optimistic about the future and have self-confidence.

Unfortunately, in Turkey, KPSS and employment is the most emphasized problem among prospective teachers (Beşoluk & Horzum, 2011). The students prioritize a department to what extent they can appoint easily. Unfortunately, the order of preference is not in line with interests and abilities but under the influence of easy appointments (Kızılçaoğlu, 2003). This research has determined that appointments affect prospective teachers' concerns about future appointments. It is the determinant of many things, from the department they would choose if they had a second chance, to the post-graduation career plans, and feelings about the post-graduation period. Although no comparison was made between the grade levels in this study, when the literature was examined, it was seen that the anxiety of appointment negatively affected the attitudes of the pre-service teachers in the last year more than the pre-service teachers in the first year towards teaching (Bulut & Doğar, 2006).

According to the Universal Declaration of Human Rights "Everyone has the right to education." (United Nations, 2023). Starting from this point UNESCO detailed the knowledge fund about education being a fundamental right and emphasized that the right to education entails

well-designed teaching activities (UNESCO, 2023). Therefore, more qualified teaching activities mean a more supportive undergraduate teacher education program (Musa & Bichi, 2015). The quality of a teacher education program can be better by paying attention to the experiences and opinions of those who are educated according to it. For this reason, the PCTs' views about the chemistry teaching program were investigated in the current research.

The PCTs complained about why there were so many teaching profession courses, similar to Beşoluk and Horzum (2011), instead of more field education courses in common. They proposed two main modifications to the undergraduate chemistry teaching program, modification of the courses' distribution and modification of the courses' contexts. The first group emphasized their need for more laboratory-based courses like instrumental chemistry laboratory than teaching professional courses like education sociology. In the second group, the participants suggested more modifications just in the context of the courses. If they had a chance, they would interfere with how the courses were conducted. They wanted a more simplified teaching, more materials used instructions. Interestingly one of the participants emphasized that they need compensation for the online courses. She may have thought about the low efficiency of online education during the COVID-19 pandemic.

The participants criticized the chemistry teaching program. As a result of less experience, the participants attending the program's early years were generally pleasant about it. However, due to the victimization of compelling laboratory performance, the rest complained about why they have fewer laboratory-specific courses. Most emphasized that both laboratory and field education courses were insufficient. They complained about why there were so many professional knowledge or general cultural courses instead of more chemistry-focused courses in common. Moreover, this non-proportional distribution of courses can cause them to become unqualified chemistry teachers in the future. Because they do not have enough laboratory experience and have limited laboratory culture. As an individual experience of the researcher, the PCTs could hardly set up the experimental equipment as much as their counterparts did in previous years. Briefly, they may favor such modifications due to their awareness of these inadequacies. However, in the past (before 2018), the chemistry teaching program was much more intense in terms of the number of chemistry courses and class hours. For example, general chemistry laboratories were placed in the first and second semesters, but now the new version of these laboratories is in the second semester only. The inorganic chemistry laboratory extinced, which was a compulsory course in the third and fourth semesters with four class hours in the past. The analytical and organic chemistry laboratories were also reduced to two class hours from four hours. Nor is this all the physichochemistry lab shifted to an elective course in the sixth semester with two hours. It was like inorganic, analytical, and organic chemistry laboratories, a compulsory course in the fifth and sixth semesters with four class hours. These alterations in laboratory courses affected the PCTs directly and excessively. Based on the experience, the participants were satisfied and dissatisfied with the percentages of the courses in the program, which are similar results in the literature, can be caused by the shortening of Beşoluk and Horzum (2011) expressed the prospective teachers' denouncements of the program. The participants said that some courses were unnecessary, more teaching experience-focused courses should be placed, and pedagogical courses may not be required. These inferences overlapped with the current research. The shortening of the chemistry teaching program from ten semesters to eight semesters can be the reason for alteration both in course types (compulsory or elective courses) and course hours. Ergun (2013) compared the chemistry teaching programs in Turkey and Switzerland and stated that the longer program (seven years in Switzerland) may enable more different course types like Organic Chemistry III, Physical Chemistry III, Mass Spectroscopy, Chemistry Education Seminar, and School Experience II.

While the current research was being carried out, the responsibility for the design of teacher training programs was given to the faculties of education by the Council of Higher Education. While some faculties across the country implemented this decision, some continue to use the program implemented in 2018. As mentioned in the previous sections, the chemistry teaching

program that meets the expectations of the PCTs has been prepared and even started to be used by some faculties. At this point, the validity of the participants' views in the current study has been confirmed, in a sense.

Sadly this research has some limitations in itself. Due to the difference in the number of participants among the classes (especially third and fourth grades with first and second grades), a comparison did not prefer whether the PCTs' opinions changed according to the year. Moreover, this was cross-sectional research in a state university. Longitudinal research may be designed with the same participants to see the change over the years. Another design may be done countrywide, so the different chemistry teaching departments can be compared in different universities and a more holistic perspective can be provided.

Some suggestions will be made at this point to make the chemistry teaching program more preferred and popular. First of all, it is seen that a solution to the appointment problem is required both in this research and when the country's agenda is examined. Unfortunately, PCTs take the possibility of finding a job into consideration before choosing a department. The possibility of appointment can be increased with multifaceted work such as increasing the number of chemistry course hours in the secondary education program, improving teachers' conditions after retirement so that they can retire easily and young teachers can be appointed easily as well, increasing the types of chemistry-related courses (such as chemistry applications), and limiting to become teacher via the pedagogical certificate program. The pedagogical certificate program decreases the possibility of working as a teacher both in public and private schools. Because with this program, the number of chemistry teachers increases. This situation reduces the interest in the chemistry teaching program because it reduces the motivation of the PCTs. Another important point is the need for studies to increase the quality of the chemistry teaching undergraduate program. As it is known, the laboratory is at the center of chemistry teaching. If the PCTs do not gain sufficient laboratory experience during their undergraduate degree, they may not be able to integrate the laboratory into their chemistry courses in their professional lives. This may pose an obstacle to secondary school chemistry course success. Therefore, more types of laboratory courses should be included in the undergraduate program, as in previous programs. When solutions to all these problems are offered, chemistry teaching programs can receive the attention they deserve and chemistry teachers can be trained to educate students who can represent our country in important scientific studies.

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## GENİŞLETİLMİŞ ÖZ

### Giriş

Nitelikli öğretmen; mesleğini seven, tüm avantaj ve dezavantajlarını göze alıp bu mesleği yapmaya devam eden kişidir. Bir öğretmen mesleğine değer vermediğinde mesleğine dışsal nedenlerle bağlanabilir bu da sınıf içindeki öğrenme-öğretme süreçlerine yansıyabilir. Öğrenciler negatif anlamda bu süreçten etkilenebilirler. Öte yandan mesleğini severek yapan bir öğretmen ise sadece konu içeriğini öğretmekle kalmaz, aynı zamanda öğrencinin yaşamına da katkıda bulunabilir. Bu sayede öğrenciler dersten keyif alabilir hatta gelecekte öğretmen olmanın hayalini bile kurabilirler. Çünkü öğrencilerin bir mesleğe ilgi duyması ve onu sevmesi, o mesleğe sahip olan kişilerin işlerinden ne derece zevk aldıkları ile ilgilidir (Csikszentmihalyi, 1982). Özetle "öğretmen eğitim sürecinde kilit rol oynar" denilebilir. (Bulut ve Doğar, 2006, s.14).

Ülkemizde liseden sonra bir öğrenci hayatının geri kalanında hangi mesleği yapacağına karar verir ve sırasıyla Temel Yeterlilik Testi (TYT) ve Alan Yeterlilik Testi (AYT) olmak üzere iki aşamalı sınavlara girer. Sınav sonucunda tercih ettiği programların sıralamasını yapar ve aldığı puana göre ÖSYM tarafından bir programa yerleştirilir (YKS Yükseköğretim Programları ve Tercih Kılavuzu, 2023). Adaylar tercihlerini yaparken sıralama, ilgi alanı, içinde bulunduğu şartlar veya kendince önemli bulduğu kriterleri dikkate alabilirler. Kimya öğretmenliği bölümü öğretmen adaylarının tercih edebileceği programlardan birisidir.

Türkiye'de 2022 yılı için 11 üniversitenin kimya öğretmenliği bölümü aktif olarak öğrenci almaktadır. Bölümlerin kontenjanlarının tamamı 20 kişi olup, 1 kişilik de okul birincisi kontenjanı ayrılmıştır. Boğaziçi Üniversitesi ülke genelinde en yüksek başarı derecesine sahip öğrencileri kabul etmektedir. Atatürk ve Van Yüzüncü Yıl Üniversiteleri kimya öğretmenliği bölümleri birkaç yıl önce öğrenci alımını durdurmuş ancak bu yıl yeniden öğrenci alımına başlamıştır. Ne yazık ki Dicle, Ondokuz Mayıs ve Trabzon Üniversiteleri kimya öğretmenliği bölümlerine bazı kriterlere uymadığı için son vermişlerdir (Dicle Üniversitesi, 2023; Ondokuz Mayıs Üniversitesi, 2023; Trabzon Üniversitesi, 2023).

Bu çalışmanın amacı kimya öğretmen adaylarının gözünden kimya öğretmenliği bölümünün mevcut durumunun ortaya konulmasıdır. Kimya öğretmenliği programına ülkemizde yıllar içinde daha az öğrenci alınmaya hatta bazı üniversitelerde öğrenci alınmamaya başlanmıştır. Bu durumun üzerine bir de Kamu Personeli Seçme Sınavı'nda (KPSS) atanmanın da zorlaşması eklenince kimya öğretmenliği daha az tercih edilir hale gelmiştir. Alanyazın incelendiğinde bu programının kimya öğretmen adaylarının perspektifinden tercih edilme durumlarına yönelik güncel bir çalışmaya rastlanmaması da bu yönde bir araştırmanın yapılma ihtiyacını doğurmuştur.

Çalışmada cevap aranan araştırma soruları aşağıda sunulmuştur.

1. Kimya öğretmenliği bölümüne isteyerek mi yerleştiniz, istemeyerek mi?
2. Neden kimya öğretmenliği bölümünü seçtiniz?
3. İkinci bir şansınız olsa hangi bölümü tercih ederdiniz? Neden?
4. Mezuniyet sonrası kariyer planınız nedir?

5. Mezuniyet sonrası dönem size nasıl hissettiriyor?
6. Kimya öğretmenliği lisans programında ne gibi değişiklikler yapılmasını isterdiniz?

**Yöntem**

Nitel bir anlayışa gore gerçekleştirilen çalışmada durum çalışması modeli tercih edilmiştir. Kimya öğretmen adaylarının kimya öğretmenliği bölümüne yönelik görüşleri bir durum olarak kabul edilmiştir. Katılımcılar amaçsal örnekleme yöntemlerinden ölçüt örnekleme tekniği kullanılarak belirlenmiştir (Patton, 2002). Ölçüt olarak Türkiye'nin batısında yer alan bir devlet üniversitesinde kimya öğretmenliği anabilim dalında öğrenim görme ve gönüllü olma olarak belirlenmiştir. Bu ölçütleri sağlayan 47 kimya öğretmen adayı ile çalışma yürütülmüştür. Katılımcılar aynı fakültenin kimya öğretmenliği programında bir, iki, üç ve dördüncü sınıfta öğrenim görmektedir. Veriler araştırmacı tarafından geliştirilen açık uçlu sorulardan oluşan bir görüş formu ve odak grup görüşmesi ile iki aşamada toplanmıştır. Katılımcılar önce görüşme formunu doldurmuş sonrasında her sınıf düzeyi ile ayrı bir zaman dilimi içinde odak grup görüşmeleri gerçekleştirilmiştir. Elde edilen verilerin analizinde klasik içerik analizi yapılmıştır (Leech & Onwuegbuzie, 2011).

**Bulgular**

Çalışmadan elde edilen bulgular incelendiğinde ilk olarak katılımcıların büyük çoğunluğunun kimya öğretmenliği programına isteyerek yerleştiklerini ifade ettikleri belirlenmiştir. Devamında bölümü daha çok içsel nedenlerin sağladığı motivasyonla tercih ettiklerini ifade etmişlerdir. Bu içsel faktörler arasında kimyayı sevmeleri, öğretmen olmak istemeleri gibi başlıklar öne çıkmıştır. Katılımcılar ikinci bir tercih hakları olsa daha çok sağlık alanındaki bölümleri tercih edeceklerini belirtmiş ve örnek olarak da hemşirelik, eczacılık, diyetisyenliği ilk sıralara yerleştirmişlerdir. Eğitim alanında tercih yapacaklarını ifade eden bazı öğretmen adayları da ilk sırada matematik öğretmenliği, fen bilgisi öğretmenliğini belirtmişlerdir. Bu tercihlerin de atanma, iş bulma olasılığının yüksek olmasına göre öncelik kazandığı görülmüştür. Mezuniyet sonrası döneme ilişkin kariyer planları sorgulandığında önceliklerinin atanmak olduğu, eğer atanamazlarsa özel kurumlarda çalışmak yönünde olduğu belirlenmiştir. Mezuniyet sonrasındaki döneme ilişkin duyguları incelendiğinde ilk sırada korku, belirsizlik, hüznün yer aldığı belirlenmiştir. Son olarak kimya öğretmenliği lisans programına yönelik ne gibi değişiklikler yapmayı istedikleri incelendiğinde olası değişiklik önerileri iki başlık altında toplanmıştır. İlk olarak programdaki derslerin dağılımına yönelik değişiklik, ikinci olarak da programda yer alan derslerin içeriğine yönelik değişiklik istedikleri belirlenmiştir. Daha çok kimya ve laboratuvar odaklı derslerin olması gerektiğini, birbirini takip eden meslek bilgisi derslerin çıkarılması gerektiğini düşündükleri ortaya çıkmıştır.

**Sonuç**

Bu araştırmada kimya öğretmen adaylarının kimya öğretmenliği bölümü hakkındaki görüşleri incelenmiştir. Başlangıçta asıl çıkış noktası, bu bölümü isteyerek tercih edip etmediklerini görmek olup hemen hemen tamamının bu program isteyerek tercih ettikleri görülmüştür ve bu sonucun ilgili alanyazın ile uyumlu olduğu belirlenmiştir (Beşoluk & Horzum, 2011). Laboratuvar çalışması nedeniyle kimya öğretmenliği gibi zahmetli bir bölüme isteyerek yerleşmek ve bölümden mezun olmak öğretmen adaylarının çalışma hayatlarındaki mesleki dayanıklılığı artırabilir. Çünkü daha öğrenciyken laboratuvar ortamında zorlu çalışma şartları ile karşı karşıya kalabilmektedirler. Öğretmen adaylarının kendi bölümlerini tercih etmelerinde alanyazınla uyumlu olarak tek bir neden değil birçok neden etkili olmuştur (Sinclair, 2008) fakat daha çok içsel faktörler bu konudaki tercihleri üzerinde etkili olmuştur (Sinclair, 2008; Struyven vd., 2013).

Katılımcılara ikinci bir şansları olsa hangi bölümü tercih edecekleri sorulduğunda sağlık, eğitim, kimya, sosyal bilimler, güvenlik gibi farklı alanlarda cevaplar verdikleri belirlenmiştir.

Bu sonuç alanyazın ile uyum içindedir (Çermik vd., 2010). İlginç bir şekilde bazı adaylar yüksek öğrenim dışında bir şeyler yapacaklarını ifade etmişlerdir. Bazı katılımcılar, ikinci bir şansları olsa yine de kimya öğretmenliği, kimya ve kimya mühendisliği gibi kimya ile ilgili bir şeyi tercih edeceklerini belirtmişlerdir. Bu sonuç öğrencilerin kimyayı sevdiklerinin bir göstergesi olarak yorumlanabilir. Kimya öğretmen adaylarının mezuniyet sonrasına yönelik kariyer planları; öğretmen olmak, akademik araştırma yapmak ve öğretmenlik dışında bir şeyler yapmak şeklinde çeşitlilik göstermektedir. Bu grupta KPSS'de atanmak alanyazınla uyumlu olarak ilk sırada yer almaktadır (Beşoluk & Horzum, 2011). Atanamayanlar ise özel kurslarda öğretmenlik yapmayı planladıklarını ifade etmişlerdir. Bazıları ise doğrudan kendi yaşadıkları şehirde mevcut düzenlerini bozmadan kurumları tercih edeceklerini belirtmişlerdir. Bu durumun nedeni olarak Türkiye'de kariyerinin başındaki kimya öğretmenlerinin ülkenin doğusuna atanmaları ve bir süreliğine ailelerinden uzak yaşamak zorunda kalmaları olabilir.

Katılımcılardan kimya öğretim programını eleştirmeleri istendiğinde pek çoğu laboratuvar derslerinin yetersiz olduğunu öne sürmüştür. Daha fazla kimya odaklı dersin yerine genel kültür ve meslek bilgisi derslerinin ön planda olması gelecekte yetkin birer kimya öğretmeni olmalarını engelleyebilir. Örneğin, genel kimya laboratuvarları eski programda bir ve ikinci yarıyılda yer alırken 2018 yılındaki programda yalnızca ikinci yarıyılda yer almaktadır. Ek olarak üç ve dördüncü yarıyılda dört ders saati ile zorunlu olan anorganik kimya laboratuvarı dersi de yeni programda yer almamaktadır. Analitik ve organik kimya laboratuvarları da dört saatten iki ders saatine indirilmiştir.

Kimya öğretmenliği programının daha çok tercih edilir hale gelebilmesi adına bu noktada bazı önerilerde bulunulacaktır. Öncelikle atanma problemine bir çözüm gerektiği hem bu çalışma özelinde hem de ülke gündemi incelendiğinde görülmektedir. Çünkü ne yazık ki öğretmen adayları bölüm tercih ederken iş bulma olasılığını dikkate almaktadırlar. Atanma olasılığı ise ortaöğretim programındaki kimya ders saatlerinin artırılması, kimya ile ilgili ders çeşitlerinin artırılması (kimya uygulamaları gibi), emeklilik hakkı kazanan öğretmenlerin emekli olmayı tercih edebilecek şartların sağlanması, pedagojik formasyon ile öğretmen olma hakkı elde etmeye sınır getirilmesi gibi çok yönlü bir çalışma ile artırılabilir. Özellikle pedagojik formasyon ile öğretmenlik hakkı kazanan kişilerin sayısının artması ile eğitim fakültesi mezunlarının iş bulma olasılığı hem özel sektörde hem kamuda giderek azalmaktadır. Bu durum da öğretmen adaylarının motivasyonlarını düşürdüğü için kimya öğretmenliği programına gösterilen ilgiyi azaltmaktadır. Bir diğer önemli nokta ise kimya öğretmenliği lisans programının niteliğini artırmaya yönelik çalışmalara duyulan ihtiyaçtır. Bilindiği üzere laboratuvar kimya öğretmenliğinin merkezinde yer almaktadır. Kimya öğretmen adayları lisans süresince yeteri kadar laboratuvar deneyimi kazanmadıklarında meslek yaşamında da laboratuvarı kimya derslerine entegre edemeyebilir. Bu durum da ortaöğretim kimya ders başarısının önünde bir engel teşkil edebilir. Dolayısıyla lisans programında daha önceki programlarda olduğu gibi daha fazla türde, ders saatinde laboratuvar derslerine yer verilmelidir. Tüm bu problemlere çözüm önerileri sunulduğunda kimya öğretmenliği programları hak ettiği ilgiyi görebilir ve ülkemizi önemli bilimsel çalışmalarda temsil edebilecek öğrencileri yetiştiren kimya öğretmenleri yetişebilir.