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Views of Instructors about Academic Productivity

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Abstract

The purpose of the study is to determine the views of the instructors about the experiences they have during the international publishing in terms of academic productivity. The study aims to reveal the problems the instructors experience during the publication process in international journal indexes and in the journals like SSCI, SCI and AHCI and to determine the needs of the instructors in order them to succeed in this process. In the study, one of the qualitative methods, phenomenological research design was used. The study group consists of 15 instructors determined by criterion sampling within the purposive sampling methods. The basic criterion in determining the study group is that the instructors should complete the doctoral degree in Turkey in the last 10 years or abroad and they should have international publications. The data of the study were collected with semi-structured interview forms. based on the sub-problems of the study and the interviews with the instructors, the following issues were discussed about: the purposes of the instructors in overseas publishing, their experiences in international publishing, the factors motivating themselves for international publishing, if there is, the reason why they didn't want to publish in foreign countries and somehow the reason why they didn't want to publish in the journals in the country, the difficulties they encountered with during the process of international publishing, the strategies they followed during the publication and their recommendations for the researches who wish to make publishing abroad.

Keywords: Productivity, academic productivity, higher education

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Introduction

Universities are educational institutions which combine economic, social and cultural changes together which are shaped under the concept of globalisation, a worldwide phenomenon and which affect the process of globalisation (OECD, 2009). In the 21st century when innovation and competence are regarded as main driving forces, universities which are on the focus of search and development activities and instructors which are the basic elements of universities couldn't resist long against global tendency.

It can be underlined that it is a must that universities should enhance their missions to make scientific studies, which is one of their purposes of existence, in terms of obtaining competition superiority in today's world where mobility of students and instructors, innovation, technology and economic policies based on information are predominant. This necessity also results from the development of the third-generation universities which are entrepreneur and can easily integrate with public.

Many new properties have appeared with the term of third-generation universities. Wissema (2009) stated that the basic core of third world universities consists of interdisciplinary agreement and perception that the driving force is the creativity, industry, research and development institutions, as well as financiers and professional service-providers, collaboration with other universities, working in an international competitive market, hiring the best academicians and students, being active in making research protocols with industry, multiculturalism, transferring the asset of produced data into society, promoting the design and innovation and cosmopolitan organisation. The so-called elements are under the responsibility of not only the management of universities but also of instructors.

During the transformational process of the universities into third generation universities, one of the most important factors to support them is the instructors and their productive activities. The universities whose priority concerns are branding, internationalization, being a renowned university in international area. Likewise, the instructors who wish their scientific studies to reach larger audience are involved in the activities such as increasing their academic productivity and publishing international papers and articles accordingly. This has contributed the universities to promote the instructors to publish academic papers and forced the instructors to develop some strategies for the process of international publishing.

Conceptual Framework: Academic Productivity

The academic progress of the instructors are basically structured under some certain principles. The most renown of these principles is academic productivity also known as productivity or productivity of the instructors. Scientific researches and academic publishing are regarded as an indispensable context of academic progress (Atasoylu, Wright, Beasley, Cofrancesco, Macpherson, Partridge, 2003). It is thought that it is difficult to describe academic productivity in higher education (Gates and Stone, 1997). The term of productivity is generally considered together with effectiveness and prolificacy (Salaran, 2010). Bibliometric analysis is among the most common elements in measuring the performance of the instructors. The number of publications produced by a group, an institution or a nation is considered as an indication of the productivity (Katz and Hicks, 1997; Yinian and Zainab, 2001). The number of scientific research papers is shown as an evidence of academic productivity (Huang, Hsu, 2005). In academic circles, the most critical indicator of research productivity is regarded as publishing (Wood, 1990). Besides, academic productivity or research productivity is defined as one of the most significant promotion tools for post-graduation process (as cited in Mishra and Smyth, 2013). Academic productivity is also thought as a strategy which was developed to tackle with the decrease of government grants (Gates and Stone, 1997).

In academic circles, publishing brings promotion and recognition both for the academicians and their institutions (Salaran, 2010). The process of academic productivity is not only about the

instructors but also an issue which the universities are closely concerned with. With the improvement of economic strategies based on information, the classification of universities has gained importance and this classification is linked with academic productivity. In recent times, in determining the rank of the countries in scientific world, in comparison of universities or institutions in terms of their scientific qualifications and in evaluation of the academic performances of the scientists, three criterion which bring “international publishing activities” into the forefront have generally been accepted: 1) the number of the papers published in international journals, 2) publishing the papers in scientific journals which are reviewed by scientific indexing services 3) the number of citations for the papers (Ak and Gülmez, 2006). Rushton and Meltzer (1981) stated that when the common features of the top universities which take first places in university rankings are studied, the activity of academic productivity come to the front.

The term of academic productivity that gained importance in 1970s is about producing and promoting knowledge. Since it is predominantly based on various aspects of research, teaching, social activities and scientific researches, it is generally considered as a multi-dimensional process (Dundar and Lewis, 1998). Academic productivity is accepted as a strenuous topic due to multi-dimensional structure of producing scientific knowledge and there have been some people who approach the topic by using different perspectives.

One of the issues of those focusing on academic productivity is to define the determinants of academic productivity and to determine the effects of academic productivity on institutions and individuals (Abramo, D’Angelo and Costa, 2009). In the researches, the factors affecting academic/scientific productivity are divided into three groups; personal features (age of the researcher, gender and educational status), institutional and departmental features (the features of the institution, size of the faculty, technological and hardware/IT infrastructure) and environmental features (business policies, funds etc.) (Abramo, D’Angelo and Costa, 2009). Similarly, Rushton and Meltzer (1981) who regard academic productivity as multidimensional divided it into three groups; individual features (natural abilities such as intelligence, age and gender and personal/environmental factors such as the quality of post-graduation education and organizational culture), institutional and departmental factors (organizational structure and leadership, extent of the program, role of private sector, financial potential of the university, technological possibilities of the university, the capacity of the library, etc.) departmental culture and working conditions (labour force policies, travel funds to make researches, institutional funds, etc.).

Abramo, D’Angelo and Costa (2009) and Lee and Bozeman (2005) stated that scientific cooperation was considered as a part of the process of academic productivity, however, Creswell (1986) underlined that departmental culture should be added in the process. Crewe (1998) said that research productivity was about department policies such as permissions, travel expenses, teaching load and research funds (as cited in Dundar and Lewis, 1998). There are studies which claim academic productivity relies on academic seniority and state the academicians whose seniority is higher are more productive than those of lower ones (Carayol and Matt, 2004; Green, 1998). Besides, self-sufficiency, (Vasil, 1993), research support (Wood, 1990), internal motivation, mentorship process, a research-based culture, a network of international colleagues (and a network of external colleagues) (Bland et al., 2005) are regarded as the elements affecting academic productivity. Bland et al. (2005) stated that academic productivity is influenced with individual, institutional and leadership elements. Academic productivity at an individual level is about socialization, motivation, content information, research abilities at basic and advanced level, simultaneous projects, tendency, autonomy and commitment (to time and purpose) and working habits. Academic productivity at an institutional level is about employment, open targets, importance given for the research, culture, organisational atmosphere, mentorship, networks for professional communication, sources, working time, experience and proficiency, communication, reward mechanisms, distribution of the roles and sharing the managerial responsibility with the shareholders. Academic productivity at leadership level is often linked with implementing some critical roles such as being research-based, participative leadership, management of human and resources, providing resources, creating the group mission and making this mission appreciated. Similarly, Santo et al. (2005) divided the elements affecting academic

productivity into internal and external factors. Accordingly, academic productivity is linked with internal factors such as enjoying doing researches, being motivated, being knowledgeable and skilled and point of view for academic career; and it is linked with external factors such as having sufficient time, having no lack of resources, involving in institutional academic culture, having good relationship with colleagues, mentorship and making collaboration with international colleagues.

Another issue that was analysed in the studies is the obstacles during the process of academic productivity. These obstacles differ in terms of departments. However, in general terms these can be described as financial problems, incentive mechanisms (Smeltzer et al., 2014), time (Bland et al., 2005; Ma and Runyon, 2004; Zhang, 2014), social networks (Santo et al., 2009), age (Levin and Stephan, 1991), gender (Alonso-Arroyo, Gómez-Guardeño, González-Sanjuán, Aleixandre-Benavent, 2013; Levin and Stephan, 1991), departmental culture (Smeby and Try, 2005).

Academic Productivity in Turkey

In Turkey, some certain strategies towards determining policies that will contribute the number of the universities to increase, growing scientists and thus improving the quality of post-graduate programs have recently been adopted in order to follow the global trends in higher-education such as competitiveness, branding and internationalization. In this context, some various studies were implemented to promote academic productivity (especially publishing papers in indexed journals). Turkish Scientific and Technological Research Council of Turkey (TÜBİTAK) and universities started to promote the studies published in international journals by rewarding with different levels. With the Incentive Program for International Scientific Publications which is within the part of TÜBİTAK, international publishing for the researchers working in the research centres of the universities, of public or private institutions was incited (Eti, 2016). However, with the regulation which was published in 2000 and issued in 2017, the obligation that those who want to be academicians should have a published paper in the journals of SSCI, SCI, SCI- Expanded ve AHCI except for the letter to the editor, abstract or a book review; or they should have a published paper in an internationally indexed journal except for the letter to the editor, abstract or book review enhanced the academic productivity of the academicians. In other words, academic productivity can be described as a prior condition for academic progress. Therefore, it is thought that the evaluation about the experiences in the process of academic productivity may lead the way of the instructors.

The Purpose of the Study

The purpose of the study is to determine the views of the instructors about the experiences they have during the international publishing in terms of academic productivity. The study aims to reveal the problems the instructors experience during the publication process in international journal indexes and in the journals like SSCI, SCI and AHCI and to determine the needs of the instructors in order them to succeed in this process.

Method

In the study, one of the qualitative methods, phenomenological research design was used. Phenomenological researches which predominantly focus on the experiences are based on exploring the underlying meaning of these experiences (Merriam, 1998).

Study Group

The study group consists of 15 instructors determined by criterion sampling within the purposive sampling methods. The basic criterion in determining the study group is that the instructors should complete the doctoral degree in Turkey in the last 10 years or abroad and they should have international publications. The demographic features of the study group are shown in Table 1.

Table 1. The demographic features of the study group

| Code of the Instructors | Gender | Age | Professional Seniority | Number of International Publications |
|-------------------------|--------|-----|------------------------|--------------------------------------|
| I1 | M | 32 | 4 | 10 |
| I2 | F | 32 | 9 | 4 |
| I3 | F | 33 | 11 | 2 |
| I4 | F | 31 | 9 | 2 |
| I5 | F | 31 | 9 | 2 |
| I6 | M | 33 | 9 | 4 |
| I7 | M | 31 | 3 | 9 |
| I8 | M | 45 | 10 | 12 |
| I9 | M | 45 | 17 | 6 |
| I10 | F | 46 | 8 | 10 |
| I11 | M | 33 | 9 | 4 |
| I12 | M | 31 | 8 | 3 |
| I13 | F | 32 | 9 | 5 |
| I14 | F | 32 | 9 | 4 |
| I15 | F | 33 | 10 | 4 |

When Table 1 is studied, it is observed that 7 of the instructors are male and 8 of them are female.

Their ages range from 31 to 46 and their professional seniority changes from 3 to 17 years. When the number of international publications is studied, it is noticed that the number is changing from 2 till 12.

Data Collection and Analysis

The data of the study were collected with semi-structured interview forms. The interview form was developed by the researcher. While the interview form was formed, the literature on the academic productivity process was first reviewed. Then the opinions of the two instructors were taken for the interview questions. The questions in the interview form were designed to take the views of instructors,

- Purpose of academic productivity,
- Experiences about the process of academic productivity
- Motivation sources during the process of academic productivity
- The reasons for not publishing in international journals
- The Reasons for not publishing in national journals
- The strategies the instructors followed during the publication process in international journals.

If possible, the instructors were interviewed face to face, if not, they had to be interviewed by phone. The duration of the interview ranged from 30 to 45 minutes. The content analysis was used in data analysis.

Validity and Reliability

In the context of validity and reliability of the conclusions, credibility (internal validity), transmissibility (external validity), consistency (internal reliability), approvability (external reliability) were overwhelmingly attached importance. In order to provide credibility, experts' opinions were taken during data analysis. Besides, confirmation of the participants was received. While providing external validity (transmissibility), the priority was to determine the participants through purposive sampling method. Additionally, determining the participants, the process of data collection and analysis was described in detail. To provide internal reliability (consistency) of the study, raw data from the interviews and sub-themes from the analysis were shown to the experts and the consistency was reviewed accordingly.

Finding and Conclusions

In this chapter, based on the sub-problems of the study and the interviews with the instructors, the following issues were discussed about: the purposes of the instructors in overseas publishing, their experiences in international publishing, the factors motivating themselves for international publishing, if there is, the reason why they didn't want to publish in foreign countries and somehow the reason why they didn't want to publish in the journals in the country, the difficulties they encountered with during the process of international publishing, the strategies they followed during the publication and their recommendations for the researches who wish to make publishing abroad.

Purpose of Academic Productivity

According to the data of the study, there are differences in purpose between the instructors who completed their doctoral degree in abroad and in Turkey. Findings about the purpose of the instructors in publishing international journals are shown in Table 2.

Table 2. Purposes of Academic Productivity

| Theme: Purposes of Academic Productivity | |
|--|---|
| Codes | - to provide academic progress |
| | - to contribute to the science world |
| | - to develop collaborative activities with scientists in international fields |
| | -sharing the results of the study with international community |
| | - desire to publish in indexed journals |
| | -to fulfil the criteria for associate professorship |
| | - benefitting from academic incentive system |

While the instructors were expressing the purpose why they would prefer to make activities of academic productivity, they underlined the importance of sharing the results with international community and of developing collaborative activities with scientists in international fields. However only the instructors completing their doctoral degree in Turkey emphasized the purposes of academic progress such as publishing in indexed journals and fulfilling the criteria for associate professorship, assignment process and academic progress. I-7 underlined that the purpose in the process of Academic Productivity is to contribute to the field and added:

“My intention in having international publishing is to contribute to the field. As far as I see, national publishing is caught in a vicious circle; it doesn't progress and mostly takes after another. The publishing you present to an international journal is not like this; your paper should fill in an important gap and take the field a step further. Thus, I try to make international publishing to contribute to the field globally. Another aim is of course to progress academically. Each academician has an intention

to achieve and progress academically and they should. It is impossible to progress academically without making international publication...”

Experiences about the Process of Academic Productivity

Experiences of the instructors about making international publications are classified as the factors which facilitate the process and the obstacles for academic productivity. Experiences of the instructors about the process of making international publications are given in Table 3.

Table 3. Experiences about the Process of Academic Productivity

| Theme: Experiences about the Process of Academic Productivity | | |
|--|--|---|
| | Sub-theme 1: Facilitating Factors | Sub-theme 2: Encountered Obstacles |
| Codes | - Process of uploading publication | - Prejudices against Turkish writers |
| | - Objective Assessment process | - System of the journal |
| | -Advisory guidance | - Slow feedback |
| | -Quick feedback | -Journal format |
| | - Past experiences | - Colleagues |
| | | -Paid journals |
| | | -language problems |

While the instructors were talking about the process of their academic productivity, they emphasized the facilitating factors and the obstacles they encountered in the process. During the process of publishing, they stated that uploading stages were too complicated but after uploading, the ongoing process was clear and understandable; the experiences about the process were affected positively since the assessment process was based on objective criteria. Apart from these, the instructors who completed their doctoral degree in foreign countries underlined the issue of advisory guidance. About this, I-8 stated: “since I experienced that process with my advisor, I published the first few of my publications with my advisor. My advisor is in US, but I cannot tell that I have experienced too many difficulties because he/she is the person to know the process pretty well and I could make my publications comfortably during the first years.

I-2 said that “the studies conducted by sampling only Turkey might be perceived as too specific or some prejudices against such studies might exist, these are my negative experiences... I can take a quite quick feedback, (negative/positive), for the paper I sent to an international journal, even if the paper is rejected, favourable feedback is always given, the paper is assessed objectively, you can understand what mistakes you have done, I can see that the referees just focus on the study itself, hereby you can feel that the region you are in, your belief or your ethnic identity has no significance. I can see that the referees completely focus on my study during the assessment process, the negative things I said at the beginning are about the process of editorship, if the sampling is about Turkey or if the researcher is someone from Turkey, you can feel the prejudice at this point, I can say that they can provide a quick feedback even in this process. As you know, in Turkey we can wait for long times just for the paper to be sent to the editor, I myself waited for 8 months once, it nearly takes about one and a half year to be sent to the referees. Therefore, it is a positive experience for me when I don’t see these kinds of problems in international journals.

Motivation Sources during the Process of Academic Productivity

The factors motivating the instructors during the process of academic productivity to publish in international journals are shown in Table 4.

Table 4. Motivation Sources of the Instructors about Publishing in International Journals

| Theme: Motivation Sources | |
|---------------------------|--|
| Codes | - Contributing to science |
| | - Contributing to the field |
| | - Reaching the large masses |
| | - Creating a prestigious/professional CV |
| | -Improving personal development |
| | - To be cited |
| | - Benefitting from academic incentive |
| | - An open and clear process |
| | - Generally quick feedback |

As seen in Table 4, in the process of their academic productivity, the instructors classified the motivation sources as contributing to science and to the field, reaching the larger masses, creating a prestigious/professional CV, improving personal development, being cited, benefitting from academic incentive, an open and clear process, generally quick feedback. From these statements, only those who completed their PHD in Turkey emphasized the element of benefitting from academic incentive.

Defining the motivation sources in publishing in international journals, I-11 stated that “well, there is one important thing, they are working quite systematically, I also emphasized about this while talking about the experiences, this is good thing. The fact that they work systematically encourages me to send my other papers to international journals”. I9 also stated that “Here, this is important, you say to yourself you are doing a good study as an academician, because when you publish a study there, which is possible to say depending on the journal you send your paper, you make a more prestigious study, but if this study only stays with you, it doesn’t mean anything. This publishing motivates you of course, another thing is the career development, you have to do that so that you can progress in your career and being renowned and celebrated is also important”.

The reasons for not publishing in International Journals

The factors about the instructors’ reasons for not publishing in international journals are shown in Table 5.

Table 5. The reasons for not publishing in International Journals

| Theme: The reasons for not Publishing in International Journals | |
|---|--|
| Codes | - Finding a suitable national journal |
| | -Researches about national problems |
| | - Increasing the accessibility among the shareholders in the country |
| | - Paid journals |
| | -Feeling of insufficiency |
| | -Concerns about rejection |

When the instructors’ reasons for not publishing in international journals were studied, it was observed that when they found a suitable national journal, made a research about national problems or wanted to increase the accessibility among the shareholders in the country, they preferred national journals instead of sending publication to international journals. Besides, since some international journals are paid-ones, it can be counted as an important factor in choosing a journal. Feeling of insufficiency and concerns about rejection were considered as important factors mostly by the instructors who completed their doctoral degree in the country. About this, I-10 stated that “No, I have nothing, I am not in this situation. But maybe I can say something like that; some cases are only meaningful in these territories not in abroad. For instance, we have a publishing like that, about

Science High Schools. this may not be a valid research topic, because there are no counterparts of Science high schools in some other countries, when there is specific situation like this, I prefer publishing in national journals.

I4 stated that "... Sometimes I am worried, I say myself, now, what if I cannot get accepted, Well, I mean I am afraid of feedback too, have I done so many mistakes in the paper? I am always concerned about such a criticism to come."

I5 "The reason of this can be; If my study is about the system in Turkey or if it will contribute to the field in Turkey, I would like to send the paper to the national journals so that shareholders could benefit from the study and I also would like to do so for those who have language concerns.

The Reasons for not Publishing in National Journals

The factors about the instructors' reasons for not publishing in national journals are shown in Table 6.

Tablo 6. The Reasons for not publishing in National Journals

| Theme: The Reasons for not Publishing in National Journals | |
|---|--|
| Codes | <ul style="list-style-type: none"> - Less reading - Concerns about being cited - Referee process - the length of time in publishing process - Vision of journal |

When the the instructors' reasons for not publishing in national journals were studied, it could be said that those who completed their doctoral degree either in a foreign country or in Turkey had similar worries. The instructors in both groups stated that their publications in national journals would read less and because of this the citation will be less. Apart from these, the ambiguities in referee process were among their concerns.

I-5, "In a foreign country, when a question is asked, they respond it as soon as possible, but I had such a problem in Turkey, I waited for a year and sent many e-mails to the editorship to have an answer. Yet, in abroad, they immediately try to turn back to you with sufficient data..."

I-10 stated that "I plan more comprehensive paper of mine to publish in international journals when I want it to reach larger audiences and if I don't want to restrict only for those who know Turkish. If I make a significant research or if I think my research would pay more attention or if I want it to reach large masses and thus if I want to be cited many times, my preference about publishing paper in a national journal would be limited.

The strategies the instructors followed during the publication process in international journals

The strategies the instructors followed during the publication process in international journals are shown in Table 7.

Table 7. The strategies the instructors followed during the publication process in international journals

| Theme: The strategies the instructors followed during the publication process in international journals | | |
|--|--|---|
| | Sub-theme 1: Strategies about the Journal | Sub-theme 2: Strategies about the Research |
| Codes | Reviewing Journals | Citing papers published in journals |
| | Considering about the topic choice | Valuing language using |
| | Reviewing publishing policies of the journals | Developing a powerful method |
| | Reviewing the editorial / referee board | Creating a strong theoretical basis |
| | Refereeing in national/international journals | Having support from the experts/consultant |
| | Reviewing the focus and content of the journal | |

During the process of publishing in international journals, based on the strategies about journal the instructors focused on the strategies such as reviewing journals, considering about the topic choice, reviewing publishing policies of the journals, reviewing the editorial / referee board. The instructors determined some strategies about researches in sub-theme2 such as citing papers published in journals, valuing language using, developing a powerful method, having support from the experts/consultants.

I-8 stated that “when a research topic comes to my mind, I just start to think about which journal I should send it, at the very beginning, I determine the journal so that I can arrange the quality and content of the study, data analysis and all the other things accordingly. It is too important to determine the target at first, towards the publishing stage, I present the paper in a congress, but I don’t publish it as a paper there, after I get feedback, I send it to a language editor by finalizing the last details. Although I completed my doctoral thesis abroad, our native language is not English, so I send it to a native speaker to review and then I start the publishing process.

I-13 stated as “first, we should study the content of the journal, I mean if it has a specific, minor but quality journal, we should prepare and send the paper based on their publishing policy. They are especially interested in actual events. I pay special attention to cite papers published in their journal”.

Results and Discussions

According to the results of the study, the instructors described the purposes of academic productivity as academic progress, process of academic incentive and contribution to the scientific world. The issues of academic progress and academic incentive were predominantly emphasized by the instructors who completed their doctoral degree in domestic universities. The instructors often approached academic productivity in the context of individual purposes. When the relevant literature was studied, it is possible to see similar results with the purposes of our study about the process of academic productivity. Huang and Hsu (2005) in their studies in which they analysed the process of institutional and individual academic productivity stated that the increasing competition of publishing in eligible journals among researchers could be about some purposes such as gaining a reputation, having a competitive advantage, taking up a position or taking promotion. Similarly, about the purposes of academic productivity, Long (1993) underlined the importance of prestige, Long and McGinnis (1985) and Nordhaug (1993) emphasized educational outcomes; and Mullins (1968) stated about creating social business networks (as cited: Dietz and Bozeman, 2005). Dundar and Lewis (1998) defined that academic productivity is important due to its contributions to corporate reputation; on the other hand, according to Youn and Price (2009) academic productivity seems important for academic progress and employing academicians.

In accordance with the results of the study, the instructors emphasized the facilitating factors and the obstacles they encountered during the process of publishing in international journals. The

instructors described the facilitating factors as the process of uploading publication, objective assessment process, advisory guidance, quick feedback and past experiences. When the favourable experiences were studied, it is possible to say that all experiences were about the factors facilitating the process. The difficulties encountered were described as prejudices against Turkish writers, language problems (emphasized by the instructors who completed their doctorate in domestic country), system of the journal, slow feedback, journal format, colleagues (emphasized by the instructors who completed their doctorate in a foreign country) and paid journals. It is possible to say that the instructors generally based the facilitating factors on the institutional process. They didn't dwell on individual process while talking about their experiences. However, when the literature was reviewed, the experiences based on academic productivity were mostly related with individual factors such as gender and mentorship (Diamond et al., 2016), individual conditions and age of career (Rauber and Ursprung 2008), completed academic program (Brusa, Carter and Heilman, 2010), self-sufficiency, research support, course load, business networks and organizational culture (Zhang, 2014), motivation (Horodnic and Zait, 2015), collaboration and business networks (Defazio, Lockett and Wright, 2009), having education of scientific and academic writing (Keys, 1997). Brew et al. (2015) summarized the factors contributing to academic productivity as institutional properties (organizational culture and atmosphere, finance, laboratory facilities), demographic variables (gender, family size, age of children), academic qualifications, trust and perception of self-sufficiency, work load, spending time, types of communication and guidance. Likewise, in the literature the obstacles the instructors encountered during the academic productivity were addressed as lack of time for making researches, lack of financing, lack of mentor, departmental culture (Nieuwoudt and Wilcocks, 2005) and obstacles about language (Gantman, 2012).

According to the results of the study, basic motivation sources of the instructors during the process of academic productivity, which can also be assessed as external motivation sources, are to contribute to science, to reach of the study to larger publics, to create prestigious/powerful CV, to contribute to personal development, to be cited, to benefit from academic incentive, a clear and open process and quick feedback. When the literature about the issue was reviewed, it was encountered with some studies which made emphasizes on both internal and external factors. As similar to the results of our study, Stephan and Levin (1992) stated that the basic motivation sources of the instructors during the process of academic productivity are internal pleasure, recognition and rewards (as cited: Dietz and Bozeman, 2005). While expressing the motivational factors of the instructors during the academic productivity, Bland et al. (2005) underlined the importance of internal motivation which results from contributing to society through creative studies, findings and innovations.

In the study, it was concluded that the instructors did not wish to publish papers in international journals owing to the reasons such as not being able to find a journal fitting their purpose, studies towards national problems, wishing to increase the accessibility of the study among national shareholders, costs of international journals, feeling of insufficiency and worry about rejection. Besides, it was concluded that the instructors did not wish to publish papers in national journals owing to the reasons such as less reading, concerns about being cited, referee process, the length of time in publishing process and vision of journal. In other words, the instructors encounter with several boundaries about the preference of either national or international journals in the process of publishing papers. In literature, although there has been no direct study about the reasons why the instructors do not wish to publish in national or international journals, some studies are encountered about the points the instructors should consider in finding the perfect journal. Assessment of acceptance possibility of the paper, journal prestige, reading percentage of the journal (journal visibility), publishing in time and ethical issues to consider were described as the points to take into consideration in the process of the instructors' preference of journals (Knight and Steinbach, 2008). Rowlands and Nicholas (2005) stated that journal prestige, journal visibility and impact of the journal are three important elements that should be considered. According to Björk and Holmström (2006), journal infrastructure (submission fee, journal resources, service level of journal, marketing strategies, reviewed indexes, technical facilities and payments for the writers), readership, (individual subscribers, institutional subscribers, electronic alert subscribers, impact on practitioners, web downloads, regional and topical fit of readership, impact on scientists and citations), journal prestige (publisher's prestige, impact

factor, journal ranking, prestige of editorial board, CV value of publication and institutional reward schemes) and performance of the journal (scientific level of journal, publication delay, journal rejection rate, quality of the review process and Submission rejection risk) are the points to consider in choosing the journal (as cited: Dalton, 2013).

It was concluded in the study that the instructors determined a follow-up strategy about international journals and divided these strategies into two: strategies about the journal and strategies about the publication. The instructors expressed to appreciate the strategies about the journals as reviewing journals, considering about the topic choice, reviewing publishing policies of the journals, reviewing the editorial / referee board and the strategies about the publication as citing papers published in journals, valuing language using, developing a powerful method, having support from the experts/consultants. When the literature was reviewed, it was revealed that many strategies about publication process were developed, which supported the results of the study. The strategies that should be followed in the publication process in international journals were defined with three steps: preparations before publishing, publishing process and technical process. The points that should be considered before publishing are choosing the research topic, determining the type of the article and audiences, finding the perfect journal in terms of aim and content, type of article, reading percentage and the actuality of the research topic and reading the writers' guidance carefully. A well-organized paper editing (title, writers, abstract, keywords, introduction, method, results and discussions chapters should be given systematically) the design of graphics and tables and a well-built reference chapter should be taken into consideration in the process of publishing; text layout, length of the article, abbreviations and cover letter should be considered important in the process of technical design (Lee, 2008). According to Brunn (1998), to increase the acceptance possibilities of the paper, the writers should read the content of the journal and letters from the editors carefully and discuss about it with the colleagues. On the other hand, Harper (2006) stated that the writers should determine the journal before they start to write the paper. Additionally, choosing the topic and revising the paper (about spelling rules, language, method and content) before sending it to the journal are within the strategies that should be followed.

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A Qualitative Study to Determine Expectations of Students Studying at a Faculty of Tourism from Vocational English Course

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Abstract

The aim of the research is to determine the expectations of the students studying at Faculty of Tourism from a Vocational English course. Qualitative research method, phenomenological design and convenient sampling technique were used in the research. Study group included the students who study at two departments, Tourism Management and Gastronomy and Culinary Arts, at a Faculty of Tourism in Turkey and who take Vocational English course for the first time. The study group was determined purposefully in that the researcher would teach Vocational English to the students in 2017-2018 fall semester. The students who attended the course in the first week of the semester participated in the study voluntarily. Data were analyzed by content analysis. The findings of the study showed that the expectations of students from vocational English course clustered around four main themes as objectives, content, teaching-learning process and assessment.

Keywords: Expectation, qualitative study, Faculty of Tourism, vocational English course.

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Introduction

Faculties of tourism are higher education institutions and cover at least eight semesters and four years based on secondary education. The main objective of tourism education institutions is to contribute the development of tourism sector by giving basic education as well as tourism awareness and philosophy to the students who will work in tourism sector and thus to provide skilled personnel for tourism sector (Üzümcü & Alyakut, 2017). In other words, the aim of faculties of tourism is to prepare students for the job market right after graduation helping students receive vocational training and practical internship.

Faculties of tourism have different departments, such as tourism management, gastronomy and culinary arts, tourism guidance, recreation management. The department of tourism management targets to train qualified personnel, middle and upper management candidates for the tourism sector by providing contemporary, scientific and qualified education and training in the field of tourism management. For this purpose, the students are equipped with knowledge and skills about information technologies, tourism industry and tourism businesses, contemporary management and two foreign languages one of which is English. The department of gastronomy and culinary arts aims to train qualified chefs for the accommodation and catering businesses. In the direction of this goal, students are supplied with two foreign languages one of which is English, information technologies, tourism sector and tourism businesses, contemporary management and leadership, Turkish cuisine, International cuisine, principles of nutrition, food science and technology, and food and beverage production (<https://portal.nevsehir.edu.tr>). As seen from the aims of departments, English language is very important for faculties of tourism and tourism sector. English for Specific Purposes (ESP) becomes vital for students at faculties of tourism in that they need the language for their profession.

Faculties of tourism offer vocational English courses, a branch of ESP, generally for four semesters. The students who will take the course for the first time have some expectations from the course. Chu and Huang (2007) claim that exploring students' expectations in an English Language Teaching (ELT) classroom assists teachers to select and design materials and choose appropriate methods leading to improve both their performance and students' dynamic and autonomous learning. Moreover, Lobo and Gurney (2014) point out the importance of students' expectations and regard that their expectations are one of the most crucial variables at tertiary education level, particularly in English as a Second Language (ESL) classrooms because students expect a lot from ESL courses. If their expectations are satisfied, it will influence their attitudes toward and engagement with the course. In order to meet their expectations from the course or to provide a curriculum as close to their expectations as possible will help to achieve the aims of the departments.

When the literature is reviewed, it is observed that the number of research about vocational English course at tertiary education is limited. There are many studies about general English at tertiary education (Al-Issa, 2017; Kaçar and Zengin, 2009; Crosling and Ward, 2002; Warden and Lin, 2000), curriculum of English language course in vocational colleges (Ödemiş, Yüksel and Ünal, 2014), second foreign language (Balci, 2016), preparatory classes for departments of tourism (Davras and Bulgan, 2012) and different departments at universities (Şen Ersoy and Kürüm Yapıcıoğlu, 2015), tourism education at universities (Üzümcü and Alyakut, 2017) and students' perceptions of English courses at vocational high schools (Hau and Bevertson, 2013). On the other hand, Özer and Yılmaz (2017) carried out a research directly about vocational English course at departments of tourism. Thus, the study will shed further light on the matter. Taking these into account, the study aims to determine the expectations of students studying at a faculty of tourism from vocational English course. Some suggestions will be made to guide instructors of English how to design the curriculum of vocational English course to meet the expectations and enhance the quality of vocational English course and vocational education.

Method

Research Design

The research was designed as a phenomenological study. In the phenomenology design, the research focuses on how people perceive a particular phenomenon, how they describe it, what they feel about it, how they judge it, how they remember it, how they understand it, and how they talk about it with others (Patton, 2014). Phenomenological study was used in the study because the expectations of students studying at a Faculty Tourism from the Vocational English course would be determined.

Participants

Convenient sampling method was used in the study. The study group was composed of the students who would take Vocational English course for the first time in fall semester of 2017-2018 academic year. The students study at the departments of Tourism Management and Gastronomy and Culinary Arts. Students who participated in the first lesson of Vocational English course at the first week of the semester constituted the study group and students participated in the study voluntarily. The students were also informed that information obtained would be used only for scientific purposes and that they could withdraw from the study at any time. The demographic features of the study group are given in Table 1.

Table 1. The demographic features of the study group

| Demographic features | | f |
|----------------------|------------------------------|----|
| Gender | Female | 13 |
| | Male | 24 |
| | Total | 37 |
| Department | Tourism Management | 25 |
| | Gastronomy and Culinary Arts | 12 |
| | Total | 37 |

When Table 1 is examined, it is seen that 13 of 37 students who participated in the study were female and 24 were male. 25 of these students were studying Tourism Management and 12 of them were studying Gastronomy and Culinary Arts.

Data collection tool

In the study, the students were asked "What are your expectations from Vocational English course?" They were required to express their thoughts in own handwriting.

Data Analysis

The data were analyzed by content analysis method. In content analysis, first of all, coding was used to make sense of the concepts in the data. The similarities and differences of the codes were determined, and the codes related to each other were grouped together and the themes were determined. The codes and themes were then checked by an external researcher. Direct quotations were included in the study so that the views of the participants can be reflected more accurately. When the opinions of the students were quoted, "S" letter was used for each student and numerical codes of 1, 2, 3, 4 ... were used for the order of handing over the forms.

Findings

Opinions of students about their expectations from Vocational English course were examined and the expectations of the students were gathered under four main themes as objectives, content, teaching-learning process and assessment. Findings related to the themes were given below.

Findings related to theme “objectives”

It has been observed that the expectations of the students from the Vocational English course were based on two subthemes as expectations about personal development and expectations after graduation under the main theme “objectives”. These sub-themes and categories are given in Table 2.

Table 2. Expectations from the course objectives

| Theme | Subthemes | Categories |
|------------|---|--|
| Objectives | Expectations about personal development | Contribution to personal development |
| | | Developing speaking skills |
| | | Improving current English level |
| | | Contribution to communicate easily |
| | | Improving vocabulary |
| | | Improving grammar |
| | | Improving writing skills |
| | | Improving reading/comprehension skills |
| | | Contribution to speak fluently |
| | Expectations after graduation | Contribution to professional life |
| | | Facilitating work and internship |
| | | Facilitating finding jobs |
| | | Contribution to daily life |

When Table 2 is examined, it is seen that the subtheme “expectations about personal development” was composed of nine categories as “contribution to personal development”, “developing speaking skills”, “improving current English level”, “contribution to communicate easily”, “improving vocabulary”, “improving grammar”, “improving writing skills”, “improving reading/comprehension skills” and “contribution to speak fluently”. Opinions of some student about these categories are as follows:

S8: *“The course should help us learn the words and phrases that we can use in our professional life, and use them practically in the classroom so we will be able to speak without thinking about making mistakes in the future. It should help us develop confidence without excitement and comfortably. There should be activities requiring speaking. ... We can make new sentences by learning new words.”*

S11: *“I expect to improve my professional knowledge while developing my general English skills. When I talk in my profession, I want to be able to master English.”*

S33: *“My expectation from the course is to be able to speak in English. I just want to talk. The grammar does not help us speak very well in daily life.”*

S34: *“My expectations from the course are to improve my current English, to get higher levels and to improve professional vocabulary and pronunciation. When this year is over, I want to speak English fluently.”*

S35: *“First, I want to add something to my current English language skills. I also think I will benefit from this course and it will help me in my professional life in the future. I hope that I I will make the best of the course and I will do my best.”*

Likewise, when Table 2 is examined, it is seen that the subtheme “expectations after graduation” was composed of four categories as “contribution to professional life”, “facilitating work and internship”, “facilitating finding jobs” and “contribution to daily life”. Opinions of some student about these categories are given below:

S9: *“I think that we can learn, understand and comprehend the techniques, speaking styles and new words that we can use in tourism sector or in other sectors, which we can use in many fields of our lives. We will be able to learn all of them during a whole year and the most efficiently. I think the Vocational English course will provide a meaning and significance in our lives if we meet the case with our own efforts.”*

S12: *“I believe that it will be useful to express myself better in my relations with tourists or other people in the sector in the future. With the language I will learn in Vocational English course, I believe I can get better positions and work in higher levels in a business.”*

S16: *“When I learn professional vocabulary (words, terms, phrases), I can communicate with the guests more easily. It will be easier for me to work in tourism. It will also be easier when doing the internship. I do not have any difficulty working in the department I want. It will make it easier for me to find a job.”*

Findings related to theme “content”

The second theme regarding the expectations of the students from the Vocational English course was called as content. The categories of the theme are given in Table 3.

Table 3. Expectations from the course content

| Theme | Categories |
|---------|--|
| Content | Including professional terms/vocabulary |
| | Learning patterns in sentences |
| | Being an important lesson for the department |
| | Not just giving importance to grammar |
| | Giving importance to grammar |
| | Organizing subjects from general to specific |

When Table 3 is examined, it is seen that the theme “content” was composed of six categories as “including professional terms/vocabulary”, “learning patterns in sentences”, “being an important lesson for the department”, “not just giving importance to grammar”, “giving importance to grammar” and “organizing subjects from general to specific”. Opinions of some student about these categories are as the following:

S3: *“Vocational English course means tourism terms, professional patterns, words, expressions and phrases. I think that all the subjects in the course will include these words, expressions, terms, phrases, patterns about tourism. ...”*

S18: *“I think Vocational English course will involve a lot of terms and phrases related to tourism. Speaking skill will be more important than grammar. ... This is a course designed from general to specific.”*

S25: *“I think this course will enable me to have a good communication with people in my professional life in the future. I think that it will improve me in my profession and help me get positions in the sector if I study hard. The course will also enable us to learn many expressions used in the hospitality industry.”*

S29: *"I think that Vocational English course is as important as general English for our department. I expect from the course to contribute us a lot for our professional life."*

Findings related to theme "teaching-learning process"

It has been observed that the expectations of the students from the Vocational English course were based on two subthemes as expectations from the process and expectations from students under the main theme "teaching-learning process." These sub-themes and categories are given in Table 4.

Table 4. Expectations from teaching-learning process

| Theme | Subthemes | Categories |
|---------------------------|-------------------------------|---|
| Teaching-learning process | Expectations from the process | Teaching based on speaking |
| | | Teaching enjoyably |
| | | Giving importance to pronunciation |
| | | Giving importance to communication |
| | | Making the course loved |
| | | Offering more practice |
| | | Not only teaching in English but also using Turkish |
| | Expectations from students | Giving importance to the course |
| | | Revising subjects learnt in the course |
| | | Reducing absenteeism |
| | | Revising new vocabulary |

When Table 4 is examined, it is seen that the subtheme "expectations from the process" was composed of seven categories as "teaching based on speaking", "teaching enjoyably", "giving importance to pronunciation", "giving importance to communication", "making the course loved", "offering more practice" and "not only teaching in English but also using Turkish." Opinions of some student about these categories are as follows:

S4: *"I think that the process will be more efficient by using Turkish in the course instead of completely teaching in English. I want to learn with activities in an enjoyable way. I do not want to get lost between pages and I do not want to fly off at a tangent."*

S10: *"I expect to learn English well and improve my level, and then I want to be able to use it in my professional life. I want to love English. I want to love English. I think we will have enjoyable English lessons. I don't want to learn the rules just on the book but I want be able to talk."*

S14: *"I expect to be more conscious about English necessary for my department and to obtain information to take me a step further. I think the course will be instructed using dialogues and we will be able to speak more in the course."*

S15: *"My expectation is to reach a level that we can speak enough because it is a competent of our department. I want to reach the advanced level generally in grammar and specifically in speaking, by learning both theoretically and practically. I want to communicate with foreign tourists easily. Conveying the message may sometimes be just using simple vocabulary needed for my profession. I think we should not just learn the grammar of English. I expect to pronounce correctly to be able to speak and communicate in English."*

S27: *"I expect that Vocational English course will contribute me about both reading-comprehension skill and speaking skill. I think Vocational English course will be more enjoyable and this is a great advantage. ..."*

Similarly, when Table 4 is examined, it is seen that the subtheme "expectations from students" was composed of four categories as "giving importance to the course", "revising subjects learnt in the

course”, “reducing absenteeism” and “revising new vocabulary”. Opinions of some student about these categories are given below:

S7: *“After graduating from school, I think that Vocational English course will determine the place and position in my professional life and that I will benefit a lot from what I have learned in tourism sector in the future. Of course, it is very important for me to attend and participate the lessons and to complete successfully in order to be able to do so.”*

S22: *“I expect from the Vocational English course to receive a more prospective and vocationally efficient instruction. I believe that this course will be based on mutual dialogues and will focus on speaking skills. I believe I will do my best. Everything we learn will help us in terms of profession in a positive way.”*

S24: *“I think that Vocational English is very important for us because we will be employed in tourism and we will always deal with tourists after we graduate. If we revise what we learn in the lessons, this contributes to us more. If we deal with activities based on conversations, we can get more efficiency.”*

Ö26: *“My expectations from Vocational English course are to improve my grammar, to my vocational vocabulary, to improve my speaking and writing skills, to practice more, to learn vocational English necessary for tourism in detail and to contribute to my professional life. In order for these expectations to come true, I will have to attend and participate in the lessons and revise what I learn.”*

S28: *“I believe that Vocational English course will be enjoyable. I think I can get a lot from the course for both my profession and myself. As usual, I will revise what I learn and repeat new vocabulary.”*

S31: *“In order to get better positions in my professional life, I will have to do my best in addition to what we learn in the lessons.”*

Ö37: *“I think Vocational English course will be for me. I think we will learn some patterns in sample conversations. It will also contribute to me professionally so I have to pay attention to the course.”*

Findings related to theme “assessment”

The fourth theme regarding the expectations of the students from the Vocational English course was called as assessment. The categories of the theme are given in Table 5.

Table 5. Expectations from the course assessment

| Theme | Categories |
|------------|--|
| Assessment | Being successful in the course |
| | Tasks and assignments being based on dialogues/conversations |
| | Role-playing dialogues/conversations |
| | Exams being not difficult |

When Table 5 is examined, it is seen that the theme “assessment” was composed of four categories as “being successful in the course”, “tasks and assignments being based on dialogues/conversations”, “role-playing dialogues/conversations”, and “exams being not difficult”. Opinions of some student about these categories are as the following:

S1: *“I feel I’ve always progressed in English in my education life. I’ve been successful before and I expect great success.”*

S5: *"Since the activities include Vocational English, we can study and practice them as if we were at work. Tasks and assignments may be based on dialogues/conversations. We can prepare dialogues and conversation at home and role play them in classroom. For example, we can prepare ordering food dialogues or conversations in a restaurant and we can role play them."*

S13: *"I think we will learn professional vocabulary Vocational English course. I believe that the lessons will pass enjoyably. I think we will learn the sentences used in restaurants, food and beverage businesses and so we can express ourselves better. I hope we will study well, we will learn a lot, we will not have much difficulty in exams and we will finish this year successfully."*

S20: *"Unlike previous English courses, in Vocational English course, we will learn vocabulary, terms and grammatical rules related to our department. Thus, I believe it will help us in our internship and in our professional life. I think I will be more successful in this year."*

S30: *"My expectation from this course is to help me learn English necessary for professional life. I think I can get enough yield from the course. I believe I will have a successful year by doing my best."*

Discussion

The findings of the study show that the expectations of students from vocational English course were gathered under four main themes as objectives, content, teaching-learning process and assessment. The first main theme "objectives" consists of two sub-themes as "expectations about personal development" and "expectations after graduation". The subtheme "expectations about personal development" include nine categories as "contribution to personal development", "developing speaking skills", "improving current English level", "contribution to communicate easily", "improving vocabulary", "improving grammar", "improving writing skills", "improving reading/comprehension skills" and "contribution to speak fluently". Likewise, Balcı (2016), in a qualitative study carried out with tourism undergraduates, finds out that personal development is among the reasons why students take a second foreign language course. These findings imply that students intend to learn vocational English to invest in their personal development, by acquiring the language ability to interact with tourists, that is, they expect to learn English not just for academically-oriented factors, such as passing exams but for practical factors.

The subtheme "expectations after graduation" consists of four categories as "contribution to professional life", "facilitating work and internship", "facilitating finding jobs" and "contribution to daily life". Some studies supporting this finding are available in the literature. Balcı (2016) reveals that the most frequent reason of students' taking second foreign language course is the desire to work in tourism sector. Undergraduate students participate in the optional English preparatory classes in order to contribute to their personal development and careers (Şen Ersoy and Kürüm Yapıcıoğlu, 2015); they regard English as the key to a successful professional life (Davras ve Bulgan, 2012); they consider learning English as a tool to make them more successful in life and they intend to learn English for communication purposes (Kaçar ve Zengin, 2009). The management staff, teaching staff and students think that the aim of English language curriculum at Vocational Colleges at higher education is to achieve a good knowledge and level of foreign language necessary for professional life (Ödemiş, Yüksel and Ünal, 2014). The most repeated reason why vocational high school students learn English in Taiwan is career development (Hau and Beverton, 2013). In addition, Warden and Lin (2000) examine the reasons and orientations of Taiwanese students' towards English learning in a technology college and find out that students have strong instrumental motivation in their English studies, associated with career improvement. Therefore, students want to invest in their professional future by establishing a link between foreign language education in general and vocational English courses in particular and vocational education.

The second theme "content" involve six categories as "including professional terms/vocabulary", "learning patterns in sentences", "being an important lesson for the department",

“not just giving importance to grammar”, “giving importance to grammar” and “organizing subjects from general to specific”. Similarly, in a qualitative study carried out by Özer and Yılmaz (2017) reveals that instructors of English who give vocational English courses, students who took the course and students who have not taken the course yet at a vocational college at a university think that the course content should be designed to be used in professional life, the content should give priority to dialogues/conversations and roleplays, it should develop vocabulary, materials appropriate to student interest and level of English should be used and it should include at least a little grammar. In his research, Al-Issa (2017) revealed that students expected from the content to include certain activities that combine learning, enjoyment, entertainment, fun, amusement, excitement and challenge at the same time. They also want to learn professional terms, pronunciation and grammar. Moreover, in another study, vocational high school students prefer job-oriented English rather than general English because they think vocational English will be more useful and helpful for them in the future. Besides, students state a desire to learn and comprehend technical terms related to their profession (Hau and Beverton, 2013).

The third theme “teaching-learning process” comprises of two subthemes as “expectations from the process” and “expectations from students”. The subtheme “expectations from the process” includes seven categories as “teaching based on speaking”, “teaching enjoyably”, “giving importance to pronunciation”, “giving importance to communication”, “making the course loved”, “offering more practice” and “not only teaching in English but also using Turkish.” Similarly, in another study, tourism undergraduate students emphasize the importance of speaking skill among four basic language skills during the course (Balci, 2016). A study carried out by Crosling and Ward (2002) reveals that companies underline the significant role of oral communication in the workplace and emphasize that university courses which focus on oral skills are regarded as appropriate. However, undergraduate students expect from their teachers to give four language skills equal attention, move beyond the prescribed textbook and supplement the syllabus through using different activities, materials and aids that would promote student-centeredness and help them purposefully practice the language and enjoy the lessons. In addition, they expect from their teacher to help them acquire certain important soft skills for the job market as it is the case with developing self-confidence, working in teams and collaboratively, solving problems and acquiring research skills (Al-Issa, 2017).

The subtheme “expectations from students” involves four categories as “giving importance to the course”, “revising subjects learnt in the course”, “reducing absenteeism” and “revising new vocabulary”. In parallel with this result, another study result emerges that the instructors think that if the students take responsibility for their learning, English course at vocational colleges at universities will provide students great benefits for their profession (Ödemiş, Yüksel and Ünal, 2014). English would become more significant for students if they notice the relationship between vocational English and their profession. If vocational English curriculum fits more closely to the real contexts, it will help students perceive that their English learning efforts are worthwhile. Furthermore, as Hutchinson and Waters (1987) express, if English course is relevant to learners’ needs, they will be more motivated to learn and will learn better and faster.

The last theme “assessment” is made up of four categories as “being successful in the course”, “tasks and assignments being based on dialogues/conversations”, “role-playing dialogues/conversations”, and “exams being not difficult”. In a similar vein, students state that English contributes a lot in amount to their success and total GPA because it is the most valuable course in credit at vocational college (Ödemiş, Yüksel and Ünal, 2014). In the light of these findings, it can be concluded that since Vocational English course is worth 10 ECTS (European Credit Transfer System), the highest credit with six hours a week, students want to succeed in the course.

Conclusion

The aim of the research is to determine the expectations of the students studying at Faculty of Tourism from the Vocational English course. Qualitative research method, phenomenological design

and convenient sampling technique were used in the research. Data were analyzed by content analysis. The expectations of students from vocational English course were grouped under four main themes as objectives, content, teaching-learning process and assessment.

Students emphasize on objectives of the course because they generally want to develop themselves personally and because they want to get better positions in their professional life. The students study at Faculty of Tourism and having a good comprehension of at least a foreign language is crucial for their professional life. Thus, they are aware of the necessity. The students generally do their internship in hotels and restaurants so they realize the essentialness of English in their profession. Therefore, the instructors of English should determine the objectives of the course to meet the expectations of students.

Students stress on the content of the course because they want to learn the language in professional life. The instructors of English should design the curriculum in such a way that it will provide students learn and comprehend professional vocabulary, terms, and patterns in context. The subjects should be organized from general to specific. Speaking skill should be more important than grammar.

Students highlight teaching-learning process because most of them just learnt about grammatical rules of English language in their previous language classes and many of them get really bored of just memorizing the rules and filling in the blanks in the exams. The instructors of English should design the curriculum in such a way that it will provide students use the language in the classroom as if they were employees in tourism enterprises. The course should cover mainly pronunciation and communication, that is, speaking skill. The activities should be enjoyable so they can learn entertainingly. Students should role play dialogues and conversations in the classroom, which gives them the chance to practice. If necessary, the instructors may use native language to clarify the meaning or usage of some words or phrases. Students should often be informed about the necessity and advantages of speaking a foreign language in tourism sector. They should be encouraged to revise after school so that they can give more importance to the course. If they are involved in the course, they will not tend to be absent in classes.

Students underline assessment because they have six hours of Vocational English classes in their schedule. They want to be successful in the course and increase their total GPA. Tasks and assignments to be given to students may include preparing dialogues and conversations with or without clues. Process and formative assessment may be used to help students notice their lack and imperfection and improve themselves.

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Digital Literacy Perceptions of the Students in the Department of Computer Technologies Teaching and Turkish Language Teaching

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Abstract

The rapid spread of information with the wide use of the printing press has gained momentum in the 21st century as digital texts have become widespread. Reading is among the major abilities educated individuals are expected to hold and Turkish language teachers are looked to in the acquisition of this ability. Besides, computer technologies teachers are expected to teach how to use digital devices. To fulfill this duty, they are required to have developed a high level of digital literacy. The present study aims to determine and compare the perceptions of prospective teachers of computer technologies and Turkish languages. This descriptive study follows a survey model.. The population of the study comprises the students at a university located in western Turkey and the sample consists of the first-, second-, third-, and fourth-year prospective teachers of Turkish Language and Computer Technologies. The results revealed that the students in the department of Turkish Language Teaching and of Computer Technologies Teaching considered that they were sufficient enough in the attitudinal, technical, cognitive, and social sub-dimensions and differences were observed only in the sociability sub-dimension to favor the male students. Interdepartmental differences were observed in terms of the attitude and sociability sub-domains in favor of computer technologies students and statistically significant differences were found between the scores concerning the freshman and senior undergraduates of both departments.

Keywords: Prospective Turkish language teacher, prospective computer technologies teacher, digital literacy

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Introduction

Humans are different than other beings in transferring their sets of knowledge and experiences to the next generations. Transfers may occur orally or in writing and individuals can avail themselves of the transfers through their ability to read. Thousands of languages are spoken in the world; however, the number of languages with literature to transfer what they know to the next generations and accordingly the number of languages with literate people is very low. Literate people constitute a very small portion of the world population, yet their power is felt greater than their number is. In a way, it is a lesson by literacy: The literate have the power of expressing their thoughts members of an oral culture will never be able to do (Sanders, 1999).

Developments in informatics and communication in the 21st century require individuals be competent in both literacy and technological issues (Eryaman, 2007). Now, people live as a member of the information age. “Visualize an amphibian with its shell inside and its organs outside. Electronic man wears his brain outside his skull and his nervous system on top of his skin. Such a creature is ill-tempered, eschewing overt violence” (McLuhan & Powers, 2001, 156). Literacy once having occurred only through printed materials has moved into a new dimension in the present age. In the past too, literacy reminded us of making sense of a written text, yet literacy was always the process of interpreting what is seen, heard and even felt, be it written or not. Studies on language enabled us to look at the concept of literacy from different perspectives. Freire (1998) expresses the act of reading as follows: “Reading the world always precedes reading the word, and reading the word implies continually reading the world. As I suggested earlier, this movement from the word to the world is always present; even the spoken word flows from our reading of the world. In a way, however, we can go further and say that reading the word is not preceded merely by reading the world, but by a certain form of writing it or rewriting it, that is, of transforming it by means of conscious, practical work. For me, this dynamic movement is central to the literacy process” (Freire & Macedo, 1987, 23).

With the discontinuation of the conception that literacy is the process of reading a text and making sense out of it, new literacy types emerged. “Creation of knowledge, its presentation in various media, and technological revolution built on information technologies led to multiple and new literacy types in education systems. Multiple intelligence applications, desire for differentiation, interdisciplinary perspective, cultural structure, and ever-changing social needs not only increased the literacy types but also resulted in expectations of literacy proficiency” (Önal, 2010, 101).

Individuals of the 21st century have been encountering digital devices in every aspect of life. “Digital technologies have become unavoidable elements of political life, of everyday consumption, of social relations, and indeed of community and public pedagogy and learning. Simply childhood, ‘development’ and learning have changed in unprecedented ways that researchers and teachers are struggling to come to grips with” (Luke, 2012, 9). Due perception of the messages sent via digital devices is of great importance for the people of this century. Digital literacy can be defined as the ability to achieve goals or to retrieve information by using the device with a digital screen and to use the achieved goal and obtained information. The concept of digital literacy has come into prominence in the 1990s. “The concept of digital literacy as it is now was introduced by Paul Gilster (1997). In fact, Gilster was not the first person to use “digital literacy”. Gilster refers to digital literacy as the ability to retrieve and use information from various digital sources without being concerned about different competence lists mostly criticized for being restrictive (Koltay, 2011, 216).

Being digitally literate is important. “Socially powerful institutions, such as education, tend to support dominant literacy practices. These dominant practices can be seen as part of whole discourse formations, institutionalized configurations of power and knowledge which are embodied in social relationships” (Barton and Hamilton, 2003, 12). Efforts have been made in relation to digital literacy in Turkey with the introduction of the FATİH Project by the Ministry of National Education at schools. Today, education in various areas can be received in digital media with a less investment of time, effort, and money than in the past. “The digital revolution having originated from rapid

developments in information and communication technologies has resulted in very significant changes in daily communication and information transfer. Individuals and communities have enjoyed the opportunity to express themselves more democratically and to get quicker access to information in this new virtual environment” (Öymen Dikmen, 2011, 156).

People at any age and in any social class use the internet by signing in social networks or visiting websites. Every website accessed when online records what that user has looked at and for. This is performed via small files uploaded in the computer by the web server. In other words, record of digital readers is kept by the visited website or page. These records determine what that particular reader will see on the internet, from advertisements to the first shown content. As a result, digital reader is trapped in the world of what he/she has looked at and for before.

It is expected that teachers teaching language and other teachers teaching by using a language should be qualified enough in digital literacy to communicate with the children of the digital age. Skills required for digital literacy are as follows:

- internet search
- hypertext navigation,
- information collection,
- content evaluation (Koltay, 2011).

“As educators, we need to be thinking about how to teach both Legacy and Future content in the language of the Digital Natives” (Prensky, 2001, 5). Teachers are responsible to transmitting past experiences and new pieces of information/knowledge to their students. “The primary way of acquiring information about the world we live in is the experiences in the broadest sense” (Adalı, 2004, 176). Fulfilling this responsibility, in other words, the transfer of experiences is directly and closely related to being a competent digital literate. Digital literacy will enable us to be successful in educational issues by spending less time and making less effort. Digital literacy is also effective in answering a number of questions for diagnosis and treatment of the diseases in medicine. Digital literates use social networks more efficiently to socialize and to be able to join a group and express themselves. Moreover, knowing what is going on in the world and following cultural and artistic events are among the benefits of digital literacy.

While a digitally literate individual gain a number of advantages, many dangers await individuals incompetent in digital literacy. Digital illiterates may suffer from various mishaps ranging from personal data breach, online theft and fraud, misleading in educational and health-related issues and from their devastating consequences.

Digital literacy of prospective teachers trained in the field of education will help them become proficient teachers capable of exploiting information and communication technologies efficiently and effectively. Digital devices facilitate finding, transferring, using and storing information, the skills teachers are expected to develop. A teacher aware of all of these will practice his/her profession more efficiently. The concept of literacy incorporates the competency in reading and writing. Digital literacy should be understood as the ability to read and understand the digital texts and to create digital texts. Digital literacy should not be considered as solely reading and interpreting texts and visuals on a computer screen. Understanding the signs on a refrigerator, visuals on an oven, and directives on a toy refers to digital literacy. Digital authoring is sharing texts or visuals created with digital tools with whoever requests communication in a well-planned and functional way. All individuals in a society need these competencies and digital literacy stands out as the prominent literacy type for these reasons.

Baştuğ and Keskin (2017) carried out a study where students were asked to transfer textual contents from papers to digital media to investigate their writing attitudes in digital media. The research by Öcal (2017) titled *Primary school teachers and parents' perceptions of competency about Themselves and the Children* demonstrated that teachers and parents considered themselves highly competent in digital literacy ,while children moderately competent. In a similar study, Acar (2015) revealed the views of parents about the digital literacy of their own and their children at varying teaching levels.

Purpose of the study

The purpose of this study is to determine the perceptions of students of Turkish Language Teaching and Computer Technologies Teaching about digital literacy and investigate whether there is a difference between the students' perceptions of digital literacy. To this end, the present paper seeks answers to the following questions:

1. What are the perceptions of the students of Turkish Language Teaching and Computer Technologies Teaching Turkish Language Teaching and Computer Technologies Teaching about digital literacy?
2. Is there a difference between the perceptions of the students of Turkish Language Teaching and Computer Technologies Teaching about digital literacy?
3. At what level are the skills of the students of Turkish Language Teaching and Computer Technologies Teaching in technical issues concerning digital literacy?
4. Is there a difference between the skills of the students of Turkish Language Teaching and Computer Technologies Teaching in technical issues related to digital literacy?
5. How are the cognitive perceptions of the students of Turkish Language Teaching and Computer Technologies Teaching about digital literacy?
6. Is there a difference between the cognitive perceptions of the students of Turkish Language Teaching and Computer Technologies Teaching related to digital literacy?
7. At what level are the social skills of students of Turkish Language Teaching and Computer Technologies Teaching related to digital literacy?
8. Is there a difference between social skills related to digital literacy of students of Turkish Language Teaching and Computer Technologies Teaching?
9. Is there a gender-related difference between perceptions of students of Turkish Language Teaching and Computer Technologies Teaching about digital literacy?
10. Is there a class standing-related difference between the attitudes of the students of Turkish Language Teaching and Computer Technologies Teaching towards digital literacy?

Method

This survey was carried out to evaluate the digital literacy levels of the students of Turkish Language Teaching and Computer Technologies Teaching and to investigate whether there is a difference between the digital literacy levels of these students. This method was chosen to quantitatively assess the differences and similarities between variables. "General survey models are surveys conducted on an entire population or a sample out of the population to pass general judgments about the population" (Karasar, 2013, 79). This paper aims to reveal the digital literacy levels of the

students of Turkish Language Teaching and Computer Technologies Teaching in terms of class standing, gender, and departments and to this end a quantitative research approach was adopted. Creswell (2002,26) expresses the quantitative research as “describing a research problem through a description of trends or a need for an explanation of the relationship among variables; providing a major role for the literature through suggesting the research questions to be asked and justifying the research problem and creating a need for the direction (purpose statement and research questions or hypotheses) of the study; creating purpose statements, research questions, and hypotheses that are specific, narrow, measurable, and observable; collecting numeric data from a large number of people using instruments with preset questions and responses; analyzing trends, comparing groups, or relating variables using statistical analysis, and interpreting results by comparing them with prior predictions and past research; and writing the research report using standard, fixed structures and evaluation criteria, and taking an objective, unbiased approach”. This paper attempts to describe the present situation of the students and to demonstrate the similarities and differences between two groups.

Population and sample

The population of the study comprises students of college of education at a university in Turkey. The sample consists of first- (87 students), second- (58 students), third- (108 students), and fourth-year students (64 students) of the Department of Turkish Language Education and of the Department of Computer and Teaching Technologies (317 students in total) and was produced by simple random sampling. The reason for selecting the students of these two departments is that the research subject is digital literacy. The researcher attempts to determine the population by creating ad hoc criteria. The best way to determine a population is to produce criteria for the purpose of the study and to include individuals conforming to these criteria in the population (Karasar, 2005, 110).

Data collection tool

Digital Literacy Scale, developed by Ng in 2012 and adapted to the Turkish academia by Hamtuoglu et al. (2017) was used in the study. There are four factors in the scale, i.e. attitudinal, technical, cognitive, and social factors. This scale of 17 items contains no reversely scored item. A 5-Point Likert with levels ranging from rating “I strongly agree (5)” to “I strongly disagree (1)” was employed for the purpose of the study.

Data collection

Previous studies related to the research subject were reviewed for the theoretical framework. The data were collected with the Digital Literacy Scale, developed by Ng in 2012 and adapted to Turkish academia in 2017. The data were collected from prospective Turkish Language teachers expected to be competent in literacy and prospective Computer Technologies teachers expected to be competent in digital subjects.

Analysis of data

SPSS17.0, a statistical software program, was used to analyze the data. The analyses were intended to investigate whether there were differences between digital literacy levels of students of Turkish Language Teaching and Computer Technologies Teaching by department, gender, and class standing. Kolmogorov-Smirnov test of normality was employed to find out whether the data are normally distributed. Since the data were found out to exhibit non-normal distribution ($p < .05$), the non-parametric Mann-Whitney U and Kruskal Wallis H test were used.

Findings and Interpretation

Table 1. Analysis of digital literacy levels of the participants (mean and standard deviation)

| | Attitudinal | Technical | Cognitive | Social | Total |
|-----------|-------------|-----------|-----------|--------|-------|
| \bar{X} | 3.85 | 3.87 | 3.92 | 3.65 | 3.84 |
| s | .74 | .74 | .83 | .93 | .69 |

The views of the students of Turkish Language and Computer Technologies teaching about digital literacy by dimensions are presented in Table 1. It can be observed that the students of Turkish Language Teaching and Computer Technologies Teaching strongly agreed with the statements of cognitive domain ($\bar{X} = 3.92$), and still agreed with the ones of the social domain but at the lowest level ($\bar{X} = 3.65$). It is understood that prospective teachers consider themselves more proficient in terms of the cognitive domain but less in the social one. The attitudes of the students of Turkish Language Teaching and Computer Technologies Teaching towards the digital literacy are “good”.

Table 2. Analysis of the Differentiation of the Attitudes of the Participants towards Digital Literacy by Department - The Results of Mann-Whitney U Test

| | | N | Mean Rank | Sum of Ranks | Mann-Whitney U | Z | Asymp. Sig. (2-tailed) |
|--------------------|------------|-----|-----------|--------------|----------------|-------|------------------------|
| <i>Attitudinal</i> | Comp.T. | 106 | 185.23 | 19634.50 | 8296.50 | -3.71 | 0.000* |
| | Turkish T. | 210 | 145.01 | 30451.50 | | | |
| | Total | 316 | | | | | |
| <i>Technical</i> | Comp.T. | 106 | 170.69 | 18093.50 | 9837.50 | -1.69 | 0.091 |
| | Turkish T. | 210 | 152.35 | 31992.50 | | | |
| | Total | 316 | | | | | |
| <i>Cognitive</i> | Comp.T. | 106 | 170.11 | 18031.50 | 9899.50 | -1.64 | 0.100 |
| | Turkish T. | 210 | 152.64 | 32054.50 | | | |
| | Total | 316 | | | | | |
| <i>Social</i> | Comp.T. | 106 | 178.09 | 18878.00 | 9053.00 | -2.75 | 0.006* |
| | Turkish T. | 210 | 148.61 | 31208.00 | | | |
| | Total | 316 | | | | | |
| <i>Total</i> | Comp.T. | 106 | 182.81 | 19378.00 | 8553.00 | -3.36 | 0.001* |
| | Turkish T. | 210 | 146.23 | 30708.00 | | | |
| | Total | 316 | | | | | |

* $p < .05$

In Table 2, a statistically significant difference is observable in the digital literacy levels of the students of Turkish Language Teaching and Computer Technologies Teaching in consideration of the attitudinal domain ($U=8296.50$; $p<.05$). The scores of the students of computer technologies teaching are higher than those of the students of Turkish Language teaching. The attitudes of the students of computer department are significantly higher than those of the students of Turkish Language teaching. It may be related to the fact that the students of computer technologies department come across digital literacy media more frequently and even it is a prerequisite to their future professions.

There is no significant difference related to technical subdimension between the students of computer technologies teaching and Turkish language teaching ($U=9837.50$; $p>.05$). It was expected that the students of computer technologies teaching would be more positive about the technical subdimension. However, it can be suggested that they have no statistically significant difference in technical domain with the students of Turkish Language teaching due to the proliferation of the media requiring digital literacy.

There is no significant difference related to the cognitive subdimension between the students of computer technologies teaching and Turkish language teaching ($U=9899.50$; $p>05$). It can be realized that the students of both departments believe that both they and instructors should benefit more frequently from digital media for cognitive subjects. This finding is related to the fact that the students are aware that digital media are integral to daily life.

In the social subdimension, A statistically significant difference is observable in digital literacy levels of the participants in favor of the students of computer technologies teaching ($U=9053.00$; $p<.05$). The fact that the students of computer technologies consider themselves more competent in the social subdimension of digital literacy may be related to the fact that they are knowledgeable about the subject, which may have resulted from the opportunity offered to them to learn about digital subjects in a formal education setting.

It is clear that there is a statistically significant difference between the total scores of the students of Turkish language and computer technologies in the attitudinal domain of digital literacy in favor of the students of computer teaching ($U=8553.00$; $p<.05$). The significant difference in favor of the students of computer technologies is expected. Literacy is a skill that every individual in a society should have and digital literacy is a type of literacy that individuals should be qualified in since digital media has become an integral part of our daily life. However, this difference might have caused by the fact that the students of computer technologies have the opportunity to receive the related formal education and the students of other teaching departments need to develop competence in such literacy through their efforts and opportunities they can find.

Table 3. Analysis of the Differentiation of Digital Literacy Levels of the Participants by Gender- The Results of Mann-Whitney U Test

| | | N | Mean Rank | Sum of Ranks | Mann-Whitney U | Z | Asymp. Sig. (2-tailed) |
|--------------------|--------|-----|-----------|--------------|----------------|-------|------------------------|
| <i>Attitudinal</i> | Female | 179 | 157.59 | 28208.00 | 12098.00 | -0.31 | 0.754 |
| | Male | 138 | 160.83 | 22195.00 | | | |
| | Total | 317 | | | | | |
| <i>Technical</i> | Female | 179 | 155.92 | 27909.50 | 11799.50 | -0.68 | 0.494 |
| | Male | 138 | 163.00 | 22493.50 | | | |
| | Total | 317 | | | | | |
| <i>Cognitive</i> | Female | 179 | 161.44 | 28897.50 | 11914.50 | -0.55 | 0.581 |
| | Male | 138 | 155.84 | 21505.50 | | | |
| | Total | 317 | | | | | |
| <i>Social</i> | Female | 179 | 145.99 | 26131.50 | 10021.50 | -2.92 | 0.003* |
| | Male | 138 | 175.88 | 24271.50 | | | |
| | Total | 317 | | | | | |
| <i>Total score</i> | Female | 179 | 154.47 | 27651.00 | 11541.00 | -1.00 | 0.316 |
| | Male | 138 | 164.87 | 22752.00 | | | |
| | Total | 317 | | | | | |

* $p<.05$

Table 3 shows that there is no by-gender significant difference in the digital literacy levels of the students of computer technologies teaching and Turkish language teaching in terms of total scores ($U=11541.00$; $p>05$) and attitudinal ($U=12098.00$; $p>05$), technical ($U=11799.50$; $p>05$), cognitive ($U=11914.50$; $p>05$), and social domain ($U=10021.50$; $p>05$). The fact that there is no gender-based difference between the scores of the students of both departments in relation to their attitudes towards digital literacy can be associated with the fact that the individuals of both gender engage in environments requiring digital literacy and are aware that digital literacy is an integral part of daily life.

Table 4. Analysis of the Differentiation of Digital Literacy Levels of the Participants by Class Standing--The Results of Kruskal-Wallis H Test (a.b)

| | | n | Line Mean | Chi-Square | df | Asymp. Sig. |
|-------------|--------|-----|-----------|------------|----|-------------|
| Attitude | Year 1 | 87 | 139.88 | 22.93 | 3 | .000* |
| | Year 2 | 58 | 122.75 | | | |
| | Year 3 | 108 | 179.09 | | | |
| | Year 4 | 64 | 183.94 | | | |
| | Total | 317 | | | | |
| Technique | Year 1 | 87 | 134.32 | 11.23 | 3 | .011* |
| | Year 2 | 58 | 155.34 | | | |
| | Year 3 | 108 | 177.79 | | | |
| | Year 4 | 64 | 164.16 | | | |
| | Total | 317 | | | | |
| Cognitive | Year 1 | 87 | 133.83 | 17.25 | 3 | .001* |
| | Year 2 | 58 | 140.51 | | | |
| | Year 3 | 108 | 180.12 | | | |
| | Year 4 | 64 | 174.33 | | | |
| | Total | 317 | | | | |
| Social | Year 1 | 87 | 133.31 | 19.77 | 3 | .000* |
| | Year 2 | 58 | 137.15 | | | |
| | Year 3 | 108 | 183.48 | | | |
| | Year 4 | 64 | 172.41 | | | |
| | Total | 317 | | | | |
| Total score | Year 1 | 87 | 131.32 | 26.68 | 3 | .000* |
| | Year 2 | 58 | 131.19 | | | |
| | Year 3 | 108 | 184.71 | | | |
| | Year 4 | 64 | 178.45 | | | |
| | Total | 317 | | | | |

* $p < .05$

a Kruskal Wallis Test

b Grouping Variable: year

In Table 4, a significant difference in total scores ($\chi^2=22.68$; $p<.05$) between the digital literacy levels of the students of Turkish Language and computer technologies teaching by class standing is presented. The differences were observed in attitudinal ($\chi^2=22.93$; $p<.05$), technical ($\chi^2=11.23$; $p<.05$), cognitive ($\chi^2=17.25$; $p<.05$), and social ($\chi^2=19.77$; $p<.05$). The scores of the students starting to receive undergraduate education may vary in the next stages of their undergraduate education depending on their education and experiences. This change can be observed in all different aspects of an individual, i.e. physical, mental, spiritual, and emotional aspects. This change occurring in time can also be observed in the attitudes of the students towards digital literacy. It can be claimed that undergraduate education contributes to students of both teaching departments in terms of digital literacy.

Conclusion and Discussion

1. The good level of the attitudes of Turkish language and computer technologies teaching is the outcome of the proliferation of information and ubiquity of information in the 21st century. Although there is a difference in the digital literacy levels in favor of the students of computer technologies, the fact that both groups replied this item as "I agree" is an indicator of the interest in and need for digital literacy as a skill of individuals in the digital age.

In the study by Üstundağ, Güneş, and Bahçivan (2017), the qualities of science teaching students were investigated in view of the skills associated with digital literacy and it was found out that the skills of digital literacy of the science teaching students were good. The present study and a study on the students of science teaching yielded similar results. It makes us think that the attitudes of undergraduate students of the college of education towards digital literacy are positive. Since the students from the college of education will pursue their professional life in education, it is important that they exhibit a positive attitude towards digital literacy.

2. the high-level skills of the students of Turkish language and computer technologies teaching in technical issues related to digital literacy is favorable for the achievement of a high level of proficiency in digital literacy proficiency. “Functional Internet literacy is not the ability to use a set of technical tools; rather, it is the ability to use a set of cognitive tools” (Johnson, 2008, 42). The fact that students consider themselves proficient enough in the technical aspect of digital literacy suggests that they consider themselves cognitively competent. Although there is no significant difference between the skills of the students of Turkish language and computer technologies teaching in the technical subjects related to digital literacy, actually a difference was expected. Students are granted the right to study in their respective departments based on different score types of the examinations they sit for and therefore the students of computer technologies teaching were expected to feel proficient in technical issues.

3. The high level of cognitive perception related to the digital literacy of the students of Turkish language teaching and computer technologies teaching and no difference between the cognitive perceptions concerning the digital literacy of the students of Turkish language teaching and computer technologies teaching show that the students of both departments have internalized the use of digital sources. “Dissemination of the digitalization in education as education technologies has occurred with the proliferation of educational technologies. For this reason, all stakeholders of the education world should be digitally literate” (Sönmez and Gül, 2014). It can be realized that the students of both departments are aware of the significance of digital literacy and that the use of digital tools and materials in education activities will prove beneficial.

4. The high level of digital literacy-related social skills of the students of Turkish language teaching and computer technologies teaching and the observed difference in favor of the students of computer technologies teaching demonstrate that digital information affects the proficiency in this issue. The students of computer technologies teaching know how to benefit from digital media socially, to avoid losses, and to use these media more efficiently. The reason is the education they receive and their interests motivating them to pursue this education. For this reason, their considering themselves more proficient than the students of Turkish language teaching is an expected result.

5. Gender caused no difference in the attitudes towards the digital literacy of the students of Turkish language teaching and computer technologies teaching. In a study on digital literacy carried out on prospective teachers in Turkey and Kazakhstan (Ozerbas & Kuralbayeva, 2015), a significant by-gender difference was found in favor of male students. It does not overlap with the data herein. In the study where the result obtained in favor of male prospective teachers was interpreted to suggest that male prospective teachers were better at the use of technology. However, the scale used in the aforementioned study is “Digital Literacy Evaluation Scale”, developed by Acar and Simsek (2015), and different from the scale in this study.

6. Higher class standing translated into more positive attitudes towards digital literacy exhibited by the students of Turkish Language Teaching and Computer Technologies Teaching. When “literacy” and “digital” are tackled separately, it is an expected result that the students of Turkish language teaching are more competent in any kinds of literacy as the class standing gets higher. Similarly, the students of computer and technologies teaching are expected to be more competent in digital subjects and digital media as the class standing gets higher. For this reason, an increase in the level of positive attitudes towards digital literacy with higher class standings is an expected and desired result.

Suggestions

1. The students of computer technologies teaching consider themselves more competent in digital literacy than the students of Turkish language teaching, which may have resulted from the education they have received. Hence, elective courses can be offered in undergraduate programs especially for the students of the Turkish language teaching department and of all other teaching departments.

2. Digital literacy is an integral part of daily life and therefore introducing informative and conscious-raising classes or activities related to digital literacy in all education levels starting from elementary school will prove useful.

3. The number of studies on digital literacy is quite limited. Conducting research on this subject will be fruitful for societies to become more informed and to raise an awareness of this issue.

4. Institutions such as İSMEK, Microsoft, and Bilgi University offer courses and hold activities related to digital literacy. Rendering such courses and events accessible for all age groups and social classes is believed to be beneficial.

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Engineering Major Students' Perceptions of Nanotechnology

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Abstract

Nanotechnology will be among the most needed workforce areas in the near future. It is also a creative and highly dynamic field of innovative research areas that displays numerous open fields for future graduates. The central thesis of this paper is to better understand undergraduate engineering students' awareness, exposure, and motivation towards nanotechnology, how those constructs correlate with each other, and whether there are differences by gender or year of study. This exploratory study used mixed methods to answer the research question. Results revealed that engineering students have more motivation to pursue further nanotechnology knowledge or study than they have exposure or awareness about nanotechnology. The results showed that male students have more awareness about nanotechnology than female students. Educational implications are that it is necessary to provide students with more opportunities to learn about and study nanotechnology during their undergraduate experience. While students are interested in learning more, their current levels of awareness and exposure may hold them back in pursuing nanotechnology-related careers.

Key words: Nanotechnology, Engineering students, Perception

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Introduction

For the first time Richard Feynman, an American physicist, mentioned the nanoworld with his famous speech "There's Plenty of Room at the Bottom," at an American Physical Society meeting at Caltech on December 29, 1959. Since then, Taniguchi Norio, a professor of Tokyo University of Science, coined the term *nano-technology* in 1974 (Taniguchi, 1974). Shortly after that, an American engineer named Drexler first popularized molecular nanotechnology in the late 1970s. The field of nanotechnology in the 1980s was brought on by the union of research and technical advances, for example, the innovation of the scanning tunneling microscope in 1981 and the discovery of fullerenes in 1985. The field came into prominence in the mid-2000s with governments moving to advance and create research into nanotechnology. Since that time nanotechnology research and government investments have been rising.

The term nanotechnology has come to be used to refer to the arrangement of molecules and atoms at sizes between 1 and 100 nanometers (Blonder & Sakhnini, 2012; Ramsden, 2014). Material shows different properties at the nanoscale than at the macroscale. Material scatters light at different wavelengths, the melting point [increases or decreases], and catalysis and magnetism properties are changed with particle size. For instance, gold is known as yellow a noble metal but at 10 nanometers (nm) gold particles absorb green light and appear red (Roduner, 2006). Building material at the nanoscale offers many advantages that make it a preferred product, one of which is its superior properties (Sobolev, 2016). Nanotechnology is used in many fields such as environmental production, energy, electronics, military, drug delivery, security and foods (Pagliaro, 2015). It includes many research disciplines and is becoming the driving force in fields such as chemistry, physics, biology, engineering, materials science and medicine (Pagliaro, 2015; Porter & Youtie, 2009).

Nanotechnology became an emerging research field in the 21st century (Jackman et al., 2009). Since then, billions of dollars have been invested in nanotechnology investigations. For example, the president of the United States' 2015 Budget provides over \$1.5 billion for the National Nanotechnology Initiative (NNI) (Bhushan, 2015). In the last decade many scientists around the world have conducted research in the area of nanotechnology. As such, there has been an increasing amount of research papers and published studies on nanotechnology, including several top journals focused on nanoscience research (e.g., Nature Nanotechnology, Nano Letters, ACS Nano). Due to this rapid growth, nanotechnology will be one of the most needed workforce areas in the near future (Greenberg, 2009; Malsch, 2014; Roco, 2003). With this in mind, it is becoming more necessary for engineering students to gain some nanotechnology skills, as these skills are needed by industry (Roco, 2003). Uddin et al. (2001) described nanotechnology-related abilities as those which, 'Provide understanding, characterization and measurements of nanostructure properties...[the] ability for synthesis, processing and manufacturing of nanocomponents and nano systems... [the] ability for design, analysis and simulation of nanostructures and nanodevices...and [which] prepare students to conduct research and development of economically feasible and innovative applications of nanodevices in all spheres of our daily life'.

Researchers have advocated the integration of nanotechnology into the undergraduate engineering curriculum (Drane, Swarat, Light, Hersam, & Mason, 2009; Newberry, 2011; McNally, 2013; Balasubramanian & Meliabari, 2016) and into education as a whole (Jones et al., 2013). Following a review of the literature, Ghattas and Carver (2012) argue that there is a strong need for integration of nanoscience topics into the school curriculum. Greenberg (2009) further argued for the integration of nanoscience into the classroom; in particular stating that the undergraduate classroom presents less barriers to integration than the secondary education level. It follows that universities have increasingly been seeking to educate their students in this field (Goodhew, 2006). Nonetheless, nanotechnology integration has not yet been fully achieved in the undergraduate curriculum. Since nanotechnology is a new and rapidly evolving field, there is a gap between research studies and their application in education. A main challenge for nanotechnology is the education and training of engineering students for the rapid knowledge generation and research in this field (Chang, 2006; Jones

et al., 2013; Uddin et al., 2001). Educators are needed to fill this gap between nanotechnology research and educational programs. Ineke (2014) demonstrated that workers in manufacturing as well as teachers have not learned about nanotechnology during their education, and thereby identified European employers' needs for nano-education (Malsch, 2014). That being said, several attempts have been made to integrate nanotechnology in education (Ambrogi, Caselli, Montalti, & Venturi, 2008; Ron Blonder & Dinur, 2011; Moyses, Rivet, & Fahman, 2010; O'Connor & Hayden, 2008; Pagliaro, 2015; Moyses, Rivet, and Fahlman 2010; Sakhnini & Blonder, 2015) but more research is needed. In order for successful nanotechnology research, development, and social discourse to take place in this field, education research is needed to inform the development of standards, course development, and workforce preparation (Jones et al., 2013).

Research across several countries has demonstrated that there is a general lack of understanding about nanotechnology. In the United States, previous research has reported a public lack of understanding of nanotechnology and its applications (Cobb & Macoubrie, 2004; Waldron, Spencer, & Batt, 2006; Macoubrie, 2005; Cobb, 2011). In Turkey, Senocak (2014) has also questioned the public's perception of nanotechnology, by collecting data from 513 Turkish participants of different backgrounds. He found that the Turkish public is unfamiliar with nanotechnology, while most of the sample had heard little to nothing about nanotechnology; however, participants often have positive emotions toward nanotechnology. Another study examined public perceptions of nanotechnology in France and found that the majority of participants had never heard of nanotechnology, and participants who had heard of nanotechnology had little knowledge about the subject (Vandermoere, Blanchemanche, Bieberstein, Marette, & Roosen, 2011).

This lack of awareness applies to the student population as well as the general public. In an investigation into middle school (6th, 7th and 8th grade) students' awareness of nanotechnology, Sahin and Ekli (2013) found that students have low awareness of nanotechnology, yet most students have positive feelings towards nanotechnology. Karataş' (2015) research with science and chemistry undergraduate students found that students' nanotechnology knowledge level is low and students are thus unable to transfer their science information to nanotechnology. Another study with Turkish undergraduates, this time with science education students, found that before a curriculum module students had little or no prior knowledge of nanotechnology (Senocak, 2015). In the United States, Diefes-Dux, Dyehouse, Bennett, and Imbrie (2007) found that first year undergraduate food and agriculture students showed little to no awareness of nanotechnology. Marikar et al. (2014) conducted a study with 80 medicine students' awareness about nanotechnology in Sri Lanka. The authors concluded that students gave strong responses on basic knowledge of nanoscale concepts; however, they found that students show a lack of knowledge about the relationship between nanotechnology and nanomedicine. Although some of these studies did not take place with undergraduate engineering students, they provide a general overview of the lack of awareness regarding nanotechnology in the public and with students. Overall these studies highlight the need for understanding students' perceptions of nanotechnology before planning a training program.

One of the areas in which nanotechnology is most used is engineering. However, to the best of our knowledge, no report has been found so far investigating engineering students' perceptions of nanotechnology in Turkey. This study aims to fill this research gap by examining Turkish engineering students' exposure, awareness and motivation levels towards nanotechnology.

The paper seeks to address the following main research question.

How do engineering students perceive nanotechnology?

Our research sub-questions are as follows:

Are there significant differences between male and female students with regards to exposure, awareness and motivation towards nanotechnology?

Are there any significant differences among first year, second year and third year engineering students in terms of exposure, awareness and motivation towards nanotechnology?

Are there any correlations among students' exposure, awareness, and motivation towards nanotechnology?

Methods

Participants

Participants were selected from engineering classrooms with faculty permission in a state university in Turkey that does not have a nanotechnology program. The initial sample consisted of 145 undergraduate engineering students, of which we eliminated 33 of whom did not complete all of the items. 112 surveys were found useful for this empirical analysis. The independent variables included by gender between year of study; the sample distribution is given in Table 1. Approximately half of those surveyed did not comment on open ended questions. The total number of responses for open ended questions was 51.

Table 1. Sample Profile

| | 1 st Year | 2 nd Year | 3 rd Year | Total |
|--------|----------------------|----------------------|----------------------|-------|
| Male | 26 | 18 | 33 | 35 |
| Female | 9 | 9 | 17 | 77 |
| Total | 35 | 27 | 50 | 112 |

Study design

In this study we used mixed-methods to address our research questions. An explanatory sequential design was used; quantitative analysis findings clarify with qualitative analysis results (Creswell et al., 2008). We collected quantitative data using a survey and qualitative data using open-ended questions. Qualitative analysis was used to provide more in-depth understanding of students' responses.

Data collection

We used the Nanotechnology Awareness Instrument, which was developed and validated for use with undergraduate students (Dyehouse et al., 2008). The instrument was developed to measure three constructs of nanotechnology perceptions: nanotechnology awareness, nanotechnology exposure, and motivation to pursue further knowledge or careers in nanotechnology. An exploratory factor analysis took place to determine the dimensionality of the instrument, and Cronbach's α coefficient determined that there was high internal consistency reliability among the three subscales (Dyehouse et al., 2008). The instrument shows acceptable psychometric properties in three subscales: Nano-Awareness, Nano-Exposure, and Nano-Motivation. Cronbach's α coefficient was 0.91 for the Nano-Awareness scale, 0.82 for the Nano-Exposure subscale, and 0.94 for the Nano-Motivation subscale, which is a high level of internal consistency reliability (Dyehouse et al., 2008). Firstly, the exposure scale items have five answer choices ranging from strongly disagree to strongly agree. Some of those items are 'Heard the term nanotechnology', 'Read [something] about nanotechnology', and 'Taken a class about nanotechnology'. Secondly, the awareness scale items have five answer choices ranging from strongly disagree to strongly agree. Some of items are 'I can name an application of nanotechnology', 'Describe a process to manufacture objects at the nanoscale' and 'Name an

instrument used to make measurements at the nanoscale'. Finally, the motivation scale has answer choices ranging from strongly disagree to strongly agree. Some items for this scale are 'I plan to read a research journal article about nanotechnology', 'Enroll in a course about nanotechnology', 'Obtain a work experience or undergraduate research opportunity related to nanotechnology'. Qualitative data were collected with open-ended questions focused on students' exposure, background, and plans regarding nanotechnology (e.g., 1. Where did you encounter the concept of nanotechnology? 2. What do you know about nanotechnology? 3. What are the things you plan to do regarding nanotechnology?)

Data analysis

Data management and analysis were performed using SPSS 20.0. Descriptive data were generated for all variables. Because of the ordinal-level data, we used nonparametric tests as well as the mode for descriptive analysis. Mann-Whitney U Tests were used to analyze the relationship between gender and students' nanotechnology perceptions. In order to assess year of study, Kruskal-Wallis Tests were used. In addition, Kendall's tau_b correlation coefficients were used to examine the relationships between the variables that were measured on an ordinal scale. A content analysis using a classification approach was used for qualitative data analyses. First, response phrases were categorized and then analysed according to the recurring themes. An example of coding for Exposure is: TV; Daily life product; Internet; School. Examples for the Background theme were: Small technology; Advanced Technology; Something that makes life easier. Finally, examples of coding for the Motivation theme were: Education, Work.

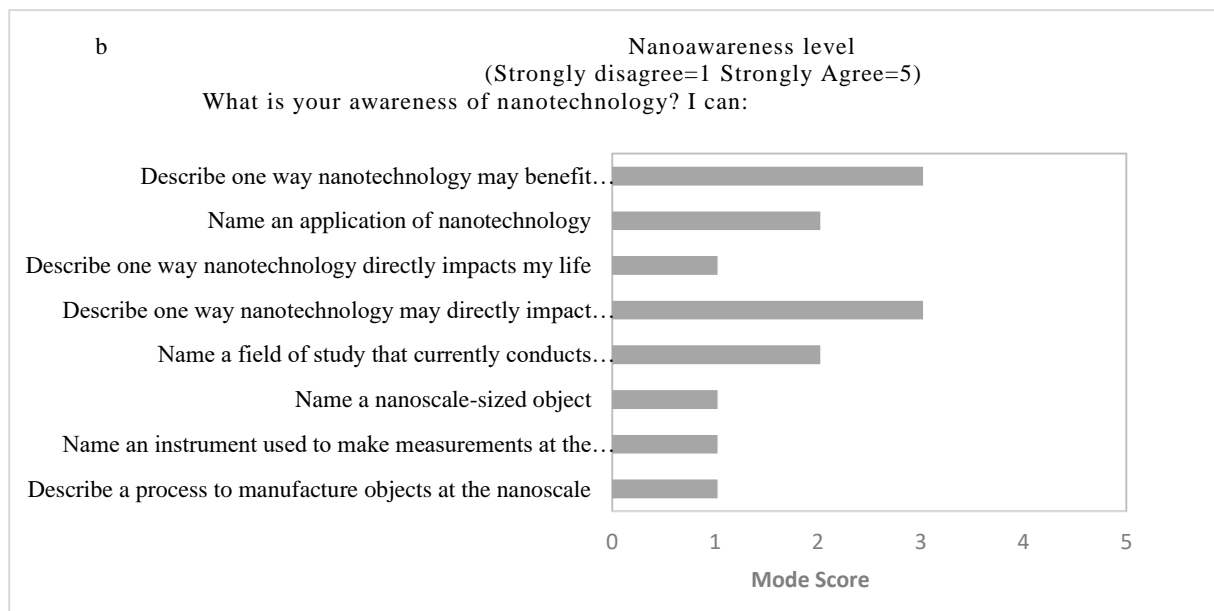
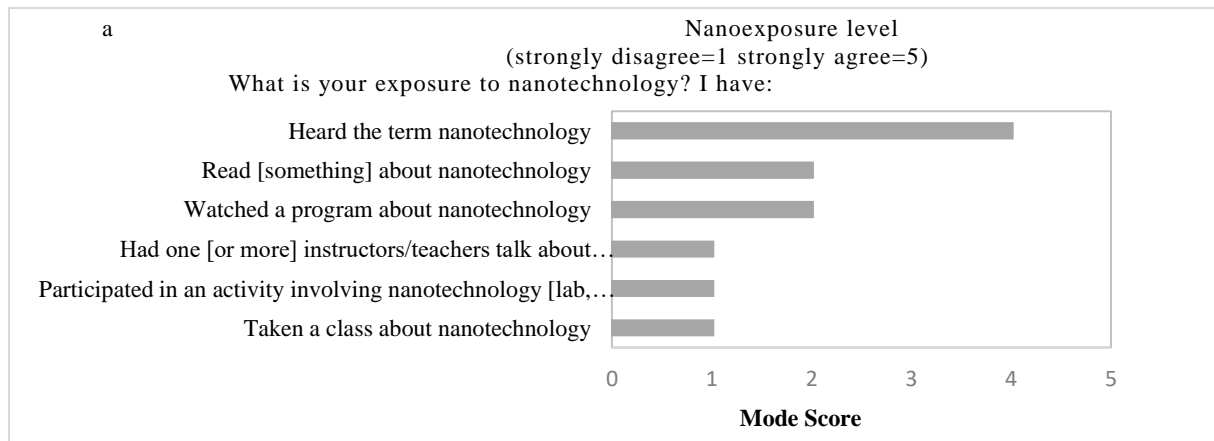
Results

The quantitative results are presented in the following tables and figures including first descriptive statistics and then inferential statistics. Table 2 presents the results of the Mann-Whitney U Tests to examine the relationship between gender and nanotechnology perceptions. To determine whether there were any year of study effects, the results of Kruskal-Wallis Test tests are presented in Table 3. Lastly, to understand the relationships between variables, Kendall's tau_b correlation was used (Table 4). The qualitative results include analysis of responses given to open-ended questions shown in Table 5.

Quantitative results

Descriptive statistics

The descriptive data analysis was used to answer the research question: How do engineering students perceive nanotechnology? More specifically, what are students' perceptions about nanotechnology in terms of exposure, awareness and motivation towards nanotechnology? Because the data were ordinal, the mode rather than the mean score was used.



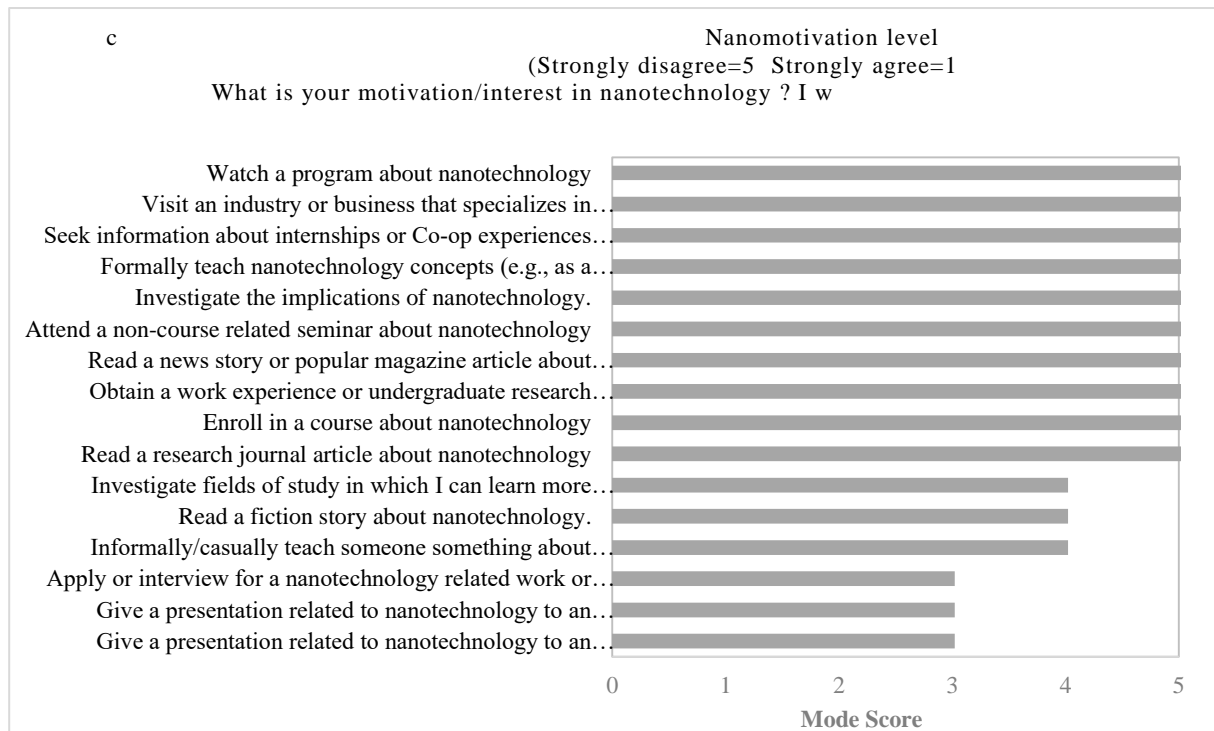


Fig.1. Mode scores for the respondents' nano (a) exposure (b) awareness (c) motivation

Figure 1 provides detailed descriptive statistics regarding the participants' nano-exposure, nano-awareness and nano-motivation mode scores. From the data in Figure 1a, it is apparent that almost all students have heard about nanotechnology (mode: 4). Some students have read or watched something related to nanotechnology (mode: 2). A small number of students listened to something about nanotechnology from their teachers, participated in an activity involving nanotechnology, or have taken a class about nanotechnology (mode: 1).

Results showed that the modes of almost all items that belong to nanotechnology awareness were under the score of 3.0 (see Figure 1b), meaning that most students lack awareness about nanotechnology. Fewer than half of students have awareness about societal benefits. Students cannot describe one way that nanotechnology may impact their daily life, but they can describe one way that nanotechnology may directly impact their life in the future. Only a few students can describe the manufacturing process at the nanoscale and can name an instrument used to make measurements at the nanoscale (mode: 1).

Finally, it Table 1c shows that the mode score for all items that belong to nanotechnology motivation were above 3.0. That is, students' motivation to learn, work and take part in research experiences related to nanotechnology is high (mode: 5). Students willing to apply or interview for nanotechnology-related work is moderate (mode: 3).

Inferential statistics

Inferential statistics, including Mann-Whitney U Test, were used to answer the first research sub-question: Are there significant differences between male and female students with regards to exposure, awareness and motivation towards nanotechnology?

Table 2. Mann-Whitney U Tests results for the comparison by gender with nano-exposure, awareness and motivation

| Nano-exposure | n | Mean Rank | Sum of Rank | U | p |
|-----------------|----|-----------|-------------|----------|-------|
| Female | 35 | 54.06 | 1892.00 | 1262.00 | 0.590 |
| Male | 77 | 57.61 | 4436.00 | | |
| Nano-awareness | | | | | |
| Female | 35 | 43.63 | 1527.00 | 897.000 | .005 |
| Male | 77 | 62.35 | 4801.00 | | |
| Nano-motivation | | | | | |
| Female | 35 | 48.04 | 1681.50 | 1051.500 | .063 |
| Male | 77 | 60.34 | 4646.50 | | |

As shown in Table 2, there was no significant difference between males and females on the subscale measuring students' exposure to nanotechnology ($p > 0.05$). That is, we found that both female and male students have a similar self-reported level of exposure to the field of nanotechnology. As can be seen from the data in Table 2, there were significant differences between males and females in term of nano-awareness ($p < 0.05$), with males showing a higher mean rank than females. That is, males had significantly higher awareness about nanotechnology than did females. Finally, results showed no significant difference between males and females in terms of motivation to pursue further exploration of nanotechnology ($p > 0.05$). Thus, both males and females showed similar levels of their self-reported plans to pursue further knowledge or careers in the field of nanotechnology.

Inferential statistics including a Kruskal-Wallis Test were used to answer the second research sub-question: Are there any significant differences among first year, second year and third year engineering students in terms of exposure, awareness and motivation towards nanotechnology?

Table 3. Kruskal-Wallis Test results in terms of year of study

| Nano-exposure | n | Mean Rank | df | χ^2 | p |
|-----------------|----|-----------|----|----------|------|
| Year 1 | 35 | 38.06 | 2 | 16.681 | .000 |
| Year 2 | 27 | 62.87 | | | |
| Year 3 | 50 | 65.97 | | | |
| Nano-awareness | | | | | |
| Year 1 | 35 | 48.63 | 2 | 3.371 | .185 |
| Year 2 | 27 | 63.15 | | | |
| Year 3 | 50 | 58.42 | | | |
| Nano-motivation | | | | | |
| Year 1 | 35 | 72.90 | 2 | 13.751 | .001 |
| Year 2 | 27 | 44.67 | | | |
| Year 3 | 50 | 51.41 | | | |

There were significant differences between year of study in terms of nano-exposure ($p < 0.05$), indicating that year in university program has effects on students' self-reported exposure to nanotechnology (Table 3). Next, there were no significant differences between year of study in terms of students' awareness of nanotechnology ($p > 0.05$), indicating that students in different years of study have similar levels of awareness. We also found significant differences between year of study in terms of motivation ($p < 0.05$). Surprisingly, first year students have a higher nano-motivation mean rank score than second and third year students.

Kendall's tau b was used to answer the third sub-research question: Are there any correlations among students' exposure, awareness, and motivation towards nanotechnology?

Table 4. Kendall's tau_b correlation values between variables.

| | | Nano-exposure | Nano-awareness | Nano-motivation |
|-----------------|-------------------------|---------------|----------------|-----------------|
| Nano-exposure | Correlation Coefficient | 1.000 | .551** | .039 |
| | p | | .000 | .558 |
| Nano-awareness | Correlation Coefficient | .551** | 1.000 | .144* |
| | p | .000 | | .028 |
| Nano-motivation | Correlation Coefficient | .039 | .144* | 1 |
| | p | .558 | .028 | |
| | n | 112 | 112 | 112 |

** . Correlation is significant at the ($p < 0.01$ level).

*. Correlation is significant at the ($p < 0.05$ level).

Table 4 shows the Kendall's tau_b correlation between variables. We found positive correlations between the nano-exposure subscale and the nano-awareness subscale in addition finding positive correlations between the nano-motivation subscale and the nano-awareness subscale. This indicates that students' awareness about nanotechnology increases with their exposure to nanotechnology. Furthermore, students' motivation to pursue further knowledge or careers in nanotechnology increases with their awareness about the field.

Qualitative data analysis

To provide further information about students' perceptions about nanotechnology, we performed a content analysis on the qualitative data. The results of the qualitative data analysis are presented in Table 5.

Table 5. Themes, codes, students' frequency and percent

| Themes | Codes | Frequency | % |
|--|----------------------------------|-----------|----|
| Encountering the concept of nanotechnology | Daily life product | 9 | 21 |
| | TV, internet | 16 | 37 |
| | Nowhere | 10 | 23 |
| | School | 7 | 16 |
| Background about nanotechnology | Something that makes life easier | 10 | 26 |
| | Advanced technology | 7 | 18 |
| | I have no information | 16 | 41 |
| | Small technology | 6 | 15 |
| Future plans regarding nanotechnology | Education | 15 | 48 |
| | Work | 6 | 19 |
| | I have no plan | 10 | 32 |

Regarding where students have encountered the concept of nanotechnology, we found that the largest percentage of students responded that they have encountered nanotechnology on the TV or internet (37%). However, many students (23%) responded that they have not encountered nanotechnology anywhere. Surprisingly, the smallest percentage of students have encountered nanotechnology in the school environment (16%).

Next, we examined students' responses to better understand what background they have in nanotechnology. Almost half of the respondents reported that they have no information about nanotechnology (41%). However, on the positive side, a small number of respondents believe that

nanotechnology is something that makes life easier (26%). The smallest percentage of students know that nanotechnology is an advanced technology and a small technology (18% and 15%, respectively).

Examining the open-ended responses regarding students' future plans, we found that approximately half of the respondents have motivation to get nanotechnology training (48%). A smaller number of participants have motivation to work on nanotechnology related areas (19%). Finally, fewer than half of the respondents have no plans regarding nanotechnology (32%).

Discussion

The main research question that this study sought to answer was: How do engineering students perceive nanotechnology? Results revealed that students have low exposure and awareness regarding nanotechnology and high motivation towards learning more about nanotechnology. It seems that while that students have a belief about the importance of nanotechnology, they also have insufficient knowledge about nanotechnology. These results could possibly be due to a lack of nanotechnology education (Jackman et al., 2009; Jones et al., 2013; Malsch, 2014). Students' information is limited to the internet, TV and some products which used nanotechnology in the production process. At the same time, while students have high motivation to visit an industry and business that specializes in nanotechnology, they have low motivation to apply or interview for related nanotechnology work. In sum, the majority of the students have encountered nanotechnology, but they are lacking information about the field. Additionally, the majority of students are willing to learn nanotechnology and report that they want to enroll in nanotechnology education. Students' lack of motivation to apply for a job related to nanotechnology could be a result of their low nanotechnology knowledge, which would not be sufficient for a nano-related career. These results are consistent with those of other studies (Chen et al., 2013; Farshchi, Sadrnezhaad, Nejad, Mahmoodi, & Abadi, 2011; Hanoglu, Douglas, Madhavan, & Diefes-Dux, 2015; Waldron et al., 2006), which show lower awareness about nanotechnology but a higher interest in pursuing additional knowledge.

We also found a lack of exposure to nanotechnology in the classroom on both quantitative and qualitative responses. Most students reported that they have not had one or more instructors/teachers talk about nanotechnology and that only a small percentage have encountered nanotechnology in a school setting. We found this surprising for engineering students, because of the wide applications for nanotechnology across all engineering fields. This lack of exposure is consistent with students in other fields of study and other educational levels (Sahin & Ekli, 2013; Marikar et al., 2014; Karatas, 2015; Senocak, 2015).

The first research sub-question asked whether there are significant differences between male and female students with regards to exposure, awareness and motivation towards nanotechnology. These results indicated that there is no significant difference between gender for students' exposure and motivation regarding the field of nanotechnology. That is, both males and females have similar exposure and motivation levels towards nanotechnology. However, significant differences were found between males and females regarding their level of awareness about nanotechnology; specifically, male students showed higher levels of awareness than female students. Many engineering fields, which are associated with hardware and technical tools, such as mechanical and electrical engineering, are populated by many more men than women (Miller et al., 2000). Su, Rounds, and Armstrong (2009) performed a meta-analysis of sex differences in career interests and found that men prefer working with things and women prefer working with people, with women showing a greater preference for socially-oriented occupations. Furthermore, women tend to leave engineering for majors that are perceived to be more likely contributors to social good (Borrego et al., 2005). It may be that because nanotechnology is perceived as a highly technical field that women lack enough interest to increase their awareness about the field. This difference between genders should be more closely examined in future research.

Our second research sub-question asked, 'Are there any significant differences among first year, second year and third year engineering students in terms of exposure, awareness and motivation

towards nanotechnology’? The results showed a significant difference in students’ nano-exposure level across years of study. These results showed that as students move through their program of study they gain increasing exposure to nanotechnology. However, we are unable to say if this exposure is the result of the university environment. Results also showed no significant differences for students’ levels of awareness towards nanotechnology between years of study. It is unclear why students’ exposure increases over the years but awareness does not. It may be that exposure to nanotechnology does not necessarily lead to awareness. Because awareness indicates some level of knowledge or learning about nanotechnology, such as the ability to name a nanoscale sized object, students who are exposed to nanotechnology (i.e., hearing about it in the classroom) may not be willing to seek out more information or be interested enough to retain any information. However, significant differences were found for students’ motivation towards nanotechnology by year of study. Surprisingly, students’ nano-motivation decreases as they increase in their years of study. The findings of the current study are consistent with those of Hanoglu et al. (2014) who found students’ exposure and awareness increases but not motivation towards nanotechnology after an educational intervention. The reason for this may have something to do with self-efficacy, behavioral (e.g., enrolling a laboratory course) and environmental factors (e.g., high school) (Pintrich, 2003).

Finally, the third research sub-question asked ‘Are there any correlations among students’ exposure, awareness, and motivation towards nanotechnology’? Results showed a high positive correlation between nano-exposure with nano-awareness and again between nano-awareness and nano-motivation. A possible explanation for these results are that students’ awareness increases with their exposure level and in turn as students become more aware of the field, they increase in their motivation to pursue further information. However, there was no direct correlation between exposure and motivation level. In this case, exposure could indicate a more passive attentiveness about nanotechnology, while awareness may indicate a conscious effort to understand nanotechnology. In the psychology literature, exposure alone does not increase liking of a certain object, whereas conscious awareness can have an effect (de Zilva et al., 2013). For example, if students have read a newspaper that mentioned nanotechnology but skimmed over it or if nanotechnology was mentioned in a class and they were not attentive, then their exposure does not necessarily indicate any understanding or awareness of nanotechnology, thus not leading to motivation to pursue further information.

Conclusion

This study set out to determine engineering students’ perceptions of nanotechnology. The most obvious finding to emerge from this study is that students’ exposure to nanotechnology and awareness about nanotechnology is low, but their motivation to pursue nanotechnology knowledge or careers is high. This lack of exposure and awareness is problematic at a time when nanotechnology is becoming increasingly important to the field of engineering. As this study has shown, engineering students have little to no exposure to nanotechnology in a classroom setting. Educators can take advantage of students’ motivation to learn more about nanotechnology by integrating information about the field into the engineering curriculum, thereby increasing students’ exposure and awareness.

Additionally, although students’ exposure to nanotechnology and awareness about nanotechnology were low, there were still significant differences found between males and females with regard to levels of nanotechnology awareness. Because females show a lower awareness of nanotechnology than males, it may be helpful for educators who integrate nanotechnology into their curriculum to emphasize the more socially relevant aspects of nanotechnology that may interest women in particular, such as how nanotechnology can improve society.

Surprisingly, no significant differences were found between year of study in terms of awareness towards nanotechnology. We found a high positive correlation between the constructs of exposure with awareness and awareness with motivation. It is important that educators integrate

nanotechnology into the curriculum in meaningful, relevant ways in order to engage students and move beyond mere exposure to nanotechnology.

In sum, the evidence from this study suggests that engineering faculty should amend their curriculum to give more attention to nanotechnology education given the prevalence and need for nanotechnology-trained engineering graduates. The high levels of motivation to pursue further information about nanotechnology among engineering students is encouraging. This is the first time that perceptions about nanotechnology have been studied with Turkish engineering students. These findings enhance our understanding of engineering students' perceptions of nanotechnology, specifically with regards to exposure, awareness, and motivation. The current investigation was limited to a state university. Further research should explore nanotechnology awareness at other types of institutions, in addition to examining more closely the links between year of study and gender with regards to nanotechnology perceptions.

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Gifted Students' Perception of the IBDP and National Programme, and the Effects of these Programmes on their Academic Achievement: A Review within the Context of Turkey

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Abstract

The general objective of this study was to investigate the advantages and disadvantages of the national curriculum and IBDP according to the perception of gifted students, and to determine the effects of the programmes on the academic achievement of the aforementioned students. Data was collected with an information form. It was found significant difference between mean scores of English and the grade point average in respect of the IBDP students. The students of the IBDP mentioned the advantages of the programme, such as exploring skill areas, the opportunity to study abroad, acquiring self-discipline, developing awareness of responsibility, and developing creative and critical thinking ability. The national curriculum was criticized in terms of being based on competition and rote learning, not having the opportunity for practice, impairing creative and critical thinking skills, being an exam-oriented system, and requiring extensive daily study workload.

Keywords: International Baccalareate, gifted, Turkish national programme, GPA, achievement.

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Introduction

In designing the curriculum of the International Baccalaureate (IB), the principles of high levels of abstraction of the content, depth, complexity, inter-disciplinary approach and creativity are based on the IB (2017a) by using this programme and the students' skills for self-directional learning and working independently (Poelzer, 1994). Moreover, the flexible structure of the curriculum allows skills to be explored and developed in various fields varying from art to science. Due to the characteristics mentioned above, the aforementioned IB programme might be considered to be an appropriate programme to satisfy the needs of gifted and high-ability students (Anderson, 1994; Hertberg-Davis, Callahan & Kyburg, 2006; Poelzer, 1994; Poelzer & Feldhusen, 1997; VanTassel-Baska, 2003).

One of the most comprehensive studies which analysed some effects of the IB high school (DP) programme was conducted by Hertberg-Davis, Callahan and Kyburg (2006). In the research report, the students stated that the IB programme motivated them to use their ability for critical thinking, provided an opportunity to collaborate with their peers at similar levels of motivation and ability, allowed them to communicate with their teachers as if they were adults, and was necessary to enrol in a good university in the future. However, that there was no need to think too much in the programme sustained by the scope of their general education. The difficulty level of the IBDP was appropriate and the students were able to access numerous opportunities which they cannot also access in the general education classrooms. The teachers pointed out that interactive education contributed to the development of thinking skills among the students.

Another study was conducted by Foust, Hertberg-Davis, and Callahan (2009b). In a study which included 85 students from 24 schools in seven US states, the researchers found that the IBDP had some advantages in terms of establishing a positive classroom climate, establishing a special connection among the participants, and developing academic self-reliance.

In a group of studies, grade point average (GPA) and other test scores of students who had completed the IBDP were analysed. It was found that there was a positive relationship between the first semester college GPA and high school GPA (Grumurthy, 2016), high school GPA and SAT II scores in English (Luo, 2013), and their readiness for university education was high (Anderson, 1994), additionally their academic achievement at university was higher than their peers (Coco et al., 2012; Culross & Tarver, 2007; Duevel, 1999; Foust et al., 2009a; Foust, Hertberg-Davis, & Callahan, 2009b; Frost, 2011; Poelzer & Feldhusen, 1996; Saavedra, 2011; Sagun, Ateşkan, & Onur, 2016; Suldo, Shaunessy, Michalowski, & Shaffer, 2008; Shaunessy, Suldo, Hardesty, & Shaffer, 2006). In the study by Thomas (1988, 1999, as cited in Grumurthy, 2016), which enrolled in a university after the IBDP programmes in the UK, it was found that 98% of them graduated from university with a certificate of honour. The findings of Smith (2009) and Duevel (1999) were consistent with those results. The IBDP students were found to have 76% better university academic performance than their peers (Smith, 2009), and 92% of them graduated from university sooner than expected (Duevel, 1999). Based on the studies compared different test scores, it could be concluded that IBDP has effects on the more engagement in university level courses and having more academic success.

In another group of research, the qualifications of the students who completed an IBDP programme were analysed. It was found that these students had improved problem-solving skills, ability to cope with stress (Grumurthy, 2016), time management (Grumurthy, 2016; Sagun, Ateşkan, & Onur, 2016; Tarc & Beatty, 2012; Taylor & Proath, 2006), cultural awareness, the use of verbal (Culross & Tarver, 2007) and written language (Culross & Tarver, 2007; Grumurthy, 2016), critical (Culross & Tarver, 2007; Demir, 2009; Sagun, et al., 2016) and creative thinking (Culross & Tarver, 2007; Taylor & Proath, 2006), critical reading and studying habits (Tarc & Beatty, 2012; Sagun, et al., 2016), and perception of academic self-awareness (Sagun, et al., 2016; Shaunessy et al., 2006).

In further studies, some findings related to the constraints and disadvantages of IBDP were determined. Some of these included intense work load (Hertberg-Davis, Callahan & Kyburg, 2006;

Foust, Hertberg–Davis & Callahan, 2009; Hertberg–Davis & Callahan, 2008; Tarc & Beatty, 2012; Taylor & Proath, 2006), being a costly application (Hertberg–Davis & Callahan, 2008; Smith, 2009; Wright & Lee, 2014), intensive stress (Feld & Shusterman, 2015), exhaustion and establishment of the perception of a negative stereotype which reduced social acceptance (Shaunessy et al., 2006). In another study, 9% of the students failed to benefit from the course of Theory of Knowledge, and 30% of them stated that the course of Creativity, Action and Service (CAS) had no academic contribution (Jenkins, 2003, as cited in Grumurty, 2016).

Conceptual Framework

International Baccalaureate

The content of the IBDP consists of courses under six main topics: native language and literature, acquisition of a second language, individuals and societies, mathematics, science, and arts. The students have to choose one course from each group. In addition, there are three major components: Theory of Knowledge, Extended Essay and CAS. The students have to take three courses at an intensive level (240 hours per course) and another three courses at a standard level (150 hours per course; International Baccalaureate, 2017b). The activities of the students are evaluated at two levels – national and international levels. To obtain the diploma, the students should achieve 150 hours CAS activities and also complete the Extended Essay and Theory of Knowledge presentation and paper, as well as all the homework and activities. The maximum score achievable from the courses is 45. In order for a student to succeed, he or she should obtain at least 24 in total score as a result of the evaluations both inside and out of the school.

In the Turkish National Education system, students who are enrolled in the IBDP programme receive some courses together with the students in the national curriculum. The common courses in the curriculum of the science high school comprise 17 hours in the 11th grade¹, and 18 hours in the 12th grade². In total, the IBDP has 22–28 hours of elective courses. The weekly course load is 40–45 hours (for the details of the programme; TTKB, 2015b).

Turkish national curriculum

The Turkish National Education system has a hierarchical order. The curriculum of high schools is common at the national level. There are programmes at the high school levels considering the ability levels of the students (Author, 2015). The science high school is one such programme. The basic objective is to prepare high ability students in the fields of science and mathematics for the higher educational institutions in those fields.

The biggest difference between the programme in the science high schools and those of general high schools is related to content. The content of the courses is faster than the programme applied in the general high schools, there is more acceleration, challenge, abstract, and deeper work (Sak, 2010). The students of the 11th grade have to receive 37 hours of obligatory courses and 3 hours of optional courses, while the students in the 12th grade receive 36 hours of obligatory courses and 6 hours of optional courses, making a total of 40 hours a week (for the details of the programme; TTKB, 2015ba).

Those students who successfully complete the programmes take the university entrance exam which is executed nation-wide. The national university entrance exam measures knowledge and skills

¹ *Common courses for 11th grades:* Language and expression, Turkish literature, education in religion and ethics, Turkish history of revolution and Kemalism, first and second foreign language, physical education, and counselling and guidance.

² *Common courses for 12th grades:* Language and expression, Turkish literature, education in religion and ethics, philosophy, traffic and first aid, first and second foreign language, physical education, and counselling and guidance.

that are gained through the courses in general education, and the exam does not differ based on students' cognitive level and programs they attend. According to the results of the exam, a central placement is implemented. The students decide to enrol at a university according to the results of the exam. For that reason, preparation for the examination has significant importance on the choice of programme content and teaching methods in scientific high schools.

Problem Statement

The IBDP is applied in 4.583 schools worldwide. In Turkey, the IBDP programme was applied in 1994 for the first time, and has been employed in 46 high schools since 2007 (International Baccalaureate, 2017a). Although there is a rich international literature about the effects of the IB programme on gifted students, the analysis is from various dimensions. There are a limited number of studies which analyse its difference from the general curriculum. One of those studies was conducted by Poelzer and Feldhusen (1996). The researchers compared the academic achievements of students who received the IBDP programme at a higher level for physics, biology and chemistry courses, those who received the IBDP courses at a standard level, and those who were only taught the national curriculum. In the research of Hertberg-Davis, Callahan and Kyburg (2006), the opinions of the students related to IBDP were analysed. In consequence, it was found that there was no need for a great deal of thought in the programme within the context of general education, while IBDP had appropriate difficulty levels and the students had numerous opportunities which they were unable to access in the general education classes.

The IBDP is compatible with the Turkish education system. In the national literature, fifteen studies have analysed the effects of the IBDP programme. No study has been undertaken in relation to the comparison of students who follow the IBDP in Turkey with those who follow the national curriculum, either in terms of their academic achievement or an examination of their opinions about the programme. The opinions of the students related to a programme provide important clues about the social validity of that programme. Thus, such research is important in terms of obtaining the basic data required to determine the samples to be applied to obtain a high and perfect social validity about gifted students. Starting from this need, it was decided to conduct this research. The general objective of this research is to analyse whether the general curriculum and the IBDP have an effect on GPA (mathematics, foreign language [English], literature and the averages of science [physics, chemistry, biology] and year-end average scores). It also examines the advantages and disadvantages (limitations) of the national curriculum and the IBDP, according to the opinions of the students. Within this scope, answers to the following questions will be sought:

1- What are the advantages and disadvantages of the aforementioned programmes according to the opinions of the students enrolled in the IBDP programme and those who follow the national curriculum?

2- Do the academic achievements of the students of the IBDP programme (mathematics, foreign language, literature, science and year-end average scores) differ from those of the students who follow the national curriculum?

Method

The Design of the Research

The research used the descriptive survey model. Among survey models, the descriptive cross-sectional desing was employed in this study. Survey models are research approaches which aim to describe a past or existing event as it is (Büyüköztürk, Çakmak, Akgün, Karadeniz, & Demirel, 2009). The reason for choosing the descriptive survey model in this study was to analyse the academic achievements of the students and their opinions related to the national and IBDP programmes.

Study Group

The research study group consisted of 84 students who attended Turkish Education Foundation İnanç Türkeş Private High School (TEVITOL) during the 2016–2017 academic year. The aforementioned institution is the only school in Turkey at high school level which evaluates the students' intelligence scores and all students in attendance are gifted. The school employs the curriculum of science high schools and the IBDP in parallel. To select the students, they were required to receive +2 *Sd* or higher scores from at least one of the WISC–R IV verbal intelligence test, performance and total scores, and be free from adaptive and behavioural problems. The student prefers which program to register. All the students of the aforementioned school in the 11th and 12th grades were included in the study. Of the students who were enrolled in the IBDP, 19 (43.20%) were female, and 25 (56.68%) were male. Of the students who attended the national curriculum, 20 (52.40%) were female while 20 (47.60%) were male.

Data Collecting Instrument

Data collection form

In the study, both qualitative and quantitative data was obtained through a data collection form prepared by the researcher. Related to the quantitative data, the gender, class level, academic achievement and their status or being enrolled in the IBDP were collected by self-reported. The GPA of the students and their year-end average scores for the spring 2016–2017 academic year were considered. The scores of the students who were not able to remember their scores were determined from the school management. Regarding the qualitative data, the opinions of the students related to the advantages and disadvantages of both curriculums were collected through two open-ended questions. The aforementioned questions are as follows:

1-What type of advantages does IBDP/ National program provide to you?

2-What are the negative aspects of IBDP/ National program that you do not like?

The Validity and Reliability of the Data

Throughout the process, from the collection of data in the study to its analysis, a number of precautions were taken in order to increase the validity and reliability. Before the application, the teacher, who was a graduate student of the researcher and also teaches to the research student groups, gave information related to the objectives of the study and its contribution to society. The students were encouraged to willingly participate in the study. While answering the research instrument questions, there was no limitation related to time, thus, it was aimed that the students answer as many open-ended questions as possible. The data was collected during the study time hours through face-to-face interviews.

To increase the external validity of the quantitative data, the strategy of consulting an expert was conducted. Within this scope, an expert's opinion was taken prior to the prepared of the application form. To increase the internal validity or cogency, the data was collected through written open-ended questions. Thus, there was an opportunity to analyse the data more than once without any loss of information. In order to increase the internal reliability or consistency, the consistency levels among the evaluations were analysed. During the calculations, the formula of "*Reliability = consensus/consensus + divergence X 100*" was employed. A reliability level of .70 and over indicates that the research data is reliable (LeCompte & Goetz, 1982, as cited in Yıldırım & Şimşek, 2011: 263). During the calculation, the researcher repeated the process of setting codes and establishing sub and main categories every two weeks. Afterwards, the sum of the frequency of the responses given in each category and sub-category was measured. At the end of the measurements, the general consistency of

the research was estimated as .87. Then, the codes presented by the researcher, sub-categories and the structures related to categories were presented to an expert who was experienced in qualitative studies. His opinions related to the consistency of the codes, sub-categories and categories. Considering the suggestions, two different opinions in two different sections were connected under a single expression since they contained similar meaning and the name of one of the sub-categories was changed to give the final form. The results related to the sub-categories and categories were enriched through a descriptive approach, employing the citations from the participants. To provide external reliability or confirmed availability, as will be mentioned in the next chapter, a systematic method was employed to decode and analyse the data. The internal validity of the quantitative data was analysed through use of the Cronbach Alpha internal consistency coefficient.

Decoding and Analysing the Data

The quantitative data was analysed using the SPSS package program version 16.0. Related to academic achievement, the scores of the students for the courses of mathematics, foreign language, literature, and science, as well as their GPA were separately analysed. The score of foreign language was also considered. The average score of the science course was calculated employing the arithmetic averages of the courses physics, chemistry, and biology. The arithmetical average of all the courses (year-end average scores) considered for the GPA was evaluated according to the 100-point grading system. In case the results were significant between the compared binary groups, Cohen *d* was employed as the size of effect.

Qualitative data was analysed through inductive analysis, one of content analysis. The codings related to such type of analysis are employed to create a conceptual structure especially related to the non-hypothesized issues (Yıldırım & Şimşek, 2011). According to Stauss and Corbin (as cited in Yildirim & Simsek, 2011: 227), an inductive analyze is required when there is not a theoretical baseline for examined concept. In content analysis, the answers of the participants related to the questions were analysed and those unrelated were extracted.

To codify and analyse the listed data, the three-stage procedure presented by Stauss and Corbin (1990, as cited in Yıldırım & Şimşek, 2011: 227) was employed. In the first stage of codifying, all data was reviewed and analysed line by line to select categories. In the following stage, sub-themes were established. This process contributed to the collection of data necessary to present the relationships between the categories. Afterwards, the relationships were categorized and labelled. In the final stage, which is known as selective codifying, the main categories on the horizontal axis were defined. It was aimed to establish a system throughout the study by employing sub-themes which emerged in relation to the answers for the advantages and disadvantages of the national curriculum and IBDP, and employing concepts as similar as possible. Related to the presentation of the data, the intensity (different opinions), capacity for explanation (thematic compliance), diversity and extreme examples were considered in the selection of the citations (Carley, 1992, as cited in Memduhoğlu, 2012). The opinions of the participants were codified in the forms of S1, S2, S3 ... S86 to protect the identity of the students.

FINDINGS

In the research, the answer to the question: “What are the advantages and disadvantages of the curriculum according to the opinions of the students who follow the national curriculum?” was investigated. The emerging themes and sub-themes were formed in accordance with the answers of the participants within the scope of the objectives of the research. In Table 1, the distribution of the students’ opinions to the themes and samples of the participants’ opinions is given.

Table 1. The Themes, Sub-Themes and Citations from the Sample Expressions Related to the Advantages and Disadvantages of the National Curriculum

| | Themes | Sub-themes | Sample expressions of sub-themes | Examples of the participants' opinions |
|--------------|----------------------|---|--|---|
| Advantages | Personal development | Building discipline | Habit of studying regularly, time-planning, self-directed learning, efficiency of solving tests... | <i>The sole contribution of the curriculum to me is the study discipline. Because, being prepared for two years later requires a very big plan, motivation and discipline. Those aspects of the curriculum improved my ability (S57).</i> |
| | | Development of skills and general culture | Selecting various courses, development in the general culture, multi-directional development, gaining information on various fields, exploring the fields of interest... | <i>...obviously, I think that the information I learn is useful for me. For example, mathematics and geometry improve our skill to see events from different perspectives. Or, we explore ourselves in biology through learning the human body and systems. In the literature course, we analyse our own language and our skills improve (S60).</i> <i>Since I am a student of equal ability and there are more of the verbal courses, such as history and philosophy, than the courses in science, I think the curriculum contributes to the general culture greatly (S47).</i> |
| | Thinking skills | General thinking skills | Thinking faster, development in solving questions, development in the skill of memorizing, analytical thinking... | <i>My skills of thinking faster and solving tests faster improved. I can find the correct option in five seconds (S79).</i> |
| | Programme | Vision | The targets are apparent, the limits of the issue are distinct, the criteria of success are simple and distinct, the probability of receiving a scholarship increases, preparing for the university entrance exam... | <i>Knowing what is expected from me (the OSS score) and the criteria for my acceptance to university, and seeing the rough lines of the road in front of me gives me comfort (S61).</i> <i>Frankly, its biggest contribution is the lack of risks about finding scholarships or being rejected (S78).</i> |
| | | Management | It is free of charge, comfortable and free of stress... | <i>...If you ask me the reason why I don't take the IB, I have no money. IB means abroad and that means money.... We are comfortable, we aren't stressed. We have less responsibility than compared to IBs (S47).</i> |
| | Personal development | Development of skills | Exploring the fields of ability, development of the fields of ability, passiveness of the student, limitations for the freedom of selecting courses, lack of encouragement for intellectual development, obligation for working out of the fields of interest... | <i>I don't think it provides me with the necessary information about life. Instead of guiding people according to their skills, it draws the outlines of their dreams by testing them through an examination which consists of only required issues and courses... Instead of studying in line with my skills and desires, I memorize the types of questions and try to avoid being deceived (S53).</i> |
| Disadvantage | Programme | Structural | It is an examination-oriented system, a memorization-based system, a competition-based system, too much | <i>It is a completely routine programme. It is a system which allows nothing but studying lessons and solving tests; it ranks people according to the period of time they study and places them in a so-called rank</i> |

| | | | |
|-----------------|------------|---|--|
| | | daily class load, an intensive and compressed curriculum... (S51). | |
| | Functional | No applications are employed, being detached from real life, unable to prepare for real life... | <i>The daily course hours should be decreased. The students should be more active during the lesson. Through this system, we learn a lot but we instantly forget ... I won't study unless my family forces me ... The system is so bad. There is theory but there is no practice... (S64).</i> |
| Thinking skills | Limitation | Quitting questioning, unable to develop thinking skills, dulling the creativity... | <i>...I stopped questioning things and turned to a mechanism only focused on doing something. I think less and I memorize more (S51).</i> |

When the responses of the students were considered, three themes related to the advantages of the national curriculum emerged (see Table 1 for the details). The first theme is their personal development. Personal development has the sub-themes of providing discipline, and the development of talent and general culture. Related to providing discipline, the planned activities conducted within the scope of being prepared for the university entrance exam were emphasized. Another sub-discipline employed emphasized that the courses within the scope of the national curriculum supported the talents and development of general culture. One of the students commented:

"...Obviously, I think the information I get is useful for me. For example, mathematics and geometry improve our ability to see events from various perspectives. Or, we explore ourselves through learning about the human body and systems. In the literature course, we analyse our language and our skills develop (S60, April 14, 2017)."

Another theme was the skill of thinking, which included the sub-theme of general thinking skills. Implying the performance at solving tests, the students stated in this sub-theme that their performance of rapid thinking, and making decisions increased. The third theme was the programme which included sub-themes such as vision and management. Both sub-themes placed emphasis on the university entrance exam. It was stated that the national curriculum helped to make plans for university exams, uncertainties were abolished and the targets were concretized. When compared to the IBDP, the programme had lower costs, was comfortable and there were low levels of stress.

The disadvantages of the national curriculum emerged under three themes. First was the personal development with a sub-theme of self-improvement. The students assumed the national curriculum to be a programme within the axis of university entrance exams. S53 expressed his opinion related to the issue as follows:

"I don't think it equips me with the necessary information. Instead of directing people in accordance with their talents, it draws the outlines of the dreams of them by forcing all of them to take the examinations which employs only the necessary courses and issues ... Instead of studying in accordance with my talents and desires, I prefer memorizing the question types and avoid being deceived (S53, April 14, 2017)."

The second theme was the programme, with two sub-themes: structural and functional. Both themes were seen to be within the context of the structure of the national curriculum and the university entrance exam. Related to the third theme, thinking skills, the students determined that the national curriculum blunts thinking skills. S51 expressed his opinion by saying *"...I stopped questioning the things and turned into a mechanism focused on exercising. I think far less and I memorize more. April*

14, 2017.” In Table 3, the frequencies and percentages of the opinions related to the advantages and disadvantages of the national curriculum are given.

Table 2. The Frequencies and Percentages of the Themes Related to National Curriculum

| | Themes | Sub-themes | f | % |
|---------------|----------------------|--|------|--------|
| Advantages | Personal development | Providing discipline | 14 | 36.84* |
| | | The development of talents and general culture | 7 | 16.67 |
| | Total | | 21 | 55.26 |
| | Thinking skills | General thinking skills | 4 | 10.53 |
| | Total | | 4 | 10.53 |
| | Programme | Vision | 11 | 28.95 |
| | | Management | 2 | 5.26 |
| | Total | | 13 | 34.21 |
| | General Total | | 38 | 100.00 |
| Disadvantages | Personal development | Development of talents | 14 | 22.22 |
| | Total | | 14 | 22.22 |
| | Programme | Structural | 41 | 65.10 |
| | | Functional | 4 | 6.35 |
| | Total | | 45 | 71.43 |
| | Thinking skills | Limitation | 4 | 6.35 |
| | Total | | 4 | 6.35 |
| | General Total | | 63** | 100.00 |

*Percentages were estimated through the sum of responses.

**General total may be more than 42 since the students gave more than one answer.

Related to the advantages of the programme, 38 opinions were presented while 63 different opinions were obtained related to the disadvantages (see Table 2 for the details. Of all the students, 14 (33.33%) stated that the national curriculum had no advantages at all, while 9 (21.43%) stated that there was no disadvantage at all. As for the advantages, the theme of personal development was mentioned most frequently, while thinking skills were mentioned the least frequently. On the other hand, the theme of programme was mentioned most frequently as a disadvantage, while thinking skills were mentioned the least frequently. In the study, the answer to the question: “What are the advantages and disadvantages of the curriculum in accordance with the opinions of the students who follow the IBDP curriculum” was investigated.

Table 3. The Citations from the Themes, Sub-Themes and Sample Expressions Related to the Advantages and Disadvantages of IBDP

| | Themes | Sub-themes | Sample expressions related to sub-themes | Examples of participants' opinions |
|------------|----------------------|--|---|--|
| Advantages | Personal development | Providing discipline | Developing study habits, self-directed learning, sense of responsibility, problem solving, coping with pressure, group work, and stress management... | <i>Problem solving, time management, crisis management, my competencies developed (S43).</i> <i>I learned crisis management, the ability to do much work in a short time, coping with sleeplessness and fatigue, and standing on my own feet (S42).</i> |
| | | Development of talents and general culture | Concentrating on the fields of interest, freedom to choose, development in general culture... | <i>[IB programme] The freedom to choose the courses provided me with the chance to focus on the courses I am interested in (S14).</i> <i>I think being able to choose the courses I want contributed to me in terms of doing what I want (S13).</i> |
| | Thinking skills | Critical thinking | Development in the ability of critical thinking, | <i>It provided me with different points of view from various perspectives from literary</i> |

| | | | | |
|---------------|-----------|---------------------------------|--|---|
| Disadvantages | | | assessing the events from various perspectives.... | <i>analysis to mathematical thinking. Especially thanks to the literature and economics courses, I think I can see the events from different perspectives and interpret them accordingly (S25).</i> |
| | | General thinking skills | Analytical thinking, interrogative thinking... | <i>....my skills to express things I have learned and questioning improved. Being away from multiple choice exams which I had encountered earlier forced me to use the information by applying it (S28).</i> |
| | Programme | Structural | Detailed curriculum, profound curriculum, multi-directional curriculum, different perspectives... | <i>Thanks to its detailed curriculum structure, it provided a positive effect in giving an international perspective... It is an education system based on interpretation not on memorization (S34). I think that its major contribution is the content of the curriculum of the programme. Opposite to the other curriculum, it has a philosophical depth which is rather useful. It reaches the notion that "The way to the result is as important as the result itself" (S73).</i> |
| | | Functional | Society-based activities, connections with real life, interactive education, education abroad, a better future... | <i>It is nice that it not only supports studying [lessons] but also the activities out of school... opposed to the other [national curriculum], I am being taught information that will serve me after school (S73). I think it contributes to me since I want to study abroad. It will help me to study abroad... (S33)</i> |
| | Academic | Abilities of scientific process | Designing experiments, researching, article, writing essays and reports, reviewing books, preparing projects, employing scientific resources | <i>I think it provides me with a huge contribution especially on experiments and research. I improved my ability in designing experiments and writing reports and doing research. Instead of solving tests, I can write, make an analysis and read books [related to the topic] ... (S27).</i> |
| | Program | Application | Intensive work load, a tiring, costly and, risky selection | <i>The work load is too much and you cannot feel sure about what you will encounter. From now on, I can follow the stage very seriously (S38). When I reconsider it now, I find it a risky business. The OSS exam is more boring but more guaranteed. I caused problems financially for my family (S36).</i> |
| | | Content | International assessment | <i>Obviously, I find many aspects of the programme rather unnecessary: International assessments. Although the assessment of some courses is useful, Mathematical exploration [review] is actually something like death. Actually, the abundance of the assessments causes serious damage to the psychology of the students. I, personally, drew closer to depression while I was trying to write my extended essay (S37).</i> |

The opinions of the students related to the advantages of the IBDP were classified under the titles of four themes (see Table 3 for the details). The first theme was personal development with sub-themes such as providing a discipline and talents, as well as general culture. Related to providing a

discipline, the students emphasized that their problem-solving, time management, crisis management and self-discipline improved. Within the context of development of talents and general culture, the students were given the opportunity of choosing courses which allowed them to focus on their talents.

The second theme was thinking skills, which consisted of sub-themes such as critical thinking and general thinking skills. The students emphasized that their ability to see events from different perspectives improved their skills of critical thinking. One of the students gave the following comment: *"It provided more, different perspectives from numerous dimensions from literary review to mathematical thinking. Especially, the courses of literature and economics allowed me see and interpret the events differently (S25, April 12, 2017)"*. Another sub-theme, general thinking skills, was said to improve the efficiencies of the students related to questioning and analysing the events. S28 stated following:

".... My ability of expressing the things learned became better and seeing the events from a broader perspective and questioning them was improved. Being away from the multiple choice exam system which I had encountered previously encouraged me to employ my knowledge through applying it (S28, April 12, 2017)."

The third theme was the programme, consisting of sub-themes such as structural and functional. In the sub-theme of structural, the philosophical depth of the programme was highlighted, and it was also stated that it was a programme structure based on interpretation, not memorization. S73 expressed his opinion as follows: *"It is good that it not only supports studying [lesson] but also the activities out of school ... on the contrary to the other [national curriculum], it teaches information that will be useful after I graduate (S73, April 14, 2017)."* Within the context of the functional sub-theme, it facilitates studying abroad, is a society-based programme and employs functional information.

The fourth theme was academic which contained the sub-theme of scientific process. In this sub-theme, the students noted that their skills of designing an experiment, undertaking research and writing reports were improved. S27 expressed his opinion as follows:

"I think it provides me with a huge contribution, especially on experiments and research. I improved my ability in designing experiments and writing reports and undertaking research. Instead of solving tests, I can write, make an analysis and read books [related to the topic] ... (S27, April 12, 2017)".

The disadvantages of the IBDP emerged under the theme called programme, which contained the sub-themes such as application and content. As for the sub-theme of application, it was emphasized that it involved an intensive work load, was tiring and costly, and was a risky choice. S38 expressed his opinion as follows, *"The work load is too much and you may not know what exactly is waiting for you. From now on, I can follow the courses. April 13, 2017."* while S36 stated as follows: *"When I consider it now, I find it a riskier business, SSS is more boring but it is more guaranteed. I risked my family financially. April 11, 2017."* Related to the sub-theme of content, international assessment was regarded as unnecessary. S37 had striking opinions:

"Obviously, I find many aspects of the programme rather unnecessary: international assessments. Although the assessment of some courses is useful, mathematical exploration [review] is actually something like death. Actually, the abundance of the assessments causes serious damage to the psychology of the students. I, personally, drew closer to depression while I was trying to write my extended essay (S37, April 11, 2017)."

Table 4. The Frequencies and Percentages of the Themes of IBDP

| | Themes | Sub-themes | <i>F</i> | % |
|---------------|-------------------------|--|----------|--------|
| Advantages | Personal development | Providing discipline | 25 | 22.73* |
| | | Development of the talents and general culture | 16 | 14.54 |
| | Total | | 41 | 37.27 |
| | Thinking skills | General thinking skills | 9 | 8.18 |
| | | Critical thinking | 11 | 10.00 |
| | Total | | 20 | 18.18 |
| | Programme | Structural | 6 | 5.45 |
| | | Functional | 24 | 8.18 |
| | Total | | 30 | 13.64 |
| | Academic | Abilities of scientific process | 19 | 17.27 |
| Disadvantages | Total | | 19 | 17.27 |
| | General total | | 110** | 100.00 |
| | Administrative problems | Application | 13 | 86.67 |
| | | Content | 2 | 13.33 |
| | Total | | 15 | 100.00 |
| | General total | | 15 | 100.00 |

*The percentages were calculated according to the total of the responses.

**Since students gave more than one answer the general total may be more than 46.

In the study, 110 different opinions were obtained related to the advantages of the IBDP. Among the students, two (4.55%) stated that the IBDP had no advantages, while 34 (77.27%) claimed that it had no disadvantages. Related to the advantages, personal development was the most frequently mentioned theme, while academic was the least popular. Related to the disadvantages of the programme, all of the students' opinions consisted of administrative issues (it contains a heavy work load, it is costly and risky and employs limited international evaluation).

Within the scope of the research, the second question in the study analysed the GPA and year-end average scores of the students who attended the IBDP and those who followed the national curriculum. Before conducting the analysis, the set of quantitative data was analysed in terms of missing values and normality assumptions. There was no deficient value and the coefficients of stickiness and skewness covered the assumptions of normal distribution (the range of skewness: $-.89 - -.23$; the range of kurtosis: $-.12 - .25$).

Table 5. Paired t-Test Table

| Courses | Curriculum | n | \bar{x} | <i>Sd</i> | <i>Df</i> | <i>t</i> | <i>p</i> |
|---------------------|------------|----|-----------|-----------|-----------|----------|----------|
| Mathematics | IBDP | 44 | 88.95 | 6.86 | 64.450 | .180 | .860 |
| | National | 42 | 88.57 | 12.05 | | | |
| Foreign language | IBDP | 44 | 93.98 | 4.75 | 63.970 | 3.972 | .00* |
| | National | 42 | 88.07 | 8.44 | | | |
| Turkish literature | IBDP | 44 | 92.36 | 5.13 | 68.050 | 1.060 | .293 |
| | National | 42 | 90.79 | 8.24 | | | |
| Science courses | IBDP | 44 | 90.77 | 7.77 | 84 | -.372 | .710 |
| | National | 42 | 91.36 | 6.72 | | | |
| Grade point average | IBDP | 44 | 93.02 | 3.69 | 84 | 2.454 | .016* |
| | National | 42 | 90.74 | 4.89 | | | |

* Significant at the level of $p < .05$

When the students who attended the IBDP were compared to those who followed the national curriculum, according to their GPA, no significant difference was observed between mathematics, literature and science courses ($p > .05$). Related to the GPA of foreign language and year-end average scores, there was a significant difference on behalf of IBDP ($t_{(63.97)} = 3.972$ and $t_{(84)} = 2.454$, $p < .05$; $d = .86$ and $.53$, respectively). It was determined that a high level of effect was observed in foreign

language, while there was a moderate level for year-end average scores. Besides, Cronbach's alpha coefficient of the year-end average scores were calculated as .80 for IBDP and to .78 national curriculum.

Discussions and Conclusions

The most frequent criticism of the IBDP in other research was the work load. In their study, Taylor and Proath (2006) stated that work load is a factor which is intensive and unmanageable and influences the psychological health of the students negatively. In another group of studies, the density of the work load was determined as the most frequent limitation (Hertberg–Davis, Callahan & Kyburg, 2006; Foust, Hertberg–Davis & Callahan, 2009; Hertberg–Davis & Callahan, 2008; Tarc & Beatty, 2012). Those results are in line with the findings of this research. The students have to make an extra payment to enrol in the IBDP and take an international exam. This leads to the observation that the programme has disadvantages. In the studies by Smith (2009), Wright and Lee (2014), Hertberg-Davis and Callahan (2008), the IBDP was criticized for being costly. Those findings coincide with the results of this essay.

Higher levels of student satisfaction are in line with the results of the studies by Teke (2015) and Paris (2003). In the post graduate study of Teke, it was observed that students attending the IBDP programme have higher satisfaction levels than their peers attending the national curriculum. Paris (2003) determined that the majority of students found the IBDP more qualitative when the opinions of the students related to the national curriculum were compared to those of the students related to IBDP. The satisfaction levels of the students related to curriculum increase so long as their needs and expectations are met (Şahin, 2009). According to those results, it can be concluded that the IBDP meets the concerns, needs and expectations better when compared to the national curriculum.

The study contains some clues which indicate that the critical thinking skills of the students who attend IBDP improved. As for the national curriculum, such a sub-theme was not observed. On the contrary, the national curriculum was criticized by some students stating it limited their critical thinking skills. In the study by Aktaş and Güven (2015), the critical thinking skills of the IBDP students who received the score of A1 in the literature course (mother language) had higher values than the students of the national curriculum. In the studies by Culross and Tarver (2007), Sagun et al. (2016) and Demir (2009), it was apparent that the critical thinking skills developed depending on the IBDP programme. Those results indirectly support the findings of this study. According to Hill (2006), the aforementioned results were obtained because a detailed and interrogative perspective related to the universal culture was presented through the Information Theories course and, thus, the development of core cognitive skills, as well as the development of critical thinking skills was supported. The theme of academic was included in the advantages of the programme determined by the students of the IBDP. The long-term research nature may be the basic reason. Namely, the scientific processes of the IBDP students such as designing experiments, undertaking research, writing reports, reviewing books, preparing projects and using scientific resources are supported more than those of the students of the national curriculum.

One of the striking results that emerges in the study indicates that the IBDP develops the students' skills in relation to self-directed learning, taking responsibility, coping with pressure, management of crisis and stress, dimensions of sense of responsibility, and time management. Poelzer and Feldhusen (1996) stated that the teachers of IB students regarded that their students displayed higher levels of attitudes from the dimensions of "*passion of duty, interrogating, independence, skills of seeing the connections between the concepts, taking over responsibility related to learning*". The results of the aforementioned research support the findings of this study. In some research, IBDP students were found to develop time management skills (Grumurty, 2016; Sagun, et al., 2016; Tarc & Beatty, 2012; Taylor & Proath, 2006), the skills of problem-solving and coping with stress (Grumurty, 2016), studying habits (Tarc & Beatty, 2012; Sagun, et al., 2016) and perception of academic self-

sufficiency (Sagun, et al., 2016; Shaunessy et al., 2006). Those findings are also supported by the results of this research.

When the findings are evaluated in general, the differentiation of students' opinions related to the advantages and disadvantages of IBDP and the national curriculum may be the result of CAS, the courses Information Theories and Extended Essay which exist in the IBDP but do not exist in the national curriculum. Namely, the interaction of the students with individuals from different cultures, economic levels and social strata is supported through CAS activities, thus their international perspectives (Hinrich, 2003) and skills of leadership, cooperation and problem-solving increase (Resnik, 2009). In the Information Theories course the students are supported in reflecting about information in different ways, considering the role of information by considering their own culture and world cultures (Wright & Lee, 2014). In the study of Extended Essay, the students are expected to implement their academic skills in practice and mentally explore them through the processes of researching and writing (Inkelas et al., 2013).

One of the general reasons for the high level of students' satisfaction with the IBDP when compared to the national curriculum is that more difficult tasks exist in the IBDP than the national curriculum (Hertberg-Davis & Callahan, 2008; Hertberg-Davis et al., 2006). Due to the cognitive differences, gifted students preferred challenging tasks more than their peers (VanTassel-Baska, 2003). The findings of this study support those results. One of the other major issues analysed in this study was whether the students who attend the national curriculum and the IBDP differ in terms of academic achievement. The results of analysis indicate that the scores of the students who attend the IBDP for the GPA of English course and year-end average scores was higher than their peers who attend the national curriculum. Within the context of the IBDP programme, the students receive 22 hours of lessons per week during the preparatory class, 8 hours in the first class and 5 hours of lessons during the second class. In the national curriculum (science high schools), the English course is 22 hours of lessons per week during the preparatory class and 5 hours during the first and second year. In both curriculums, the courses are taught in English. Although the lesson periods have similar levels for both curriculums, the students of the IBDP programme obtained higher levels of achievement since their other written activities may be conducted in English. Since no data was obtained related to the English levels of the students at the beginning, no comments were made related to the other factors.

No significant difference was noted between the scores of the students in the courses of mathematics, literature and science. In the study by Poelzer and Feldhusen (1996), the academic achievement of the students who attended the IBDP with high levels for the courses of physics, biology and chemistry was found to be higher than that of the students who attended the national curriculum. The results of the science course are contradictory to the results of the aforementioned study. According to the researcher, the contradictory factor may be explained within the scope of the students' access to the talents and educational opportunities. In this study, both groups of students compared attended the same school and they jointly received some of the courses. For example, the common courses during the 9th and 10th years were mathematics and science, while the common courses during the 11th and 12th years were language and expression and Turkish literature. The significant difference in the aforementioned lessons may be for that reason. The significant difference in the overall performance related to lessons may be a reflection of different courses taken incidentally to the curriculums. In another study, collecting data related to the attitudes and motivations of the students towards the courses and some variances, such as the methods of teaching which may influence the academic achievement, may help in access to detailed information related to this issue.

This research has some limitations. First, limitation is the number of participants. The data was collected from a limited number of participants and at a single school. The reason for this is that students who had been identified as gifted consisted of the subjects of the research. The only institution in Turkey which accepts students in accordance with the results of intelligence tests and consists of only gifted students at the level of high school is TEVITOL. In the aforementioned institution, data was collected from all of the students in the first and second grade. For that reason, it was quite difficult to enlarge the study group.

Another limitation of the study is related to the content of the qualitative data obtained in the study. In this study, data was collected through open-ended questions in order to reveal the differences depending on numerous variances in a wide range which had not previously been analysed in Turkey. Considering all the factors within this framework, it is naturally difficult to profoundly and multiply reveal the advantages and disadvantages of the IBDP and the national curriculum through the information accessed. For that reason, it can be stated that general conclusions were obtained related to the advantages and disadvantages of both programmes. Paying regard to this study as a pioneer research or preliminary results, profound information may be obtained through considering each of the emerging themes and sub-themes as research topics in different studies.

One of the other limitations of the study is related to the academic achievements of the students. Students take some common courses. This may influence the results related to the GPA of the students. In another future study, both curriculums could be compared by collecting comprehensive data related to deficiency courses and this may lead to clearer results related to the academic achievement of the students. Moreover, the findings that emerged in the study (acquisition of academic achievement, the development of critical thinking skills) are limited to the opinions of the students. The differences between the opinions of the students could be analysed through performance-based tests and more precise results may be revealed related to both curriculums.

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Pre-Service Elementary Mathematics Teachers' Specialized Content Knowledge: The Case of Integer Addition and Subtraction

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Abstract

Pre-service mathematics teachers' content knowledge is an important issue. Therefore, detailed studies are needed to be conducted on mathematical topics. The study examines preservice elementary mathematics teachers' (PEMTs) special content knowledge (SCK) of integer addition and subtraction in the context of using multiple representations, explaining mathematical reasons lying behind the concepts and justifying them. The findings obtained from the written responses of 42 PEMTs reveal that preservice teachers do not have sufficient and balanced special content knowledge. This is especially more so in the case of addition and subtraction of numbers with opposite signs. The preservice teachers were observed to have more difficulty in using the number line model compared to the use of other representations. The findings offer some indicators about how PEMTs understand integer addition and subtraction through multiple representations and why more emphasis on the SCK components

Keywords: Specialized content knowledge, Integer addition and subtraction, Pre-service elementary mathematics teachers.

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Introduction

Although there are various studies on the qualifications of mathematics teachers and the quality of mathematics teaching (Silverman & Thompson, 2008; Fennema & Franke, 1992; Hill, Rowan & Ball, 2005; Ma, 1999), there has been a growing interest in studying mathematics teachers' special content knowledge. Greenberg & Walsh (2008) report that such interest in the improvement of teachers' mathematical knowledge is observed both in the educational policies and the studies conducted. There are alternative beliefs regarding the structure and characteristics of content knowledge in-service and pre-service mathematics teachers have. We can show the studies conducted by Shulman (1986) and Ball (2000) as the leading studies in this regard. Emphasizing that mathematics teaching knowledge requires more than content knowledge, Shulman (1986) developed a model of teacher knowledge which has been a pioneering model in mathematics education just like in other fields. Ball, Thames and Phelps (2008) took Shulman's model as a basis and developed the Mathematical Knowledge for Teaching (MKT) model, the scope of which covers mathematics education. In this model, SCK is the most important component for teachers to increase success in their classes.

Specialized Content Knowledge

The model called MKT developed by Ball et al. (2008) regarding the knowledge that teachers must have consists of two dimensions: content knowledge and pedagogical content knowledge. SCK is one of the three categories of content knowledge. SCK is defined as the mathematical knowledge specific to teachers. Delaney, Ball, Hill, Schilling and Zopf (2008) defines specialized content knowledge as the mathematical knowledge and skills used by teachers. Studies on mathematical success of students have been focusing more and more on the content knowledge of mathematics teachers. In this sense, pre-service and in-service processes of mathematics teachers have been addressed in a more detailed way. Pointing out the importance of this issue, Morris, Heibert and Spitzer (2009) indicate that SCK serves as a good candidate for topics to be covered in preservice teacher education.

Mathematical knowledge of teachers and pre-service teachers in a way characterizes their ability to understand and use the subject knowledge during mathematics teaching. Hill, Rowan, and Ball (2005) reports that these tasks covers having knowledge of mathematical teaching programs, explaining clearly the mathematical concepts and concepts to students and assessing the thoughts of students as well as choosing and using the best representations and examples in teaching mathematical concepts. Given the expression "Knowledge for teaching" which can be considered as the basic paradigm of MKT, SCK is also a need for the efficiency of the in-class teaching activities. In this sense, teachers or pre-service teachers should be able to accurately represent mathematical ideas, provide mathematical explanations for common rules and procedures, and examine and understand unusual solution methods to problems (Hill, Ball & Schilling, 2008). Petrou and Goulding (2011) define SCK, which is the focus of the conceptualization of mathematical knowledge, as the type of knowledge that teachers or pre-service teachers need for effective mathematics teaching and use in the classroom environment.

It is hard to say that the scope and limitations of SCK, which is defined as the mathematical knowledge used or to be used by teachers in the classroom, are clear. In her study on pre-service teachers' specialized content knowledge of the associative property of multiplication, Ding (2016) addressed representation and explanation as two components of this type of knowledge. Ball et al. (2008) also examined the examples of explaining and justifying mathematical ideas like "explanation of the reason for using the invert and multiply method in division of fractions" within the scope of specialized content knowledge. Lin, Chin and Chiu (2011) suggest that SCK consists of three components, i.e. representation, justification and explanation, and define these components as follows:

Representations: Choosing and using mathematical representations accurately and effectively

Justification: Descriptions and justifications of mathematical ideas

Explanation: Providing mathematical expressions of common rules and procedures

The term representation refers both to process and product. Representations are used to emphasize mathematical ideas and support learning and they can be divided into two categories as internal and external representations. Internal representations refer to internal organization of knowledge, while external representations refer to the external tools used in modelling mental processes such as real world contexts, manipulative models, diagrams and verbal or symbolic expressions. Since each of these representation types has certain limitations, the gaps can be minimized only by using multiple representations during the teaching process. Representations are also the most important elements of the specialized content knowledge which is one of the three components of subject matter knowledge together with common content and horizon content knowledge. Edward (1998) stated that external representations, especially in terms of communication skills, are conventionally used more than internal representations. This study only focuses on external representations. The representations used in this study were limited to the following most commonly used three representations: number line, counters and real world context. Number line and neutralization models are used extensively in understanding of addition and subtraction in integers. Two-color counters are used in general for the neutralization model. Real world context are also a useful representation of in order to make sense of the operations. These representations will help revealing pre-service teachers' specialized content knowledge of integer addition and subtraction in a more detailed way. The pre-service teachers' representations and explanations about these operations constitute the basis for how they make sense of these concepts.

Tasks such as explanation and justification are effective in ensuring meaningful and high-level learning. Such tasks are given importance in studies due to their contribution to encouraging individuals to justify their thoughts and hypotheses and to deep understanding and thinking (Schwarz, Herschkowitz & Prusak, 2010; Yackel & Hanna, 2003). Lewis (1998) indicates that personal explanations of students about their mathematical thoughts contribute to the improvement of their learning. Explanations and justifications of pre-service teachers offer strong clues to their ability to ensure high-level learning of students in the future courses they will deliver. At this point, pre-service teachers' explanations and justifications for integer addition and subtraction operations may refer to the structural relations rather than general superficial characteristics and to the relationships between quantities rather than just numbers. Venkat (2015) points out that focusing on representations and explanations might simultaneously support teachers' mathematical learning and their learning about the mathematics they will teach.

In fact, representations should not be considered separately from justifications and explanations. These three components are intensively used during the process of teaching and/or learning mathematics subjects. Pre-service teachers' specialized content knowledge not only includes using multiple representations, but also explanations and justifications. In a sense, the intersection of the characteristics of common content knowledge (CCK) and horizon content knowledge (HCK), which are the other two dimensions of specialized content knowledge and content knowledge, is not an empty set. In the CCK dimension, it is possible to solve a question without providing any justification or using any representatives. The SCK dimension, which indicates deeper and more comprehensive knowledge of any mathematics subject, involves understanding the important of concepts and expressing the meanings lying behind the operations. In this study, which examines pre-service mathematics teachers' specialized content knowledge of integer addition and subtraction, the theoretical framework proposed by Lin et al. (2011) which covers these three components was taken as basis.

Integer Addition and Subtraction

Integers constitute one of the basic math topics in secondary education. Bolyard (2005) states that understanding integers is important for laying the foundation of various other topics to be covered

in the future like algebra. However, basic concepts and operations involving integers are among the math concepts that are most difficult to understand in secondary education. Although integers is a math topic, they are frequently used to represent many real world situations, such as temperature, profits and losses of money and location. Studies reveal that students do not understand addition and subtraction at a conceptual level especially due to the intensive use of operational approaches. One of the reasons for having difficulty is that students proceed to addition and subtraction operations without learning integers and their characteristics at the conceptual levels. Qualifications of mathematics teachers and their content knowledge are important in helping students overcome the difficulties they have. Mathematical knowledge of pre-service or in-service teachers is addressed in general terms as understanding mathematical concepts and establishing relationship between concepts and procedures.

Studies reveal that students do not understand integer addition and subtraction at a conceptual level (Ferguson, 1993; Wilkins, 1996; Shore, 2005; Bofferding, 2014). Operational approaches are more frequently used in teaching this topic. Results from the Second Mathematics Assessment of the National Assessment of Educational Progress (Carpenter, Corbitt, Kepner, Lindquist & Reys, 1981) show that 75% of 13-year olds correctly added two negative integers but only about 43% correctly added a negative integer and a positive integer.

SCK for Integer Addition and Subtraction

Although it is generally accepted that pre-service or in-service mathematics teachers' specialized content knowledge is important, there is still a need for detailing on the basis of topics. In this sense, this study focuses on pre-service mathematics teachers' specialized content knowledge of integer addition and subtraction. In their study, Mitchell, Charalambous and Hill (2013) examined the behaviors of teachers in classroom environment and stated that the use of representatives is a must in teaching integers. They also developed a typology of the tasks performed by teachers involving the use of representations in teaching integers. It is necessary to use representation in deal with integers operations, since features of the operations are not easy for students. Stephan and Akyuz (2012) pointed out that integer operations offer some challenges for representation use, because unlike natural numbers, students cannot construct the meaning of integer operations by mere abstraction from real objects. Number lines reveal the ordinal meaning and counters reveal the cardinal meaning of numbers; therefore, Davidson (1987) points out the necessity of understanding both ordinal and cardinal meanings of integers during the conceptualization of these numbers. In this sense, both teachers and pre-service teachers should have a deep conceptual understanding regarding why and how addition and subtraction of integers is performed.

Method

Participants

The study was carried out using the case study model of descriptive research methods. The study sample included 42 fourth-grade PSTs studying in teaching program at a state university located northeast of Turkey. 27 participants were female and 15 participants were male. The participants aged 20 to 24 years. All participants had previously taken courses related to teaching concepts in secondary education mathematics and had basic knowledge and approaches related to teaching integers. Especially the course "special teaching methods" the pre-service teachers took in the third grade in both terms is extremely important for the development of their specialized content knowledge. This course aims to help pre-service mathematics teachers gain a deeper and conceptual understanding of integers and operations as well as of many other concepts in secondary mathematics. In this study, we tried to reveal the specialized content knowledge of integer addition and subtraction that pre-service teachers who took this course previously have by means of their explanation, justification and representation abilities. In this context, the data were collected by open-ended questions and semi-structured interviews.

Instrument

Considered as a type of knowledge specific to teaching, specialized content knowledge is addressed as the mathematical knowledge teachers use/will use in the classroom environment. In this study which examines this type of knowledge whose scope and limitations are not clear, the categorization of specialized content knowledge proposed by Lin et al. (2011) (Explanation, Justification and Representation) was used. An analytical data collection tool was developed to identify pre-service teachers' specialized content knowledge of integer addition and subtraction by taking the relevant literature into account. The data collection tool which included all three dimensions mentioned above consisted of a total of 16 items. Written responses of the pre-service mathematics teachers were received in two separate sessions. Following the first session held for the representation dimension, another session was held after a while for the explanation and justification dimensions. Both sessions took about 60 min. Table 1 shows some examples taken from this data collection tool.

Table 1. Examples from data collection tool

| | Explanation-Justification | Representations | | |
|------------------|--|--|---|---|
| | | Real world context | Number line | The counters |
| Integer addition | Tuna found the sum $(+5) + (-3) = -2$. Do you think his answer is correct? (If you think the answer is not correct) How do you explain it to Tuna? | Write a real world situation that can be represented by the expression $(-5) + (-3) = ?$ | Use a number line model to show $(-5) + (-3) = ?$ | Use counters to model $(-5) + (-3) = ?$ |
| | Ceyda answered the subtraction operation $(-5) - (+3) = -2$. Do you think her answer is correct? (If you think the answer is not correct) How do you explain it to Ceyda? | Write a real world situation that can be represented by the expression $(-5) - (+3) = ?$ | Use a number line model to show $(-5) - (+3) = ?$ | Use counters to model $(-5) - (+3) = ?$ |

It is possible to construct four different types of questions using numbers with the same signs and numbers with the different signs. However, the data collection tool used in this study included 2 types of questions for addition and subtraction operations in order to limit the number of questions asked in line with the above-mentioned purpose. The pre-service teachers were asked two types of questions: numbers with the same signs (i.e. $(-5) - (-3) = ?$) and numbers with the different signs (i.e. $(+5) + (-3) = ?$). While developing the data collection tool, the three dimensions mentioned above were taken into account and the representations, i.e. counters, number line and real world situations, were used. Besides, the pre-service teachers were asked to provide justification and explanation by taking account of the answers of the wrongly answered questions. Finally, interviews were held with three pre-service mathematics teachers (coded as $PEMT_1$, $PEMT_2$, $PEMT_3$) who performed differently in terms of the representation ability in order to examine their specialized content knowledge of integer addition and subtraction in more detail.

Data collection and data analysis

The analysis of the data collected was performed at three stages: (i) identifying whether the answers of PEMTs were correct/wrong; (ii) identifying and coding the representations, justifications and explanations used by the pre-service teachers; (iii) qualitative and quantitative interpretation of the data (Creswell, 1994). First, a framework including the representation, justification and explanation dimensions was formed for the data analysis in line with the theoretical framework of the study. For the analysis of the data in the representation dimension, we tried to identify correct/incorrect uses in all

three representation types. In the justification dimension, first the answers of pre-service teachers to the relevant questions were analyzed. Incorrect justifications were analyzed in the “incorrect” category, while correct justifications were analyzed under two subcategories, i.e. incomplete and complete. For example, any “yes” answer to the question “*Tuna found the sum $(+5)+(-3) = -2$. Do you think his answer is correct?*” was analyzed as incorrect. The statements like “*I would want him to move 5 steps forward and then 3 steps back on the number line. And I would make him to express that point as the result of the operation.*” were considered as incomplete, while statements like “*I would explain this on a number line model. First I would tell Tuna to face towards the positive direction while standing at point zero. And then I would tell him to move 5 steps forward and then 3 step back without changing his direction. I would tell him that the point he is at is the result of the operation*” were analyzed in the complete category. Besides, the statements in which only incomplete or complete justifications were considered were analyzed under three categories, i.e. only operational, partial/incomplete and complete statements. However, the data obtained for the reliability of the study was coded twice by the researcher at different times and the coding reliability percentage was found as 86%. For the remaining 14% difference, the researcher and a field expert discussed and reached consensus. The data obtained were organized and defined based on the framework formed accordingly. The data were described in detail by using direct quotations, where necessary. At the final stage, the findings were explained and correlated.

Results

Pre-service elementary mathematics teachers’ ability to explain integer addition and subtraction using representations

Table 2 shows the data on PEMTs’ ability to explain integer addition and subtraction using representations.

Table 2. Frequency table of representations component

| Types of representations | | Number line | | The counters | | Real world context | |
|---------------------------|-------------|-------------|------------|--------------|------------|--------------------|-----------|
| | | Correct | Incorrect | Correct | Incorrect | Correct | Incorrect |
| The addition operation | $(+5)+(-3)$ | 18 (%42.9) | 24 (%57.1) | 26 (%61.9) | 16(%38.1) | 20 (%47.6) | 22(%52.4) |
| | $(-5)+(-3)$ | 20 (%47.6) | 22 (%52.4) | 32(%76.2) | 10 (%23.8) | 30(%71.4) | 12(%28.6) |
| The subtraction operation | $(+5)-(-3)$ | 20 (%47.6) | 22 (%52.4) | 26(%61.9) | 16(%38.1) | 14 (%33.3) | 28(%66.7) |
| | $(-5)-(-3)$ | 16(%38.1) | 26(%61.9) | 30(%71.4) | 12(%28.6) | 28(%66.7) | 14(%33.3) |

A general comparison of the use of three representations shows that the pre-service teachers use counters more accurately in all four operations (Table 1). 32 pre-service teachers (76.2%) used counters correctly while explaining $(-5)+(-3)$, while 30 pre-service teachers (71.4%) used counters correctly while explaining $(-5)-(-3)$. Another remarkable finding is that the rate of correct modelling is lower (61.9%) in explaining the operations with numbers with the different signs ($(+5)+(-3)$ and $(+5)-(-3)$). In other words, the pre-service teachers used counters more successfully while explaining addition and subtraction of numbers with the same signs compared to addition and subtraction of numbers with the different signs.

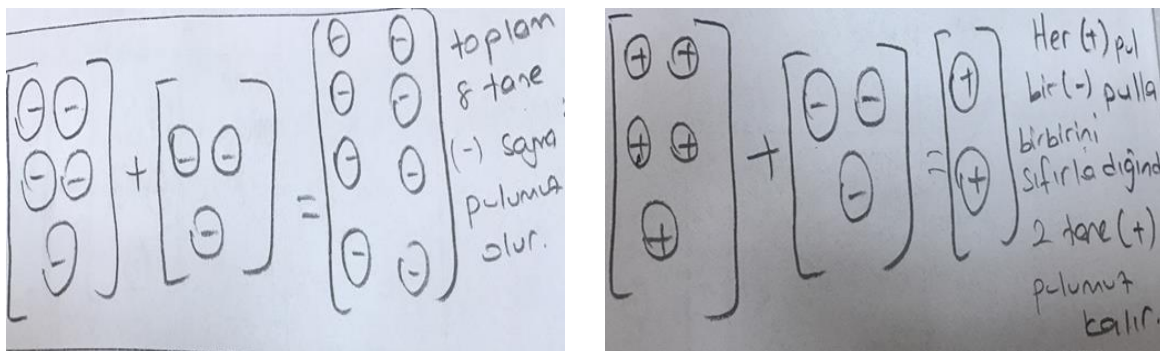


Figure 1. Modeling with the counters of pre-service teachers'

The pre-service teachers had difficulty especially in using counters to explain the process of forming zero-pair while adding and subtracting integers. For example, Figure 1 shows the interview held with a pre-service teacher who correctly modelled $(-5)+(-3)$ by using counters. The statements of the pre-service teacher about the modelling of $(+5) + (-3)$ confirm this finding.

Researcher: Could you explain how did you solve $(-5)+(-3)$?

PEMT₁: I used counters to solve $(-5)+(-3)$.

Researcher: How did you get the answer?

PEMT₁: Since the numbers have the same sign, I combined the counters of the same color. The total number of counters gives us the answer.

Researcher: What do you think of this model?

PEMT₁: To be honest, I am a little confused about the model.

Researcher: What do you mean?

PEMT₁: I am not confused about $(-5)+(-3)$ because the counters are of the same color. However, for $(+5)+(-3)$, the process of getting number pairs from counters of different colors is a little complex.

Number line, which is an important model for reflecting the structural characteristics of integer operations, was found to be the representation type that pre-service teachers had the most difficulty in using. Widjaja, Stacey and Steinle (2011) state that number line is both a didactical model and an important means of representation due to its wide use in various math topics. This representation, which is most likely to be focused on in the studies on teaching integer operations, was correctly used by a maximum of 20 pre-service teachers (47.6%) (Table 1). More than half of the pre-service teachers used this representation wrong/inadequately while explaining all four operations. For example, only 38.1% of the pre-service teachers were able to model $(-5)-(-3)$ correctly. Figure 2a shows how one of the pre-service teachers who had difficulty in using a number line modelled $(+5)-(-3)$. Figure 2b shows how another pre-service teacher modelled $(-5)-(-3)$ using a number line.

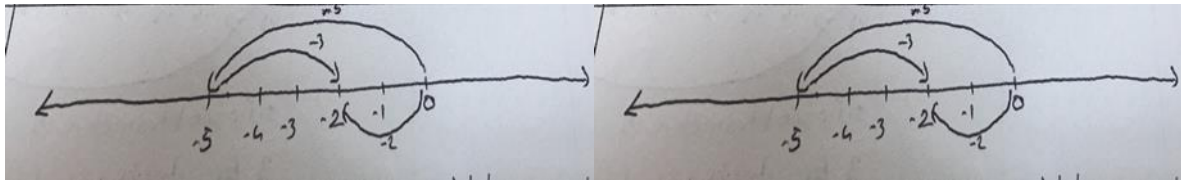


Figure 2 a-b: Pre-service teachers' modeling the operations $(+5)-(-3)$ and $(-5)-(-3)$ using a number line

Figure 2a shows that the pre-service teacher was not able to emphasize the meaning of subtraction when modelling $(+5)-(-3)$ based on the equation $(+5)+(+3)$. Figure 2b shows that the pre-service teacher used arrows pointing towards different directions to express (-5) and (-3) . We see that the pre-service teachers mistook the signs of integers for the symbols of addition and subtraction. This forms the basis of the most significant challenges the pre-service teachers had in modelling with number lines. The following interview section shows the confusion that one of the pre-service teachers had during this process.

Researcher: Could you please explain how you modelled $(+5)-(-3)$ using a number line?

PEMT₁ : Since the first number is $(+5)$, I moved 5 steps forward. Then I turned around and faced towards the negative direction since this is a subtraction operation. As the second number is (-3) , I turned towards the direction opposite to the point I was at.

Researcher: What if the operation was addition, not subtraction?

PEMT₁: Then we should not change our direction.

Researcher: How did you find the answer?

PEMT₁: As a result, I was facing the positive direction. I arrived at 8 units. I mean, the result is $+8$.

Another point that is remarkable is that PEMTs usually used the metaphor of “walking” on the number line. The following interview section shows that one of the pre-service teachers who found the correct answer had difficulty in explaining how to distinguish between the symbol of subtraction and the minus sign of a negative integer on the number line.

Researcher: Are there two minus signs here, right?

PEMT₁: Yes

Researcher: The symbol of subtraction and the minus sign of a negative integer

PEMT₁: Yes

Researcher: Do you think there are any difference between these two?

PEMT₁: Actually, they are both minus signs. But one of is the subtraction operation's symbol and the other one is the sign of the integer

Researcher: Good... Well, were you able to show this difference on the number line?

PEMT₁: Since this is a subtraction operation, I faced towards the negative direction. While expressing (-3) , I only turned towards the direction opposite to the point I was at.

Finally, Table 2 reveals that the pre-service teachers do not have sufficient content knowledge of how to construct real world situations. They mostly preferred using assets-debt and check-bill contexts. Mukhopadhyay, Resnick & Schauble (1990) indicated that students most easily use assets and debts as a foundation for negative numbers. The following interview sections shows why PEMT₂ preferred using these contexts.

Researcher: Why do you think it is important to relate integer operations with everyday life?

PEMT₂: It is important to relate these operations with everyday life. Relating them with real life contexts such as debit-credit helps students develop reasoning about these operations. It helps them concretize.

Researcher: Which contexts do you think will be most effective?

PEMT₂: Debit and credit bills

Researcher: Why do you think so?

PEMT₂: Because they are the easiest and most practical contexts.

We observed that the pre-service teachers were more successful in using number line to explain addition and subtraction of numbers with the same signs, just like they were in using counters. The rate of constructing real world contexts for both addition and subtraction with number with opposite signs is reduced by almost half compared to adding and subtracting numbers with the same signs. For example, only 14 pre-service teachers (33.3%) constructed a real world context correctly for $(+5)-(-3)$. One of the pre-service teachers who correctly constructed a real life context for $(5)+(-3)$ by stating “A submarine dived up 5 m below the sea level. To explore more, it dived up 3m more. What is current the position of the submarine?” did not prefer this context for $(+5)+(-3)$, but constructed a real life context by stating “I have 5 TL. I received a 3 TL electric bill. How much will I have when I pay the bill?”. The following interview held with this pre-service teacher confirms this finding.

Researcher: You preferred two different contexts for two different addition operations. Is there any particular reason why you did so?

PEMT₂: I actually thought to use the same contexts for both operations.

Researcher: Why didn't you use then?

PEMT₂: I was not able to express $(+5)+(-3)$ with the sea level context.

Researcher: What is the difference between the real life contexts of $(-5)+(-3)$ of $(+5)+(-3)$?

PEMT₂: We can do the same operation again when the signs are the same. But things get a little complex when the signs are different.

It is possible to establish strong connections with real life contexts and integer addition and subtraction operations. In other words, the real life contexts constructed by the pre-service teachers might offer strong clues about the meanings of these operations. Fuson (1992) divides the meanings of integer addition and subtraction operations into three: combine, change or compare. Representation of a safe in which there are documents showing assets and debts with integers is related to the combine meaning. The difference between profit and loss of a person or a company is related to the change meaning, while comparison of two situations using integers is related to the compare meaning. At this point, we observed that the pre-service teachers highlighted the combine and change meanings in the real world contexts they constructed and put almost no focus on the compare meaning. The context constructed by one of the pre-service teachers for $(+5) + (-3)$ by stating “If 5 TL credit and 3 TL debit bill is put in a safe, what is there in the safe?” can be given as an example to the combine meaning.

The context constructed by one of the pre-service teachers for $(-5) - (-3)$ by stating “*My current debt is 5 TL. If I pay 3 TL, how much do I owe?*” is related to the change meaning.

Pre-service elementary mathematics teachers’ justifications and explanations for integer addition and subtraction

This section presents the findings obtained from the justifications and explanations of PEMTs for integer addition and subtraction. Table 3 shows the findings from the justifications of pre-service teachers for integer addition and subtraction. 2 pre-service teachers (4.8%) answered “yes” to the question “*Tuna found the sum $(+5)+(-3) = -2$. Do you think his answer is correct?*”. 95.2% of the pre-service teachers answered two addition questions correctly. The rate of answering correctly decreases down to 85.7% for $(+5) - (-3)$ and 81% for $(-5) - (-3)$.

Table 3. Frequency table of justification component

| | | Incorrect | | Incomplete | | Complete | |
|---------------------------|---------------|-----------|------|------------|------|----------|------|
| | | f | % | f | % | f | % |
| The addition operation | $(+5) + (-3)$ | 2 | 4.8 | 31 | 73.8 | 9 | 21.4 |
| | $(-5) + (-3)$ | 2 | 4.8 | 27 | 64.3 | 13 | 30.9 |
| The subtraction operation | $(+5) - (-3)$ | 6 | 14.3 | 28 | 66.7 | 8 | 19 |
| | $(-5) - (-3)$ | 8 | 19 | 24 | 57.2 | 10 | 23.8 |

Table 3 shows that the pre-service teachers are more successful in providing justification for addition operations compared to subtraction. It is possible to say that the above-mentioned difficulties the pre-service teachers had in using number line, counters or real-life contexts form the basis for their justifications. For example, the pre-service teacher who used the statement “*I would want him to move 5 steps forward and then 3 steps back on the number line. And I would make him to express that point as the result of the operation.*” while representing $(+5) + (-3)$ with a number line did not express the position at the beginning and did not highlight the different between the plus sign of the integer and the symbol of the addition operation. Such inadequate representations stem from the lack of representation abilities. When we examined their justifications, we saw that asset-debt and check-bill contexts were more frequently used. We also observed that they had lack of knowledge of the concept of integer while using integers in their justifications. For example, some pre-service teachers neglected the direction meaning of integers by using such statements “ *$(+5)$ represents the number of oranges that grow on an orange tree and -3 represents the number of apples he ate or the number of rotten fruits*”. These findings offer a clue that the pre-service teachers have limited content knowledge of the meaning of integers rather than of operations.

Only incomplete or complete justifications were taken into account in the explanation dimension of specialized content knowledge. The statements of two pre-service teachers regarding the addition operation were not included in the analysis shown in Table 4. Similarly, statements of eight pre-service teachers regarding $(+5) - (-3)$ and six pre-service teachers regarding $(-5) - (-3)$ were not included in the analysis.

Table 4. Frequency table of explanation component*

| Types of explanations | | Procedural | | Partial explanations | | Complete explanations | |
|---------------------------|---------------|------------|------|----------------------|------|-----------------------|------|
| | | f | % | f | % | f | % |
| The addition operation | $(+5) + (-3)$ | 17 | 42.5 | 18 | 45 | 5 | 12.5 |
| | $(-5) + (-3)$ | 14 | 33.3 | 21 | 50 | 7 | 16.7 |
| The subtraction operation | $(+5) - (-3)$ | 11 | 30.6 | 19 | 55.9 | 6 | 17.6 |
| | $(-5) - (-3)$ | 14 | 41.2 | 15 | 44.1 | 5 | 14.7 |

* Explanations of pre-service teachers’ incomplete or complete justifications

Table 4 reveals that the pre-service teachers mostly highlighted their operational knowledge while explaining operations of integer addition and subtraction. For example, one of the pre-service teachers used the following statement for $(+5)+(-3)$ which is focused on operational knowledge: “*I would subtract the larger number from the smaller one while adding two integers with different signs. I mean, I would subtract 3 from 5 and find 2. I would add the plus sign in front of the larger number before 2.*” When examined from the perspective of operational knowledge, another remarkable point is that the subtraction operation is transformed into addition. The interview held with a pre-service teacher who adopted this approach for subtraction operations confirms this finding.

Researcher: “How do you find the answer to $(+5)-(-3)$?”

PEMT₃: “The signs in $(+5)-(-3)$ are distributed and the answer will be found $(+5)+(3)=8$ ”

Researcher: So you transformed subtraction into addition.

PEMT₃: “It is quite logical... the numbers with the same signs are added. The result is found by adding the common sign.”

Researcher: Does not multiplication, which is a further operation than addition and subtraction, come up here?

PEMT₃: “Hmm... yes, but the operation is solved more easily in this way”

Explanations and quotations from the interviews show that the pre-service teachers usually adopt this approach. Among the main reasons why they adopt this approach may be the failure of addressing addition and subtraction operations at the conceptual level. Besides, we observed that explanations of almost half of the pre-service teachers about each of the addition and subtraction operations were incomplete (Table 4). Based upon these findings, we can say that the pre-service teachers do not have sufficient content knowledge of integer addition and subtraction.

Discussion and Recommendations

Studies on in-service or pre-service teachers’ content or pedagogical knowledge show that their teaching knowledge is one of the factors that affect their in-class decisions and their preferences in achieving their objectives. This study examines preservice elementary mathematics teachers’ content knowledge of integer addition and subtraction in the context of developing multiple representations, explaining mathematical reasons lying behind the concepts and justifying them. The findings of the study present some indicators about how PEMTs understand integer addition and subtraction in multiple representations as well as about the changes that might be made in the teaching programs. When their representations, justifications and explanations were examined together, it was found that the pre-service teachers do not have sufficient content knowledge. We believe that studies on this issue will contribute to pre-service teachers’ professional development, and thus the assessment of the important elements of SCK. In this sense, the findings of this study point out some critical points.

Comparison of the pre-service teachers in terms of their representation ability shows that number line is the representation model that the pre-service teachers had the most difficulty in using, while the counters are the means of representation that they were most successful in using. This finding is in parallel with the findings of previous studies (Birenbaum & Tatsuoka, 1981; Liebeck, 1990) which revealed that counters were more effective than number lines. Janvier (1983) indicates that the use of counters seems logical to students, claiming that they are hard to use in integer addition and subtraction. However, this study revealed that the pre-service teachers used counters more effectively especially while adding numbers with the same signs. The need for forming zero-pairs while using counters for the operations with numbers with opposite signs and the failure to make sense of this process are the main challenges they were confronted. Moreover, the pre-service teachers

usually mistook the signs of integers for the symbols of addition and subtraction when modelling operations with number line. Number line is also important due to its role in providing the opportunity to observe the thinking process of pre-service teachers regarding addition and subtraction and in revealing the potential challenges they may encounter. Another point that is remarkable is that PEMTs usually used the metaphor of “walking” on the number line. Billstein, Libeskind, and Lott (2010) indicate that the metaphor of “walking” on the number line is frequently used to visually enact integer operations. Diezmann, Lowrie, and Sugars (2010) emphasizes the importance of students’ development of appropriate representational apprehension.

Another remarkable finding is that, while using both counters and number lines, the pre-service teachers were not able to make sense of the concepts of magnitude and sign which are the characteristics of integers.

Researcher: What do you think positive and negative integers have in common?

PEMT₃: Actually, they are both integers.

Researcher: Well, what could be the difference between positive and negative integers?

PEMT₃: They are on the opposite sides of zero.

Researcher: I want you to think how you would model (+5) and (-3) using a number line and counters. (Showing the previous modellings) What is different between the number line and counters when modelling the sign and size of the number?

PEMT₃: Hmm. Now I realize. I used counters of opposite colors to show them. But I used arrows when showing them on the number line.

This interview reveals that the pre-service teachers have a lack of knowledge of the meanings lying behind modelling with the counters and number lines. The interviewed pre-service teacher stated that the sign of an integer is shown using arrows on the number line or using counters of opposite colors. However, the preservice teacher was not able to state that the magnitude of the number should be shown with the number of counters or the length of the arrows.

Steiner (2009) points out that pre-service teachers find it more difficult to correctly write word problems for integer addition and subtraction than to perform the operations symbolically. This study found that the pre-service teachers mostly preferred using debit/credit and gains/losses contexts and were more successful in constructing real world contexts for operations involving numbers with the same signs. Furthermore, it is possible to establish strong connections with real life contexts and integer addition and subtraction operations. We also observed that, among the categories proposed by Fuson (1992) for the meanings of integer addition and subtraction, the pre-service teachers highlighted the combine and change meanings more, neglecting the compare meaning.

Most of the pre-service teachers were found to have had difficulty in explaining the reason to someone who did not solve an integer addition or subtraction equation correctly. Their justifications were usually found to be incomplete. They were observed to be more successful in justifying addition operations than subtraction operations. The studies (Nunes, 1993; Shawyer, 1985) show that subtraction is harder to understand than addition due to the multiple use of the minus sign “-”. Actually, this not only holds true for integers, but also for all number groups.

Finally, the findings reveal that the pre-service teachers mostly highlighted their operational knowledge while explaining operations of integer addition and subtraction. Symbolic presentation of integer addition and subtraction operations without associating them with the real world is what Skemp (1987) call ‘instrumental understanding’ and it can be said to be one of the main reasons for rote learning. In this sense, proper use of number line and counters, together with proper contexts, is of

critical importance in the development of relational or conception understanding. The components of SCK defined in this study which considers SCK to be of critical importance in revealing the in-depth knowledge of mathematics teachers or pre-service teachers for mathematics teaching may be reinforced with other subjects and further studies may be carried out with teachers in the context. To help students develop a conceptual understanding of integers and operations, especially pre-service teachers should be provided with the opportunity to improve their mathematical understanding of this topic. Therefore, particular importance should be attached to developing contents for the undergraduate level theoretical and practical courses which aim to improve skills and knowledge regarding this topic.

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The Relationship Between Pre-service Teachers' Attitudes towards Research and Their Academic Dishonesty Tendencies

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Abstract

The aim of this study is to examine the relationship between the research attitudes of the pre-service teachers and their academic dishonesty tendencies. This study employs a quantitative method with a correlational design consisting of 659 volunteer pre-service teachers from the faculty of education of a state university in East of Turkey. The data of the study were gathered through "Attitudes toward Research Scale" and "Academic Dishonesty Tendency Scale". The analysis of the obtained data showed that there is a significant difference between the two genders in favor of the female pre-service teachers on both the attitudes towards research and the tendency of academic dishonesty. It was found that the academic dishonesty tendencies of the senior year pre-service teachers are higher than that of the sophomore year pre-service teachers. There is a negative meaningful relationship between the academic dishonesty tendencies of the pre-service teachers and their attitudes towards the research.

Keywords: Attitude towards research, academic dishonesty, pre-service teachers

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Introduction

Research can be defined as a process in which a person tries his/her best in order to find answers to curious questions as well as a systematic approach that is followed to find answers to problems (Shavelson, 1996). Research can be perceived as an art of "how to do" rather than an academic field of study, and it requires skills and experience. This experience lead people to be able to conduct independent research and criticize others' research activities (Simon & Burnstein, 1985). Scientific research can be defined as a process that establishes a continuous ongoing interaction between methods, findings and theories, and provides understanding of testable models and theories on the fields like education, economics, physics, molecular biology, etc. (Shavelson & Towne, 2002) as well as collecting data for specific purposes via systematic processes and analyzing those collected data (McMillan & Schumacher, 1984).

Research should be performed in a systematic, skeptical and ethical way. What is meant by systematic is the seriousness of what researchers do, why and how they do it. By skepticism, it is meant that there is a possibility that thoughts may not be confirmed. This also includes thinking about alternative assumptions and interpretations, and examining the initial observed results carefully. Being ethical means to follow the code of conduct that guarantees the concerns and inferences of those who are involved in the research or are likely to be affected by the research (Robson, 2013). In addition, research ethics help researchers conduct high quality research in an ethical way (Johnson & Christensen, 2014).

Determining research attitudes is important for the development of a positive attitude among students and their ease of learning (Papanastasiou, 2005). Research attitudes define feelings about research. These feelings include negative thoughts, anxiety, fear of failure, inadequacy, and lack of interest (Bolin, Hag Lee, GlenMaye & Yoon, 2012). When the literature on reseach attitudes of teachers, pre-service teachers, and students is reviewed, it is found that the pre-service teachers have negative attitudes towards research (Papanastasiou, 2005; Butt & Shams, 2013). For example, teachers are not interested in research due to the lack of time, lack of comprehension, lack of confidence in research findings (Shkedi, 1998). On the other hand, students find research difficult and boring (Adams & Holcomb, 1986). Female teachers have a more positive research attitude than male ones (Williams & Coles, 2003). Even if students are aware of the importance of research, they are anxious about the research process and they are afraid of conducting a research and they feel weak (Morgenshtern, Freymond, Apyapong & Greeson, 2011). Students, who believe that research is useful, feel less anxious and have an increased interest in research (Bolin et al., 2012). Papanastasiou (2005) stated that the students who encounter some obstacles during research and the ones who do not understand the research process exactly have negative attitude towards research. In addition, he explained that graduate students have positive research attitude since they believe it will help them in their professional life.

Academic dishonesty is often used as a synthesis of the concepts of cheating and plagiarism. Academic dishonesty is described as the tendency of an individual to intentionally commit plagiarism, passing off someone else's work as his own by not giving citation of any academic work. In addition, fraudulent academic documents, blocking or harming others' academic work, directing other individuals to conduct academic dishonesty (Hulsart & McCarthy, 2011), and individuals' wrong declarations in academic work (Krueger, 2014) may also be included as academic dishonesty. Academic dishonesty includes all kinds of fraud in educational settings, from plagiarism to deception and fabrication (Jurdi, Hage & Chow, 2012). Academic honesty center (1999) defines academic dishonesty as cheating, plagiarism, deception, a student's unfair advantageous position from other students and dishonest behaviours about academic achievement (Wideman, 2008). Other researchers may also use the information produced by academic dishonesty (Petress, 2003). As a result, academic dishonesty can cause a negative effect on the development of people and society (Imran ve Nordin, 2013).

There are several studies about academic dishonesty and the types of it in the literature. Findings of some of those are; students declare that they choose academic dishonesty to avoid academic failure (Thomas, 2017), more than half of the students participated in the study had applied to different forms of academic dishonesty within the last six months (Hensley, Kirkpatric & Burgoon, 2013), female students tend to be less fraudulent than male students (Nonis & Swift, 2001; Straw, 2002; Szabo & Underwood, 2004), among the high school students, 3rd year students tend to cheat less than the 1st and 2nd year students (Szabo & Underwood, 2004), younger individuals are more likely to cheat than adults (Straw, 2002), 95% of high school students confessed that they have cheated throughout their education life (Wangaard & Stephens, 2011), students with low grades tend to have more academic fraud than students with high grades (Hensley, Kirkpatric & Burgoon, 2013) and tend to cheat more (Yardley, Rodriguez, Bates & Nelson, 2009), international undergraduates are more likely to be fraudulent than domestic students (Beasley, 2016), despite the fact that students find academic dishonesty wrong, they commit it because of the pressure of university studies and family expectations (Finchilescu & Cooper, 2017) and masters students are more likely to perpetrate academic fraud than PhD students (Yang, 2012).

In addition, there are also findings about the causes of such unethical behaviors in the related literature. Some of those are as follows; the need for students to achieve higher success in a shorter time (Cummings, Maddux, Harlow & Dyas, 2002; Straw, 2002; Whiteman & Gordon, 2001), students' perceptions that some of the lessons are unimportant, the teachers' irrelevant and permissive attitudes (Gerdeman, 2000), students' lack of confidence, feeling under pressure, and need to be approved by peers and their parents (Raffetto, 1985), the absence of prohibitive penalties and prohibitions of academic dishonesty (Macdonald & Carroll, 2006), peer effect (Brown, 2002; Myrick, 2004; Petress, 2003), time constraints and helping a friend (Yardley et al., 2009).

We believe that if teachers develop good research skills, which is essential for learning and generating their own reflections and ideas, and demonstrate ethical behavior during their pre-service preparation period, they will be good role models for their students when they start their professional lives. The main objective of this study is to examine the relationship between pre-service teachers' research attitudes and their tendency to academic dishonesty. In the literature review, it was not encountered to a study about the relationship between research attitudes and academic dishonesty tendency, hence we believe that this study will be a contribution to the related field. In this study, we tried to answer to the following questions:

a) Does the score of pre-service teachers' research attitudes reveal significant difference according to gender?

b) Does the score of pre-service teachers' academic dishonesty tendency reveal significant difference according to gender?

c) Does the score of pre-service teachers' research attitudes reveal significant difference according to year of study?

d) Does the score of pre-service teachers' academic dishonesty tendency reveal significant difference according to year of study?

e) Does the score of pre-service teachers' research attitudes reveal significant difference according to department?

f) Does the score of pre-service teachers' academic dishonesty tendency reveal significant difference according to department?

g) Finally, is there a meaningful relationship between pre-service teachers' scores for Attitude towards Research Scale and Academic Dishonesty Tendency Scale?

Methods

Participants

The research study group consisted of 659 volunteer students from the faculty of education of a state university in the East of Turkey. For the creation of the sample, we tried to include students from various departments and different years of study as much as possible. Of the sample, 140 (21,2%) participants were from Preschool Education, 161 (24,4%) from Social Sciences Education, 199 (30,2%) from Turkish Language Education and the remaining 159 (24,1%) from Guidance and Psychological Counseling Education programs. According to gender, 440 (66,8%) participants were female and 219 (33,2%) were male. According to year of study, 157 (23,8%) participants were freshman year, 162 (24,6%) were sophomore year, 132 (20%) were junior year and 208 (31,6%) were senior year pre-service teachers.

Research Design and Instruments

This research employs a quantitative method with a correlational design that examines the relationship between pre-service teachers' attitudes towards research and their academic dishonesty tendency. We applied "Attitudes towards Research Scale", "Academic Fraud Tendency Scale" and "Personal Information Form" to the pre-service teachers to collect data. It took approximately 30 minutes to complete the scales. We informed the participants about the purpose of the research study, confidentiality of the data collected and that they could feel free to choose the closest statement while answering the questions since there is no ultimate true answer to any question.

a) Attitudes towards Research Scale

The "Attitudes towards Research (ATR)" scale developed by Papanastasiou (2005) has been adapted to Turkish by Yapalak and Ilgaz (2013). The linguistic validity provided scale was analyzed through Confirmatory Factor Analysis (CFA) and item-total correlation and item discrimination parameters were examined. According to the obtained CFA and item analysis results, it was determined that the scale preserved its original structure in Turkish culture. The scale of ATR has 5 factors and consists of 32 items. The factors are "research usefulness for profession", "research anxiety", "positive attitudes towards research", "relevance to life" and "research difficulty". The maximum score that one can get from the scale is 224 while the minimum is 32. The Cronbach Alpha reliability coefficient of the scale is 0,82. The high scores indicate that the pre-service teachers' research attitudes are high.

b) Academic Dishonesty Tendency Scale

The Academic Dishonesty Tendency Scale (ADTS) developed by Eminoğlu and Nartgün (2009) has 4 factors and consists of 22 items. After examining the structures of these items, the identified factors are called as "tendency towards cheating", "dishonesty tendency at studies as homework, project, etc. - common", "dishonesty tendency at research and process of write up" and "dishonesty tendency towards reference" respectively. The construct validity of the scale was tested by Confirmatory Factor Analysis. The Cronbach alpha reliability coefficient of the scale is 0,88. The maximum score that can be obtained from the scale is 110 while the minimum is 22. As the score gets higher, the pre-service teachers' academic dishonesty tendency rises.

c) Personal Information Form

This form was used to gather information about the gender, the year of study and the department of the participants.

Data Analysis

During the analysis, it was first examined whether the data were presenting a normal distribution or not and it was concluded that data were normally distributed. Independent Sample t-Test was performed to investigate the difference of scores of Attitudes towards Research Scale and Academic Dishonesty Tendency Scale according to the gender. One way ANOVA is used to compare more than two groups, i.e. to look for the difference of scores of Attitudes towards Research Scale and Academic Dishonesty Tendency Scale according to year of study and also for department. Pearson Correlation Coefficient is used to calculate the relationship between Attitudes towards Research Scale and Academic Dishonesty Tendency Scale.

Results

Table 1 shows the results obtained from the Independent Sample t-Test analysis which was applied to determine whether there was a difference between the mean scores of the two genders according to the research attitudes of the pre-service teachers.

Table 1. Results of Independent Sample t-Test to determine whether Attitudes toward Research Scale scores differ according to gender

| | Subscale | Gender | N | \bar{X} | sd | t | df | Sig. Dif. |
|---------------------------|------------------------------------|--------|-----|-----------|-------|-------|-----|-----------|
| Attitudes toward Research | Research usefulness for profession | Female | 440 | 49.86 | 10.13 | 1.772 | 657 | .077 |
| | | Male | 219 | 48.36 | 10.47 | | | |
| | Research anxiety | Female | 440 | 34.14 | 8.75 | 4.095 | 657 | .000 |
| | | Male | 219 | 31.10 | 9.37 | | | |
| | Positive attitudes toward research | Female | 440 | 38.52 | 10.94 | -.968 | 657 | .334 |
| | | Male | 219 | 39.40 | 10.92 | | | |
| | Relevance to life | Female | 440 | 15.13 | 3.62 | -.507 | 657 | .612 |
| | | Male | 219 | 15.29 | 4.03 | | | |
| | Research difficulty | Female | 440 | 11.28 | 4.19 | 1.174 | 657 | .241 |
| | | Male | 219 | 10.89 | .77 | | | |
| | Total | Female | 440 | 148.93 | 21.26 | 2.137 | 657 | .033 |
| | | Male | 219 | 145.04 | 23.58 | | | |

Table 1 depicts that when the scores of research attitudes according to gender are analysed, it is found that there is a significant difference between the two genders in “Research Anxiety” subscale [$t_{(657)} = 4,095$; $p < 0,05$] in favor of female pre-service teachers (average score for females ($\bar{X} = 34,14$) is higher than that of the males ($\bar{X} = 31,10$). Similarly, there is a significant difference in the total scores for the scale [$t_{(657)} = 2,137$; $p < 0,05$] in favor of female pre-service teachers (average score for females ($\bar{X} = 148,93$) is higher than that of the males ($\bar{X} = 145,04$). This result can be interpreted as even if the female pre-service teachers feel more anxious than male ones, their research attitudes are more positive. Table 2 presents the results of the Independent Sample t Test for analyzing pre-service teachers’ academic dishonesty tendency according to gender.

Table 2. Results of Independent Sample t-Test performed to determine whether Academic Dishonesty Tendency Scale scores differ according to gender

| | Subscale | Gender | N | \bar{X} | sd | t | df | Sig. Dif. |
|------------------------------|--|--------|-----|-----------|-------|--------|-----|-----------|
| Academic Dishonesty Tendency | Tendency towards cheating | Female | 440 | 9.79 | 5.08 | -3.432 | 657 | .001 |
| | | Male | 219 | 11.30 | 5.71 | | | |
| | Dishonesty tendency at studies as homework, project, etc. – common | Female | 440 | 13.40 | 5.88 | -3.439 | 657 | .001 |
| | | Male | 219 | 15.10 | 6.25 | | | |
| | Dishonesty tendency at research and process of write up | Female | 440 | 8.90 | 3.65 | -1.126 | 657 | .261 |
| | | Male | 219 | 9.24 | 3.81 | | | |
| | Dishonesty tendency towards reference | Female | 440 | 10.49 | 4.05 | -3.757 | 657 | .000 |
| | | Male | 219 | 11.78 | 4.34 | | | |
| | Total | Female | 440 | 44.53 | 15.73 | -3.841 | 657 | .000 |
| | | Male | 219 | 49.71 | 17.41 | | | |

Table 2 shows that the average scores of female pre-service teachers are higher than that of the males not only for the subscales “Tendency towards cheating”, “Dishonesty tendency at studies as homework, project, etc. – common”, and “Dishonesty tendency towards reference” but also for the total. This result suggests that female pre-service teachers tend to commit less academic dishonesty than males.

The data obtained as the result of the one-way ANOVA conducted in order to determine whether there is a difference between scores of the research attitudes and academic dishonesty tendency of the pre-service teachers according to year of study are presented in Table 3 and Table 4.

Table 3. Descriptive statistics on attitudes towards academic research and academic dishonesty tendency scores according to year of study

| Dependent Variable | Variables | N | \bar{X} | sd |
|------------------------------|----------------|-----|-----------|-------|
| Attitudes toward Research | Freshman Year | 157 | 147.71 | 24.16 |
| | Sophomore Year | 162 | 148.82 | 20.92 |
| | Junior Year | 132 | 149.59 | 21.97 |
| | Senior Year | 208 | 145.43 | 21.46 |
| | Total | 659 | 147.64 | 22.12 |
| Academic Dishonesty Tendency | Freshman Year | 157 | 46.44 | 16.55 |
| | Sophomore Year | 162 | 43.79 | 14.63 |
| | Junior Year | 132 | 45.16 | 17.23 |
| | Senior Year | 208 | 48.72 | 17.05 |
| | Total | 659 | 46.25 | 16.48 |

Table 4. One-way ANOVA results on the differences between the attitude towards research and the academic dishonesty tendency according to year of study

| | Variance Origin | Sum of Squares | Degrees of Freedom (df) | Mean Square | F | p | Significant Difference |
|------------------------------------|-----------------|----------------|-------------------------|-------------|-------|-------|------------------------------|
| Attitudes toward Research Scale | Between Groups | 1.740.758 | 3 | 580.253 | 1.187 | 0.314 | |
| | Within Groups | 320.080.569 | 655 | 488.673 | | | |
| | Total | 321.821.327 | 658 | | | | |
| Academic Dishonesty Tendency Scale | Between Groups | 2.409.609 | 3 | 803.203 | 2.984 | 0.031 | senior year > sophomore year |
| | Within Groups | 176.280.404 | 655 | 269.130 | | | |
| | Total | 178.690.012 | 658 | | | | |

As shown in Table 4, there is no difference according to year of study in Attitudes toward Research Scale. On the other hand, it is observed that there was a significant difference between the average scores calculated for year of study of 659 pre-service teachers ($F_{(3-655)} = 2,984$, $p < 0,05$) in Academic Dishonesty Tendency Scale. The result of the multiple comparison test shows that this meaningful difference in favor of the senior year pre-service teachers when they are compared with sophomore year pre-service teachers (average score for sophomore year students is lower than that of senior year students).

This result shows that senior year pre-service teachers have higher academic dishonesty tendency than the sophomore year pre-service teachers. The effect size variable was calculated as $\eta^2 = 0,013$, which indicates the ratio of the dependent variable to the variance explained by the independent variable, and this shows that the year of study variable has a weak effect on academic dishonesty tendency.

In order to explore whether pre-service teachers' departments affect their research attitudes and academic dishonesty tendency, again one-way ANOVA was used. The results were depicted in Table 5 and Table 6.

Table 5. Descriptive statistics on attitudes towards academic research and academic dishonesty tendency scores according to department

| Independent Variable | Department Variable | N | \bar{X} | Sd |
|------------------------------------|---|-----|-----------|-------|
| Attitudes toward Research Scale | Preschool Education | 140 | 144.87 | 22.12 |
| | Social Sciences Education | 161 | 150.15 | 22.70 |
| | Turkish Language Education | 199 | 149.13 | 22.45 |
| | Guidance and Psychological Counseling Education | 159 | 145.66 | 20.32 |
| | Total | 659 | 147.64 | 22.12 |
| Academic Dishonesty Tendency Scale | Preschool Education | 140 | 45.74 | 16.44 |
| | Social Sciences Education | 161 | 45.35 | 17.29 |
| | Turkish Language Education | 199 | 46.90 | 17.55 |
| | Guidance and Psychological Counseling Education | 159 | 46.80 | 14.21 |
| | Total | 659 | 46.25 | 16.48 |

Table 6. Results of one-way ANOVA used to determine whether Attituded toward Research Scale and Academic Dishonesty Tendency Scale differ according to department

| | Variance Origin | Sum of Squares | df | Mean Squares | F | p |
|------------------------------|-----------------|----------------|-----|--------------|-------|------|
| Attitudes toward Research | Between Groups | 3150.641 | 3 | 1050.214 | 2.159 | .092 |
| | Within Groups | 318670.687 | 655 | 486.520 | | |
| | Total | 321821.327 | 658 | | | |
| Academic Dishonesty Tendency | Between Groups | 297.556 | 3 | 99.185 | .364 | .779 |
| | Within Groups | 178392.456 | 655 | 272.355 | | |
| | Total | 178690.012 | 658 | | | |

The results shown in Table 6 reveals no meaningful difference between the attitudes towards research and the tendency of academic dishonesty according to departments [$F_{ATR(3-655)} = 2,159$, $p < 0,05$; $F_{ADTS(3-655)} = 0,364$, $p < 0,05$].

Pearson Product-Moment Correlation Coefficient is to used to determine the relationship between Attitudes towards Research Scale and Academic Dishonesty Tendency Scale for pre-service teachers and Results are presented in Table 7.

Table 7. The relationship between pre-service teachers' research attitudes and their academic dishonesty tendencies

| | | Attitudes toward Research | Academic Dishonesty Tendency |
|------------------------------|---------------------|---------------------------|------------------------------|
| Attitudes toward Research | Pearson Correlation | | -.207 |
| | p | | .000 |
| Academic Dishonesty Tendency | Pearson Correlation | -.207 | |
| | p | .000 | |

Table 7 shows that there is a negative correlation [$r=-0,207$, $n=659$, $p<0,01$] between pre-service teachers' research attitudes and their academic dishonesty tendencies.

Discussion and Conclusion

When the research attitudes of pre-service teachers are examined according to gender, it is found that there is a significant difference in favor of the female pre-service teachers. This shows that female pre-service teachers' have more positive attitudes than the male pre-service teachers. This result is similar to the results of Williams and Coles (2003).

Similarly, when the academic dishonesty tendency of pre-service teachers are examined according to gender, it is found that there is a significant difference in favor of the female pre-service teachers. This shows that female pre-service teachers tend to commit less academic dishonesty when compared to male pre-service teachers. Hensley, Kirkpatrick and Burgoon (2013), Jensen, Arnett, Feldman and Cauffman (2002), Newstead, Franklyn-Stokes and Armstead (1996) and Wideman (2008) have found similar results in their studies. Eret and Ok (2014) and Akbulut, Uysal, Odabaşı and Kuzu (2008) concluded in their studies that female pre-service teachers plagiarize by internet less than male pre-service teachers. The research conducted by Yang (2012) presented that girls criticize academic dishonesty more than boys. As there are studies that presented opposite findings (Graham, Monday, O'Brien, & Steffen, 1994), there are also others that could find no difference in academic dishonesty according to gender (Beasley, 2016).

When the research attitudes of the pre-service teachers are examined according to year of study variable, it was found that junior year pre-service teachers has the highest average score ($\bar{X} = 149,59$), while the senior year ones have the lowest average ($\bar{X} = 145,43$). However, no statistically significant difference is found between the research attitudes of pre-service teachers and their year of study.

When the academic dishonesty tendencies of the pre-service teachers are examined according to year of study, it was found that senior year pre-service teachers have the highest average score ($\bar{X} = 48,72$), while the sophomore year ones have the lowest average ($\bar{X} = 43,79$). It has been determined that there is a significant difference in favor of sophomore year pre-service teachers compared to senior year pre-service teachers for academic dishonesty tendencies. This result indicates that sophomore year pre-service teachers are less inclined towards academic dishonesty than senior year pre-service teachers. This result may be due to the fact that senior year students feel high pressure of maintaining high GPAs, that a partial course may be irrelevant for their professional lives, that the teachers do not pay attention to academic integrity and that the penalties for sanction are not functional. Iyer and Eastman (2006) specified that the students with low GPA tend to commit more academic dishonesty. However, there are studies that show the opposite results; Wideman (2008) stated that younger students cheat more. Beasley (2016) explained that this is because younger students are more ignorant than older students. This study reveals no meaningful difference between the attitudes towards research and the tendency of academic dishonesty according to departments.

The main finding of this study is that there is a significant negative correlation between pre-service teachers' research attitudes and their academic dishonesty tendencies. This result shows that the higher the academic dishonesty tendencies of pre-service teachers, the more negative attitude towards research. Thomson (2017) on his study about academic dishonesty, determined a negative correlation between students' learning climate, mind-set, individualism and motivation and academic dishonesty. In his study, Thomson (2017) stated that students will commit less academic dishonesty and have higher motivation if the teachers support the class environment with discussion, problem solving and question based applications. Davis, Drinan, and Bertram Gallant (2006) reported that only 2% of those who committed academic dishonesty were reported in one of their institutions, while Happel and Jennings (2008) pointed out that only 1,5% of students who committed academic dishonesty in college were penalized.

In this context, policies should be produced for the prevention of academic dishonesty and the existing penalties should be put into practice. If the penalties are not deterrent, the penalties must be reviewed. Finchilescu and Cooper (2017) concluded that a group of university students pointed out that the lack of clear rules on academic dishonesty and inconsistent practices led to academic dishonesty. Thus, the research attitudes can be increased to the extent to which academic dishonesty can be reduced.

The pre-service teachers should follow the new developments in their fields, have knowledge about the new applications and learn the scientific research process very well so that they can give their students a better education. In this context, the tendency for academic dishonesty will decrease if the pre-service teachers learn the process of scientific research in accordance with its rules and can make appropriate scientific research according to these rules.

On the basis of the findings of this study, it is suggested to add practical activities to the contents of the lectures to develop pre-service teachers' research skills, to check the conformance to ethical rules of the research reports prepared by pre-service teachers in more detail and give detailed feedback to the students, create homeworks that courage originality, give precise and explicit definition of academic dishonesty and what kinds of sanctions they will face in situations contrary to ethical rules in the syllabus of the lectures. The "Scientific Research Methods" course taken by the students during their undergraduate period cover ethical issues. In addition to that, a new course related to ethics could be added to the undergraduate curriculum.

Limitations

There are some limitations of this study. The first limitation is that all of the survey respondents attend the same university. For the generalization of the findings the study could be repeated for various universities in Turkey. It is found that there was a significant difference between research attitudes and academic dishonesty tendency according to departments. This could be because of the limited type of departments. It is suggested to include pre-service teachers from other faculties like computer education, mathematics and science education and foreign language education for further research.

The types of academic dishonesty that the pre-services teachers commit and how often they do it could not be addressed in this study. Moreover, the reasons for the students to commit academic dishonesty could be examined in detail. Another limitation is that pre-service teachers' attitudes towards research and academic dishonesty tendencies are limited to scores obtained through a data collection tool.

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Opinions of Turkish Language Teacher Candidates on a Primary-level Reading and Writing Teaching Course: A Qualitative Study

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Abstract

The purpose of this study was to reveal prospective Turkish Language teachers' views on the *primary level Reading and Writing* course they take at university. Employing the qualitative research method, data were collected from participants by administering a semi-structured interview form with six open-ended questions that was prepared and administered to the participants by the researcher. Findings obtained were then interpreted under six individual themes. Based on the results of this research, it can be argued that the prospective teachers selected the course mostly to benefit their personal and professional development. They believed in the need to make the lesson compulsory, deemed the course effective, and they regarded using audio-visual and technology-supported materials as important. However, they faced certain problems on the course due to a number of factors stemming from the insufficiency of the physical setting and equipment, inadequacy of total course hours, special features of consonants, change of format in writing activities, characteristics of students to whom they showed their presentations, and challenges experienced in material design.

Keywords: Primary Level Reading and Writing Course, Department of Turkish Education, Prospective Turkish Language Teachers, Qualitative Research

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Introduction

Language is the medium allowing the transmission of one's feelings, thoughts, desires and dreams to others in letters or in words. In oral transmission, listening and speaking skills take the stage; while in written transmission, reading and writing skills are featured. Yavuz (2010) claims that the mother-tongue is acquired sequentially in the order of listening, speaking, reading and writing. Based on this order, it is safe to argue that one skill prepares the scene for the emergence of an upcoming skill.

Among these skills, listening is an inborn feature for everyone except those with hearing impairments and "it is a domain in which children acquire certain basic skills before starting school" (Güneş, 2014, p. 92). Speaking is the second language skill acquired after listening; "Initially, children imitate the sounds of those nearby. Later, they improve their speaking skills with the accumulation of both personal and social experience" (Güneş, 2007, p. 74). It is suggested that children who acquire a certain range of listening and speaking skills before starting school can develop those skills after formal education begins, in which they are also required to acquire reading and writing skills.

The Basic Reading and Writing course is the first and fundamental course that children, having acquired a certain level of listening and speaking skills, would instantly experience once starting primary school. Reading and writing constitutes the foundation of educational life. "The knowledge, skills and habits that students acquire in the very first period when the most basic and essential steps of education are taken will have a direct effect on students' success in both primary education and the ensuing years" (Göçer, 2014, p. 12). Thus, it would be unwise to expect any academic achievement from children without their having a sound reading-writing education.

Considering the varying educational systems around the world, it should be mentioned here that the Turkish 4+4+4 system introduced in 2012 consists of 4 years at Primary school (ages 5/6-10/11), 4 years at Elementary (also termed "Secondary" or "Middle") school (ages 11-14), and 4 years at high school (ages 15-18).

Reading and writing are two complementary skills inseparable from one another. A person not knowing how to read cannot be able to write. That is why the pupil is first taught to read then taught to write. The order of primacy-recency does not include a time gap but one follows the other successively. First the child learns how to read, then is taught how to write letters, words or sentences" (Coşkun, 2007, p. 50). "Reading-writing on the one hand allows us to transfer the collective experience of past generations to later generations; on the other hand it functions as a significant and effective means of communication between existing generations" (Öz, 1999, p. 3). "Because writing occupies such a critical place in human life, gaining literacy skills by spreading reading-writing among the young generation is of great significance for mankind" (Aydın & Kartal, 2017, p. 36).

"The scope of the reading-writing concept refers to a range of skills from reading and writing a simple sentence to computer literacy" (Sağırlı, 2015, p. 6). There are five different levels of literacy; namely, illiteracy, semi-literacy, basic literacy, functional literacy and multifunctional literacy (Güneş, 2000). If a child having recently started primary school has not been taught reading or writing at home or by teachers and self-attempts at kindergarten, the child is assumed to be at the illiteracy level. Children in the first year of primary school could "via an effective program guided by a qualified teacher reach a basic level of literacy by means of primary Reading and Writing lessons. In senior classes and at higher levels, the child would reach functional and multifunctional levels; hence, it is expected that they would develop themselves and also the society in which they live" (Sağırlı, 2015, p. 7).

"Any society developed in the social, economic and cultural domains and aspiring to improve even more is mandated to rectify any gaps in the area of reading and writing (literacy) as the pillar of education itself and is required to take all measures in parallel with global advancements and any further steps necessary" (Bulut, 2015, p. 105). In the Congress on Education held under the auspices of

President Mustafa Kemal Atatürk between 16 and 21 July 1921, Atatürk announced his firm belief that the Turkish Republic to be established in 1923 could only maintain its existence through education. As part of the Public Schools Project, a number of tangible measures were taken to teach reading and writing to the public (Önal, 2010). In November 1922, the Department of Education circulated a decree to governors requiring them to initiate public education activities. One month later, a second decree was issued and Public Schools and evening courses commenced in 105 different regions whereby about 7,000-8,000 persons were enrolled on an adult reading-writing course (Sevinç, 2016).

In the ensuing attempts to increase literacy, a number of literacy campaigns were enacted in Turkey and these continue today. The most-recent action has been decree no. E.3323631 on 16.02.2018 “Assigning Instructors to Reading-Writing Courses within the Scope of the Literacy Campaign”, issued by the General Directorate of Lifelong Learning under the Ministry of Education. Based on this decree, in schools having no classroom teacher present, full-time instructors that normally teach Turkish Language or Turkish Language and Literature lessons will be appointed initially (<https://www.memurlar.net/haber/733795/okuma-ve-yazma-kurslarinda-kimler-gorevlendirilecek.html>). Therefore, teaching of the primary-level Reading and Writing course is crucial not only for students in the Department of Classroom Teaching but also for students studying in the Turkish Language Department.

The Turkish Council of Higher Education (YÖK) has completed updating Undergraduate Teacher Training programs and announced the amendments on its official webpage on 16.05.2018 (<http://www.yok.gov.tr/web/guest/ogretmen-yetistirme-lisans-programlari>). The most noteworthy development in the curriculum is that in the Undergraduate Program of Turkish Language Teacher Training, the *Primary level Reading and Writing course*, has been integrated into the elective courses. Based on the course content issued by YÖK, the scope of the *Primary level Reading and Writing* course includes the following: “History of Primary Reading and Writing education in Turkey, primary reading and writing teaching methods (alphabet, spelling, story-sentence formation, etc.), the phoneme-based sentence approach, implementation stages, alternative practices, reading and writing problems at secondary school level, and the teaching of reading and writing in senior classes” (YÖK, 2018, p. 502).

The *Primary level Reading and Writing* course was offered as an elective course in Gazi and Hacettepe universities even before the recent updating by the Council of Higher Education. Starting with the fall term of 2017-2018 academic year, the same lesson was included in the elective course list of Çanakkale Onsekiz Mart University (ÇOMÜ), Department of Turkish Language Teacher Training. This study aims to identify the attitudes of prospective Turkish Language teachers in the Faculty of Education at ÇOMÜ on the *Primary Reading and Writing* course in the curriculum. One of the main reasons for carrying out this study is that no research has so far been identified in the relevant literature on the views of Turkish Language teacher candidates about this specific course. It is thus suggested that the findings of our research are likely to make a significant contribution to the literature.

Method

Research Model

The qualitative research method was employed in this study to provide an insight into the attitudes of prospective Turkish Language teachers on the *Primary level Reading and Writing Teaching* course. Qualitative research is “a study in which data collection methods such as observation, interview and document-analysis are utilized; it is a qualitative process based on evaluating perceptions and actions in a realistic and holistic manner in a natural setting” (Yıldırım & Şimşek, 2008, p. 39). Among these methods, interviewing is a technique employed to measure individuals’ experiences, attitudes, views, beliefs, comments, perceptions and reactions (Yıldırım & Şimşek, 2008). Based on the “accessibility of resources and qualities of the target data to be collected

in the research” (Büyüköztürk, Kılıç Çakmak, Akgün, Karadeniz & Demirel, 2008, p. 233), the interview technique is grouped into five formats: the structured interview, unstructured interview, semi-structured interview (Karasar, 2005; Punch, 2005), ethnographic interview, and focus-group interview (Büyüköztürk et al., 2008). In a semi-structured interview, survey questions are predetermined with the aim of gathering data by directing these questions at the participants (Karasar, 2005, p. 167-168). Such interviews “unify both fixed responses and in-depth reasoning in the relevant domain” (Büyüköztürk et al., 2008, p. 234). Accordingly, in this study the semi-structured interview technique was employed in the data collection process.

Population of the research

In qualitative research, the random sampling and selective sampling methods are utilized. Of these two methods, the most obvious advantage of random sampling is that a maximum population is represented. In this study, simple random sampling was used since it is a method in which “each sample is given an equal chance of being selected and the overall sampling is formed of selected units” (Büyüköztürk et al., 2008, p. 74). In this context, the research population consisted of 25 students (15 female, 10 male) who selected the *Primary level Reading and Writing* course from the Elective course list in their second year at, the Faculty of Education (Turkish Language Teacher Training Department) of ÇOMÜ during the fall term of 2017-2018 academic year. In order for the students’ identity to be anonymous, female students were encoded as F1, F2, F3...etc. and male students as M1 to M10.

Data Collection

In order to identify the views of prospective teachers about the *Primary level Reading and Writing Teaching* course, a semi-structured interview form containing six open-ended questions was prepared by the researcher. (In this study, “primary”, “primary level” and “primary school” are considered to be synonymous, i.e. the child’s “first” educational years. For brevity, the Reading and Writing course is often referred to as “R/W course”.) The interview form was checked by three specialists in the field to establish the internal consistency of the study. The specialists were requested to check the comprehensibility of questions in the interview form and ensure that the questions related to the scope of the research topic. Based on feedback, the questions were reviewed and corrected where necessary then a pilot interview was conducted with three prospective teachers excluded from the total sampling. In this pilot study, comprehensibility of the questions by students was tested and, based on this feedback, it was concluded that the questions would provide the required data for this research. Following this, the 25 prospective teachers were supplied with the interview form.

Data Solution and Analysis

Data gathered from the interviews applied to prospective teachers were examined via content analysis. The findings were grouped under six themes in relation to the *Primary R/W Teaching course*. These themes focused on (1) reason(s) why the prospective teachers selected the course; (2) their opinions on whether the course should remain an elective course or be compulsory; (3) views on personal gains acquired from the course; (4) views on materials utilized in the course; (5) problems encountered on the course; and (6) suggestions to correct problems witnessed in the course and solutions to make the course more effective. Then, the prospective teachers’ views obtained were contrasted with the findings of similar studies, which are presented in the discussion section.

Findings

1. Reasons for prospective teachers selecting the primary level R/W course

When the views of the Turkish Language teacher candidates regarding their reasons for selection of the R/W course are analyzed, it is seen that students hold a variety of views. 44% of the prospective teachers chose the course based on the belief that they would benefit in their personal and professional development. This response was followed successively by being of help to students and adults not knowing how to read and write (24%), on recommendation or out of curiosity (16%), and the fact that primary level reading and writing is fundamental to Teaching Turkish (12%). One (4%) of the prospective teachers stated they selected the course without any specific reason in mind.

Among the students who selected the *Primary R/W* course with the conviction of gaining benefits for their personal and professional development, student F5 responded: *"I selected the course because, compared to the other elective courses, I found it more relevant to my department. Also, I believe that this course can make us more experienced in teaching and provide us with great benefits in the teaching profession."* M3 shared his views on the same question like this: *"I chose this course because it was related to my department and when I start work, I intend to make use of the knowledge and experience I have gained on this course."* M9 stated that: *"As a prospective Turkish Language teacher, I believe I have made an informed choice. When I start teaching, I want to have developed myself by taking varied courses; not only ones directly relevant to the topics I would teach. So I chose this course because I am sure it will contribute a lot to my field."*

Student F2 declared that she selected this course to be of help to students and adults not knowing how to read or write, and continued: *"I selected this course because, when I am assigned in the future, I want to possess the required knowledge to teach any potential students who are not able to read or write in the schools I would teach in."* Student F7 stated that: *"The R/W course is not only a subject interesting for our friends in the Department of Classroom Teaching but also a subject of great significance for us. When I am a teacher, I will teach the Turkish Language course, but I am positive I will definitely see students who are less than fully literate to some degree. I chose this course with the purpose of helping these students or adults."*

A number of prospective teachers stated that their reason for selecting the R/W course was because they deemed it to be the basis of teaching Turkish language. On this issue M1 responded: *"My field is Teaching Turkish. That is to say, I will teach in secondary level state schools. Yet considering the sociological composition of Turkey in certain parts of our country, there still exist - though few - some students not knowing reading and writing even at secondary education level. As you would agree, there is no way to teach linguistic components or syntax to a person who doesn't know how to read or write. That is why I truly appreciate the integration of this course into the Turkish Teacher Training program and I strongly believe this course is a must for my field."* M2 commented: *"I selected the primary level R/W teaching course because I consider it to be directly or indirectly connected with my professional and social life. In Turkey, a number of students who have completed primary education and are now studying at secondary level may still struggle in reading and writing tasks. The basic discipline of Turkish teachers is language and its accurate use; that is why this course is a sine-qua-non for us."*

F10 explained that her choice of the course was based on peer recommendation and interest in the course: *"I heard about this course from my friends in Classroom Teaching. Based on my friends' recommendation and curiosity about the course content and implementation, I selected it."* M11 stated that; *"I selected it because I wanted to learn how make a person literate and which methods and techniques to use to that end."* His answer echoed the responses of previous participants.

M8 deviated from the previous comments and said: *"In fact, I selected it randomly with no specific purpose in mind. I had no idea about what it was exactly. But after taking the course, I was*

thankful for my choice.” This indicates he had no specific aim in selecting the course but felt grateful to have chosen it.

2. Views of prospective teachers on whether the Primary R/W course should be elective or compulsory

Findings about the opinions of prospective teachers on whether the Primary R/W course should remain as an elective course or be integrated into the compulsory course list were analyzed. 60% of prospective teachers reported that they were in favor of including it as a mandatory course. Some of their views are as below:

M1: *“I personally believe it should be compulsory. Because it is necessary to train Turkish teachers who don’t stumble when seeing secondary school students still not knowing how to read and write but who know which techniques to implement in the face of this problem.”* M4 said, *“It should be added to compulsory course list, because as prospective Turkish teachers, we may witness in our schools some students who are not fully competent in reading and writing. We should certainly all know what to do in such a situation. That is why I believe it must be compulsory.”* F1 expressed her views as such: *“Knowing that there may be even fifth graders unable to read and write, Turkish teachers are also expected to know how to teach Primary level Reading and Writing. That is why I believe it must be compulsory.”* With these statements, prospective teachers underlined that the knowledge and skills needed to help those not fully literate could only be offered to all Turkish Language teachers provided that this course is compulsory.

F4 argued that this course must be compulsory because the Primary R/W course is the starting point of Turkish education: *“I think it must be compulsory because this course is the very basis of our field.”* Similarly, F9 stated: *“It must be an obligatory course because primary reading and writing lays the foundation of the Turkish course itself and is very influential in learning Turkish.”*

In contrast, 40% of prospective teachers reported that this course should continue to be elective. Those voting to let this course remain optional claimed that priorities varied among the students. Below are the views of a number of students:

M3 said, *“It should stay as an elective course because every person has different fields of interest.”* F13 maintained that: *“It should stay as an elective course because no matter how important it is, it would be torture for those who did not want to take it at all. This course appeals to those students who can partake in several activities and can teach even elementary level learners. So, one should have the freedom of choice.”*

M2 prospective teacher reported that primary R/W activities should be performed by classroom teachers and that this course must continue to be an elective course; *“I believe the primary R/W course should continue to be an elective course for prospective teachers. I think like this because classroom teachers are the main providers of reading and writing instruction. Still, it does not mean that this course is less important for teachers of Turkish.”*

3. Views of prospective teachers on benefits from taking the primary R/W course

Analysis of the results related to the views of prospective teachers on the benefits to themselves of taking the R/W instructional course demonstrated that participants had a varied range of views. Accordingly, 60% of prospective teachers reported that it would enable them to teach reading and writing at various institutions and bodies including Education Centers for the public; 60% said the course would contribute significantly to their personal and professional development; 36% reported that it was useful because in the future they could help their own children in their first attempts at reading and writing, 28% believed that by taking this course they could act as classroom teachers if

needs be; 28% said that by remedying pupils' deficiencies they would then be able to instill in them the reading habit, and 12% argued that the literacy level in the community would increase.

Among the prospective teachers believing that they could teach R/W courses in state-run schools and organizations, foremost of which are evening courses or the like, M1 stated that: *"I believe that I can teach reading-writing courses in Public Education Centers or in various institutions and organizations."* F1 echoed the same conviction, saying: *"In my workplace, I can open literacy courses for adults who do not know how to read and write so I may be a successful educator."*

A considerable number of prospective teachers stated that the Primary R/W course would significantly contribute to their personal and professional development. Some prospective teachers shared their views such: *"By taking this course I will move one step ahead in my personal development."* (M2). Another said, *"Compared to other teachers, I will be able to pronounce letters more correctly."* (F2).

F1 suggested that taking the Primary R/W course would assist her when her own children learn reading and writing: *"It will be of help in the primary reading and writing process of my own child."* M2 said that: *"The course will be beneficial for my parental role in the future."* and F8 shared similar views; *"In the future, I may assist my kids in their reading and writing endeavors."*

Prospective teacher F1 reported that after taking the Primary R/W course she could also perform as a classroom teacher if need be and she continued: *"Maybe I will not be assigned officially. In that case I may work as a contract teacher and teach in secondary schools. Because I took the Primary R/W course I may be a better teacher in elementary classrooms as well."* F14 argued that: *"When we are officially assigned as teachers, we will encounter in our schools and region a lack of teachers and teaching materials. In our professional life, particularly in certain parts of the country, it is most likely that we will substitute for classroom teachers if necessary."*

A range of prospective teachers claimed that by taking the Primary R/W course they acquired advantages in correcting students' shortcomings and instill in them the reading habit: *"I may be of help to my students challenged with reading and writing problems for several reasons and I may be able to influence them so that they develop regular reading habits."* (F9). *"I could assist senior students still trying to cope with reading and writing problems."* (F3).

F1 stated that taking the Primary R/W course would be of great help in improving the reading and writing average of society; *"I hope to become a teacher who can contribute to increasing the literate population among my people."* F12 said; *"Everyone in society would thus know how to read and write."* F14 noted: *"If we can make the literacy level 100%, there would be an increase in professional esteem."*

4. Views of prospective teachers on materials used on the Primary R/W course

All of the prospective teachers partaking in the interviews agreed that material usage mattered greatly on the Primary R/W course and added that the more human senses these materials addressed, the greater the success would be. Regarding the same issue, M7 reported that: *"Sound-based audio materials should be employed because this course is based on feeling the sound and comprehension. Learning becomes more permanent once students hear the sound from a variety of different and fun materials. Audio books could be used, for instance."* M11 said: *"To help them feel the sounds, rhymes, tongue-twisters and songs could be used"*. This implies that since reading and writing in Turkey relies on the phoneme-based sentence method, audio materials are more useful than other materials.

F1 was among the prospective teachers testifying that in teaching reading and writing, the smart board plays a vital role; *"Absolutely, smart boards should be used because they support the teaching process audio-visually"*. F11 stated; *"To demonstrate visual materials in the classroom, a*

projector, computer and relevant technological tools must be used in schools.” implying that in addition to smart boards, the projector and computer also play an important role.

M3 and F12 particularly emphasized that in the Primary R/W course, the smart board is the most critical tool; “Special whiteboards with handwriting guide lines make reading and writing exercises easier and should be used in classes.” (M3); “Smart boards with guide lines for writing should absolutely be used because they are useful both for the teacher and students.” (F12)

Some of the prospective teachers said that in the Primary R/W course, educational games and drama activities are quite important. F2 emphasized the importance of such games and activities, saying: *“Educational games and drama can be performed to assist in teaching letters and sounds better.”* F5 claimed; *“In the primary R/W course, educational toys can be used in teaching. Toys would be entertaining and instructive for children.”* Other prospective teachers argued that on the course, a variety of audio-visual aids created from all sorts of materials could be used to attract the students’ attention and keep their interest alive. On this issue, F4 argued that: *“I believe colorful materials should be used to take children’s attention. Also, different materials should be used to appeal to each student’s learning domain. These materials can be technological devices, colored puppets, and any number of basic games. To practice writing; colored paper, string, cotton, sand, rice, lentils and similar materials could be used. However, moderation should be observed in using games and prepared materials to try and make the course more enjoyable. If the child forgets the course objectives and simply focuses on the extra materials supporting the course content, the child may forget about the essentials of the lesson.”* As argued by this participant, it is recommended that children engage in games and use extra materials in lessons but excessive use of distracting course materials could adversely affect the flow of the lesson.

5. Problems encountered by prospective teachers on the Primary R/W course

Interviews with prospective teachers manifested that 64% attending the Primary R/W course encountered certain problems. Based on their opinions, it is seen that some of the challenging factors of the Primary R/W course are: an unfavorable physical setting, insufficient course equipment, inadequate course hours, specific features of consonants, behavioral traits of students in class, constant changes in the officially-sanctioned writing style to be taught on the curriculum, and material design. Below are prospective teachers’ views on these adverse factors.

Unfavorable Physical Setting

Crowded classrooms could pave the way for certain issues in the lesson hour. Facing such a challenge, M1 reported that: *“Because a lot of students selected this course, our classroom was very crowded. When we were asked to practice in class, it was too noisy at times.”* F4 declared similarly: *“During practical activities I had a hard time due to the large number of students in the class.”*

Inadequate Equipment

F3 shared her problem related to malfunctioning or broken equipment: *“We had problems due to not finding or unsuitable equipment. Nowadays in almost all schools, technological devices are ubiquitous. The greater the variety of equipment we use, learning becomes not only more permanent but also more enjoyable for students. In our presentations, we didn’t want to limit ourselves to the materials we always used but also wanted to use technological apparatus, viz. smart board and projector, etc. Yet occasionally these gadgets didn’t work.”* F6 reported: *“This is not a problem directly stemming from the course, but occasionally, when the projector failed to work, there were interruptions.”* F11 said that: *“In the class there was no technological equipment so our presentations were not as we wanted them to be.”* M9 added: *“The board in our class was unsuitable for teaching reading and writing, so before any activity we had to draw the lines manually. We failed to draw*

perfect lines. Also, we lost a lot of time because we had to draw the lines repeatedly before each exercise." This reveals some of the problems associated with equipment in the classroom.

Inadequate Course Hours

A number of prospective teachers reported facing time-related problems. M2 expressed his views like this: *"The Primary Reading and Writing course is a three-hour course but still it wasn't enough."* F7 commented: *"Some of our friends worked diligently to make their presentations so their presentations lasted a bit longer. Since we did not have another lesson after this course, we could extend the lesson time for one or two hours sometimes. But if we had to attend another lesson after this course, we could not do that."*

Specific Features of Consonants

M8 attributed one of the problems to the specific features of consonants to be taught; *"I believe the biggest challenge is teaching consonants. When teaching consonants it may become hard to teach some of them because only the sounds are provided to the learners."* F9 stated: *"The biggest challenge for me was teaching the sounds r, s, f which are exceptionally difficult to pronounce."*

Constant Changes in Writing Format on Curriculum

F5 reported having problems because of the constant changes in the writing format issued for the Primary R/W course; *"A good number of people, including me, learnt to write with straight (manuscript) letters. Later, the authorities said cursive was better. However, now straight letters are used again in schools. When the script changes, the writing style of some letters is also transformed. Indeed, this is a significant matter of confusion. On this course, I was having a lot of difficulty deciding whether or not I wrote the letters correctly."*

Problems arising from the student composition of the course

According to some of the prospective teachers, several problems originated because the students in the class did not consist of elementary school first graders. From this viewpoint, F1 stated that; *"It really troubled me to teach my classmates something they already knew quite well and something really easy for us because of our age."* F14 said; *"After the theoretical part of the course, all students taught a sound for practice in the implementation stage. As our classmates taught the sounds, others behaved like elementary school students not knowing how to read or write. But in truth, because our friends are not elementary school students, it was difficult for us to teach them something they already knew."* Regarding a different problem, M4 said; *"Because we are university students, admittedly we hesitated to use some materials that our friends had already used in their presentations. Also, initially we found it fun to partake in the games, but later we all had a lot of fun together."*

Material Design

M3 reported that he had difficulty in selecting the material to use while making a presentation: *"Each week, four friends tried to teach the sound they were assigned. Those starting in the first week had some difficulties but each following week the presentations were more successful compared to the previous week. That is why the bar was raised even higher. As we were presenters during the last weeks, it was very hard to decide what to do differently and more successfully."* F12 reported that; *"In material design, it was particularly difficult to manage time."* This implies that she failed to manage time effectively regarding preparation of materials used in the presentation.

A total of 64% of prospective teachers admitted facing problems on the course while 36% stated they did not face any challenges. Among these students, M7 mentioned: *"We have so much fun*

in this lesson. I can't say I really had any problems." F10 said; *"I really love this course and so far I have not faced any challenges."*

6. Suggestions by prospective teachers to make the R/W teaching course more successful

Respondent prospective teachers were asked, "What can be done to make the Primary level R/W course more effective?" Accordingly, prospective teachers came up with some suggestions. These are itemized under the headings below.

Course hours

M2 and M6 suggested increasing the course time, which is one 3-hour session per week. They stated that; *"To enable us to conduct more practice, we need to increase the total course hours during the week."* (M2). *"I think every opportunity should be used to practice as much as one can. Total course time in a week could be increased so there would be more practice in the classroom."* (M6).

Practice with those who cannot read and write

Aside from theoretical knowledge and sample in-class activities on the course, a majority of prospective teachers shared their views on practical applications for those not able to read and write. M4 stated: *"In addition to the primary level R/W course, we may be given a chance to practice among first graders in elementary schools."* F2 reported: *"If we had a chance to teach reading and writing among actual first graders in schools, I believe this course could be even better. We may be given an opportunity to practice with first graders on certain days and lesson hours in elementary schools."*, emphasizing that practicing with first graders in primary/elementary schools would offer benefits.

M3 said, *"By bringing early learners of reading and writing to the course lessons, we might be asked to practice with them."*, suggesting the advantage of bringing first graders to the classroom. F14 suggested: *"This course could be even more versatile by bringing those who are really not yet literate to the lesson hours for actual teaching. Maybe it is difficult to bring elementary school children to this course; so instead, adults who did not know how to read or write could be invited."* Instead of elementary school students, illiterate adults could be taught in a real class atmosphere.

F10 stated that: *"This course should be given not only in one semester but in two. In the first semester it would be better to focus on teaching all topics related to reading and writing education. During the second semester, as a social responsibility project or similar, we might be asked to work in centers educating those not knowing how to read and write."* This underscores the need to put the knowledge acquired on the course into practice via social responsibility projects.

Classroom design and equipment

Insufficient equipment in classrooms impedes effective teaching in practice-based courses. On this issue, F3 stated that *"On the R/W course there is a special board for writing on and it is vital. Also, there should be special classrooms equipped with different kinds of materials useful for reading and writing activities."* F6 also responded: *"An effective course depends on physical conditions above all else. Currently, the conditions in our schools are not favorable because there is ongoing construction work so we are temporarily using the classrooms of a building not ours. As for this course, if we had a special writing board for teaching reading and writing and if we had a classroom equipped with all essential materials, the lesson would be even more effective."*

Benefitting from experience of Classroom Teachers

M1 suggested: "To make the course more effective, a classroom teacher employed in an elementary (primary) school could be invited to our lesson to share with us his experience on teaching reading and writing." F5 argued that: "This course should be taught in place and by actual practitioners. That is to say, we could visit elementary schools or elementary school teachers could be invited to our lesson. Extra insights from their presence and the experience they share could add versatility to the course." This response indicates that by inviting primary level classroom teachers to talk about R/W instruction, the course context would be enriched.

Observation in Primary-Elementary schools

Some prospective teachers taking the primary R/W course declared that by visiting elementary schools to observe the way that classroom teachers taught reading and writing, they would gain immense benefit. For example, M8 stated: *"We take this three-hour course during fall term so it coincides with the reading and writing activities of first graders. In addition to the knowledge we learn on our course, we could visit elementary schools to spend one or two hours for observation. We could personally observe the way reading and writing is taught to first graders."* F4 noted that: *"We didn't have a chance to witness R/W activities among pupils who had not yet learnt to read and write. If we had the opportunity to observe in real classrooms where R/W learning is being carried out, this course could be more effective."*

Smaller groups in the classroom

M5 pointed out that the number of students taking the R/W course was large so that it was necessary to divide them into smaller groups: *"Since the primary R/W course is basically practice-based, there may be a lot of noise during practice. To prevent that, students taking this course could be divided into smaller groups. The course lecturer may have to teach in different classrooms but I do believe this course would be more effective when there are fewer students in one class."*

Conclusion and Discussion

Findings of the interviews concluded that 44% of prospective Turkish Language teachers selected the Primary Level Reading and Writing course to gain benefits in their personal and professional development. Following this, the successive reasons were listed alternately as being helpful to students and adults not knowing how to read and write (24%), peer recommendation and personal curiosity (16%), and the course being the basis of Turkish Education itself (12%). 4% of prospective teachers reported that they had selected the course without any idea in their mind. The fact that most of the prospective teachers selected the course to benefit in their personal and professional development might be related to circumstances encountered particularly while teaching in rural areas where the literacy ratio is lower, and they wanted to be ready and equipped for possible difficulties.

Based on the collected data, 60% of prospective teachers believed that the R/W teaching course must be compulsory. This shows that prospective teachers valued the significance of this course.

Regarding the views of prospective teachers about the potential benefits they would gain from taking a Primary Level Reading and Writing Teaching course, it surfaced that all of the teachers gave positive feedback. Most of the teachers (60%) agreed that after taking this course they would be qualified to work in reading and writing centers of various institutions and establishments; Public Education Centers in particular. Based on decree E.3323631 concerning assigning instructors to Reading-Writing courses as part of a Literacy Campaign (issued by the Ministry of Education, Directorate of Lifelong Learning, 16.02.2018), in schools with no classroom teacher present, full-time

teachers of Turkish Language and Turkish Language and Literature would be appointed. Thus it is rational for prospective teachers to select the Primary Reading and Writing course.

Audio-visual and technology-supported materials play a critical role in any course. Based on the interviews, on the Primary level R/W course it is suggested that audio books, rhymes, and tongue-twisters that support the Phoneme-Based Sentence Method of teaching be employed and use should be made of technology-supported materials such as the smart board, projector and computer. Prospective teachers also reported that using a white board, educational games and toys, play dough, puppets, string, cotton, sand and relevant teaching materials is also crucial. This finding is in parallel with the sample materials suggested in Aksin's (2015) study "Using equipment and materials in primary reading and writing education".

Interviews with prospective teachers manifested that they found a number of factors challenging on their R/W course. These factors stemmed from inadequate physical setting and equipment, too few course hours, special features of consonants, producing lesson materials and the composition and characteristics of student groups in their class especially in regard to presentations. An identical finding is echoed in the study of Adıgüzel and Karacabey (2010) entitled "Problems encountered by classroom teachers in first reading and writing." Their study emphasized that overcrowded classrooms, insufficient teaching materials and suchlike affected Primary Reading and Writing Teaching adversely. Babayiğit and Erkuş (2017) in their research "Problems and suggested solutions in the literacy training process" attest to a similar finding. According to their research, in addition to challenges originating from the teacher, the pupils and parents, overcrowded classrooms, insufficient teaching and technological materials in classrooms also posed difficulties. In the analysis of Demir and Ersöz (2016, p. 19), "An evaluation of the difficulties classroom teachers experience while giving primary reading and writing education within the 4+4+4 education system", it was identified that classroom teachers faced difficulties due to insufficient educational materials, play areas, crowded classrooms, lack of classrooms, etc. It can thus be argued that the present study overlaps with the findings of three research studies mentioned above.

Suggestions

Based on the findings of current study, the following suggestions can be made:

1. "The Primary Level Reading and Writing Teaching course could be turned into an 'applied course' and practice could be performed in actual classroom settings" (Şahin, 2010, p. 1749).
2. By inviting senior classroom teachers to the course, their experience could be benefited by all.
3. Prospective teachers should be encouraged to partake in public service, social responsibility activities and similar projects for reading-writing practice to reach different target masses.
4. To ensure that courses are more effective; projectors, smart boards, computers and similar technological tools should be used in classrooms and be periodically maintained.
5. By designing Reading and Writing classrooms, a set of materials - special writing boards in the first place - and sand, cotton, colored paper, cardboard and crayons, play dough, and primary level reading and writing sets are essential materials that need to be readily available for use.
6. To conduct teaching practice freely, the total number of students in one classroom should not exceed 25.

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High School Students' Images of Physicists

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Abstract

The aim of this study is to reveal the high school students' images of physicists. Participants of this study consisted of 85 students in a high school in a province center on the East Black Sea Region of Turkey. The data were obtained by adapting the "Draw A Scientist Test" developed by Chambers (1983) and updated by Song & Kim (1999) to "Draw A Physicist Test". The obtained data were analyzed by content analysis. In this study, it was determined that most of the high school students described a scientist as male, 40-49 years old, wearing sports/daily clothes, wearing glasses, looking happy, working individually, and teaching in class. It was seen that students often drew or described scientists by thinking of their own physics teachers. For this reason, it is suggested that more activities with the topic of physicist should be included in the curricula, textbooks, and course contents in order to create a more accurate perception of physicist in high school students.

Keywords: High school students, physicist, image

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Introduction

As necessitated by the information age we live in, it is important to develop the scientific skills of each individual. In order for these skills to be developed, it is also necessary for students to look at the world from the eyes of scientists (Kaya, Doğan & Öcal, 2008). At this point, students' perceptions and attitudes towards scientists can encourage students to become scientists (Karaçam, 2016; Köseoğlu & Durukan, 2017). When the literature is examined, in recent years, many national and international studies have been carried out to determine the perceptions and mental images about scientists of participants at different levels of education (Ağgül-Yalçın, 2012; Barman, 1999; Buldu, 2006; Buluş-Kırıkkaya, Bozkurt & İşeri, 2011; Chambers, 1983; Eyceyurt-Türk & Tüzün, 2017; Farland-Smith, 2009; Finson, Beaver & Cramond, 1995; Finson, 2002; Fort & Varney, 1989; Fung, 2002; Güler & Akman, 2006; Karaçam, 2015; Karaçam, 2016; Mead & Metraux, 1957; Medina-Jerez, Middleton & Orihuela-Rabaza, 2011; Newton & Newton, 1992; She, 1995; Song & Kim, 1999; Turgut, Öztürk & Eş, 2017; Türkmen, 2008; Ürey, Karaçöp, Göksu & Çolak, 2017). The first attempt to identify the origins of the image of scientist is Mead and Metraux's (1957) study. Their findings summarized as in the following sentences: The scientist is a man who is elderly or middle aged, bald, wears white coat and glasses, works in the laboratory and does experiments, and has experimental equipments (test tubes, microscope, telescope, etc). In another study which identified the image of scientist, Chambers (1983) found out that the scientist in children's mind is generally a man who wears white coat and glasses, has beard or unshaven, uses computer, telescope or microscope, and has scientific instruments, different laboratory equipments and books. Likewise, many studies about the subject have shown that, apart from a few different findings, participants of these studies have similar images of scientists. In these studies, scientists have been described as man who is in his 30s, bald, wears a lab coat, works in a laboratory or an office does experimenting, thinking (Ağgül-Yalçın, 2012; Chambers, 1983; Eyceyurt-Türk & Tüzün, 2017; Finson, 2002; Song & Kim, 1999; Turgut, Öztürk & Eş, 2017; Türkmen, 2008; Ürey, et al., 2017). This definition has been accepted as stereotype scientist image (Chambers, 1983; Eyceyurt-Türk & Tüzün, 2017; Görece-Baybars, 2017; Song & Kim, 1999; Finson, 2002; Ağgül-Yalçın, 2012; Türkmen, 2008; Karaçam, 2016).

A considerable number of these studies in the literature have focused on identifying participants' perceptions of scientists using the "Draw A Scientist Test" developed by Chambers (1983) and updated by Song and Kim (1999). Some studies in the literature have adapted this test to their focus concepts or subjects. The adapted version of DAST to different concepts or subjects can be listed: 'Draw an engineer test' (Cunningham, Lachapelle & Lindgren-Streicher, 2005; Knight & Cunningham, 2004; Koyunlu-Ünlü & Dökme, 2017; Sungur-Gül & Marulcu, 2014), 'Draw a science teacher test' (Minogue, 2010; Thomas, Pederson & Finson, 2001), 'Draw an environment test' (Moseley, Desjean-Perrotta & Utley, 2010) and 'Draw a computer user test' (Brosnan, 1999). These adapted tests have been applied to primary school students (Brosnan, 1999; Knight & Cunningham, 2004; Cunningham, Lachapelle & Lindgren-Streicher, 2005), middle school students (Knight & Cunningham, 2004; Koyunlu-Ünlü & Dökme, 2017), high school students (Knight & Cunningham, 2004), pre-service preschool teachers (Moseley, Desjean-Perrotta & Utley, 2010), pre-service classroom teachers (Thomas, Pederson & Finson, 2001; Minogue, 2010), pre-service science teachers (Sungur-Gül & Marulcu, 2014), and in-service science teachers (Sungur-Gül & Marulcu, 2014).

Although several studies have been carried out to identify the participants' images of a scientist in the literature by using DAST, few studies have adopted the test into different concepts and used to identify the participants' images about it. It can be seen in the adopted versions of DAST that, physics, one of the science disciplines, has not been chosen as the focus concept. In this study, we chose the concept of physics and expected that the findings of this study can be enlighten the question for researchers; 'Why physics course is not liked and why it is considered difficult by students?'. The result of the national studies conducted on the attitudes of high school students towards the physics course revealed that the attitudes of high school students towards the physics course are neutral (Sezgin-Selçuk, Özkan & Demircioğlu, 2015) or negative (Kaya & Büyük, 2011) and the average attitude scores decrease as the grade level increases (Yiğit, Kurnaz & Şahinoğlu, 2015). It is also

known that students' perceptions and mental images of scientists have a significant influence on their attitudes towards science (Finson, 2002) and affect the students' career plans (Karaçam, 2016). The OECD report in 2017 indicated that, quite a few students selected science-related study fields in higher education (URL-1). Thus, it is important that students have positive images of scientists (Kaya, Doğan & Öcal, 2008). It is believed that identifying participants' images of scientist/physicist is a significant requirement in this context.

Method

This study was carried out according to the case study method, one of the qualitative research methods. It is thought that the holistic single case study which used to illuminate specific cases and carried out with a single analysis unit (an individual, a program, a school etc.) is appropriate for the nature of this study (Yıldırım & Şimşek, 2006).

Participants

The participants were chosen by convenience sampling, which is one of the purposive sampling methods. This sampling method gives speed and practicality to the research (Yıldırım & Şimşek, 2006). The participants consist of a total of 85 high school students who are studying in a high school in a province center on the East Black Sea Region of Turkey, who voluntarily participated in the study and completed the entire scale.

Data Collection Tool and Process

In this study conducted with the aim of revealing the images of high school students towards physicists, the "Draw A Scientist Test" developed by Chambers (1983) and updated by Song & Kim (1999) was adapted to "Draw A Physicist Test" (DAPT). No changes were made to the data collection tool, only the word of the "a scientist" was changed to "a physics scientist". Two experts (a science education and a physics education) opinions were received about the suitability of using the data collection tool.

As in the original test, a box was given to the students in DAPT so that they could draw the physicist in their imagination, and the students were asked descriptive questions regarding the gender, age, physical appearance, what it did, the environment it was in, and the characteristics of this physicist drawn in the box. In addition to these questions, they were asked to indicate by reason a physics they respected/admired. Finally, in order to identify the sources inspired by the students while drawing the physicists, the students were presented with options such as movies, cartoons, science journals, documentaries, student's family, or teachers.

In the data collection process, there was no time constraint, and students were left free to answer the DAPT easily. On average, the forms were filled in during 1 lesson (40 minutes).

Data Analysis

In the process of the controlling data, 85 students' forms were deemed to be valid and 12 students' forms were excluded from the study for various reasons (drawing-explanation is unrelated, drawing only). The obtained data were separately analyzed by content analysis and presented in tables with frequency and percentage values. The sum of percentile values can exceed 100% in some cases, as students indicated multiple opinions.

In the data analysis stage, both researchers examined the papers separately and made classifications. After this stage, the classifications with agreement were accepted, and the classifications with no agreement were reevaluated and categorized.

Findings

Findings related to the physicist images of high school students were presented in tables. The findings about the gender and age of physicists are shown in Table 1.

Table 1. Gender and age of physicists as imagined by high school students

| Gender | f | % | Age range | f | % |
|----------------------|----|-------|--------------|----|-------|
| Male | 66 | 77,65 | 20-29 | 26 | 30,59 |
| Female | 14 | 16,47 | 30-39 | 20 | 23,53 |
| Both male and female | 3 | 3,53 | 40-49 | 28 | 32,94 |
| Other (robot) | 1 | 1,18 | 50 and above | 6 | 7,06 |
| Unspecified | 1 | 1,18 | Unspecified | 5 | 5,88 |

It was determined that high school students thought that physicists were generally male (77,65%). It was seen that 16,47% of the students drew a female physicists, and the students drawing a female physicist were girls. 30,59% of high school students described physicists to be in the age range of 20-29, 23,53% in the age range of 30-39, and 32,94% in the age range of 40-49.



Figure 1. Gender of the physicist (S32, S44)

Example drawings of high school students' views of physicists in terms of gender and age range are presented in Figure 1. The findings of the physical characteristics of the physicist in the students' images are summarized in Table 2.

Table 2. Physical characteristics of the physicist as imagined by high school students

| Physical Characteristics | f | % |
|--------------------------|----------------|-------|
| Head region | Long hair | 24,71 |
| | Short hair | 28,24 |
| | Messy hair | 22,35 |
| | Groomed hair | 31,76 |
| | Steep hair | 14,12 |
| | Curly hair | 8,24 |
| | Bald (No hair) | 4,71 |
| | Sparse hair | 7,06 |
| | White hair | 5,88 |
| | Eurycephalic | 4,71 |
| | Unspecified | 5,88 |
| Face region | Moustached | 10,59 |
| | Bearded | 5,88 |
| | Whiskered | 1,18 |
| | Colored eyes | 8,24 |

| | | | |
|-------------------|---------------------|----|-------|
| | Brown eyed | 2 | 2,35 |
| | Large eyed | 18 | 21,18 |
| | Small eyed | 5 | 5,88 |
| | Small nose | 9 | 10,59 |
| | Large mouth | 3 | 3,53 |
| | Dimpled | 3 | 3,53 |
| | Unspecified | 30 | 35,29 |
| Facial expression | Happy | 55 | 64,71 |
| | Thoughtful | 5 | 5,88 |
| | Crazy | 4 | 4,71 |
| | Unspecified | 21 | 24,71 |
| Clothes | Lab coat | 6 | 7,06 |
| | Suit | 19 | 22,35 |
| | Casual/daily outfit | 21 | 24,71 |
| | Unspecified | 39 | 45,88 |
| Accessory | Glasses | 24 | 28,24 |
| | Necklace | 2 | 2,35 |
| | Belt | 7 | 8,24 |
| | Tie | 8 | 9,41 |
| | Bow tie | 1 | 1,18 |
| | Pocket handkerchief | 1 | 1,18 |
| | Rosette | 1 | 1,18 |
| | Cloak | 1 | 1,18 |
| Height | Unspecified | 46 | 54,12 |
| | Tall height | 18 | 21,18 |
| | Medium height | 7 | 8,24 |
| | Short height | 2 | 2,35 |
| | Unspecified | 58 | 68,24 |
| Body structure | Fat | 14 | 16,47 |
| | Normal weight | 33 | 38,82 |
| | Thin | 16 | 18,82 |
| | Unspecified | 22 | 25,88 |

The students portrayed physicists with different hair styles (long hair 24,71%, short hair 28,24%, messy hair 22,35%, groomed hair 31,76%), while only 4,71% of the students pictured the physicist as bald. Furthermore, the students portrayed physicists with moustached (10,59%), with colored eyes (8,24%), with large eyes (21,18%), with a small nose (10,59%), and with a large mouth (3,53%). Most students portrayed physicists with a happy facial expression (64,71%). In addition, physicists were portrayed with casual/daily outfit (24,71%) or suit (22,35%), wearing glasses as an accessory (28,24%). 18% of the students portrayed the physicist as a tall person, while 33% portrayed it as a normal weight individual.

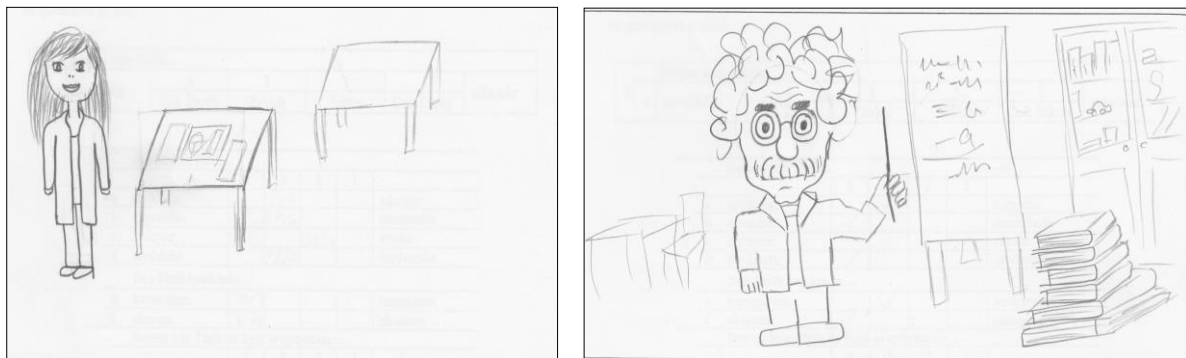


Figure 2. Physical characteristics of physicists (S62, S76)

Example drawings of high school students' views of physicists in terms of physical characteristics and features are presented in Figure 2. The findings on the type of work and work environment of the physicist in the students' images are summarized in Table 3.

Table 3. Working type and working environment of physicists as imagined by high school students

| | | f | % | |
|---|------------|-----------------------|-------|-------|
| Working type | Individual | 84 | 98,82 | |
| | Group | 1 | 1,18 | |
| Working Environment | Indoor | Classroom | 39 | 45,88 |
| | | Laboratory | 14 | 16,47 |
| | | Study / research room | 5 | 5,88 |
| | | Non-gravity room | 1 | 1,18 |
| | Outdoor | Garden/Nature | 4 | 4,71 |
| | | Space | 1 | 1,18 |
| Others (such as soccer field, house, pool, highway) | | 9 | 10,59 | |
| Unspecified | | 12 | 14,12 | |

In Table 3, it can be seen that students described the working type of physicists as individual (98,82%), and the working environment generally as an indoor such as classroom (45,88%), or laboratory (16,47%).

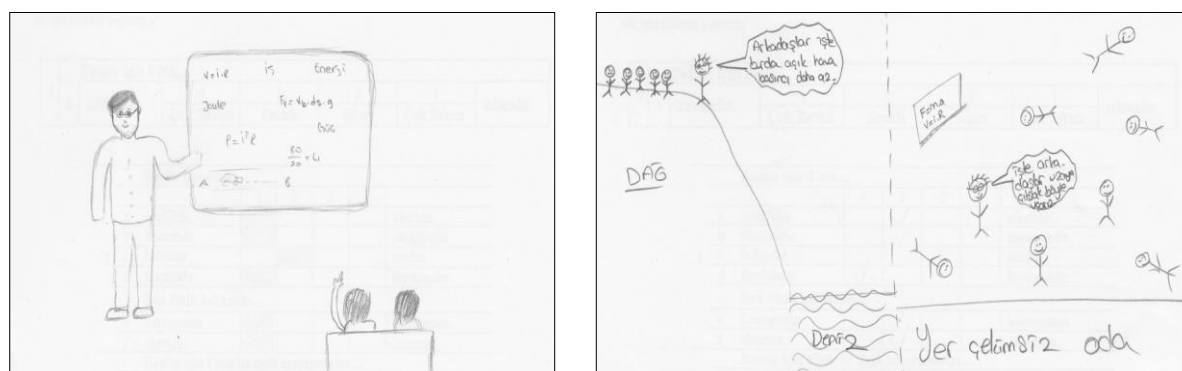


Figure 3. Working environment of physicists (S28, S57)

Example drawings of high school students' views of physicists in terms of working type and working environment are presented in Figure 3. The findings on the type of tools used by the physicist in the students' images are summarized in Table 4.

Table 4. Tools used by physicists as imagined by high school students

| Tools and Supplies | f | % |
|------------------------|---|------|
| Smart board | 6 | 7,06 |
| Key | 1 | 1,18 |
| Car | 1 | 1,18 |
| Book | 1 | 1,18 |
| Test tube | 5 | 5,88 |
| The experimental setup | 3 | 3,53 |
| Closet | 2 | 2,35 |
| Dynamometer | 1 | 1,18 |
| Electric tools | 2 | 2,35 |
| Electroscope | 1 | 1,18 |
| solar panel | 1 | 1,18 |
| Cable | 3 | 3,53 |
| Pen | 2 | 2,35 |

| | | |
|---------------|----|-------|
| Book | 4 | 4,71 |
| Mass set | 1 | 1,18 |
| Lamps / bulbs | 2 | 2,35 |
| Table | 16 | 18,82 |
| Lens | 1 | 1,18 |
| Compass | 1 | 1,18 |
| Scales | 1 | 1,18 |
| Board | 27 | 31,76 |
| Other (ball) | 2 | 2,35 |
| Unspecified | 39 | 45,88 |

Students often specified a board (31,76%), table (18,82%), smart board (7,06%), test tube (5,88%), and books (4,71%) as the tools and supplies used by the physicist.

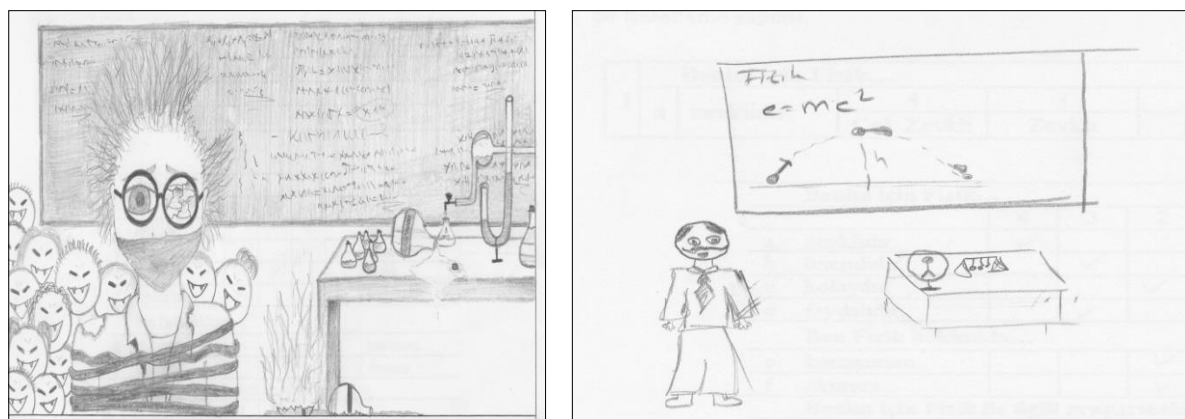


Figure 4. The tools and supplies used by physicists (S1, S51)

Example drawings of high school students' views of physicists in terms of the tools and supplies used by physicists are presented in Figure 4. The findings on the information symbols used by the physicist in the students' images are summarized in Table5.

Table 5. Information symbols used in students' drawings

| Information Symbols | f | % |
|---------------------|----|-------|
| Formulae | 16 | 18,82 |
| Symbol | 7 | 8,24 |
| Shape | 3 | 3,53 |
| Model | 2 | 2,35 |
| Unit | 1 | 1,18 |
| Table / schema | 1 | 1,18 |
| Unspecified | 61 | 71,76 |

Information symbols used by students in the physicist drawings can be listed as formulae (18,82%), symbols (8,24%), shapes (3,53%) and models (2,35%).

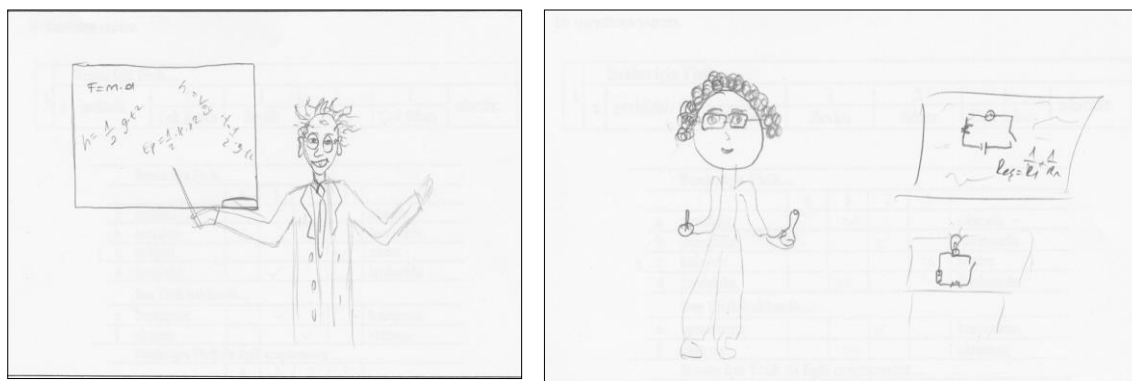


Figure 5.Information symbols used in students' drawings (S10, S27)

Example drawings of high school students' views of physicists in terms of the information symbols found in the drawings are presented in Figure 5. The findings on the professional and personal characteristics of physicists in the students' images are summarized in Table 6 -7.

Table 6. Professional characteristics of the physicist in the images

| Professional Characteristics | f | % |
|---|----|-------|
| Giving a lecture | 35 | 41,18 |
| Making an experiment | 20 | 23,53 |
| Being proficient in physics topics | 11 | 12,94 |
| Being able to do everything | 11 | 12,94 |
| Teaching | 10 | 11,76 |
| Producing new things (car, machine, robot, etc.) | 8 | 9,41 |
| Researching | 7 | 8,24 |
| Inventing | 6 | 7,06 |
| Being able to do engineering | 6 | 7,06 |
| Reading the book | 2 | 2,35 |
| Being an academician | 2 | 2,35 |
| Endearing physics to people | 2 | 2,35 |
| Being interesting in physics | 2 | 2,35 |
| Producing original ideas | 2 | 2,35 |
| Fixing | 2 | 2,35 |
| Making projects | 2 | 2,35 |
| Making the circuit with electric cables | 2 | 2,35 |
| Using formulas | 1 | 1,18 |
| Correlating events in life with physics | 1 | 1,18 |
| Describing matters in an understandable way | 1 | 1,18 |
| Repeating the issues without getting bored | 1 | 1,18 |
| Giving a reasonable explanation for the problems | 1 | 1,18 |
| Producing solutions to problems | 1 | 1,18 |
| Benefiting from the videos in the lecture | 1 | 1,18 |
| Attracting students' attention | 1 | 1,18 |
| Thinking about the laws of physics (form his theory, prove it, make laws) | 1 | 1,18 |
| Contributing to the development of science and technology | 1 | 1,18 |
| Doing all the plumbing in the house | 1 | 1,18 |
| Unspecified | 2 | 2,35 |

The students listed the professional characteristics of a physicist as giving a lecture (41,18%), making an experiment (23,53%), being proficient in physics topics (12,94%), being able to do everything (12,94%), teaching (11,76%) and producing new things (9,41%).

Table 7. Personal characteristics of the physicist in the images

| Personal Characteristics | f | % |
|--------------------------|----|-------|
| Cheerful | 11 | 12,94 |
| Intelligent | 11 | 12,94 |
| Enjoyable | 8 | 9,41 |
| Sympathetic | 8 | 9,41 |
| Good person | 6 | 7,06 |
| Understanding | 5 | 5,88 |
| Funny | 3 | 3,53 |
| Crazy | 3 | 3,53 |
| Reading a lot of books | 2 | 2,35 |
| Serious | 2 | 2,35 |
| Patient | 2 | 2,35 |
| Permissive | 2 | 2,35 |
| Loving students | 1 | 1,18 |
| Curious | 1 | 1,18 |
| Quiet | 1 | 1,18 |
| Tired | 1 | 1,18 |
| Hard tempered | 1 | 1,18 |
| Polite | 1 | 1,18 |
| Determined | 1 | 1,18 |

The personal characteristics of a physicist were listed as cheerful (12,94%), intelligent (12,94%), enjoyable (9,41%), sympathetic (9,41%), good person (7,06%) and understanding (5,88%). Findings related to the physicists admired by high school students and the reasons of their admiration are presented in Table 8.

Table 8. Physicists admired by high school students and reasons of admiration

| Physicists | Admired by | Reasons of Admiration | f | % |
|---|------------|--|----|-------|
| Students | | | | |
| Their own physics teacher (f=38, %45,88) | | Being able to teach well | 12 | 30,77 |
| | | Being a good person | 6 | 15,38 |
| | | Making the students like the course | 6 | 15,38 |
| | | Being very intelligent | 6 | 15,38 |
| | | Not recognizing anyone other than their own physics teacher | 2 | 5,13 |
| | | Being able to teach fun | 2 | 5,13 |
| | | Being patient | 2 | 5,13 |
| | | Teaching the course in different ways | 1 | 2,56 |
| | | Graduated from a good college | 1 | 2,56 |
| | | Teaching by doing experiment | 1 | 2,56 |
| Albert Einstein (f=25, %29,41) | | Being very intelligent | 8 | 32 |
| | | Standing against memorization | 4 | 16 |
| | | Personal life | 2 | 8 |
| | | Personality that makes fun of everything | 1 | 4 |
| | | The image in the photographs is beautiful | 1 | 4 |
| | | Perseverance of working | 1 | 4 |
| | | Producing good/useful things for humanity | 1 | 4 |
| | | Unspecified | 7 | 28 |
| Newton (f=6, %7,06) | | Contributing to the physics | 3 | 50 |
| | | He is the only famous physicist that he/she knows | 2 | 33,33 |
| | | Being very intelligent | 1 | 16,67 |
| | | Continuing the researches with care and interest despite all the obstacles | 2 | 66,67 |

| | | | |
|---------------------------------|--|---|-------|
| Stephan Hawking (f=3, %3,53) | Continuing the researches with care and interest despite all the obstacles | 2 | 66,67 |
| | Unspecified | 1 | 33,33 |
| His/her father (f=2, %2,35) | Being his/her father | 1 | 50 |
| | Unspecified | 1 | 50 |
| Walter Lewin (f=2, %2,35) | Doing experiments in lecture | 1 | 50 |
| | Unspecified | 1 | 50 |
| Edison (f=1, %1,18) | Perseverance, never giving up | 1 | 100 |
| Richard Dawkins (f=1, %1,18) | What his made | 1 | 100 |
| Tesla (f=1, %1,18) | Being a genius | 1 | 100 |
| Unspecified (f=4, %4,7) | | | |

The physicists most admired by students are their own physics teachers (45,88%). Among the reasons for this selection are being able to teach well (30,77%), being a good person (15,38%), making the students like the course (15,38%) and being very intelligent (15,38%). Among the admired physicists, Einstein ranks second (29,41%). Students admired Einstein for reasons such being very intelligent (32%), standing against memorization (16%) and personal life (8%). Newton, Hawking, Lewin, Edison, Dawkins and Tesla are also among the physicists admired by a small number of students. It is also seen that being very intelligent constitutes a significant part of the reasons why students admire physicists. The sources that inspire students while they draw the physicists in their images are listed in Table 9.

Table 9. Sources that inspire students while they draw the physicists in their image

| Sources that Inspire Students | f | % |
|--|----|-------|
| Physicists themselves | 26 | 30,59 |
| Movies | 24 | 28,24 |
| Their teachers | 21 | 24,71 |
| The Internet | 15 | 17,65 |
| Caricatures | 15 | 17,65 |
| Science magazines | 8 | 9,41 |
| Textbooks | 8 | 9,41 |
| TV programs (Techno HD, Doctor Who, back garden science) | 6 | 7,06 |
| Cartoons | 6 | 7,06 |
| Their family | 4 | 4,71 |
| Documentaries | 4 | 4,71 |
| Newspapers | 3 | 3,53 |
| Science fiction books | 2 | 2,35 |
| Other (football match, education system, imagination) | 11 | 12,94 |
| Unspecified | 8 | 9,41 |

The sources that students are inspired by the most while drawing the physicist in their image were the physicists themselves (30,59%), movies (28,24%), their teachers (24,71%), the Internet (17,65%) and caricatures (17,65%).

Discussion, Conclusion and Suggestion

In this study conducted with the aim of determining the physicist image of high school students, the drawings and responses to the open-ended questions were evaluated in terms of “gender”, “age”, “physical characteristics”, “working type and environment”, “tools and supplies used”, “information symbols used”, “professional and personal characteristics”, “admired physicists and reasons of admiration” and “inspired sources”.

Most students (77,65%) in this study depicted a male physicist. Many studies in the literature have found that participants mostly describe scientists as men (Ağgöl-Yalçın, 2012; Akçay, 2011; Ayvaci, Atik & Ürey, 2016; Chambers, 1983; Deniz-Çeliker & Erduran-Avcı, 2015; Finson, 2002; Görecek-Baybars, 2017; Kara & Akarsu, 2013; Nuhoglu & Afacan, 2011; Özkan, Özeke, Güler & Şenocak, 2017; Song & Kim, 1999; Türkmen, 2008; Ürey, et al., 2017; Yontar-Toğrol, 2000). In this study, it was seen that the students drawing a female physicist were girls. In general, it was seen that male students tend to draw male scientists and female students tend to draw female scientists (Chambers, 1983). Similarly, in most studies, it is found that female scientist drawings are made by female students (Ağgöl-Yalçın, 2012; Kara & Akarsu, 2013; Kibar-Kavak 2008; Korkmaz & Kavak, 2010; Özkan, Özeke, Güler & Şenocak, 2017). This shows that the idea of female physicists is still not adequately settled in minds. This is also supported by the fact that the physicists admired by the students are male physicists (i.e., Einstein, Newton). It is thought that textbooks, which are the source of inspiration for students, also play a role in the emergence of this result. Karaçam, Aydın and Digilli (2014) indicate that the majority of scientists included in the textbooks are images of stereotypical scientists of European origin, male, from the middle ages, or ancient Greece. Similarly, Köseoğlu and Durukan (2017) found that all of the scientists included in science textbooks were male. Based on these results, it is believed that contents related to scientists should be increased in textbooks by giving more emphasis to female scientists.

In this study, it was determined that most of the high school students described a physicist as 40-49 years old (32,94%), wearing sports/daily clothes (24,71%) or a suit (22,35%), looking happy (64,71%), teaching in class (41,18%), with short hair (28,24%), with groomed hair (31,76%), and with a moustache (10,59%). In the study of Kara and Akarsu (2013), it was determined that according to secondary school students, scientists are usually perceived as people wearing lab-coats and glasses, with a beard, and as people who are constantly finding new knowledge and therefore perceived as happy. Arslan and Savaş (2017)'s study revealed that, secondary school describe the social scientists as happy, having short haired and wearing glasses, studying in office or in nature and using research symbols such as paper, book, pencil and shovel and anchor in their drawings. Turgut, Öztürk and Eş (2017) found that the secondary school students often describe scientists with wearing lab-coats, glasses and laboratory materials, and think the scientists are producing information by working in the laboratory. Also, this image of physicist can be attributed to the fact that students imagine the images of Einstein in their minds as a physicist, seen in movies, in the Internet, or in textbooks (Ayvaci, Atik & Ürey, 2016). This is supported by the fact that 29,41% of the high school students indicate Einstein as a physicist they admire, and the sources they are inspired by in their drawings are movies (28,24%), internet and caricatures (17,65%). In other words, it can be said that students develop images of scientists based on media organs such as Internet, newspapers, movies and cartoons (Ağgöl-Yalçın, 2012; Kara, 2013; Kibar-Kavak, 2008; Özkan, Özeke, Güler & Şenocak, 2017). In the study of Özkan, Özeke, Güler and Şenocak (2017), it was seen that the scientist image in the drawings of university students was mostly the instructors in their departments, while Einstein, Newton and Edison were the most frequent scientists in the drawings of some students.

In the drawings of high school students, physicists are mostly depicted as working individually (98,82%). Similarly, it has been determined in various studies that participants think that scientists work alone (Ayvaci, Atik & Ürey, 2016; Deniz-Çeliker & Erduran-Avcı, 2015; Özkan, Özeke, Güler & Şenocak, 2017). The students in this study drew a physicist in the classroom (45,88%), in the laboratory (16,47%), and in the study/research room (5,88%). In the literature, it has been found that scientists are generally thought to be working in indoor areas such as a laboratory or their own study/research room (Ağgöl-Yalçın, 2012; Ayvaci, Atik & Ürey, 2016; Chambers, 1983; Eyceyurt-Türk & Tüzün, 2017; Görecek-Baybars, 2017; Finson, 2002; Özkan, Özeke, Güler & Şenocak, 2017; Song & Kim, 1999; Turgut, Öztürk & Eş, 2017; Türkmen, 2008). Akçay (2011) have found that students perceive scientists as people who work in indoor. In the study conducted by Deniz-Çeliker and Erduran-Avcı (2015), it was observed that the number of laboratory drawings were very high in primary school students in the pre-test, however, after the scientific activities they participated in, an increase in the drawings of multiple working environments (drawings with both indoor and outdoor environments) was observed in the post-test. The students' perception that scientists produce

the knowledge only indoor areas such as in a laboratory can be changed with the scientific activities of out-of school environments.

A striking result in this study is that 45,88% of the students indicated a classroom as the work environment of a physicist, and specified objects such as board, table, smart board, book as tools and supplies used by physicists and emphasized lecturing (41,18%) among the professional characteristics of a physicist. This situation has been interpreted as the fact that the students regard their physics teachers as a physicist, and this leads to the conclusion that the teachers are influential on students' images of physicists. This is supported by the fact that in cases where students indicate that they admire their own physics teachers as a physicist (45,88%), they mostly try to draw their own physics teachers. Another finding that supports this situation is that students see their teachers as a source of inspiration in the drawings they make about the image of a physicist (24,71%). The studies in the literature show that teachers are one of the factors influencing the image of scientists (Ağgöl-Yalçın, 2012; Türkmen, 2008). At this point, it is thought that as a role model, it is necessary for teachers to encourage their students towards science, and to enable their students to access information like a scientist in terms of their course contents.

The sources that students are inspired by while they draw a physicist were listed as physicists themselves, movies, their teachers, Internet, cartoon, science journals and textbooks. The studies in the literature have shown that the scientist images are influenced by textbooks, teachers, extra-curricular activities, cartoons, science fiction books, the Internet, scientists' life stories, and science journals (Ağgöl-Yalçın, 2012; Buldu, 2006; Buluş-Kırıkkaya, Bozkurt & İşeri, 2011; Güler & Akman, 2006; Türkmen, 2008; Karaçam, Aydın & Digilli, 2014). For this reason, it is recommended that written materials such as textbooks and science journals should be prepared in a way that contributes to the scientist image of students (She, 1995) and that positive features of scientists should be emphasized (Türkmen, 2008; Ağgöl-Yalçın, 2012). Scientists who work in different fields, their work and life stories should be included more in visual materials such as movies and cartoons, and written materials such as textbooks and science journals (Ağgöl-Yalçın, 2012; Finson, 2002; Karaçam, 2016; Köseoğlu & Durukan, 2017).

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Preservice Mathematics Teachers' Perceptions about Visually Impaired Persons*

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Abstract

The aim of this study is to determine what perceptions preservice mathematics teachers have about visually impaired persons and their environments. Seventy volunteer preservice mathematics teachers participated in the study. In this qualitative research, data were obtained through semi-structured interviews and “Draw a Visually Impaired Person and his/her Environment-DAVIPE” test. The results showed that perceptions of preservice mathematics teachers on visually impaired persons are in five different categories as outdoor environment, indoor environment, abstract environment, dark environment and aid-available environment. Besides, it was also determined that perceptions of preservice mathematics teachers on visually impaired persons have six different sources such as physical, emotional, sensorial, environmental, educational and mental. According to this, visually impaired persons are generally the people who can move freely with white canes, wear glasses, are happy, have improved auditory and tactual senses, and have easy lives with proper environmental arrangements, however, suffer from difficulties from insensitivities of other people, for whom accessible educational environments should be provided, and who have a rich dream world.

Keywords: visually impaired person, preservice mathematics teacher, perception, equity in education

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* The word “persons” is used to focus on a specific society.

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Introduction

Six basic principles for a qualified mathematics education were introduced in reform movements, which were started by the American National Council of Teachers of Mathematics [NCTM] in 1989 and have reached today: Equity, teaching program, teaching, learning, evaluation and technology. One of these, equity in education has increasingly become a common concern for practitioners and policy makers in the World (Herrera, Jones, & Rantala, 2006:7). Thus, the importance of education for every person is emphasized with some documents such as *Individuals with Disabilities Education Act* (IDEA, 2007) which were signed as The Education for All Handicapped Children Act in 1975 and were organized a few time, *Salamanca Statement* (UNESCO, 1994), *Principles and Standards for School Mathematics* (NCTM, 2000) and *No Children Left Behind Act* [NCLB] (2001). Today many students are struggling with mathematics and fail over and over again (PISA, 2015; TIMSS, 2016), and so, the importance of teachers and their teaching approaches and concern for equity, cannot be ignored. However, an equitable teaching is much more than providing students with an equal opportunity to learn mathematics. That is to say, it is not enough to take same mathematics course, do same homework and use same evaluation devices, because equal teaching means to encourage teachers to behave all students fair and objective with regarding the information obtained for students from different sources (Van De Walle, Karp & Bay-Williams, 2012). It can be guessed that impaired students may have to cope with more difficulties than even from students without any impairment. Therefore, the most possible large level, least restrictive environment, free of charge and proper education must be provided for impaired students (IDEA, 2007). Besides, whatever their personal characteristics, previous experiences or physical difficulties, all students must find opportunities to receive mathematics education and learn mathematics (NCTM, 2000:12).

Many countries such as Australia, Canada and USA support impaired persons' education through regulations and state policies and there are also detailed regulations for impaired persons' education in Turkey as well. *Basic National Education Act* (with number 1739) and *Special Education Services Regulation* are the most important ones. 37th article of *Regulation of special education services* (MEB, 2006) indicates the following:

"It is necessary that individuals who need special education should continue their education among their peers without disability through inclusive education; however, formal and non-formal educational schools and institutions at all types and levels are opened by the Ministry for these individuals".

Besides, *Basic National Education Act* (with number 1739) indicates that all children have right to have education regardless of their disabilities. Visual impairment is one of the disabilities that individuals may face.

Visual impairment is defined in two different views as legal and educational. The legal definition is used by medical staffs to determine whether a Visually Impaired Person (VIP)³ can benefit from legal opportunities. According to this, blinds (total visually impaired) are persons with 20/200 or less visual acuity after all treatments and whose visual field is not more than twenty-degree angle. Moreover, partially sighted are persons with 20/70 and 20/200 visual acuity after all treatments (Howard, Williams & Lepper, 2010/2011:370). Most of the persons defined as legally blind can benefit from sight residual (without light perception, sensing light and shadow or counting fingers from 1 meter at most and sensing some colors). For that reason, first educational definitions are needed to show which sensory channel is used. From education point of view, a blind is a person with high degree visual acuity loss, and who learn through touching, i.e. using Braille alphabet, hearing and listening to talking books (MEB, 2008; Özyürek, 1995). In addition, partially sighted persons are individuals who can read written materials in normal or bigger font sizes with the help of glasses and magnifiers and besides, who need some environmental arrangements such as lighting, contrast

³ The author wants to emphasize that visually impaired person is a Very Important Person

(Özyürek, 1995). All these definitions show that VIPs belong to a heterogenic group differing from each other according to some characteristics such as functional vision, socio-economic situation, cultural background, the age virtual impairment occurred, existence of other disabilities and cognitive capability (Gürsel, 2013).

VIPs cannot benefit from their visual senses, and so they are disadvantaged because they have to learn concepts only by hearing, touching etc. As a matter of fact, visual impairment affects a person's development in other areas somehow and generally all dimensions of development are negatively affected by disabilities (Brian & Haegele, 2014; Lieberman, Houston-Wilson & Kozub, 2002). While mental functions of most of them are normal, their cognitive, social and language skills are negatively affected as they cannot receive and understand any visual information from their environment (Kizar, 2012). For that reason, they may face serious problems especially about area and space concepts. Even smiling for some VIPs cannot develop by itself like social reflections of sighted persons (Vaughn, Bos & Schumn, 2003). Therefore, VIPs can experience difficulties such as spending less time with their peers (Gürsel, 2013: 226), not feeling as a part of the society and feeling lonely (Çarkç1, 2011:47, İkizoğlu, 2005). It is a known fact that in Turkey, visually impaired males can go out by themselves, but visually impaired females cannot because of physical and sexual violence (Arslan, Şahin, Gülnar & Şahbudak, 2014). Another difficulty is that VIPs may have difficulty in defining burnt smell and a crash voice with just looking at their origins and so they cannot act accordingly (Gürsel, 2013:225). VIPs can use the reflection of a voice through their hearing ability and know the distance and direction of the object; however, it may not be possible for them to know what the object is without touching it or asking information from other persons with direct experience (MEGEP, 2013:13). On the other hand, all concepts cannot be learned through touching and hearing. Especially abstract objects are difficult to learn for VIPs. Visual impairment which causes so many difficulties in learning-teaching process is a less-probable disability in comparison with other disabilities and its generality differs according to adopted definitions and ages. According to World Health Organization (WHO, 2017), there are 253 million people with visual impairment all over the world. Thirty-six million of these people are totally blind while 217 million have low vision. In Turkey, information for VIPs is given in accordance with *Survey on Problems and Expectations of Disabled People* performed by Turkish Statistics Institution (TUIK, 2010). According to this, 8.4% of 280014 impaired persons who have at least 20% disability ratio in their health reports, live in Turkish Republic and are registered in National Disability Data Base have visual impairment. Besides, 32.1% of VIPs are illiterate, 11.8% are literate without a diploma, 29% are primary school graduates, 12.5% have primary education/secondary school and equivalent education and 14.6% are high school and over graduates. These numbers may show that necessary attention is not paid to educate all VIPs. This may also be interpreted as that there are some gaps between the laws and applications on education of persons with special needs. One of the main reasons of this is the teacher factor (Allinder, 1994).

Teachers are the most important components of learning-teaching process since they configure learning-teaching process and they are responsible to prepare a rich learning environment for their students. Shulman (1986, 1987) emphasizes the basic knowledges a teacher should possess in his works. Shulman (1987) divided these basic knowledges into content knowledge, general pedagogic knowledge, educational program knowledge, pedagogic field knowledge, education system knowledge, educational targets, values, history and philosophy basic knowledge and students' characteristics knowledge. Although these are all important, teachers must determine the individual differences of their students and find out the needs of their students according to these differences. In accordance with this, in the scope of *General Proficiencies of Teaching Professional* published by Ministry of National Education (MEB, 2017) in Turkey, teachers should have some proficiency related to students' characteristics. According to this, teachers should associate the information about students' development and learning characteristics with teaching processes, prepare flexible teaching plans in accordance with their socio-cultural characteristics and individual differences of the students and construct teaching environments. Thus, teachers may apply equitable teaching approach to make their students with different characteristics reach the same target (Boaler & Staples, 2008). However, the mathematics uses so many drawings, graphs, diagrams, symbols, charts, and other illustrations to present content and relationships, these have been particularly challenging for VIP, and difficult for

many special education teachers who are unfamiliar with the content (Rule, Stefanich, Boody & Peiffer, 2011). Nevertheless, the achievement of VIP is directly affected by their teachers' teaching ability. Indeed, teachers of these students are not specially educated in this field in Turkey like in some other countries, they often have to use the "trial and error" method to find the best way of teaching as Kohanová (2008) referred. Besides, in schools for visually impaired and inclusive schools where the author made applications for her doctorate dissertation, she observed that VIPs could not have enough mathematics education (Horzum, 2013). Research shows that if the instruction is tailored to individual needs, any students can reach his/her cognitive potential in this process (Pritchard & Lamb, 2012; Spindler, 2006), because visual images and memories of VIP have astonishingly remarkable capacity (Bülbül, 2016; Haber, Haber, Levin, & Hollyfield, 1993; Kennedy, 1993; Landau, Gleitman, & Spelke, 1981; Landau, Spelke & Gleitman, 1984; Millar, 1985). In order to achieve this and design an appropriate learning environment for VIPs, it is important to determine the teachers' knowledge and perceptions as precondition which can affect the practice, because perceptions affect teaching approaches of teachers and how they handle the subjects (Hofer & Pintrich, 1997). In other words, mathematics teachers' perceptions may play either a facilitating or an inhibiting role in translating curriculum guidelines into the complex and daily reality of classroom teaching (Haynes, 1996). For that reason, determining the perceptions of preservice teachers who may teach mathematics to VIPs in future may give important clues about what kind of contents should be in undergraduate education (Johnson, 2001).

Perceptions are revealed in two ways, qualitative (e.g., interview) or quantitative (e.g., survey) techniques (Witcher, Onwuegbuzie & Minor, 2001). One of the qualitative techniques is drawings. Although drawings are limited with the abilities of individuals, especially children's skills to express themselves through pictures encourage researchers to use drawings as data collection tool (Mavers, 2003: 20). Vygotsky (1978) suggests that drawing is a pictorial language, allowing individual to find concrete visual means of representing their thoughts, much like its own form of speech. Considering the phrase "A picture is worth a thousand words", it can be thought that the findings obtained through the pictures show important indicators for researchers. Thus, many researchers have used the pictures obtained from drawings in their investigations (Akerson, 2016; Alerby, 2015; Burkitt, 2017; Burns-Nader, 2017; Hamama & Ronen, 2009; Hansen et al., 2017; Harrower, Thomas, Altman, 1975; Hertting & Alerby, 2009; Lev-Wiesel & Yosipov-Kaziav, 2005; Regev & Ronen, 2012; Tortop, Kandemir, Kaya & Demir, 2015; Villanen & Jonsson, 2013). After children's drawings, adults' drawings are also used (Akerson, 2016; Harrower et al., 1975; Lev-Wiesel & Yosipov-Kaziav, 2005; Regev & Ronen, 2012; Tortop et al., 2015). One of the most common techniques is *Drawing Human Figure*, and another one is drawings including environments (Akerson, 2016; Chambers, 1983; Hansen et al., 2017; Harrower et al., 1975; Lev-Wiesel & Yosipov-Kaziav, 2005; Mays et al., 2011; Regev & Ronen, 2012; Tortop et al., 2015; Villanen & Jonsson, 2013). In literature, preservice primary school teachers' perception about mathematics (Akerson, 2016), students' perception about mathematicians and their works (Picker & Berry, 2001; Rock & Shaw, 2000; Yazlık & Erdoğan, 2018) have been investigated. Besides, drawings are used in order to determine the perceptions in special education investigations. For example, Regev and Ronen (2012) asked Arabic and Israeli preservice special education teachers to draw about their professions. It was found that the preservice special education teachers exhibited images showing their positive attitudes about their own expertise. This shows that some special education teacher candidates have idealist approaches or point of views. Lev-Wiesel and Yosipov-Kaziav (2005) investigated how hearing-impaired adult individuals reflect hearing impairment in their drawings. Besides, perceptions of preservice teachers on mentally impaired persons were also investigated (Tortop et al., 2015). In this investigation it is determined that preservice teachers perceive mentally impaired people as individuals who are in need for others to survive, whose their social lives are restricted, who cannot fulfill some skills and who require special attention. However, any investigation about the perceptions of Preservice Mathematics Teachers (PMTs) on VIPs has not been met. The current study has an interdisciplinary position to determine the perceptions of PMTs about VIPs and the environments with VIPs. From this point of view, this study offers a unique advantage because the usage of the drawings reveals more than the perceptions depending on just the words (Regev & Ronen, 2012). In this sense, the following questions were investigated in the current study:

1. What are the perceptions of PMTs about the environments with VIPs?
2. What are the perceptions of PMTs about VIPs?

Method

Research Model

The purpose of this study is to gain insight into PMTs' perceptions about the VIPs and their environments. For this purpose, a qualitative research method influenced by phenomenology is conducted, because a phenomenological research provides a deep understanding of a phenomenon as experienced by several individuals (Creswell, 2007:62). In the studies where the phenomenology pattern used, it is aimed to determine individual perceptions or perspectives related to a certain phenomenon (Yıldırım & Şimşek, 2016) as in the literature (Tortop et al., 2015; Yazlık & Erdoğan, 2018).

Participants

The criterion sampling which is one of the purposeful samplings methods was used for the current study. In criterion sampling which is based on all situations meeting a series of criteria determined before, mentioned criterion or criteria can be formed by the researcher or any ready criteria list can be used (Yıldırım & Şimşek, 2016). The participants of the current study were 70 PMTs studying in mathematics teaching department of a university in a big city in Turkey. Thirty-five of these participants were sophomore PMTs in 2015-2016 and the other thirty-five were sophomore PMTs in 2016-2017 academic year. The reason of this difference in academic years is that consistent results were wanted through participants with different backgrounds. The main criteria while choosing the participants were that they were taking Teaching Technologies and Material Design course in second year, and they were not taking Special Education course and they were volunteers. In Teaching Technologies and Material Design course PMTs were required to design mathematics-teaching materials for VIPs as for their final papers. This practice is of special interest to the researcher. In fact, preservice mathematics teachers does not have to design the materials for visually impaired students and all preservice teachers have to take special education course in Turkey. Before participants have this practice, first their perceptions about VIPs should be known. It was decided that information about VIPs should be given in future processes of this course in determined perceptions. But PMTs who took Special Education course and have theoretical knowledge about VIPs were not involved in participants. Thus, teachers' perceptions about the education of individuals with special needs are increased positively with the increase in the number of lessons they receive in the field of special education (Bender, Vail & Scott, 1995; Johnson, 2001) and knowledge and experiences of individuals on any specific concept affect their later concept knowledge and even their teaching the students (Ball, 1988; Vinner & Dreyfus, 1989). Since information about VIPs would be given in Special Education course, the researcher did not want to direct the participants. In Turkey, Special Education course generally includes inclusive education, family education, evaluation of individuals with special needs, developing individualized education programs etc. topics. Besides, topics such as definitions and characteristics of individuals with mental disability, visual disability, hearing disability, language-speech disability, emotional-behavior disability, learning disability, definitions and characteristics of gifted individuals included in the program. Finally preservice mathematics teachers' names are not used, but instead S1, S2,..., S70 pseudonyms are used.

Data collection and analysis

In the current study, drawings as main data source and semi-structured interviews as supporting data source were used in order to determine the perceptions of PMTs on VIPs and their environments. Drawings of PMTs were obtained with the question "*Draw A Visually Impaired Person*

and his/her Environment-DAVIPE” which is adopted from “*Draw A Scientist Test-DAST*” developed by Chambers (1983). PMTs were asked to make drawing clearly and without any anxiety such as being in examination and there was no time limitation. Besides, the PMTs are reminded that their drawing skills were not evaluated, and so they should draw freely. During the study no sample to direct the PMTs was given and the PMTs were asked to reflect only their own thoughts. It was ensured that the collected data reflected the actual situation. In addition to this, they were asked to write their names on their drawing papers because interviews based on their drawings would be held later. After the coding of the drawings, 10-minute semi-structured interviews were conducted by the researcher with 20 PMTs who were thought to give remarkable answers and whose drawings had some difficulties to express the emphasized perceptions. In these interviews PMTs were asked what they intended to emphasize in their drawings about VIPs and to express their drawings.

Before data analysis the data obtained through drawings and semi-structured interviews were numbered as S1, S2, ..., S70 regarding the names. While doing this, each document and interview record also have the same number with each participant. In this respect, it was aimed that the researcher could easily see the relations between the data types (drawings as a document and the interviews afterwards), and the ground for the control of the validity and reliability of the data analysis was prepared. In this context, the data analysis conducted through content analysis. In content analysis, the aim is to form a frame for interpretation of the obtained raw data and to make it concrete in codes and categories after the determined situation becomes clear (Patton, 2002). After numbering process, constant comparisons were made to form common categories after first categorizing and sub-categorizing the environments handled in drawings and later perceptions about VIPs. Regarding the frequencies of these determined categories, each category was grouped in itself and put into table. Then, the analysis of the interviews was added to categories. During this process, VIPs’ facial expression (Akerson, 2016; Burkitt, 2017), behaviour (Harrower et al., 1975) and her/his environment (Hertting & Alerby, 2009), and the locations of the objects around VIPs or behaviours were taken into account. So, DAVIPE evaluations were covered under two sections: VIP and Environment. At the end of content analysis, the “VIP” section divided into six subsections that focus on the sources affected such as physical (free behavior skill, gender, glasses), emotional (happy, uneasy/anxious, neutral), sensorial (hearing, touching, smelling, tasting), environmental (environmental arrangements, social behaviour, dangers), educational (accessible educational environments) and mental (fantasy world, estimation ability). The second section, “Environment,” was divided into five subsections such as outdoor environment (park, road, pavement, yellow strips etc.), indoor environment, (classroom, house, room etc.), abstract environment, dark environment and aid-available environment.

Reliability and Validity

Some precautions were taken to increase the validity and reliability of the study. So, in order to increase internal validity of the study, the relations between categories obtained from the data and sub-categories of them and the relations between each category with other categories was controlled. Besides, the data analysis process mentioned above was repeated in different periods of times (approximately six months after the first coding) by the researcher. In both coding processes, the points of ‘agreement’ and ‘disagreement’ were discussed with the second researcher and necessary changes were made with two psychologists to interpret the perceptions in the drawings. Then, the results of the first coding and the second coding were united and consistency percentage was calculated using the formula $\text{Reliable} = \frac{\text{Agreement}}{\text{Agreement} + \text{Disagreement}}$ suggested by Miles and Huberman (1994). After this process, 93% agreement was achieved. For uncompromising data, the data analysis was finalized by taking the opinions of another researcher who has PhD in mathematics education. In order to increase external reliability of the study, all the processes of the study were detailed and supported with the quotations of the PMTs. In order to increase internal reliability of the study, findings were presented directly without any interpretation.

Findings

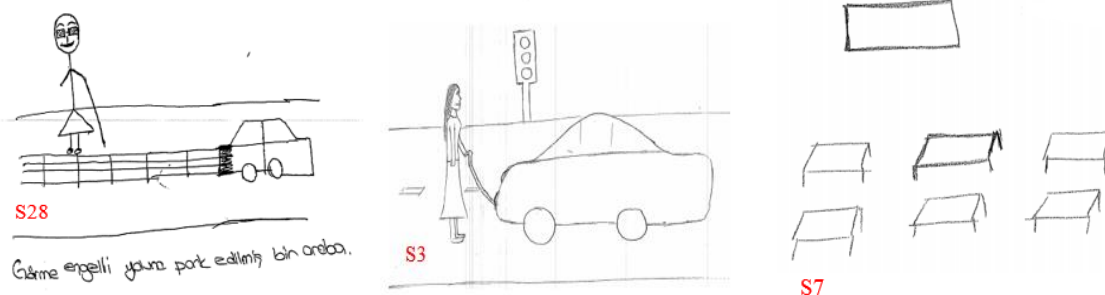
The perceptions of PMTs about the environments with VIPs

According to the drawings of the PMTs, the first perceptions were those related to the environments with VIPs. These perceptions were handled by the PMTs in five different environments such as indoor, outdoor, abstract, dark and aid-available (Table 1).

Table 1. The perceptions of PMTs about the environments withVIPs

| Environments with VIPs | | f | % |
|---------------------------|---------------------------------------|----|------|
| Outdoor environment | Walking near a road/on pavement | 18 | 25.7 |
| | Walking on yellow strips | 17 | 24.3 |
| | Crossing the street at traffic lights | 9 | 12.9 |
| | Dreaming/thinking | 8 | 11.4 |
| | Walking in the middle of a road | 5 | 7.1 |
| | Sitting in a park | 5 | 7.1 |
| Indoor environment | Classroom | 5 | 7.1 |
| | Room | 3 | 4.3 |
| | Stairs | 1 | 1.4 |
| Abstract environment | | 8 | 11.4 |
| Dark environment | | 7 | 10 |
| Aid-available environment | | 7 | 10 |

According to Table 1, most of the PMTs drew VIPs out of buildings - that is, outdoor environment. Thus, PMTs drew VIPs as walking near a road or on pavement most (25.7%), on embossed yellow strips (24.3%) and as crossing the road at traffic lights (12.9%). Besides, PMTs draw VIPs as dreaming-thinking (11.4%), as walking in the middle of a road (7.1%) and as sitting in a park (7.1%). The second environment PMTs mentioned was in a bulding -that is, indoor environment. According to this, VIPs were drawn in classroom environment (7.1%), in a room (4.3%) and on stairs (1.4%). The third environment PMTs mentioned about VIPs was the abstract environment (11.4%) where there is no open or closed environment and where the images which cannot exist in real world take place (Figure 5-S14, Figure 7-S58). The fourth environment PMTs mentioned was the dark environments (10%) where VIPs cannot see any object and where there is even no light perception. And finally the fifth environment PMTs mentioned was the environment where VIPs need help or where the society does not remain insensitive to them even if they do not need help (10%). Most of these environments indicated that VIPs need help while crossing the street at traffic lights, and only two of them indicated that VIPs need help always. Some drawings of PMTs about the environments of VIPs can be found in Figure 1.



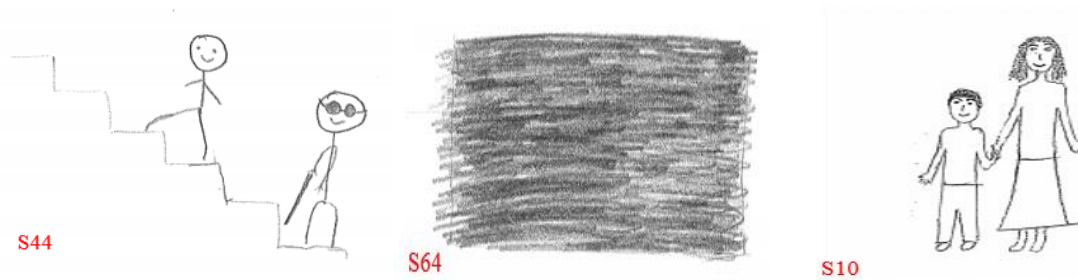


Figure 1. A few examples for the environments with VIPs

The perceptions of PMTs about VIPs

The second perception investigated in drawings of PMTs were the perceptions related to VIPs. These perceptions were affected by six different sources such as physical, emotional, sensorial, environmental, educational and mental respectively (Table 2).

Table 2. The perceptions of PMTs about VIPs

| Source | Perceptions | f | % |
|---------------|---|----|------|
| Physical | Independent mobility | 53 | 75.7 |
| | Without any support | 6 | 8.5 |
| | With a white cane | 45 | 64.3 |
| | With a white cane and a guide dog | 2 | 2.9 |
| | Not able to move freely | 2 | 2.9 |
| | Gender | 64 | 91.4 |
| | Female | 16 | 22.9 |
| | Male | 51 | 72.9 |
| | Glasses | 30 | 42.9 |
| | Black glasses | 23 | 32.9 |
| | Not black glasses | 7 | 10 |
| Emotional | Happy | 39 | 55.7 |
| | Uneasy/Anxious | 9 | 12.9 |
| | Neutral | 21 | 30 |
| Sensorial | Developed sense of hearing | 11 | 15.7 |
| | Developed sense of touching/feeling | 12 | 17.1 |
| | Developed sense of smelling | 3 | 4.3 |
| | Developed sense of tasting | 3 | 4.3 |
| Environmental | Life becoming easy with environmental arrangements | 24 | 34.3 |
| | Excluded from the society | 9 | 12.9 |
| | Having difficulties because of humans insensitivity | 13 | 18.6 |
| | Accepted by the society | 10 | 14.3 |
| | Open to dangers | 12 | 17.1 |
| Educational | In need of accessible educational environments | 9 | 12.9 |
| Mental | Having a rich fantasy world | 8 | 11.4 |
| | Having poor fantasy world | 3 | 4.3 |
| | Estimation ability | 2 | 2.9 |

As it can be seen in Table 2, the category where PMTs focused most about VIPs was the perception related to physical characteristics. This category shows that PMTs focus on whether VIPs can move freely, whether they use glasses and on their gender. According to this, 75.7% of PMTs emphasized that VIPs have the ability of being able to move freely. However, some PMTs pictured this ability to move freely as without any support (8.5%), most of them pictured it with a white cane (64.3%) and some pictured with both a white cane and a guide dog (2.9%). S43 mentioned that VIPs

can move freely with a white cane and she suggested that these white canes should have navigation on them to be more effective, and so, VIPs can move better. On the other hand, and only two of them indicated that VIPs do not have the ability to move freely and need help of others always. Besides, 42.9% of PMTs drew glasses on VIPs. In these drawing PMTs used black (32.9%) and not black (10%) glasses. And finally, most of the PMTs (91.4%) drew pictures indicating gender such as long hair, skirts for females and short hair for males. Only three of the PMTs who emphasized gender in their drawings drew both female and male VIPs, and 22.9% of them drew females (Figure 1-S10,S28, Figure 2-S26,S34) and 72.9% drew males (Figure 2-S8,Ö15,S32,S37).

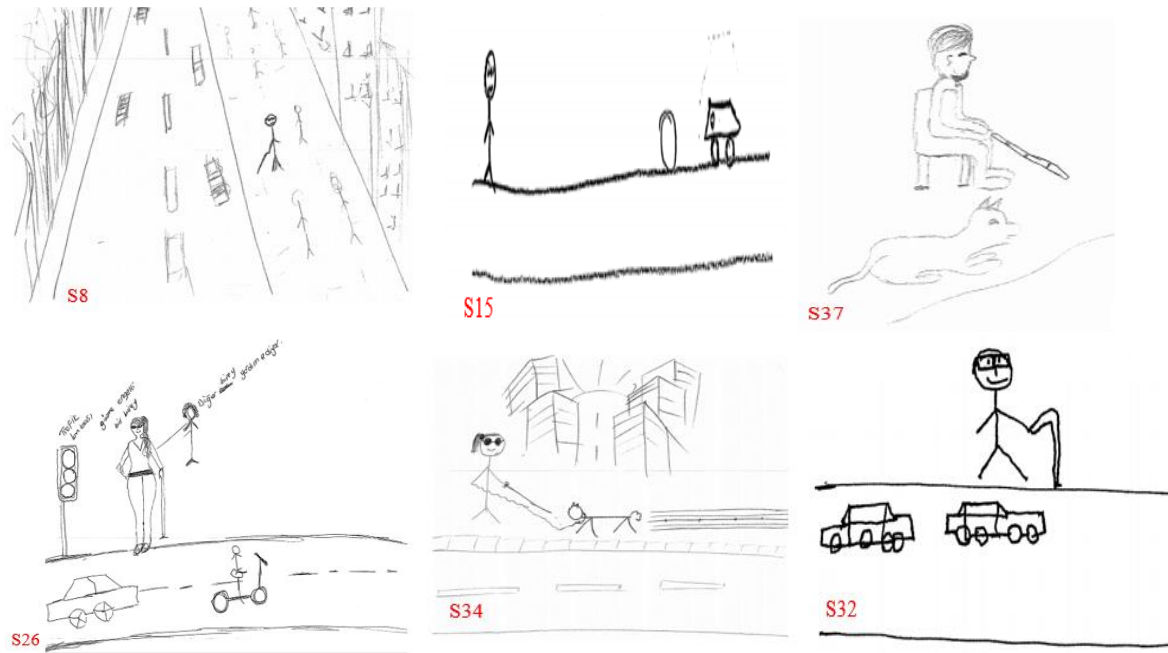


Figure 2. Some of the drawings based on physical characteristics

The second perceptions of PMTs related to VIPs were the perceptions based on emotions of VIPs. This category was classified as happy, uneasy-anxious and neutral. More than half of the PMTs (55.7%) thought that VIPs are content with their lives. 30% of PMTs drew VIPs as neutral without indicating any positive or negative emotion. But on the other hand, 12.9% of PMTs indicated that VIPs are not satisfy with their lives and are uneasy-anxious while moving. For example; S48 drew the anxiety of a VIP when she comes to the door to go out, S51 drew a VIP walking on yellow strips as neutral and S61 drew a VIP as happy (see Figure 3).

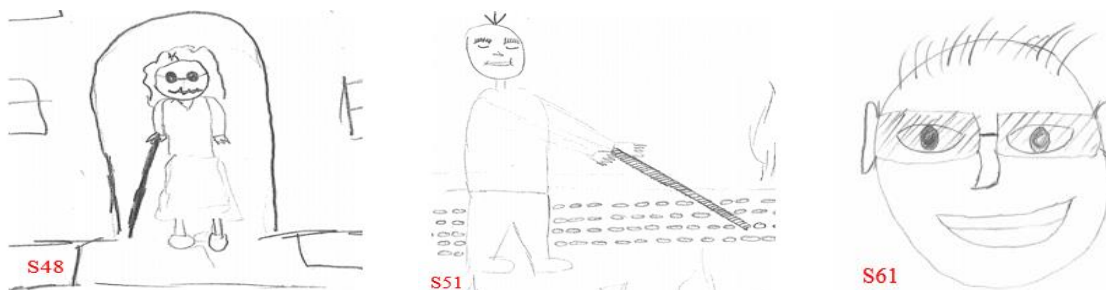


Figure 3. Some of the drawings based on emotions

The third perceptions of PMTs about VIPs were the perceptions based on sensorial perceptions. According to this, PMTs focused on senses of touching/feeling (17.1%), hearing (15.7%),

smelling (4.3%) and tasting (4.3%). As it can be seen in Figure 4, S4 indicated the developed sense of touching of a VIP through drawing big hands and developed sense of hearing through drawing big ears. S39 used the sense of seeing when a person with sight on the right saying 'Look at the flower how wonderful and colorful' in his drawing. However in the same drawing, the VIP on the left used senses of smelling and touching with his expression 'How wonderful it smells, it must symbolize the coming spring. Its tissue is so soft and delicate'. On the other hand, S47 emphasized the struggle of VIP to know the world through the sense of tasting while VIP on the right in her drawing using the question 'What kind of a thing a flower is? Can it be eaten?' when the student on the left with sight reacts as 'What a wonderful flower'.

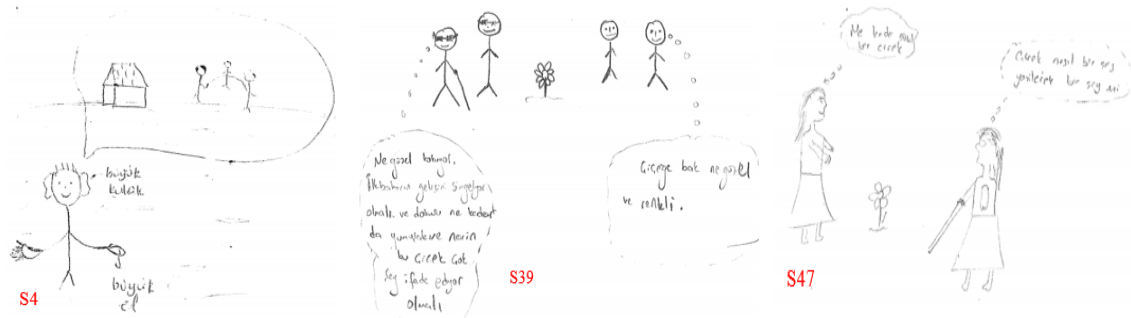


Figure 4. Some of the drawings based on senses

The fourth perceptions of PMTs about VIPs were the perceptions based on environment. Perceptions of PMTs originating from environment were shaped by both positive and negative points of views. PMTs with positive points of views drew pictures to emphasize that environmental arrangements facilitate the lives of VIPs (34.3%) and they are accepted by the society (14.3%). But PMTs with negative points of views drew pictures to show that VIPs are excluded from the society (12.9%), have difficulties because of insensitivities of others (18.6%) and are open to dangers (17.1%). As it can be seen in Figure 5, S20 drew that the embossed yellow strips on pavements make VIPs move more freely, and so, they facilitate their lives. Besides, S20 drew that yellow strips are only used by VIPs and other individuals with sight walk on their own ways, and this is interpreted as VIPs are accepted by the society. S57 drew a voiced bus stop system in which VIPs could understand which buses would arrive and when. S3 who is one of the PMTs with negative point of view emphasized the insensitivity of humans and the dangers in environment, and drew a VIP who is rescued from a car accident at the last moment. S11 showed that VIPs are excluded from the society and have difficulties because of insensitivities of the others. Similarly, S14 drew that VIPs are excluded from the society and S24 indicated that they are in jeopardy.

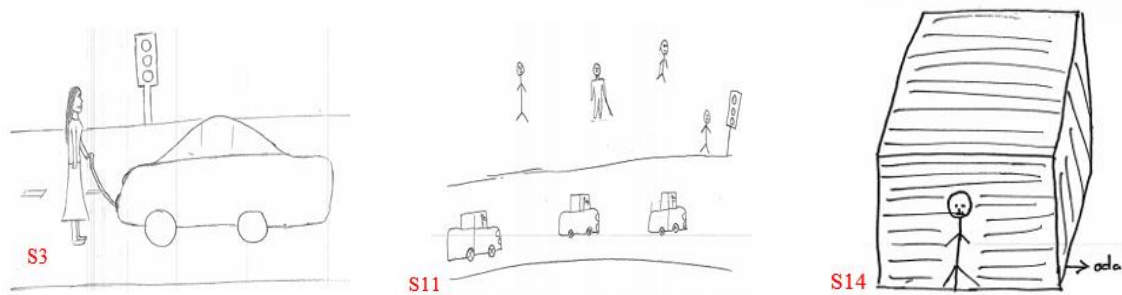




Figure 5. Some of the drawings based on environmental perceptions

The fifth perceptions of PMTs about VIPs were the perceptions based on education (12.9%). In this category PMTs pictured necessary accessible education environments for VIPs and the types of designs and even sample mathematics teaching environments (Figure 6). Accordingly, only three of PMTs paid attention to the books written with Braille, and other six paid attention to the arrangements in classroom environments. For example, S60 mentioned about reflecting the writings and visuals on the blackboard through the system established on the desks of visually impaired students. S62 indicated the necessity of using tactual materials in geometry and science lessons and of supporting them with Braille alphabet and of a more organized classroom environment in comparison with other classes. And S65 emphasized the necessity of using concrete materials for geometry lesson. Finally, S69 mentioned about building a voice system for VIPs in classroom and using yellow strips which are used out of the buildings in classroom environment as well. In interviews S69 insisted that such a system will help VIPs listen to lesson easily with their hearing ability and they will move in classroom environment more freely.

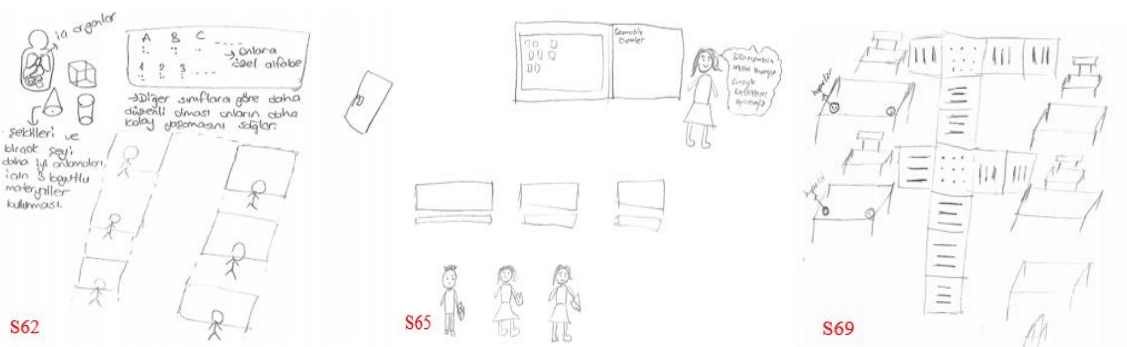


Figure 6. Some of the drawings based on educational environments

The last perceptions of PMTs about VIPs were the perceptions based on mental abilities. PMTs emphasized a rich fantasy world (11.4%), consistent estimation ability (2.9%) as positive points of view and their having poor fantasy (4.3%) world as negative points of view of VIPs (Figure 7). PMTs with positive perspective indicated that VIPs can visualize physical world if they are visually impaired from their birth and VIPs can visualize their memories if they are visually impaired later in life. PMTs also indicated that VIPs use their estimation ability when they meet unfamiliar objects and that they predict distances correctly. But PMTs with negative perspective indicated in their drawings that it is impossible to guess what VIPs think. However in interviews, they expressed that fantasy world of VIPs was not developed enough. For example, S43 drew a VIP approaching to her home as thinking 'I think there is little distance left to my home'. S58 drew concepts and objects occur in the mind of a total VIP and expressed they have a rich fantasy world. S33, on the other hand, considered a total VIP both from birth and later in life. According to this, S33 stated that she could not guess what a VIP from birth thinks and what was in her/his fantasy world was not clear (S33-1). Besides S33 also drew a total VIP later in life as s/he missed and visualized her/his old days in her/his mind (S33-2).



Figure 7. Some of the drawings based on mental abilities

Discussion

It is important to determine the perceptions about VIPs of PMTs who may teach mathematics to VIPs in future. Because, the perceptions of mathematics teachers may play a facilitating or an inhibiting role in translating curriculum guidelines into the complex and daily reality of classroom teaching (Haynes, 1996). That is, perceptions affect teaching approaches of teachers and how they handle the subjects (Hofer & Pintrich, 1997). Thus, the current study tried to reveal the perceptions of PMTs about VIPs and their environments without any direction and limitation. In this respect, the first perception was the environment where VIPs were handled. A large majority of the PMTs drew VIPs in open environments out of buildings. These were environments where VIPs walk near a road or on pavements, walk on embossed yellow strips, cross a street at traffic lights, dream/think, walk in the middle of a road, and sit in a park. It can be suggested here that PMTs think VIPs as having the independent mobility. Very few of PMTs handled VIPs in a closed environment such as in classroom and room or on stairs. But as future teachers PMTs were expected to picture classroom environment more. The third environment where PMTs drew VIPs was the abstract environment where there was no outdoor or indoor environment and full of images which were impossible to see on the world. Only a small part of the PMTs indicated that VIPs lived in a dark environment. However, this darkness represents a place where the VIPs do not see any objects and do not have even a sense of light. This result shows that the images of PMTs about VIPs are mostly the total VIPs. Finally, another environment depicted by PMTs was the environment where VIPs got help. According to this, VIPs should be helped in two ways; the first is always, and the second is in traffic when they cross a street.

The second perceptions which were determined from the drawings of PMTs were about the VIPs. These perceptions were affected from six different resources physical, emotional, sensual, environmental, educational and mental respectively. PMTs who were affected by physical resources described VIPs mostly as moving freely with the help of white cane, without any help or with both white cane and a guide dog. Actually independent mobility is to move to target securely, effectively and freely (Hill & Ponder, 1976). Here ability of independent mobility occurred mostly as white cane abilities. However, only two of the PMTs made picture to show that VIPs cannot move freely all their lives. On the other hand, 64 PMTs out of 70 made emphasis on gender by drawing females with long hair and males with short hair. Almost three fourth of PMTs emphasized here male gender and one fourth emphasized female gender for VIPs. This situation actually reflects the problem of gender discrimination in the society. According to the investigation of Arslan and his colleagues (2014), while visually impaired male persons can go out, visually impaired female persons are not allowed to go out in Turkey because of physical and sexual violence. Besides, almost half of the PMTs mentioned about glasses used by VIPs. Accordingly, 23 of PMTs mentioned the usage of black glasses and seven of them mentioned the usage of not black glasses. This finding supports the perception of total VIPs which was also a result of this study. This finding may be related to the usage of black glasses for VIPs in media and in society. But the perception that ‘they cannot do anything’ may deceive other people about what VIPs they can do (Bülbül, 2016).

The perceptions of PMTs about emotional world of VIPs were generally positive. According to this, they mentioned that VIPs are generally happy or neutral despite their disabilities or they may be anxious about their environment while they are moving. What was particularly noteworthy here was that PMTs drew VIPs with smiling faces. However, some social abilities which are natural for people with sight can be difficult for VIPs. Smiling is one of them, because smiling does not happen by itself like social reaction of people with sight (Vaughn et al., 2003).

It is also determined that PMTs also had perceptions that indicate which senses VIPs use. According to this, PMTs focused on senses of touching/feeling, hearing, smelling and tasting which are out of seeing sense for VIPs. This situation can be related to the information “the more senses are involved in learning process, the more and better one can learn” which can be explained by Edgar Dale's Cone of Experience. According to this, %85 of the information one individual gets from outer world is through seeing and this means that it is %85 less information for VIPs. This perception of PMTs overlaps with the expression of Özyürek (1995) “a VIP uses her/his other senses to achieve information”. As Buhagiar and Tanti (2011) indicated that in order for total VIPs to have a good conceptualization about the world around them, they have no other way to use their senses except their visual sense, that's to say, seeing sense. Because the information obtained through senses form the concepts about humans and objects (Fazzi & Klein, 2002).

Environmental perceptions of PMTs about VIPs were both positive and negative. PMTs with positive point of view drew pictures where life becomes easy after some environmental arrangements and the society accepts the VIPs. PMTs with negative point of view drew pictures where VIPs are excluded by the society and they have difficulties as a result of people's insensitivity and they are open to dangers. Accordingly, VIPs cannot define a burnt smell and a crash voice with just looking at their origins and so they cannot find suitable action (Gürsel, 2013:225). Therefore, they cannot react fast and properly. This finding is in accordance with the findings of other studies which indicate that VIPs who do not have opportunity to be equal in social relations and who cannot satisfy their needs enough are detached from social life, cannot find time for social relations and cannot feel themselves as a part of the society and become lonely (Çarkçı, 2011:47; İkizoğlu, 2005).

One of the most important results of the current study was the perceptions of PMTs based on education towards VIPs. In drawing where these perceptions emerged, PMTs portrayed the need for designing accessible educational environments, their designs for the VIPs, and even sample teaching environments for teaching mathematics. Accordingly, PMTs emphasized the usage of lesson materials with Braille alphabet and the necessity of making various arrangements in classrooms. This result was emphasized by very few PMTs, and this can be interpreted that PMTs do not have enough awareness about educational environments of VIPs or that PMTs do not have sufficient knowledge about these educational environments. When the insufficient academic studies on mathematics education for VIPs is taken into account, it can be understood that the perceptions of PMTs based on education are not at desired levels. One of the student characteristics which can affect the success of mathematics education is mental abilities. Perceptions of PMTs based on these abilities were shaped by positive and negative points of view. According to this, PMTs with positive perspective indicated that VIPs can visualize physical world if they are visually impaired from their birth and VIPs can visualize their memories if they are visually impaired later in life. PMTs also indicated that they use they estimation ability when they meet unfamiliar objects and that they predict distances correctly. But PMTs with negative perspective indicated that fantasy world of total VIPs does not develop enough. This situation overlaps with Kızar's [33] idea that VIPs may fail in abilities requiring especially abstract thinking as conceptual development and cognitive abilities of may be slow. However, contrary to what is believed, many psychological studies showed that total VIPs have amazing capacity of visual image and memory (Haber et al., 1993; Kennedy, 1993; Landau et al., 1984; Millar 1985).

As a result, PMTs drew more than one perception in their pictures from both same and different resources. This means that they have significant ideas about VIPs. There are also opposite perceptions as positive and negative among these. Among PMTs' positive ideas there are three different prominent perceptions. The first one is that VIPs can move freely in open air with the help of

their white cane and so, they can be happy. The second one is that VIPs do not see anything and like their lives through their senses of hearing and feeling. The third one is that VIPs are accepted by the society and so, they are happy. Two different perceptions are prominent among negative ideas of PMTs. The first one is VIPs are anxious because they are left alone and excluded by the society. As Gürsel (2013:226) indicates, it is normal that VIPs spend less time than their peers with sight. It is possible to note here that PMTs assume VIPs cannot see social messages of others and cannot react accordingly. The second one is VIPs are in danger in outdoor environment and because of this they are anxious. It is possible to note here that PMTs think so because VIPs cannot have information about the environment and cannot control (Gürsel, 2013:225). Although these positive and negative perceptions are expected to emerge, there is one unexpected perception as well. Some people in the society are insensitive but VIPs are happy with environmental arrangements and with them it is possible for VIPs to move freely. It is understood here that PMTs think VIPs have positive ideas about the life and difficulties do not scare them.

These results of the current study can be used as encouragement by PMTs for the education of VIPs. These PMTs can teach VIPs in inclusive classes or in schools for VIPs, and therefore determining their perceptions about VIPs can give clues about the content of the education to be given (Johnson, 2001). For that reason, necessary arrangements should be made to give proper and effective education and increase their proficiencies at undergraduate level for the mathematics teachers who will teach in inclusive classes and teach mathematics to VIPs. "Special Education" course in mathematics teaching program in education faculties can be used for this purpose. Opportunities to reinforce their knowledge about VIPs, to complete the insufficiencies and to correct the mistakes for PMTs can be provided in this course. The result of the current study showed that there is not much information about VIPs in closed environments such as classroom and house, and so, it can be possible to overcome this difficulty with the design of special education course both theoretically and practically. And thus, PMTs can have the ability to design flexible education environments regarding individual differences of their students, their needs and their sociocultural characteristics in accordance with Teaching Profession General Proficiencies (MEB, 2017). Beside of these, PMTs can be encouraged to participate to activities such as conferences, seminars related to special education during their undergraduate studies.

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