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Contact Addresses

Prof. Dr. Zeki Kaya, Gazi Üniversitesi, Gazi Eğitim Fakültesi, Eğitim Bilimleri Bölümü Teknik Okullar Ankara/Türkiye
E. Mail: ijonte2010@gmail.com

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Cordially,

1st July, 2018

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Prof. Dr. Zeki Kaya, Gazi University, Ankara- Turkey
Assoc. Prof. Dr. Ilknur Istifci, Anadolu University, Eskişehir- Turkey

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ARTICLES

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METAPHORICAL PERCEPTIONS OF SCIENCE TEACHER CANDIDATES TOWARDS TEACHER AND TEACHING PROFESSION

Assist. Prof. Dr. Mustafa Yadigaroğlu
Aksaray University Faculty of Education
Department of Mathematics and Science Education
Aksaray- TURKEY

Prof. Dr. Gökhan Demircioğlu
Karadeniz Technical University
Fatih Faculty of Education
Department of Mathematics and Secondary Education
Trabzon- TURKEY

Assoc. Prof. Dr. Hülya Demircioğlu
Karadeniz Technical University
Fatih Faculty of Education
Department of Mathematics and Secondary Education
Trabzon- TURKEY

Hayriye Akar
Aksaray University, Institute of Science
Aksaray- TURKEY

Abstract
The purpose of this study is to explore the metaphorical perceptions of science teacher candidates towards teacher and teaching profession. Qualitative research method was used in the study and "phenomenological approach" was employed as the design of the study. The participants of the study are comprised of 102 teacher candidates who pursue science education programs, in the fall term of 2017-2018 academic year, in the department of mathematics and science education of a middle-sized faculty of education in Central Anatolia. As data collection tool, a form consisting of 2 questions was used for the identified concepts. The obtained data were analyzed using content analysis technique, and after the accuracy of the determined metaphors and created the categories were controlled by two faculty members having expertise, the final form of metaphor and the categories were generated. As a result of the analyses, it was found out that teacher candidates generated 40 metaphors for teacher concept and 60 metaphors for teaching profession. Given the data obtained, it has been observed that prospective teachers provided positive metaphors for the concept of teaching and teaching profession.

Keywords: Science teacher candidate, metaphor, teaching, teaching profession.

INTRODUCTION

The word "metaphor" derives from the Greek word "metapherein", meaning that an individual can express any concept or phenomenon in a way that he perceives (Levine, 2005). When the literature was examined, it was determined that the concept of metaphor was defined by many researchers. According to Palmquist (2001), metaphor is a metaphorical structure created by taking into account similarities and differences between two objects or concepts. . According to Guerrero and Villamil (2002), metaphor is an tool used to describe complex structures in any area and to provide information that makes it easier to understand these structures. Saban, Koçbeker and Saban (2006) define the metaphor as a powerful mental tool that can be used to understand and explain an

extreme abstract and complex phenomenon for an individual. Metaphors are used both to enrich the educational environment and to describe complex concepts and phenomena by likening it to a known concept (Geçit and Gençer, 2011). Metaphors are also used to illustrate how a concept or a phenomenon is perceived (Aydin, 2011).

The concept of metaphor in educational studies in Turkey has been started to be used since the second half of 1990 (Balcı, 2011). It was observed that the studies in our country have been done about teachers (Saban, 2004; Zhao, Coombs and Zhou, 2009; Ekiz and Koçyigit, 2013), student teachers (Şahin, 2013; Yılmaz, Göçen and Yılmaz, 2013; Koç, 2014), inspectors (Töremen and Döş, 2009), school administrators (Yalçın and Enginer, 2012; Akan, Yalçın and Yıldırım, 2014) and the courses (Derman, 2014). Metaphors are expressed as a mental tool used in the expression and explanation of individuals' abstract, complex, or a phenomenon (Yob, 2003). In this respect, it is suggested that teachers can use metaphors as a research tool to examine, understand and explain the perceptions of teacher candidates towards teacher and teaching profession through metaphors (Saban, 2004).

There is almost no individual who does not have teacher influence (effort) from any part of society (Ayas, 2009). The teachers influence their students in different ways, through their personalities and lecturing. Teacher candidates are expected to have characteristics that can leave a positive impact on their students when they begin the professional life. This depends on the teacher candidates' acceptance of what the teaching profession means. The determination of the teacher candidates ' perceptions towards "teacher" and "teaching profession", which we will entrust the future generations, will lead to the emergence of their attitudes towards their profession.The purpose of this study is to determine the metaphorical perceptions of science teacher candidates towards teacher and teaching profession.

RESEARCH DESIGN

This research is a phenomenological study of the qualitative design, which explores the metaphorical perceptions of science teacher candidates towards teacher and teaching profession with the help of the metaphors they developed. Phenomenological studies aim to describe, understand, and interpret the structure of the phenomena that occur in conscious as a result of the interaction of the individual with the world at a given time and within a certain context (Bloor and wood, 2006; Çilesiz, 2011; Willig, 2008).

Participants

This research was carried out with the participation of 102 teacher candidates (80 girls, 22 boys) who pursue Science Teaching Program of Mathematics and Science Education Department at a faculty of education locating in Central Anatolia, during the fall semester of 2017-2018 academic year.

Data Collection Tool

As data collection tool, in this study, a form consisting of two open-ended questions was used to determine metaphorical perceptions of science teacher candidates for the identified concepts. Teacher candidates were asked to fill in the blanks arranged as "teacher is like..... because....." and "the teaching profession is like..... because it .....". The teacher candidates were asked to establish a link between the metaphor source and metaphor, with the word "like", and they were asked to give a reason for the metaphors they created with the word "because".

Data Analysis

The responses of teacher candidates to the questions in the form were analyzed using content analysis technique. The analysis of metaphors revealed by the participants was carried out in 5 stages expressed in the literature by Saban (2008).

1. Identification Phase: The form distributed to them for the purpose of revealing teacher candidates' metaphors about the concepts being studied has been examined.
2. Elimination and Refinement Phase: Metaphors revealed have been revised and metaphors are grouped according to their similar and common characteristics. While grouping, the relationship between the subject of the metaphor and its source was taken into account.
3. Compilation and Category Development Phase: The metaphors presented are arranged alphabetically, the best example metaphor expression representing each metaphor has been defined, and the "sample metaphor list" has been created. Then, metaphors are divided into categories considering the relationship between the subject and the source of the metaphor.
4. Validity and Reliability Phase: In accordance with the steps set out in the study, the lists created were shared with two experts from faculty members in order to determine the accuracy of metaphors and the categories created. Depending on the feedback from the experts, the final version of metaphors and categories were created.
5. Transferring Data to Computer: Determined metaphors and categories have been transferred to computer and are ready for description and interpretation.

FINDINGS

In this section, first, general findings for research questions were presented. As a result of the analysis, the metaphors of science teacher candidates, the categories and the answers created in terms of the common characteristics of metaphors are given together. One of the objectives of the study is to determine the perceptions of the participants about the concept of teacher. As a result of the analysis of the answers given by the participants to the related question in the form, it was found out that they presented 40 metaphors for the concept of teacher. These metaphors are listed in Table 1.

Table 1:The Metaphors of Teacher Candidates Towards the Concept of Teacher

Metaphor Name and Frequency			
Angel	1	Key	1
Artist	5	Leader	7
Book	2	Library	2
Bridge	1	Life	4
Building foundation	2	Light	5
Candle	1	Mother	5
Carpenter	1	Newsman	1
Closet	1	Ocean	1
Compass	2	Pitcher	1
Confidant	6	Polar star	2
Crossroad	1	Pomegranate	1
Enzyme	1	Rain	1
Family	40	Scientist	1
Flood	1	Season	1
Florist	1	Star	1
Friend	5	Sun	4
Garden	2	Treasury	1
Google	1	Tree	2
Guide	18	Umbrella	1
Information Source	2	Water	1

As displayed in Table 1, teacher candidates have generated 40 metaphors for the concept of teacher. Though all the metaphors produced by teacher candidates are positive, the teacher is often likened to

an inanimate being. The first five metaphors, often expressed by the participants, are as follows; family (40), guide (18), leader (7), confidant (6), mother, friend, light, artist (5). According to the metaphors given in Table 1, four categories were created. Category headings are as follows;

1. Teacher who loves and protects

There are 6 metaphors identified in this category. Metaphors clustered under this category are in alphabetical order as; angel, confidant, family, friend mother, umbrella. Once the metaphors revealed by teacher candidates are examined, it is observed that the metaphors in this category are frequently used. A few examples of responses from participants in this category are as follows;

The teacher is like my family, who can give me the peace in my family.

The teacher is like a mother; teachers take care of us as how mothers protect us.

The teacher is like a friend, sharing love when necessary, always takes place next to you in difficult moments, protects you.

The teacher is like an angel, protects us from evil.

The teacher is like a confidant, so you can share matters that will not be shared with anyone.

The teacher is like an umbrella; helps you protect yourself from the evil that comes upon you like rain.

2. Teacher as a Source of Information

There are 20 metaphors identified in this category. Metaphors clustered under this category are in alphabetical order as; bridge, book, building foundation, closet, crossroad, enzyme, flood, garden, google, information source, library, ocean, pitcher, pomegranate, rain, season, scientist, treasury, tree, and water. Here are a few examples of responses from participants in this category;

The teacher is like a garden, just as there are various trees in the gardens, and you can find a lot of information in your teacher too.

The teacher is like Google, you will find all kinds of information.

The teacher is like a flood, you will inevitably learn when you encounter the information in your teacher.

3. Teacher as A Guide

There are 9 metaphors fitting to this category. Metaphors obtained under this category are compass, guide, key, leader, light, newsman, polar star, star, sun in alphabetical order. Here are a few examples of responses from participants in this category;

The teacher is like a key, the person who opens the doors to inform us about the future.

The teacher is like a compass, you look at him and you go to the future.

The teacher is like a guide, guiding us for our prospective professional life.

4. Teachers as Shape-Building Students

There are 4 metaphors belonging to this category. Metaphors clustered under this category are artist, carpenter, florist, life in alphabetical order. Here are a few examples of responses from the participants in this category;

The teacher is like a flower, as how florists make different types of flowers as a bouquet and prepare a beautiful presentation, teachers also can make a good class out of different students.

The teacher is like life; life shapes us differently every day, so teachers also shape us like life.

Another objective of the study is to determine the perceptions of the participants towards teaching profession. For this objective, it was observed that they had revealed 60 metaphors for the teaching profession. The metaphors of teacher candidates for teaching profession are listed in Table 2.

Table 2: The Metaphors of Teacher Candidates for Teaching Profession

Metaphor Name and Frequency									
Art	1	Family owner	1	Joy in life	1	Music	2	Sacred values	3
Blood in vein	1	Farmer	1	Leadership	2	Oxygen	2	Sacrifice	3
Bridge	1	Fire	1	Life	3	Passion	2	Soil	1
Book	2	Future	1	Lifetime	1	Patience	4	Starting Line	1
Compass	1	Galaxy	1	Lion	1	Peace	3	Summit	5
Compassion	2	Gardener	4	Locksmithing	1	Pen	1	Sultan	1
Cook	1	Guidance	5	Magic wand	1	Plane tree	1	Sun	1
Country	1	Happiness	2	Mastery	4	Plant	1	Tree	2
Director	2	Heart beat	1	Matrushka	1	Precious stone	1	Victory	4
Dream	1	Hope	1	Meaning of life	1	Protagonist	1	Way	4
Duty	1	Imagination	4	Miracle	2	Rose	2	Water	5
Eraser	1	Information source	2	Motherhood	1	Sacred profession	4	Work	2

As displayed in Table 2, teacher candidates generated 60 metaphors for teaching profession. Though all the metaphors produced by teacher candidates are positive, the teacher is often likened to an inanimate being. The first nine metaphors, often expressed by the participants, are as follows: gardener, guide, imagination, mastery, patience, sacred profession, summit, victory, water.
According to the metaphors given in Table 2, eight categories were created. Category headings are as follows;

1. Teaching as A Guiding Profession
There are 5 metaphors belonging to this category. Metaphors collected under this category are in alphabetical order; art, compass, director, guidance, way. Here are a few examples of responses from the participants in this category;
The teaching profession is like making art, because art illuminates the way of societies and helps them advance.
Teaching is like a road, helps you achieve your goal, leads you to your goal.

2. Teaching as A Profession That Gives Information
There are 9 metaphors of this category. Metaphors clustered under this category are in alphabetical order; book, farmer, fire, galaxy, *matrushka,* plane, source of information, sun, tree. Here are twoexamples of responses from the participants in this category.
Teaching is like matrushka dolls, because matrushka dolls are composed of many nested babies. The teacher also has a lot of knowledge, so this analogy can be done.
Teaching is like the sun, heats up his students with his knowledge.

3. Teaching as A Sacred Profession
There are 6 metaphors belonging to this category. Metaphors collected under this category are in alphabetical order; blood in vein, country, duty, protagonist, sacred profession, sacred values. Here are an example of responses from participants in this category.
Teaching is like my country because it's sacred.

4. Teaching as A Protective Profession
There are 6 metaphors belonging to this category. Metaphors clustered under this category are compassion, earth, eraser, motherhood and sultan in alphabetical order. Here are an example of responses from the participants in this category.
Teaching profession is like motherhood, how mothers protect their children and arm them, so teachers also protect their students.

5. Teacher as Volunteer Profession
There are 15 metaphors fitting to this category. Metaphors collected under this category are in alphabetical order; happiness, heartbeat, hope, imagination, labor, life, joy in life, meaning of life, miracle, oxygen, patience, passion, peace, sacrifice. Here are an example of responses from participants in this category.

The profession of teaching is to make sacrifices because it is not possible to do it without being loved.

6. Teaching as a Future-Builder
There are 12 metaphors belonging to this category. Metaphors collected under this category are bridge, cook, family owner, future, gardener, locksmithing, magic wand, mastery, pencil, starting line. Here are an example of responses from the participants in this category.

Teaching is like a mastery, because masters shape a building and reveal it, and teachers build the future.

7. Teaching as A Necessity
There are 4 metaphors in this category. Metaphors collected under this category are in alphabetical order, dream, leadership, music, and water. Here are an example of responses from the participants in this category.

Teaching is like being a leader because how societies need leaders in the same way, teachers are necessary for society and important.

8. Teaching as A Valuable Profession
There are 3 metaphors of this category. Metaphors collected under this category are in alphabetical order; precious stones, summits and victory. Here are an example of responses from participants in this category.

Teaching profession is to stay on top because it's hard to stay on top, it's valuable.

DISCUSSION, CONCLUSION AND RECOMMENDATIONS

The results of this study, aiming to explore the metaphors of teacher candidates in relation to teacher and teaching profession, stress two important points. The first of these important points is that the concept of teacher has been tried to be explained by teacher candidates with a broad metaphorical perception. Family metaphor is the most commonly used metaphor for teacher candidates. Besides family metaphor, guidance has been used by teacher candidates in metaphors such as leader, confidant, light, and mother. In addition to these metaphors, it is observed that different metaphors are also used by teacher candidates (Table 1).

This may be evaluated as an indication that the concept of a teacher cannot be explained by one or more metaphors. This argument supported the results of some studies in both national and international literature (Gillis and Johnson, 2002; Oğuz, 2009, Patchen and Crawford, 2011). The most common metaphor used by teacher candidates is the family metaphor. This indicated that teachers play an active role on the prospective teachers as much as their parents.

To the results obtained from the responses of the participants, the second issue that is seen as important by the teacher candidates is that the teaching profession is perceived by the teacher candidates from a broad framework as in the concept of teaching. As shown in Table 2, teacher candidates used many different metaphors to explain the profession of teaching. This can be considered as proof that the teaching profession has been adopted and accepted by the teacher candidates. Metaphors can be used by researchers to explain the perceptions of teacher candidates towards the concept of teacher and teaching profession. Teachers may also be asked to develop metaphors related to different topics or concepts.

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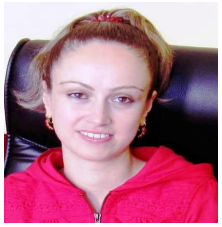
BIODATA AND CONTACT ADDRESSES OF AUTHORS

Assistant Professor Mustafa Yadigaroğlu is currently employed as an Assistant Professor at Aksaray University, Faculty of Education, Department of Mathematics and Science Education and has been a member of the Aksaray University Faculty of Education since 2015. He received his Ph.D in chemistry education in 2014 from the Karadeniz Technical University Institute of Educational Sciences. He is specifically interested in concept teaching, conceptual change, teacher education, teacher training, information and communication technology, technological pedagogical content knowledge (TPACK) and context-based learning.

Assist. Prof. Dr. Mustafa Yadigaroğlu
Aksaray University Faculty of Education
Department of Mathematics and Science Education
Aksaray- Turkey
E. Mail: mustafayadigaroglu@hotmail.com

Prof. Dr. Gökhan Demircioğlu is currently employed as a Professor at Karadeniz Technical University, Fatih Faculty of Education, Department of Mathematics and Science Education and has been a member of the Fatih Faculty of Education since 1998. He received his master's degree in physical chemistry in 1998, and his Ph.D. in chemistry education in 2003 from the Karadeniz Technical University. He is specifically interested in concept teaching, out-of-school learning environments, computer and instructional technology, secondary science education, teacher training, context-based learning, and technological pedagogical content knowledge (TPACK).

Prof. Dr. Gökhan Demircioğlu
Karadeniz Technical University, Fatih Faculty of Education
Department of Mathematics and Secondary Education
Trabzon- Turkey
E. Mail: demircig73@hotmail.com



Associate Professor Dr. Hülya Demircioğlu is currently employed as a Associate Professor at Karadeniz Technical University, Fatih Faculty of Education, Department of Mathematics and Science Education. She is specifically interested in She is specifically interested in concept teaching, conceptual change, secondary education, context-based learning, and gifted-students' education.

Assoc. Prof. Dr. Hülya Demircioğlu
Karadeniz Technical University
Fatih Faculty of Education
Department of Mathematics and Secondary Education
Trabzon- Turkey
E. Mail: hulyadem76@hotmail.com

Hayriye Akar is currently a master student at Aksaray University, Institute of Sciences. She is a Science and Technology teacher at Şerife Akkanat secondary school in Konya. She is specifically interested in concept teaching, conceptual change and STEM education.

Hayriye Akar
Aksaray University Institute of Science
Aksaray- Turkey
E. Mail: hayriye-akar@hotmail.com

REFERENCES

Akan, D., Yalçın, S. ve Yıldırım, İ. (2014). Teachers' metaphoric impressions related to school manager, *İlköğretim Online*, 13 (1), 169- 179.

Ayas, A. (2009). Öğretmenlik mesleğinin önemi ve öğretmen yetiştirmede güncel sorunlar. *İnönü Üniversitesi Eğitim Fakültesi Dergisi*, 10 (3), 1–11.

Aydın, F. (2011). Üniversite öğrencilerinin "çevre" kavramına ilişkin metaforik algıları. *Doğu Coğrafya Dergisi*, 26,25-44.

Balcı, F. A. (2011). Okul metaforları: İlköğretim müfettişlerinin okul algıları, *Eurasian Journal of Educational Research*, 3 (44), 27-38.

Bloor, M. Ve Wood, F. (2006). Keywords in qualitative methods. Thousand Oaks, London, New Delhi: Sage Publications.

Çilesiz, S. (2011). A phenomenological approach to experiences with technology: current state, promise, and future directions for research. Educational Technology Research and Development, 59 (4), 487-510.

Derman, A. (2014). Lise öğrencilerinin kimya kavramına yönelik metaforik algıları. *Turkish Studies - International Periodical For The Languages, Literature and History of Turkish or Turkic*, 9(5), 749-776.

Ekiz, D., Koçyiğit, Z. (2013). Sınıf öğretmenlerinin "öğretmen" kavramına ilişkin metaforlarının tespit edilmesi, Kastamonu Eğitim Dergisi, 21 (2), 439-458.

Geçit, Y. ve Gençer, G. (2011). Sınıf öğretmenliği 1. sınıf öğrencilerinin coğrafya algılarının metafor yoluyla belirlenmesi (Rize Üniversitesi örneği). *Marmara Coğrafya Dergisi*, (23), 1-19.

Gillis, C. ve Johnson, C. L. (2002). Metaphor as renewal: re-imagining our professional selves. *The English Journal*, 91 (6), 37-43.

Guerrero, M. C. M. ve Villamil, O. S. (2002). Metaphorical conceptualizations of ESL teaching and learning. *Language Teaching Research*, 6 (2), 95–120.

Koç, E. S. (2014). Sınıf öğretmeni adaylarının öğretmen ve öğretmenlik mesleği kavramlarına ilişkin metaforik algıları. *İnönü Üniversitesi Eğitim Fakültesi Dergisi*, 15(1), 47-72.

Levine, P. M. (2005). Metaphors and Images of Classrooms.
https://files.eric.ed.gov/fulltext/EJ724893.pdf adresinden 11.03.2018 tarihinde erişilmiştir.

Oğuz, A. (2009). Öğretmen adaylarına göre orta öğretim öğretmenlerini temsil eden metaforlar. *Milli Eğitim Dergisi*, (182), 36-56.

Palmquist, R. A. (2001). Cognitive style and users' metaphors for the web: an exploratory study. *The Journal of Academic Librarianship*, 27 (1), 24–32.

Patchen, T. ve Crawford, T. (2011). From gardeners to tour guides: The epistemological struggle revealed in teacher-generated metaphors of teaching. *Journal of Teacher Education*, 62(3), 286-298.

Saban, A. (2004). Giriş düzeyindeki sınıf öğretmeni adaylarının "öğretmen" kavramına ilişkin algılarının metafor analizi yoluyla incelenmesi, Türk Eğitim Bilimleri Dergisi, 2 (2), 131-155.

Saban, A., Koçbekir, B. N. ve Saban, A. (2006). Öğretmen adaylarının öğretmen kavramına ilişkin algılarının metafor analizi yoluyla incelenmesi. *Kuram ve Uygulamada Eğitim Bilimleri*, 6(2), 461-522.

Saban,A. (2008). Okula ilişkin metaforlar. *Kuram ve Uygulamada Eğitim Yönetimi Dergisi*, 55, 459-496.

Şahin, B. (2013). Öğretmen adaylarının "matematik öğretmeni", "matematik" ve "matematik dersi" kavramlarına ilişkin sahip oldukları metaforik algılar. *Mersin Üniversitesi Eğitim Fakültesi Dergisi* , 9(1), 313 -321.

Töremen, F. ve Döş, İ. (2009). The metaphoric perceptions of primary school teachers on the concept of inspection, *Kuram ve Uygulamada Eğitim Bilimleri,* 9 (4), 1999-2012.

Yalçın, M. ve Erginer, A. (2012). İlköğretim okullarında okul müdürüne ilişkin metaforik algılar, *Öğretmen Eğitimi ve Eğitimcileri Dergisi,* 1 (2), 229-256.

Yılmaz, F., Göçen, S. ve Yılmaz, F.(2013). Öğretmen adaylarının öğretmen kavramına ilişkin algıları. *Mersin Üniversitesi Eğitim Fakültesi Dergisi*, 9,(1),151- 164.

Yob, I. M. (2003). Thinking constructively with metaphors. *Studies in Philosophy and Education*, 22, 127-138.

Willig, C. (2008). Introducing qualitative research in psychology (2. Baskı). Berkshire: McGraw-Hill Professional Publishing.

Zhao, H., Coombs, S. ve Zhou, X. (2009). Developing professional knowledge about teachers through metaphor research: facilitating a process of change. *Teacher Development,* 14 (3), 381-395.

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SCIENCE TEACHING LABORATORY APPLICATIONS: COMMON KNOWLEDGE CONSTRUCTION, LEARNING CYCLE MODELS AND STEM APPROACH

Assist. Prof. Dr. Harun Çelik
Kırıkkale University, Faculty of Education
Kırıkkale - TURKEY

Resrch. Assist. Hüseyin Miraç Pektaş
Kırıkkale University, Faculty of Education
Kırıkkale - TURKEY

Prof. Dr. Orhan Karamustafaoğlu
Amasya University, Faculty of Education
Amasya- TURKEY

Abstract
To achieve the purpose of inquiry learning approaches and models, it is necessary to identify the difficulties encountered because the science teacher candidates have key prescriptions. Therefore, the aim is to reflect fruitful and high level critical views at the end of the process providing them different learning difficulties using different learning models and approaches at every stages. For this purpose, qualitative research method was used in the study conducted with 40 candidates selected from easily accessible case sample among the third-grade students attending the undergraduate program of science teacher education. Open-ended form was prepared as a data collection tool and the data were generated using content analysis. Finally, the answers given by the teacher candidates are thematized as advantages, disadvantages, cognitive domain, skills, affective domain, SETSE dimension, TQF. The codes generated under the themes vary according to the applied model and approach. The nature of science, team work, and discussion culture code were most evident in CMCK. While the STS code was on the forefront in 5E model, the engineering and design skills code was found to be at a high level in STEM implementation.

Keywords: Inquiry-based approach, 5E, CMCK, STEM, science teaching.

INTRODUCTION

Traditional teaching methods with long-lasting application possibilities are changing today by leaving its place to the contemporary learning concept and keeping the individual in the foreground. In this context, the aim of science teaching is to provide learners with opportunity to develop their mental representations of the natural world with the help of more reliable and useful structuring process (Loxley, Dawes, Nicholls & Dore, 2016). Ausubel's theory of meaningful learning sees this process as valuable, but its main emphasis is on preliminary knowledge and current knowledge (Özmen, 2014). When the literature is examined (Ausubel, 1968; Novak, 2002; Kara & Özgün-Koca, 2004) meaningful learning means a type of learning that is not mechanical (conditional), that is not based on memorization, and does not involve a single point of view and the acceptance of the knowledge of a particular authority. Meaningful learning can be described as a learning activity based on learning and individuality, product of high level thinking skills (transfer, problem solving, interpreting, critical thinking, etc.), result of research and examination of the individual, interactive, shaping with original thinking, learning by doing and living (Uçar & Yesilyaprak, 2006). Therefore, meaningful learning, which is one of the most basic features of learning, can be realized with the most effective constructivist approach in today's teaching concept (Gijbels & Loyens, 2009; Rikers, Van Gog & Paas, 2008). Constructivism, which enables the individual to inquire into the newly encountered and existing knowledge in the learning process and to make meaningful learning by associating

information on this subject, has an important influence on modern science teaching (Matthews, 2002). It is an inquiry-based learning approach in an important approach that fosters active participation of learners in the learning environment in the learning environment and is consistent with the basic principles of constructivist learning approaches (Budak-Bayır, 2008). Even inquiry-based learning represents a constructivist approach (Zion, Michalsky & Mevarech, 2005).

National education standards encourage learners to participate in the learning process by conducting group activities and practical activities (Hayden et al., 2004). Students are encouraged to participate in and adapt the existing knowledge of the students (Hess & Trexler 2005), to support the results with evidence and observations, and to share ideas and discussions with students' peers (Wolf & Fraser, 2008). In this process, the teacher acts as a guide that allows students to think through asking different questions (Windschitl, 2002). These practices are known collectively as inquiry-based teaching and learning (Wolf & Fraser, 2008).

In science, inquiry involves exploring natural phenomena using processes, experiments, and high-level thinking (Lee et al, 2004). Inquiry-based learning is a student-centered approach that is often used in science education (Savery, 2006). In inquiry-based learning, students are confronted with an open-ended question or surprising situation that allows for various answers or solutions. Students can ask questions about the problem and formulate their own hypotheses (Loyens, Kirschner & Paas, 2011). In the interrogation process, the teacher assigns tasks, supports or facilitates the process, but students follow their own inquiries, use existing knowledge, and determine the resulting learning needs. They seek evidence to support their ideas and undertake the responsibility of analyzing and presenting it as part of a group or as an individual supported by others (Kahn & O'Rourke, 2005). When the literature is examined, there are studies about the increase of motivation and inquiry ability and the development of scientific process skills in students with inquiry-based teaching (Colley, 2006; Davies, Collier & Howe, 2012; Ketpichainarong, Panijpan & Ruenwongsa, 2010).

Inquiry-Based Learning Approach and Models

Inquiry Based Learning is used as a broad umbrella term to describe learning models and methods guided by a research process (Kahn & O'Rourke, 2005). The first learning model and approach used in the study is the 5E learning model, a research-inquiry model based on the Science Curriculum Improvement Study (Harurluoğlu & Kaya, 2011). This learning model is used in science education researches for daily cognitive process skills, attitudes, achievements and motivations in students. The 5E-learning model consists of five steps (Bybee & Landes, 1988; Eisenkraft, 2003). These steps; enter, explore, explain, elaborate and evaluation. The second one is a Common Knowledge Construction Model (Demircioğlu & Vural, 2016), which is accepted as a model considering the deficiencies in the previous constructivist and questioning learning environments, attitudes towards nature of science, conceptual change in the phenomenon frame and development. CKCM consists of four phases (Ebenezer, et al., 2010). These steps; exploring and categorizing, constructing and negotiating, extending and translating, reflecting and assessing. The third one is the, blend of scientific research and inquiry (Wendell, et al., 2010) called STEM education approach. This approach was placed in the science program in 2017 in Turkey due to the lack of application of the skills and experienced disruptions throughout the teaching process (Çepni & Ormancı, 2017). The application of this approach in questioning learning environments can be achieved through the enrichment of learning ring models, REACT, probing and project-based learning. In this study, problem-based learning (PBL), which shares the same philosophical trends (Price, 2001) and educational intentions as the inquiry-based learning for the STEM approach was used.PBL is basically composed of four basic stages: analysis of the problem, students' orientation about their own learning, brain storming and solution testing (Massa, 2008). PBL represents an important development in the practice of education that continues to influence both lectures and disciplines around the world (Schmidt, van der Molen, te Winkel, & Wijnen, 2009).

Inquiry Based Science Teaching Laboratory Applications

Inquiry can be planned with primary data collection processes such as research activities, laboratory experiments, trips and observations, while secondary data provided through printed and digital resources can be developed (Köseoğlu & Tümay, 2015). In this process, science laboratories are a unique resource that enhances the knowledge of important tools and skills that enable students to gain interest, scientific concepts and processes and develop new understanding (Lunetta, Hofstein & Clough, 2007). The behaviors and attitudes of the learners observed in a questioning laboratory environment within a changing learning context can vary astonishingly. This is because there are a number of struggling students who are trying to solve the problems they are trying to solve during a research they have designed, rather than students who follow the instructions defined during the lab (Lord & Orkwiszewski, 2006). Similarly, according to Johnstone and Wham (1982), inquiry-oriented laboratory surveys were conducted from students; (eg: the use of a microscope) and intellectual inquiry skills (eg: formulating hypotheses) at the same time.

There are many variables that need to be considered in laboratory activities and these variables have been seen to have an important place in teaching programs related to science classes since the beginning of the 19th century. These include (1) learning objectives, (2) the quality of the instructions (printed and / or electronic and / or oral) provided by the teacher and the laboratory guide, (3) available materials and equipment for use in laboratory research, (4) the nature of the activities during the laboratory work and student-student and teacher-student interactions (5) students and teachers' perceptions about how students' performances will be assessed, (6) laboratory reports of students, (7) preparations, attitudes, knowledge and attitudes of teachers (Lunetta, Hofstein & Clough, 2007).

As seen, the responsibilities that the student or the level of guidance provided by the teacher vary the learning gains of the learners and the classification of experiment types. Hegarty-Hazel (1986) points to four different experimental activities by adding the degree of openness to the interrogator to classify laboratory activities (Table 1). If the science curriculum (MEB, 2013) is compared with the classification set out by Hegarty-Hazel (1986), the researcher inquiry approach for elementary schools can be matched in the first level. For junior high school students, the guided researcher-questioner approach in grades 5 and 6 and the open-ended researcher questioner approach for grades 7 and 8 can be associated with 2b level.

Table 1: Classification of experiment types according to contents of laboratory activities

Level	Problem	Experiment Tools	Operation Sequence	Results	Common Name
0	Given	Given	Given	Given	Verification
1	Given	Given	Given	Open	Guided Inquiry
2a	Given	Given	Open	Open	Open Ended- Guided Inquiry
2b	Given	Open	Open	Open	Open Ended - Guided Inquiry
3	Open	Open	Open	Open	Open Ended Inquiry

According to Table 1, it is possible to engage students with inquiry laboratory studies and to provide opportunities for activities ranging from highly structured laboratory experiences to open-ended surveys that students search for a question in which they can express themselves. The nature of the teacher's learning approaches and models and the guidance provided by the students in the teaching activities are very important for real learning. In this case, the selection of the relevant experimental activities in science teaching, the achievements provided by the learners, and the selection of the instructional models and methods gain importance. As a matter of fact, according to Lawson (1988), it is known that learning environments based on the constructivist approach that uses the same

philosophy as interrogation, are based on collaborative learning, probabilistic learning, and approaches such as learning ring, which is widely used in science teaching.

There are a lot of laboratory studies in science teaching in which the subject is related to the permanence of learning, science literacy, academic achievement and thinking skills. Especially, 5E learning model in the laboratory environment based on the inquiry approach (Bozdoğan & Altunçekiç, 2007; Gençer & Karamustafaoğlu, 2014; Hanuscin & Lee, 2008; Kanlı & Yağbasan, 2008; Özbek, Çelik, Ulukök & Sarı, 2012; Tural, Akdeniz & Alev, 2010; Wilder & Shuttleworth, 2005; Yalçın & Bayrakçeken, 2010), problem-based within the open-ended researcher inquiry approach (Akpınar & Yıldız, 2006; Aydoğdu & Ergin, 2010; Chin & Chia, 2006; Çelik, Katrancı & Çakır, 2017; Kocakülah & Savaş, 2013; Temel & Morgil, 2007; Yaman & Yalçın, 2005), project-based learning methods (Juhl, Yearsley & Silva, 1997; Korkmaz & Kaptan, 2002; Morgil, Seyhan & Seçken, 2009; Sezgin, Çalışkan, Çallıca & Erol, 2001; Özer & Özkan, 2011) and CKCM construct on deficiencies in existing models (Bakırcı, Çepni & Yıldız, 2015; Demircioğlu & Vural 2016) and STEM approach (Bozkurt-Altan, Yamak & Buluş-Kırıkkaya, 2016; Cotabish, Dailey, Robinson & Hughes, 2013; Gökbayrak & Karışan, 2017; Yıldırım & Altun, 2015) have frequently been examined recently.

The relevance of current science programs and science teacher candidates training depend on teacher candidates' thoughts on questioning. Teacher candidates' attitudes and beliefs affect the methods and techniques they use in their classroom when they become teachers. In this respect, 5E, CKCM, PBL and STEM approaches are frequently used in science applications and ideally suited to collaborative student team work (Kahn & O'Rourke, 2005), although there are many studies, as mentioned earlier, which reveal the opinions of candidates about inquiry learning approaches and models that provide candidate teachers to put their opinions forward.

In this respect, it is necessary to identify the difficulties encountered because teacher candidates have a key prescription to reach the aim of inquiry learning approaches and models. It is thought that the data obtained from this research will help the teacher candidates to overcome the shortcomings in this area. The data obtained from these reasons are thought to be meaningful and valuable for the literature. Considering that the inquiry learning approach is different from the more traditional approaches, the challenges of inquiry-based learning can be a crucial factor for success (Kahn & O'Rourke, 2005). The first purpose of the research is to determine the different learning difficulties of science teacher candidates by using different inquiry learning models and approaches at each stage of the inquiry process, and to put forward efficient and high-level critical views that they will reflect at the end of this process. The second aim of the research is to inform candidate teachers about inquiry learning models and approaches that they can use in their classrooms when they become teachers.

Within the framework of these objectives; The following questions have been searched for laboratory applications.
1- What are the critical views of science teacher candidates towards the model of learning circle 5E?
2. What are the critical views of science teacher candidates towards CKCM?
3- What are the critical views of prospective science teachers towards the STEM approach?

METHODOLOGY

Qualitative research method was used in the research. Because qualitative research focuses on the text and imaginary data and makes it possible to assess a situation, a case, a subject, and an event in detail through original analyzes (Creswell, 2013). The opinions of the teacher candidates were provided by content analysis through written texts in the study. In content analysis, the data may be in verbal, written or electronic form, as well as in written media such as open-ended questionnaires, interviews, focus groups, observations or articles, books and guides (Kondracki, Wellman & Amundson, 2002).

Participants

Participants of this study consisted of third-year students studying in the undergraduate program of the science teacher of a state university in the 2016-2017 academic year, and participants were selected using the easily accessible sampling. The easily accessible sampling method gives speed and practicality to the researcher. Because, in this method, the researcher chooses a situation that is close and easy to access, so that it can provide a more practical and easy perception of study, data and analysis on a familiar sample (Yıldırım & Şimşek, 2011). In this study, since the application of learning models and approaches in the laboratory environment have analyzed the projective reflections, the use of the easily accessible case sample was preferred. The study group was limited to 40 teacher candidates who participated in science teaching laboratory practices-I, II courses and volunteered to work.

Application Process

In the study, firstly the learning ring model 5E, then CKCM, and finally the STEM approach in which PBL is used as a method have been introduced and implemented. In choosing this approach and models, researchers are based on changing curricula. First, the 5E model was chosen among the learning ring models by considering the 2005 science and technology course curriculum. Secondly, the STEM approach, which takes the CKCM and finally the science and engineering skills integrated into daily life, has been chosen in consideration of the researcher-questioning approach and the nature of science in the direction of the 2013 science curriculum.

At the same time, the planning of the process was also supported by the literature review. In the first phase; the candidate teachers face with some problems such as insufficiency of the training program, the problem in time management, the need for preliminary preparation, the complexity of the model and the long process steps (Özbek et al., 2012), in the second application, the length of the first phase, the lack of explanation step, difficulty in finding socio-scientific issue, lack of knowledge of the nature of science (Bakırcı, Çepni & Ayvacı, 2015), in the last application, inexperience of the teacher candidates about the time management and method, and efforts (Tatar, Oktay & Tüysüz, 2009; Eroğlu & Bektaş, 2016) . During the 6 weeks application period, these problems were solved.

For the first two models, teacher candidates were asked to perform and report experiments on the worksheets in a laboratory environment. In the third application, teacher candidates were asked to provide scenarios in accordance with the curriculum developed by the researchers and to continue and report the probing solutions with the STEM approach. The weekly schedule for all three applications is given in the Table 2 below.

Table 2: Inquiry-based science teaching laboratory applications activity plan

Teaching Model used in the laboratory	**Time schedule**	**Weeks and experiment titles**
5E Model	10 October- 18 November 2016	**Week 1:** Explaining the Historical Development of the Model, Explaining the Steps, Lastly, Presenting and Discussing a Sample Material Suitable for the Model to the Students
		Week 2: Balance and Gravity, Which Fluid Fly Away?
		Week 3: Diver in the Bottle, Gain on Rolls
		Week 4: Observation of Physical and Chemical Changes in the Material, Separation Using the Boiling Point Difference
		Week 5: Determination of Basic Organic Food Nutrients, Investigation of Diffusion Occurrence from Membrane
		Week 6: Investigation of Enzyme Effect Mechanism, Separation of Water Elements by the Effect of Electric Current

Common Knowledge Construction Model	13 February- 24 March 2017	**Week 1:** Explaining the Historical Development of the Model, Explaining the Steps, Lastly, Presenting and Discussing a Sample Material Suitable for the Model to the Students
		Week 2: Electrical Loads, Electrification, Conductivity and Insulation, Serial and Parallel Connection of Bulbs and Batteries
		Week 3: Examination of Acids, Bases and Salts
		Week 4: Investigation of Herbal Tissues, Respiration in Plants, Chloroplast and Leaf Structure in Plants
		Week 5: Sound, Is Sound Propagated in Space? Sound Propagation in different Environment, Resonance, Sound Intensity and Frequency
		Week 6: The Production of Electric Current and Ohm's Law
STEM Training Approach Supported by PBL	10 April- 18 May 2017	**Week 1:** Explaining the Historical Development of the Approach, Explaining the Steps, Lastly, Presenting and Discussing a Sample Material Suitable for the Model to the Students
		Week 2: Heat Sensitive Fan Making
		Week 3: Brightness Adjustable Lamp Design According to Usage Environment
		Week 4: Alternative a Fuel Indicator Design
		Week 5: A Free Battery Design
		Week 6: Development of an Alternative Density Measurement Method

Data Collection and Analysis

The literature on the study topic was searched and an open-ended question form consisting of 3 questions was prepared by the researchers. The purpose of the open-ended questionnaire was to collect qualitative data on teachers' responses in written form (Creswell, 2005). The prepared open-ended questionnaire was evaluated by the field experts and the necessary arrangements were made and the final form of the open-ended questionnaire was given. The data obtained from the open-ended questionnaire were analyzed by content analyzing. Content analysis consists of identifying the research questions in which answers should be found, selecting the sample to be analyzed, defining the categories to be applied, determining the coding process and coding training, applying the coding process, determining the credibility and analyzing the results of the coding process (Kaid, 1989). In this study, it is aimed to gather the similar data in the frame of specific concepts and themes and to organize them in a way that readers can understand according to the opinions of teacher candidates reflected through content analysis and new learning approaches and applications of the models (Yıldırım & Şimşek, 2011). The researchers who created the codes and the themes at the time of this process considered the contents of the relevant models / approaches. At the same time, the vision of science, technology, and science curricula of 2005, 2013 and 2017-2018 were also taken together. In this context, cognitive domain, skills, affective domain, Science-Engineering-Technology-Society-Environment (SETSE) dimensions were established. In addition to these dimensions, the advantages and disadvantages of the model/approaches are also added to the views reflected. The code is the result of parsing the data.

To increase the quality of scientific data emerging in the direction of these codes and themes, solutions for validity and reliability should be provided before data analysis. In this context, a two-step process has been followed for validity. In the first step, researchers have developed a coding scheme that specifies variables, definitions, values, and rules for recognizing these variables in coded content. In the second step, the researchers have compared the coding decisions according to the literature in terms of discipline and subject-centered. Most content analysis can adequately capture

an expert standard and objective coding to ensure the validity of the data (Potter & Levine-Donnerstein, 2009). Reliability of measuring instrument; were tested with the percentage of agreement between the two investigators (Şencan, 2005). As the reflection of models and approaches on science teaching was analyzed through the opinions of teacher candidates, the opinions of teacher candidates were evaluated separately by the two field education specialist researchers. Then, the matching ratios were calculated. In the content analysis of data collected in the research, Miles and Huberman (1994) proposed coding reliability calculation; Reliability = Agreement / (Agreement + Disagreement) reliability formula is used. As a result of the calculation, the reliability of the coding was calculated as 87.5% and considered reliable. It is accepted that the analysis of the research is reliable more than %70 (Miles & Huberman, 1994).

RESEARCH FINDINGS

Findings that include the views of 5E, CKCM and STEM model/approaches of teacher candidates applied in science teaching laboratory applications I-II course are classified in Table 3. Therefore, the critical views of the teacher candidates responding to all sub-problems of the research through this table are reflected.

Table 3: Participatory views on model/approaches based on themes

Themes	**Codes**	**Participatory views for model/approaches (*%, f*)**					
		5E		**CKCM**		**STEM**	
		f	***%***	***f***	***%***	***f***	***%***
Advantages	Provide discussion environment (critical thinking)	8	20	28	70	25	63
	Readiness is more interrogated	3	7,5	18	45	13	33
	Problem solving skills	2	5	5	13	22	55
	Creativity	3	7,5	8	20	24	60
Disadvantages	Less experimental activities are given	3	7,5	12	30	0	0
	Does not adequately support life skills	7	18	0	0	0	0
	Activities take a long time	12	30	24	60	18	45
	No effective communication	8	20	7	18	8	20
	Inadequacy of teacher as guide	9	23	8	20	4	10
	Lack of material	12	30	14	35	26	65
	Classroom management problem	9	23	13	33	22	55
	Lack of Content knowledge	8	20	12	30	24	60
Cognitive Domain	Provides permanent learning	22	55	26	65	18	45
	Provides conceptual change	21	53	26	65	19	48
	Provides learning by doing-living	28	70	26	65	32	80
	Student-centered	24	60	27	68	30	75
	Associated with daily life	25	63	28	70	26	65
	Phenomenographic	0	0	2	5	0	0
Skills	Scientific process skills (basic skills)	28	70	18	45	16	40

	Scientific process skills (experimental skills)	28	70	24	60	35	88
	Life skills	8	20	17	43	34	85
	Engineering and design skills	0	0	0	0	35	88
Affective Domain	Attitude	9	23	16	40	15	38
	Self-efficacy	13	33	16	40	27	68
	Motivation	8	20	15	38	18	45
	self-reliance	11	28	7	18	18	45
	Courage	10	25	16	40	25	63
	Responsibility	14	35	18	45	28	70
SETSE Dimensions	Socio-scientific issues are also included	5	13	21	53	12	30
	It gives understanding of the nature of science	9	23	24	60	18	45
	There is an emphasis on science and technology	14	35	18	45	32	80
	Integrates science, engineering and technology	0	0	6	15	36	90
	It provides the connection of science and technology to society	4	10	16	40	26	65
	Sustainable development brings awareness	0	0	8	20	16	40
	Develop science and career consciousness	3	7,5	5	13	34	85

When Table 3 examined, considering the percentages and frequencies, it can be said that teacher candidates gain sufficient awareness about the level of application of 5E, CKCM and STEM models / approaches. For example, the 5E teaching model is emphasized more (70%) in the scientific process skill codes. The codes in the cognitive domain are more important than the others. In the case of life skills (20%) and SETSE sub-codes (mean: 12.6%), the emphasis on the 5E teaching model seems to be insufficient. Therefore, the determinants of the 5E teaching model are emphasized by teacher candidates. Some example statements are given below.

TC24: Creativity in the 5E model is virtually absent. We make a solution, but there is no decision-making ability.
TC18: Communication problems among students in group work may occur.
TC7: 5E model is the forefront of concept teaching as it is aimed to learn and comprehend information directly. Therefore, teacher knowledge is important.

When the frequencies and percentage distributions of CKCM codes examined, it was found that critical thinking-based culture (70%), readiness (45%), higher level representation, life skills (43%), science nature (53%) and science and technology (45%) codes are higher than others. It proves that teacher candidates are qualified within CKCM.

TC15: The disadvantage of the CKCM is that it does not have an explanation step. Students will increase their self-confidence because they will express their knowledge freely in this model, but they will not be able to verify their information because it does not have an explanation step.
TC33: Time is not enough in this model due to the fact that the subject and achievement are excessive. In addition, there is a waste of time since it has lots of activities.

It is also seen that the first two activities were compared by teacher candidates. This can be seen in Table 3 that the problem of classroom management for 5E and CKCM will increase and take more time to defeat CKCM. Thus, the participant's views in this regard are as follows: TC21: "*CKCM is more difficult than 5E model*" and TC9: "*5E learning model is like STEM and CKCM preparation stage*".

The PBL activities in the direction of the STEM approach, included in the last stage of the working period, provided sufficient awareness of the prospective teachers. Because the subcategories of the theme are compatible with the elements of the STEM approach's contribution to science teaching. For example; Discussion (63%), problem solving skills (55%), creativity (60%), conceptual change (45), science process skills (88%), life skills (85%), engineering and design skills (88%) and the codes in the content of the SETSE theme (mean: 62.14%) were adequately emphasized by teacher candidates. On the other side, there are also negative opinions of teacher candidates for STEM applications. This is mostly originated from the content knowledge, teacher competences and conceptual change elements. For example, one of the teacher candidate's view of the STEM approach is that, TC3: "*I think that STEM practice may have a negative trend in concept teaching if it is not applied properly*". In a similar case, TC17:"*In STEM, product creation is more prominent, learning dimension is less important.*"andTC11:"*I think there may be a negative trend in concept teaching if STEM practice is not applied properly.*" similar emphasis was made on the perspective. In terms of content knowledge and classroom management, TC36: "*STEM actually makes us think like an engineer, but we are not used to doing it, so we have difficulty in adaptation*", TC15: "*When there are not enough materials, more active students lose their interest and others stay silent at the back.*" These are some evaluations made by the teachers.

DISCUSSION AND RESULTS

1. Teacher candidates have awareness of the basic concepts of model/approaches. It is seen in the percentage distribution in Table 3 that teacher candidates can extract the basic elements of all three activities. Therefore, it can be said that there is awareness about approaches and models. An important reason for the improved awareness of approaches and models can be considered as planning in a sequential process. This situation seems to add value to the model from a critical point of view.
2. Limitations of models and approaches, especially CMCK, take a long time to work. Özbek, Çelik, Ulukök and Sarı (2012) compared the 5E and 7E learning models over science literacy. The repeated activities took the longest time in the classroom and it was the negative side of the model. When the literature is examined in a similar way, the science teachers have limited time for the model to take, the first stage of CMCK, Discovering and Classifying, for a long time (Bakırcı, Çepni & Ayvacı, 2015). Thus, the criticism of the CMCK model is seen more frequently than other activities in Table 3 may be related to the first step of the model.
3. Possible classroom management problems are anticipated for activities that can be implemented in both constructivist and inquiry-based approaches. Classroom management is also an important responsibility for teachers in the learning process. If classroom management does not address possible undesired behaviors, good teaching does not occur. If the students are irregular and disrespectful and the rules and instructions cannot guide them to perform good behaviors, chaos in the classroom is inevitable. As a product of the same educational philosophy, both constructivist approach and inquiry-based approach require a successful teacher to choose the effective teaching strategy, to facilitate learning and to use classroom management techniques effectively (Marzano, Marzano & Pickering, 2008).
4. While CMCK thinking skills are supported, the most emphasis is on STEM. The CMCK is often needed for creativity, imagination, and critical thinking in the process of seeking and linking to learning, active debate and socio-scientific issues in the discovery-negotiation and expansion-transfer stages (Çepni, Özmen & Bakırcı, 2012). However, among the activities in life skills in which entrepreneurship skills are included as one of the dominant factors, the most emphasis is on STEM approach.

5. As an alternative to experimental activities for structuring the concepts under C, discussion and negotiation within the group can be proposed. Participants criticize this situation in the laboratory environment despite active learning activities. This can be explained by the importance and attitude of the students to the experiment. Students will be directed to make efforts to make the experiment meaningful and to investigate the situation if they cannot explain it with their prior knowledge. In this case, it encourages them to obtain data through experimentation and observation with an investigator-questioning approach (Köseoğlu & Tümay, 2015). Therefore, the students who start with the 5E model for this study process and who are in great agreement with the inquiry learning culture might criticize the effectiveness of the active learners who do not participate in the experiment.
6. Effective domain learning products are more influential on models/approaches than the other learning products. The fact that the activities are held at a certain time is not introduced at the previous level of education and that the student does not take responsibility enough can be cited as the cause of this result. Because Gibson and Chase (2002) stated that inquiry-based science teaching is more interesting and motivate the students, rather than by oral presentations, taking notes, or enjoying demonstration experiments in the laboratory. The fact that the products of effective learning remain below the expectation can be explained by the fact that the above situation is incomplete or inadequate in the learning environment. Gibson and Chase (2002) in their studies pointed out that lessons in the learning environments based on the inquiry approach for the higher education level are not at sufficient level, and effective learning products such as attitude and motivation for the lower levels are under the expectation.
7. Collaborative group work has an effective communication problem. The solution can be related to the culture of discussion. The lack of learning discipline or culture of discussion within the group negatively affects the expectation of peer education. Speaking is very important in group work for exploration. Discussions within a group can only be provided by a specifically designed or improved classroom management culture (Loxley, Dawes, Nicholls & Dore, 2016). Köseoğlu and Tümay (2015) view learning as learning and cultural contexts as an internalization of cultural means and independent use over time, and social interactions are the key points. For a supportive social interaction, teachers and students in a learning environment should share their thoughts with a constructive and critical approach, be reasonably supported, or engage in an interrogation and collaborative effort. The problem may be that the students have earned their critical thinking skills and reflective inquiry skills earlier to increase their productivity in dialogue within the group work in the process of constructing knowledge through doing-living.
8. 5E and CMCK have more emphasis on teacher guidance. Possible professional deficiency of the teacher will affect the efficiency. In a student-centered learning environment, the teacher is a facilitating guide. For the process of structuring knowledge, the teacher is like a learning and teaching engineer in a sense. However, to be able to do these things, he/she should be able to master the basic concepts of discipline which he teaches compared to the traditional teacher understanding (Köseoğlu & Tümay, 2015). In this context, teacher candidates pointed out that the adequacy of teachers in the direction of anticipation is also important by matching the activities in the implementation process with the last three curricula respectively.
9. The STEM approach emphasizes the lack of material in freeing the student in selecting materials. Similarly, in the study conducted by Yıldırım and Türk (2018), it was concluded that STEM applications should have sufficient materials for practice in class but there may be practical problems due to lack of materials or the lack of ability to use existing materials for different purposes.
10. It was seen that the students who participated in the laboratory study emphasized that the lack of content knowledge could significantly affect the learning process in these three active teaching models/approaches. Indeed, both the constructivist and the inquiry approach are also present in the literature review, where lack of content knowledge in the reach of anticipated fertility has shown significant resistance (Demirbaş & Pektaş, 2015; Yıldırım & Türk, 2018).
11. Turkey Qualifications Framework (TQF) 's competence in learning to learn all three model / approach has been concluded that complimented on. The "Mathematical competence and basic competencies in science/technology" dimension in connection with thinking-life and engineering-

design skills within the eight competencies of TQF included in the science curriculum updated by 2018; the "learning to learn" dimension with the views to make the learning process effective at the cognitive level; "Digital competence" with emphasis on the fact that teacher candidates make effective use of information technology in the study; It can be said that the SESTE themes emphasize the "social and citizenship competencies" with the sub codes. On the other hand, the result can be reached by using all these three approaches and models that overlap with current curriculum and teacher candidates have awareness about it.

12. Scientific Process Skills (SPS) are classified as experimental and basic skills. It has been seen that the BSB is more important or aware of the 5E model. In the literature, the 5E model seems to be the most reflective learning spiral to SPS (Anagün & Yaşar, 2009).
13. Life skills were criticized negatively in 5E, while constructive in STEM. Life skills such as creativity and entrepreneurship are not among the dominant factors in science teacher candidates' views on model 5E (Özbek, Çelik, Ulukök & Sarı, 2012).
14. There is awareness of mathematics, engineering and technology related to the integration of science in nature of STEM. The fact that the STEM approach is valued within the context of current science teaching, the involvement of the activities in the vision of the internet-based environment, and its popularly on the agenda has increased the emphasis on the integrated interdisciplinary dimension and components of the STEM approach built on probabilistic learning in practice (Table 3).
15. The sub-dimensions of the SSTE dimension found in the vision of the 2013 science lesson curriculum came to the forefront in CMCK. Similarly, according to Bakırcı, Çepni & Ayvacı (2015), it can be said that the teaching processes on which the CMCK is based concentrate on the achievements of SSTE in addition to many achievements. In the process of expanding and transferring CMCK, students use a critical thinking structure to uncover the interaction between knowledge, technology, society and the environment while solving problems in daily life, thus it increases their sensitivity to socio-scientific issues (Ebenezer et al., 2010). The size of SESTE integrated with engineering and technology is dominant in STEM approach. This result is also supported in the literature (Yıldırım & Türk, 2018).

SUGGESTIONS

1. Activities to develop social communication culture in collaborative learning environments should be designed and effective classroom management skills should be developed for teacher candidates towards inquiry-based learning environments.
2. It is a fact that learning in a constructivist and inquiry-based class can take place slowly and it takes time. This situation which is taken into consideration in the developing educational programs should be felt by the teacher candidates.
3. Teacher candidates are expected to become a guide to facilitate learning. Therefore, the number of practical courses at the undergraduate level should be increased so that the pedagogical content knowledge integrating the content knowledge and pedagogy can have a cultural product.
4. Teacher candidates should be able to use the laboratory equipment for other purposes within the scope of their suitability and convenience, and to develop their competence to ensure the safety and security of the laboratory environment.
5. Attention should be paid to the fact that previous laboratory cultures are gained in previous teaching life to achieve higher levels of affective competence.
6. If it is considered that the practices in this study have provided competence and awareness to the prospective teachers, activities should be planned to provide practical professional development for the active teachers.
7. When the STEM approach is desired to support engineering and design skills, it is possible to make recommendations to the practitioner at the point of planning and managing the activities by taking negative criticism in concept teaching and considering the long duration of CMCK activities reflected in the opinions of teacher candidates.

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Corresponding Author and Contact: Dr. Harun Çelik, Kırıkkale University, Faculty of Education, Maths & Science Education Department, Kırıkkale, haruncelik@kku.edu.tr

BIODATA AND CONTACT ADDRESSES OF THE AUTHORS

Dr. Harun Çelik is an expert in science education. He received his undergraduate degree from 19 Mayıs University, Amasya Faculty of Education and received his master's degree in Science and Science and Physics-Chemistry-Biology Teachers' job satisfaction in Kırıkkale University Social Sciences Institute in Educational Sciences Department. He made his doctorate at Kırıkkale University Institute of Science and Physics Department. The researcher is engaged in metaphor and analogies in concept teaching, science learning environments enriched by technology, and science education and physics education in the areas of science laboratories.

Dr. Harun Çelik
Kırıkkale University, Faculty of Education
71450 Kırıkkale- Turkey
E. Mail: haruncelik@kku.edu.tr

Hüseyin Miraç Pektaş graduated from science teacher department of KTU in 2005. He is still a Research Assistant at Kırıkkale University, Education Faculty, Department of Maths & Science Education.

Hüseyin Miraç Pektaş
Kırıkkale University, Faculty of Education
71450 Kırıkkale- Turkey
E. Mail: hmiracpektas@kku.edu.tr

Dr. Orhan Karamustafaoğlu graduated from physics department of METU in 1993. He is specialized on physics education, science teaching practice, teaching methods and teacher education in physics and science. He is still a full Professor Doctor at Amasya University, Education Faculty, Department of Maths & Science Education. He became the President of Turkish Science Education and Research Association – TSERA-. He published 9 books on science education with co-authors printed in Turkish. He has carried out many national scientific projects. He is an editor, vise-editor, member of advisory board, member of scientific board and referee in many international and national scientific journals. He also has national and international papers and proceedings.

Prof. Dr. Orhan Karamustafaoğlu
Amasya University, Faculty of Education
05100 Amasya- TURKEY
E-mail: orhan.karamustafaoglu@amasya.edu.tr

REFERENCES

Akpınar, E., & Yıldız, E. (2006). Açık uçlu deney tekniğinin öğrencilerin laboratuvara yönelik tutumlarına etkisinin araştırılması. *Dokuz Eylül Üniversitesi Buca Eğitim Fakültesi Dergisi*, *20*, 69-76.

Anagün, Ş., & Yaşar, Ş. (2009). İlköğretim beşinci sınıf fen ve teknoloji dersinde bilimsel süreç becerilerinin geliştirilmesi [Developing scientific process skills at science and technology course in fifth grade students]. *Elementary Education Online, 8(3),* 843-865.

Ausubel, D. P. 1968. *Educational Psychology: A Cognitive View*, New York: Holt, Rinehart and Winston Inc.

Aydoğdu, B., & Ergin, Ö. (2010, November). Fen ve teknoloji dersinde kullanılan farklı deney tekniklerinin öğrencilerin öğrenme yaklaşımlarına etkileri. In *International Conference on New Trends in Education and Their Implications* (pp. 11-13).

Budak-Bayır, E. (2008). Fen Müfredatlarındaki Yeni Yönelimler Işığında Öğretmen Eğitimi: Sorgulayıcı-Araştırma Odaklı Kimya Öğretimi. *Yayınlanmamış Doktora Tezi. Gazi Üniversitesi, Eğitim Bilimleri Enstitüsü:* Ankara.

Bakırcı, H., Çepni, S., & Yıldız, M. (2015). Ortak bilgi yapılandırma modelinin altıncı sınıf öğrencilerinin akademik başarılarına etkisi: Işık ve ses ünitesi [The effect of common knowledge construction model on sixth grade students' academic achievement: Light and sound unit]. *Dicle University Journal of Ziya Gökalp Faculty of Education, 26*, 182–204. https://doi.org/10.14582/DUZGEF.660.

Bakırcı, H., Çepni, S., & Ayvacı, H. Ş. (2015). Ortak bilgi yapılandırma modeli hakkında fen bilimleri öğretmenlerinin görüşleri [Science teachers' opinions about common knowledge construction model]. *YYU Journal Of Education Faculty, 12 (1),*97-127.

Bozdoğan, A. E., & Altunçekiç, A. (2007). Fen Bilgisi Öğretmen Adaylarının 5E Öğretim Modelinin Kullanılabilirliği Hakkındaki Görüşleri [The opinion of pre-service science teachers about the utility of 5e teaching model]. *Kastamonu Eğitim Dergisi*, *15(2),* 579-590.

Bozkurt-Altan, E., Yamak, H., & Buluş-Kırıkkaya, E. (2016). FeTeMM eğitim yaklaşımının öğretmen eğitiminde uygulanmasına yönelik bir öneri: Tasarım temelli fen eğitimi [A proposal of the STEM education for teacher training: Design based science education]. *Trakya University Journal of Education Faculty*, *6*(2), 212-232.

Bybee, J. W., & Landes, N. M. (1988). The biological sciences curriculum study (BSCS). *Science and Children, 25 (8),* 36-37.

Chin, C., & Chia, L. (2006). Problem-based learning: Using III-structured problems in biology project work. *Science Education, 90(1)*, 44-67. https://doi.org/10.1002/sce.20097

Colley, E. K. (2006) Understanding ecology content knowledge and acquiring science process skills through project-based science instruction. *Science Activities: Classroom Projects and Curriculum Ideas, 43 (1)*, 26-33. https://doi.org/10.3200/SATS.43.1.26-33.

Cotabish, A., Dailey, D., Robinson, A., & Hughes, G. (2013). The effects of a STEM intervention on elementary students' science knowledge and skills. *School Science and Mathematics, 113(5),* 215-226.

Creswell, J. W. (2013). *Araştırma deseni* (S. B. Demir, Çev., Ed.). Ankara: Eğiten Kitap.

Çelik, H., Katrancı, M., & Çakır, E. (2017). Fen Öğretiminde Açık Uçlu Araştırmacı Sorgulayıcı Laboratuvar Yaklaşımının Yaratıcı Düşünme Becerisine Etkisi. *Turkish Journal of Primary Education*, *2*(1), 1-10.

Çepni, S., Ormancı, Ü. (2017). Geleceğin Dünyası. Salih Çepni (Ed.), *Kuramdan Uygulamaya STEM Eğitimi (s. 1-32)*. 1. Baskı. Ankara: Pegem A Akademi.

Çepni, S., Özmen, H. ve Bakırcı, H. (2012, Haziran). Ortak Bilgi Yapılandırma Modeline Uygun Öğretim Materyali Geliştirilmesi: Işığın Madde ile Etkileşimi ve Yansıma Örneği. Sözel bildiri, *X. Ulusal Fen Bilimleri ve Matematik Eğitimi Kongresi, Niğde Üniversitesi,* Niğde.

Davies, D. J., Collier, C., & Howe, A. (2012). A matter of interpretation: developing primary pupils' enquiry skills using position-linked datalogging. *Research in Science & Technological Education, 30(3),* 311-325.

Demircioğlu, H. & Vural, S. (2016). Ortak bilgi yapılandırma modelinin (obym), sekizinci sınıf düzeyindeki üstün yetenekli öğrencilerin kimya dersine yönelik tutumları üzerine etkisi [The effect of common knowledge construction model (ckcm) on the 8th grade gifted students' attitudes toward chemistry course]. *Journal of Hasan Ali Yücel Faculty of Education, 13 (1),* Sayı: Özel Sayı-1, 49-60.

Demirbaş, M. & Pektaş, H. M. (2015). Evaluation of experiments conducted about 5e learning cycle model and determination of the problems encountered, *International Online Journal of Educational Sciences, 7(1),* 51-64.

Ebenezer, J., Chacko, S., Kaya, O.N., Koya, S. K. & Ebenezer, D.L. (2010). The effects of common knowledge construction model sequence of lessons on science achievement and relational conceptual change. *Journal of Research in Science Teaching, 47(1),* 25–46. https://doi.org/10.1002/tea.20295

Eisenkraft, A. (2003). Expanding the 5E model: A proposed 7E model emphasizes "transfer of learning" and the importance of eliciting prior understanding. The Science Teacher, 70, 56–59.

Eroğlu, S., & Bektaş, O. (2016). STEM eğitimi almış fen bilimleri öğretmenlerinin stem temelli ders etkinlikleri hakkındaki görüşleri [Ideas of science teachers took STEM education about STEM based activities]. *Journal of Qualitative Research in Education, 4(3),* 43-67. [Online]. https://doi.org/10.14689/issn.2148-2624.1.4c3s3m.

Gençer, S., & Karamustafaoğlu, O. (2017). "Durgun elektrik" konusunun eğitsel oyunlarla öğretiminde öğrenci görüşleri [The views of students regarding teaching of "static electricity" with educational games]. *Journal of Inquiry Based Activities*, *4(2),* 72-87.

Gibson, H. L., Chase, C., (2002). Longitudinal impact of an inquiry-based science program on middle school students' attitudes toward science. *Science Education, 86,* 693– 705. https://doi.org/10.1002/sce.10039

Gijbels, D., & Loyens, S. M. (2009). Constructivist learning (environments) and how to avoid another tower of Babel: reply to Renkl. *Instructional Science*, *37*(5), 499-502. https://doi.org/10.1007/s11251-009-9100-2

Gökbayrak, S., & Karışan, D. (2017). STEM temelli laboratuvar etkinliklerinin fen bilgisi öğretmen adaylarının STEM farkındalıklarına etkisinin incelenmesi [Investigating the effect of STEM based laboratory activities on preservice science teacher's STEM awareness]. *Journal of Human Sciences*, *14(4),* 4275-4288.

Hanuscin, D. L., & Lee, M. H. (2008). Using the learning cycle as a model for teaching the learning cycle to preservice elementary teachers. *Journal of Elementary Science Education*, *20(2),* 51-66. https://doi.org/10.1007/BF03173670

Harurluoğlu, Y. & Kaya, E. (2011). Öğrenme halkası modelinin fen bilgisi öğretmen adaylarının tohum-meyve-çiçek konularındaki başarılarına ve hatırlama düzeylerine etkisi [The effect of learning cycle model on the achievements and retention levels of pre-service science teachers in seed-fruitflower topics]. *Iğdır Univ. J. Inst. Sci. & Tech. 1(4),* 43-50.

Hayden, C. T., O'Neill, D., Meyer, J. E., Carballada, R. C., Sanford, A. L., Cohen, S. B., et al. (2004). *Intermediate level science: Core curriculum grades 5–8.* Retrieved March 31, 2018, from http://www.emsc.nysed.gov/ciai/mst/pub/intersci.pdf.

Hegarty-Hazel, E. (1986). *Lab work. SET: Research information for teachers, number one.* Canberra: Australian Council for Education Research.

Hess, A. J., & Trexler, C. J. (2005). Constructivist teaching: Developing constructivist approaches to the agricultural education class. *Agricultural Education Magazine, 77*, 12–13.

İyibil, Ü. (2011). A new approach for teaching 'energy' concept: The common knowledge construction model. *Western Anatolia Journal of Educational Sciences (WAJES),* Dokuz Eylül University Institute, Izmir, Turkey.

Johnstone. **A.** H. and Wham, **A.** J. B. (1982). The demands of practical work, *Education in Chemistry,*19(3). 71-73.

Juhl, L., Yearsley, K. & Silva, A. J., (1997), Interdisciplinary project- based Learning through an environmental water quality study. *Journal of Chemical Education, 74 (12),* 1431-1433. https://doi.org/10.1021/ed074p1431

Kahn, P., & O'Rourke, K. (2005). Understanding enquiry-based learning. In T. Barrett, I. Mac Labhrainn, & H. Fallon (Eds.), *Handbook of enquiry and problem-based learning (pp. 1–12).* Galway, Ireland: CELT. Retrieved March 28, 2018, from http://citeseerx.ist.psu.edu/viewdoc/download? https://doi.org/10.1.1.461.5829&rep=rep1&type=pdf

Kaid, L. L. (1989). Content analysis. In P. Emmert & L. L. Barker (Eds.), *Measurement of communication behavior* (pp. 197-217). New York: Longman.

Kanlı, U., & Yağbasan, R. (2008). 7E modeli merkezli laboratuvar yaklaşımının öğrencilerin bilimsel süreç becerilerini geliştirmedeki yeterliliği [The efficacy of the 7E learning cycle model based on laboratory approach on development of students' science srocess skills]. *Gazi Üniversitesi Gazi Eğitim Fakültesi Dergisi*, *28(1),* 91-125.

Kara, Y., & Özgün-Koca, S. A. (2004). Buluş Yoluyla Öğrenme ve Anlamlı Öğrenme Yaklaşımlarının Matematik Derslerinde Uygulanması:" İki Terimin Toplamının Karesi" Konusu Üzerine İki Ders Planı. *İlköğretim online, 3(1).* http://ilkogretim-online.org.tr

Ketpichainarong, W., Panijpan, B., & Ruenwongsa, P. (2010). Enhanced learning of biotechnology students by an inquiry-based cellulase laboratory. *International Journal of Environmental and Science Education, 5(2),* 169-187. http://www.ijese.com

Kiryak, Z. (2013). *Ortak bilgi yapılandırma modelinin 7. sınıf öğrencilerinin su kirliliği konusundaki kavramsal anlamalarına etkisi* (Yayımlanmamış yüksek lisans tezi), Karadeniz Teknik Üniversitesi, Trabzon.

Kocakülah, A., & Savaş, E. (2013). Akran öğretimi destekli bilimsel süreç becerileri laboratuvar yaklaşımının öğretmen adaylarının bazı bilimsel süreç becerilerine etkisi [Effect of the science *process skills laboratory approach supported with peer-ınstruction on some of science process skills of pre-service teachers]. Necatibey Faculty of Education Electronic Journal of Science and Mathematics Education, 7(2)*, 46-77.

Kondracki, N. L., Wellman, N. S., & Amundson, D. R. (2002). Content analysis: review of methods and their applications in nutrition education. *Journal of nutrition education and behavior, 34(4),* 224-230.

Korkmaz, H., & Kaptan, F. (2002). Fen eğitiminde proje tabanlı öğrenem yaklaşımının ilköğretim öğrencilerinin akademik başarı, akademik benlik kavramı ve çalışma sürelerine etkisi [The effects of project-based learning on elementary school students' academic achievement, academic self concepts and study time in science education]. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi*, *22*, 91-97.

Köseoğlu, F. & Tümay, H. (2015). *Bilim eğitiminde yapılandırıcı paradigma*, Pegem Akademi Yayıncılık, Ankara.

Lawson, A. E. (1988). A Better Way to Teach Biology. The American Biology Teacher, 50, 266-89. doi: 10.2307/4448733.

Lee, O., Hart, J. E., Cuevas, P., & Enders, C. (2004). Professional Development in Inquiry-Based Science for Elementary Teachers of Diverse Student Groups. *Journal of Research in Science Teaching. 41(10)*, 1021-1043.

Lord, T., & Orkwiszewski, T. (2006). Moving from didactic to inquiry-based instruction in a science laboratory. *The American Biology Teacher, 68(6)*, 342-345. https://doi.org/10.1662/0002-7685(2006)68[342:DTIIIA]2.0.CO;2.

Loyens, S. M. M., Kirschner, P. A., & Paas, F. (2011). Problem-based learning. In K. R. Harris, S. Graham, T. Urdan, A. G. Bus, S. Major, & H. Swanson (Eds.). *APA educational psychology handbook: Application to learning and teaching, 3, 403–425. Washington D.C.: American Psychological Association*. Retrieved March 20, 2018, from http://dspace.ou.nl/bitstream/1820/2934/1/Problem-Based%20Learning.pdf

Loxley, P., Dawes, L., Nicholls, L. & Dore, B. (2016). *İlköğretimde eğlendiren ve anlamayı geliştiren fen öğretimi.* H. Türkmen, M. Sağlam & E. Şahin-Pekmez (çev.). Ankara: Nobel Yayınevi.

Lunetta, V. N., Hofstein, A., & Clough, M. P. (2007). Learning and teaching in the school science laboratory: An analysis of research, theory, and practice. Sandra K. Abell,Ken Appleton,Deborah L. Hanuscin (Eds.). *Handbook of research on science education*, 393-441.

Mantzoukas, S. (2007) Reflection and problem/enquiry□based learning: confluences and contradictions. *Reflective Practice: International and Multidisciplinary Perspectives, 8(2),* 241-253. https://doi.org/10.1080/14623940701289311.

Marzano, J. R., Marzano, S. J., & Pickering, J. D. (2008). Etkili sınıf yönetimi stratejileri (Ç. Aksoy, Çev., Ed.). İstanbul: Sev Yayıncılık.

Massa, N. M. (2008). Problem-based learning. A real-world antidote to the standards and testing regime. *The New England Journal of Higher Education, 22(4),* 19-20. Retrieved March 15, 2018, from https://files.eric.ed.gov/fulltext/EJ794238.pdf

Matthews, M. R. (2002). Constructivism and Science Education: A Futher Appraisal. *Journal of Science and Technology, 11(2)*, 121-134. https://doi.org/10.1023/A:1014661312550

Miles, M, B., & Huberman, A. M. (1994). Qualitative data analysis: An expanded Sourcebook. (2nd ed). Thousand Oaks, CA: Sage.

Milli Eğitim Bakanlığı (MEB) (2013). İlköğretim kurumları fen bilimler dersi öğretim programı *(İlkokul ve ortaokul 3, 4, 5, 6, 7 ve 8. Sınıflar*), Talim ve Terbiye Kurulu Başkanlığı, Ankara.

Morgil, İ., Seyhan, H. G., & Seçken, N. (2009). Proje destekli kimya laboratuvarı uygulamalarının bazı bilişsel ve duyuşsal alan bileşenlerine etkisi. *Türk Fen Eğitimi Dergisi, 6(1),* 89-107. http://www.tused.org

Novak, J. D. (2002). Meaningful learning: The essential factor for conceptual change in limited or inappropriate propositional hierarchies leading to empowerment of learners. *Science education*, *86(4),* 548-571. https://doi.org/10.1002/sce.10032

Özbek, G., Çelik, H., Ulukök, Ş. & Sarı, U. (2012). 5E ve 7E öğretim modellerinin fen okur-yazarlığı üzerine etkisi. *Journal of Research in Educationand Teaching, 1(3),* 183-194.

Özer, D. Z., & Özkan, M. (2011). Proje tabanlı öğrenme yaklaşımının fen bilgisi öğretmenliği bölümü öğretmen adaylarının biyoloji konularındaki akademik başarılarına etkisi [The effect of project based learning approach to the academic achievement of prospective teachers of science education department towards biology lesson]. *Uludağ Üniversitesi Eğitim Fakültesi Dergisi*, *24(1),* 181-207.

Özmen, H. (2014). Öğrenme Kuramları ve Fen Bilimleri Öğretimindeki Uygulamaları. Salih Çepni (Ed.), *Kuramdan Uygulamaya Fen ve Teknoloji Öğretimi* (s. 51-119) 11. Baskı. Ankara: Pegem A Akademi.

Özsevgeç, T. (2006). Kuvvet ve hareket ünitesine yönelik 5E modeline göre geliştirilen öğrenci rehber materyalinin etkililiğinin değerlendirilmesi. *Türk Fen Eğitimi Dergisi*, *3*(2), 36-48. http://www.tused.org

Potter, W. J., & Levine Donnerstein, D. (2009). Rethinking validity and reliability in content analysis. *Journal of Applied Communication Research, 27 (3),* 258-284.

Price, B. (2001) Enquiry-based learning: an introductory guide, *Nursing Standard, 15(2)*, 45–55.

Rikers, R. M., van Gog, T., & Paas, F. (2008). The effects of constructivist learning environments: A commentary. *Instructional Science*, *36*(5-6), 463-467. https://doi.org/10.1007/s11251-008-9067-4

Savery, J. R. (2006). Overview of problem-based learning: definitions and distinctions. *The Interdisciplinary Journal of Problem-Based Learning, 1*, 9-20. https://doi.org/10.7771/1541-5015.1002

Schmidt, H. G., Van der Molen, H. T., Te Winkel, W. W. R., & Wijnen, W. H. F. W. (2009). Constructivist, problem-based learning does work: a meta-analysis of curricular comparisons involving a single medical school. Educational Psychologist, 44, 1-23.

Sezgin, G., Çalışkan, S., Çallıca, H., & Erol., M. (2001). Fizik Eğitiminde Projeye Dayalı Laboratuvar Çalışmalarına Yönelik Öğrenci Tutumları. *Maltepe Üniversitesi Fen Bilimleri Sempozyumu,7-8 Eylül*, İstanbul.

Şencan, H. (2005). *Sosyal ve Davranışsal Ölçümlerde Güvenirlik ve Geçerlilik*, 1. Baskı, Seçkin Yayınları, Ankara.

Tatar, E., Oktay, M., & Tüysüz, C. (2009). Kimya eğitiminde probleme dayalı öğrenmenin avantaj ve dezavantajları: bir durum çalışması [Advantages and disadvantages of problem based learning in chemistry education: a case study]. E*rzincan Eğitim Fakültesi Dergisi, 11 (1),* 95-110.

Temel, S. & Morgil, İ.(2007). Kimya eğitiminde laboratuvarda problem çözme uygulamasının öğrencilerin bilimsel süreç becerilerine ve mantıksal düşünme yeteneklerine etkisi [The effect of problem solving application in laboratory within chemistry education on students' scientific process skills and reasoning abilities]. *Dokuz Eylül Üniversitesi Buca Eğitim Fakültesi Dergisi, 22*, 89- 97.

Tural G., Akdeniz, A.R., & Alev, N. (2010). Effect of 5e teaching model on student teachers' understanding of weightlessness. *Journal of Science Education and Technology, 19 (5),* 470–488.

Uçar, E. & Yeşilyaprak, B. (2006). *Öğrenmeden Öğretime.* Yeşilyaprak, B. (Ed.) Eğitim Psikolojisi. Pegema Yayıncılık, Ankara.

Wendell, K. B., Connolly, K. G., Wright, C. G., Jarvin, L., Rogers, C., Barnett, M., & Marulcu, I. (2010). Incorporating engineering design into elementary school science curricula. *American Society for Engineering Education Annual Conference & Exposition, Louisville, KY. Retrieved March 30, 2018*, from http://ceeo.tufts.edu/documents/conferences/2010kwkccwljcrmbim.pdf.

Wilder, M., & Shuttleworth, P. (2005). Cell inquiry: A 5E learning cycle lesson. *Science Activities: Classroom Projects and Curriculum Ideas, 41(4),* 37-43. https://doi.org/10.3200/SATS.41.4.37-43.

Windschitl, M. (2002). Framing constructivism in practice as the negotiation of dilemmas: An analysis of the conceptual, pedagogical, cultural, and political challenges facing teachers. *Review of Educational Research, 72 (2)*, 131–175.

Wolf, S. J., & Fraser, B. J. (2008). Learning environment, attitudes and achievement among middle-school science students using inquiry-based laboratory activities. *Research in science education, 38(3),* 321-341.

Yalçın, F. A., & Bayrakçeken, S. (2010). The effect of 5E learning model on pre-service science teachers' achievement of acids-bases subject. *International Online Journal of Educational Sciences, 2(2),* 508-531. www.iojest.net

Yaman, S., & Yalçın, N. (2005). Fen bilgisi öğretiminde probleme dayalı öğrenme yaklaşımının yaratıcı düşünme becerisine etkisi [Effectiveness on creative thinking skills of problem based learning approach in science teaching]. *İlköğretim Online*, *4(1),* 42-52. http://ilkogretim-online.org.tr

Yıldırım, B., Altun, Y. (2015). STEM eğitim ve mühendislik uygulamalarının fen bilgisi laboratuar dersindeki etkilerinin incelenmesi. *El-Cezeri Journal of Science and Engineering*, *2*(2), 28-40.

Yıldırım, B., & Türk, C. (2018). Sınıf öğretmeni adaylarının STEM eğitimine yönelik görüşleri: Uygulamalı bir çalışma [Pre-service primary school teachers' views about STEM education: An applied study]. *Trakya University Journal of Education Faculty*, *8(2),* 195-213.

Yıldırım, A. & Şimşek, H. (2011). *Sosyal Bilimlerde Nitel Araştırma Yöntemleri*, 8. Baskı, Seçkin Yayıncılık, Ankara.

Zion, M., Michalsky, T. ve Mevarech, Z. R. (2005). The Effects of Metacognitive Instruction Enbedded Within an Asynchronous Learning Network on Scientific Inquiry Skills. *International Journal of Science Education, 27(8),* 957-983.

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THE NATURE OF SCIENCE INSTRUCTION WITH A DIRECT REFLECTIVE APPROACH: "HESS" AND "THERMODYNAMIC LAWS"

Prof. Dr. Gökhan Demircioğlu
Karadeniz Technical University
Fatih Faculty of Education
Department of Secondary Education
Akçaabat, Trabzon- TURKEY

Rabia Özdemir
Karadeniz Technical University
Fatih Faculty of Education
Department of Secondary Education
Akçaabat, Trabzon- TURKEY

Abstract
The purpose of the present study is to examine the effect of the nature of science instruction based on direct reflective approach on the level of student's understanding on the Hess Law and Thermodynamic Laws and on their beliefs about the nature of science. In this study, pretest-posttest control group design was used. The research was carried out with 50 students studying in two different classes in a Vocational and Technical Anatolian High School in Trabzon. While the experimental group students were taught with activities based on the direct reflective approach, the control group was taught with the traditional approach. Chemistry and Energy Achievement Test and Views of Nature of Science (VNOS-C) interview were used to collect data. The results showed that students have a lot of alternative conceptions about the nature of science and chemistry concepts under investigation and that the experimental group was more successful than the control group.

Keywords: The Nature of Science, Direct Reflective Approach, Thermodynamic, Hess Law.

INTRODUCTION

In international literature, while the concept of nature of science has been seen as an essential objective for students to learn science for the last one hundred years (Lederman, 2006), this concept in our country has been tried to be integrated into teaching programs in recent years. Important institutions and organizations such as the National Science Teachers Association (NSTA, 1982), the American Association for the Advancement of Science (AAAS, 1993) and the National Research Council (NRC, 1996) have emphasized the importance of the nature of science concepts. The sub-dimensions of the nature of science are expressed as empiricism, subjectivity, changeability, imagination and creativity, social and cultural influence, difference of observation and inference, difference between theory and law (AAAS, 1990, 1993; Millar and Osborne, 1998; NRC, 1996). The understanding of the nature of science is claimed to have an important role in understanding the science and the value of science as a part of contemporary cultures, managing technological tools and processes, and deciding on socio-scientific issues (Driver, Leach, Millar, and Scott, 1996). The chemistry teaching program, which was revised again in 2013, emphasized the importance of increasing the level of understanding of the students about the nature of science (MEB, 2013). The aim here is to train science literate individuals who know what science is and how to use science in everyday life. Scientific literate can be defined as a person who understands the nature of science and its sub-dimensions and can use scientific process skills. As can be understood from the

definitions, scientific literacy and the nature of science are intertwined concepts. Hence it is thought that individuals who understand the nature of science and its sub-dimensions will be able to perceive the concepts of chemistry more easily.

As is known, students have difficulties in understanding the basic chemistry concepts and have many alternative conceptions about these concepts (Demircioğlu and Yadigaroğlu, 2014). One of these concepts is thermodynamic laws. Many students have difficulty in noticing the phrase "*Energy cannot be created or destroyed, it can only be changed from one to another*". They generally think that "the energy can be destroyed or crated". In addition to these, it has been identified that students held alternative conceptions as "Energy does not change", and "there is electricity in the battery" and resemble the energy to the electricity, motion, light, sun etc. types of the energy (İyibil, 2011; Yürümezoğlu, Ayaz and Çökelez, 2009). Yürümezoğlu, Ayaz and Çökelez (2009) investigated level of understanding of 120 elementary school students about the energy and the related concepts and how energy changed over time. They explored that the students' understanding of these concepts is inadequate and incomplete. According to these results, they suggested that different experiments and activities should be done while teaching these abstract concepts. Taking into account the nature and sub-dimensions of science, the teaching of thermodynamic laws and HESS law is expected to increase the level of students' understanding of these concepts and the nature of science.

When studies on the nature of science are examined, it is seen that teacher candidates are usually used as a participant (Ağlarcı and Kabapınar, 2016; Aguirere, Haggerty and Linder, 1990; Bloom, 1989). In these studies, it is emphasized that the science activities which are not aimed to directly teach the nature of science could not improve student' perceptions of nature of science and overcome their alternative conceptions about it, and new alternative conceptions could emerge. On the other hand, when the nature of science is taught with a direct reflective approach associated with science topics, there are studies that suggest that preservice teachers' understanding of the nature of science significantly improved (Lederman, Schwartz, Abd-El-Khalick and Bell, 2001). It is even thought that taking into account the historical development of concepts in science teaching provides important contributions about students' understanding of the development of science and changeability of scientific knowledge over time. When examined the studies in our country, it is understood that they has begun to emphasize on concepts of nature of science and scientific literacy. However, teaching plans and models on how to improve these concepts in students are needed. Erdoğan and Köseoğlu (2015) in their study conducted with 15 eleventh grade students used explicit-reflective inquiry activities to improve students' perceptions about nature of science while teaching the topic of chemical equilibrium. In the study, the nature and sub-dimensions of science have been tried to be integrated into the subject of chemical equilibrium. As a result of the study, it was determined that the students' perceptions of nature of science progressed considerably and participants developed a positive perspective towards chemistry. Ağlarcı and Kabapınar (2016) aimed to overcome chemistry student teachers' misconceptions about the nature of science by using the activities based on a direct reflective approach. As a result of the study, it was determined that the opinions of chemistry student teachers on the nature of science changed positively. They also indicated that teaching with activities based on the nature of science may facilitate to learn difficult chemistry topics. It is claimed that not only teacher candidates but also a great majority of teachers think that scientific knowledge is universal and that it will not change over time (Aguirere et al., 1990). Some teachers have misconceptions about the differences between theory and law (Bloom, 1989). The fact that the "nature of science" concept, which is of great importance in terms of the quality of education, is not properly structured even by teachers, shows how important this concept is and what it is worth investigating. As mentioned above, teachers, teacher candidates and high school students have similar difficulties and misconceptions about the nature of science. Indirect, direct-reflective and historical process approaches are used in the teaching of the nature of science. It is suggested that the direct reflective approach is more effective than an indirect approach (Önen Öztürk ve Bayram, 2017). For this reason, direct reflective approach was preferred in this study.

The Purpose of the study

The purpose of the this study is to determine the effect of the nature of science instruction based on direct reflective approach on the level of student's understanding on the Hess Law and 1st, 2nd and 3rd laws of Thermodynamic and on their beliefs about the nature of science.

METHOD

The experimental method is the most appropriate method to determine the effect of a variable. In this study, quasi-experimental method, which is often used in educational research (Thistlethwaite and Campell, 1969), was used. This method is preferred when groups cannot be created by random assignment. The present study was conducted with 50 students (EG: 29; CG: 21) in Trabzon Vocational and Technical Anatolian High School. In the school, one of the two classes at the 11th grade was randomly assigned to the experimental (29) group and the other control group (21). While the control group students were taught to with traditional approach, the experimental group students were taught with a direct reflective approach using various activities. The application was completed in 6 hours in the experiment group and in 8 hours in the control group.

Data Collection Tools

In this study, Chemistry and Energy Achievement Test and Views Nature of Science Form-C (VNOS-C) (Lederman, Abd-El-Khalick, Bell ve Schwartz, 2002) were used as data collection tools. Besides semi-structured interviews were conducted with the students in the experimental group in order to determine their opinions about application.

Chemistry and Energy Achievement Test (CEAT); the CEAT has been prepared by taking into consideration the learning outcomes of the Chemical and Energy unit in the 11th grade chemistry teaching program. This test consisting of 17 multiple-choice, 10 open-ended, total 27 questions, was applied to 12th grade 33 students as a pilot study. Some of the questions were taken from textbooks written in accordance with the chemistry teaching program. The others were prepared by the researchers by taking into consideration the alternative conceptions and learning outcomes. As a result of the item analysis, the reliability of the multiple choice was found to be 0.71 using the KR-20 formula. The reliability of the open ended part was calculated to be 0.96 using the inter-rater reliability method (two raters).

Views Nature of Science Form-C (VNOS-C); Form-C which designed by Lederman et al. (2002) was used to determine the students' understanding level about the nature of science. The scale contains 11 open ended questions. In this study, the test was applied twice as pre-test and post-test. Data analysis was made as suggested by Lederman et al. (2002). The answers given by the students were discussed and evaluated by two different researchers.

Procedure

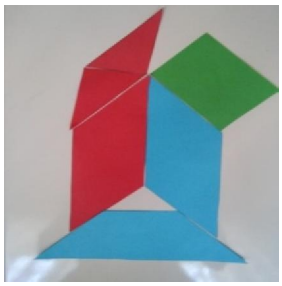
While the control group students received traditionally designed chemistry education, the experimental group students were taught with activities based on student collaboration and active participation. The activities in experimental group included daily life samples such as thermos, pressure cooker, car engine and carburetor for open, closed and isolated systems. On the other hand, concept cartoon and tangram activity were used for the nature and the sub-dimensions of science.

Tangram Activity: The purpose of this activity is to make students' understanding that scientific information may change with new information, different perspectives and interpretations. The reason for choosing this activity is to allow to work with the scientists' mind. The activity was practised by following the steps below.

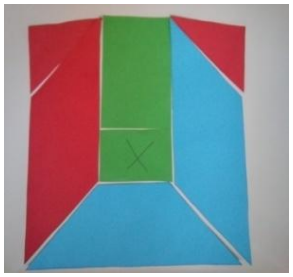
Application Steps:

1. To form a shape is asked by combining the fragments of the hands of the groups of five persons (Shape 1).

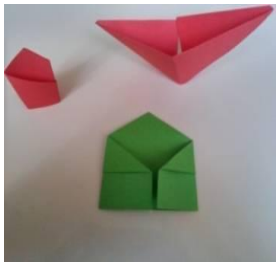
2. A piece marked with X is given each group, and it is said that this piece symbolizes a new scientific knowledge. Groups obtain following shape (Shape 2).
3. Each student in the group makes a shape that they want from a single piece in their hand (Shape 3).



Shape 1



Shape 2



Shape 3

Result: At the end of activity, students were asked to argue what aspects of a scientific work are similar with this activity, and what characteristics of nature of science reflects.

Concept Cartoon: The following concept cartoon were developed for the Hess Law to improve the students' understanding of the sub-dimensions of the nature of science (the effect of the social and cultural environment, the theory and law difference, empiricism and the effect of the imagination). Cartoon was used to determine and discuss students' existing alternative conceptions. First, the students read ideas of characters in the cartoon and expressed their own ideas. And then, ideas of each character were discussed and evaluated.

Analysis of Data

Multiple choice questions were evaluated by giving 1 for each correct answer and 0 for the wrong answer. Descriptive analysis techniques were used in analyzing open-ended questions (Yıldırım and Şimşek, 2000). The answers that the students gave to the questions were categorized as "sound understanding, partial understanding and unanswered". The t-test was used for the results of multiple choice and open-ended questions. The results of the VNOS-C scale were evaluated using percentages.

FINDINGS AND DISCUSSION

1. Findings from the multiple choice section of the test

Findings from the multiple choice section of the testfor pre-test and post-test are given in Table 1.

Table 1: Findings from the Multiple Choice Section of the Test

		Pre-test			Post-test		
		CA*	WA*	NA*	CA*	WA*	NA*
		%	%	%	%	%	%
1	EG	27.58	62.07	10.35	48.27	51.72	0
	CG	9.53	90.47	0	4.76	95.23	0
2	EG	13.79	86.21	0	62.06	37.93	0
	CG	14.28	85.72	0	19.04	80.95	0
3	EG	13.80	86.20	0	41.37	58.62	0
	CG	4.76	90.47	3.44	42.85	57.14	0
4	EG	37.93	55.17	6.89	79.31	20.68	0
	CG	14.28	85.71	0	42.85	57.14	0
5	EG	10.34	89.66	0	58.62	41.37	0
	CG	23.80	76.19	0	4.76	90.47	4.76
6	EG	20.68	79.31	0	68.96	27.58	3.44
	CG	28.57	71.42	0	42.85	57.14	0
7	EG	20.68	79.31	0	41.37	58.62	0
	CG	28.57	71.42	0	19.04	80.95	0
8	EG	41.37	58.62	0	27.58	72.41	0
	CG	14.28	85.71	0	23.80	76.19	0
9	EG	6.89	89.65	3.44	37.93	62.06	0
	CG	9.52	90.47	0	14.28	85.71	0
10	EG	10.34	86.20	3.44	82.75	17.24	0
	CG	19.04	72.72	4.76	42.85	52.38	4.76
11	EG	17.24	82.75	0	34.48	65.51	0
	CG	23.80	76.19	0	28.57	71.42	0
12	EG	27.58	68.96	3.44	24.13	75.86	0
	CG	28.57	71.42	0	42.85	57.14	0
13	EG	20.68	79.31	0	41.37	58.62	0
	CG	4.76	95.23	0	9.52	90.47	0
14	EG	24.13	75.86	0	65.51	34.48	0
	CG	19.04	80.95	0	52.38	38.09	9.52
15	EG	34.48	58.62	6.89	79.31	20.68	0
	CG	28.57	71.42	0	42.85	57.14	0
16	EG	13.79	86.20	0	41.37	58.62	0
	CG	14.28	85.71	0	9.52	90.47	0
17	EG	44.82	55.17	0	62.06	37.93	0
	CG	33.33	66.66	0	9.52	90.47	0

*CA: CorrectAnswer WA: WrongAnswer NA: No Answer

As shown in Table 1, the correct response rates of the students in the pre-test are between 6.89% and 44.82% for the experimental group; and between 4.76% and 33.33% for the control group. The highest achievement in the experimental group is on the 8th and 17th questions about the entropy and the heat concepts; the lowest achievement is on the 9th question about the heat, work and internal energy concepts. The highest achievement in the control group is on the 17th question about the heat concept; the lowest achievement is on the 3th and 13th questions about the heat of formation and the system types concepts. The correct answer rates of the students in the experimental and control groups in the post-test increased relative to the pre-test. However, success rates in the control group are not as expected. These rates are between 24.13% and 82.75% in the experimental group; in the control group is between 4.76% and 42.85%. The highest achievement in the experimental group is on the 10th question about the voluntary-involuntary event concepts; the lowest achievement is on the 12th question about the thermodynamic concept. The highest success rate in the control group is on the 3, 4, 6, 12 and 15th questions about the enthalpy of formation, constant volume-constant pressure, thermodynamic and heat-temperature concepts; the lowest achievement is on the 1st and 5th questions about the system and environment, internal energy concepts. t-test results for pre-test and post-test means of experiment and control group are given in Table 2.

Table 2: t-test Results for Pre-Test and Post-Test Means of Experiment and Control Group

Pre-test	**N**	**Mean**	**SD**	**df**	**t**	**p**
EG	29	4.06	1.73	48	2.01	0.13
CG	21	3.19	2.31			
Post-test						
EG	29	8.96	2.53	48	2.01	0.001
CG	21	4.47	2.80			

As seen in Table 1, the pre-test average of the experimental group is 4.06 and the control group is 3.19. The post-test average of the experimental group is 8.96 and the control group is 4.47. In order to compare the performance in the pre-test and post-test of the groups, an independent samples t-test was carried out. The Table 2 reports the results. Table 2 reveals that the difference between the means obtained from the pre-test of the EG and the CG students was not statistically significant ($p>0.05$). It can be said that both groups' preconceptions are equal about the studied subject. The difference between the means obtained from the post-test of the EG and the CG students was statistically significant ($p <0.05$). The experiment group is more successful about the studied subject for the multiple-choice questions.

2. Findings from the open-ended section of the test

The results from the open-ended section of the test for pre-test and post-test are given in Table 3.

Table 3: The Results from the Open-Ended Section of the Test

Item no		Pre-test			Post-test		
		SU*	PU*	NA*	SU*	PU*	NA*
		%	%	%	%	%	%
1	EG	0	17.24	82.75	17.24	58.62	24.13
	CG	0	4.76	95.23	0	0	100
2	EG	0	51.72	48.27	62.06	24.13	13.79
	CG	0	23.80	76.19	14.28	57.14	28.57
3	EG	0	27.58	79.31	31.03	13.79	55.17
	CG	0	0	100	0	4.76	95.23
4	EG	0	89.65	6.89	17.24	82.75	0
	CG	0	61.90	19.04	0	57.14	38.09
5	EG	0	17.24	82.75	27.58	31.03	41.37

	CG	0	0	100	0	0	100
6	EG	0	31.03	68.96	68.96	31.03	0
	CG	0	9.52	90.47	0	33.33	66.66
7	EG	0	37.93	58.62	96.55	0	3.44
	CG	0	4.76	95.23	38.09	0	61.90
8	EG	10.34	68.96	20.68	28.62	37.93	3.44
	CG	14.28	61.90	23.80	9.52	42.85	47.61
9	EG	72.41	20.68	6.89	89.65	3.44	6.89
	CG	42.85	33.33	23.80	28.57	4.76	66.66
10	EG	0	65.51	34.48	51.72	34.48	13.79
	CG	0	19.04	80.95	0	14.28	85.71

*SU: Sound Understanding PU: Partial Understanding NA: No answer

When the pre-test results are examined the percentage of answers of EG group students in the "Sound Understanding" category ranged from 0% to 72.41%, that of CG group students ranged from 0% to 42.85%. This result indicated that the students' understanding levels in this category are almost similar to each other except the 9th item about "reversible-irreversible processes". In the item, the experimental group had a higher level of understanding than the control group. In the "Partial Understanding" category, the percentage of the EG varied between 17.24% and 89.65%, that of the CG ranged from 0% to 61.90%. In the "Unanswered" category, the percentage of the EG varied between 6.89% and 82.75%, that of the CG ranged from 23.80% and 100%. The almost all of the control group students did not answer the questions (1, 3, 5) which required mathematical calculation mostly. When the post-test results are examined the percentage of answers of EG group students in the "Sound Understanding" category ranged from 17.24% to 96.55%, that of CG group students ranged from 0% to 38.09%. In the "Partial Understanding" category, the percentage of the EG varied between 0% and 82.75%, that of the CG ranged from 0% to 57.14%. In the "Unanswered" category, the percentage of the EG varied between 0% and 55.17%, that of the CG ranged from 28.57% and 100%. All students in the control group did not answer 1st and 5th questions about enthalpy of formation and entropy change. t-test results for pre-test and post-test means of experiment and control group are given in Table 4.

Table 4: t-test Results for Pre-Test and Post-Test Means of Experiment and Control Group

Pre-test	N	Mean	SD	df	t	p
EG	29	17.68	6.64	48	2.01	0.09
CG	21	14.33	7.15			
Post-test						
EG	29	66.68	19.15	48	2.01	0.001
CG	21	18.85	14.80			

As seen in Table 3, the pre-test average of the experimental group is 17.68 and the control group is 14.33. The post-test average of the experimental group is 66.68 and the control group is 18.85. In order to compare the averages in the pre-test and post-test of the groups, an independent samples t-test was carried out. The Table 4 reports the t-test results. Table 4 reveals that the difference between the means obtained from the pre-test of the EG and the CG students was not statistically significant ($p>0.05$). It can be said that both groups' preconceptions are equal about the studied subject. On the other hand, the difference between the means obtained from the post-test of the EG and the CG students was statistically significant ($p <0.05$). The experiment group is more successful about the studied subject for the open-ended questions. In the control group, the least success rate was on 1, 3, 5, and 10th questions which required mathematical calculation (Table 3). 4th and 6th questions are knowledge and comment questions. The control group could not answer these questions because the students were inadequate in making comments and mathematical calculations. It was observed that the students in the experiment group were able to comment on the events and

situations with a different perspective during the treatment. The experimental group students were more successful in comment questions than in questions requiring mathematical calculations.

3. Findings from the VNOS-C scale

Table 5 contains students' alternative conceptions obtained from the VNOS-C scale. When the pre-test results (VNOS-C) are examined, the percentage of answers of EG group students ranged from 6.9% to 34.5% and that of CG group students ranged from 4.8% to 14.2% (Table 5). This indicated that EG students have a higher percentage of alternative conceptions than CG students. After the treatment, the percentages of EG ranged from 0% to 48.3% and that of CG ranged from 0% to 23.8%. While the experimental group students completely corrected 2nd and 4th alternative conceptions in Table 5, the control group students remedy 3rd and 6th alternative conceptions. The result from the VNOS-C test showed that the direct reflective approach was not effective on students' perceptions of the nature of science. However, Ağlarcı ve Kabapınar (2016) investigated that the effect of activities based on direct reflective approach on the chemistry student teachers' opinions about science and pseudo-science, and on their alternative conceptions about the nature of science and science. They found that the chemistry student teachers' opinions about the nature of science changed positively. Karaman & Apaydın (2014) used *"Views of Nature of Scientific Inquiry" instrument* in order to examine *the nature of scientific inquiry understandings of elementary teachers. They found that elementary teachers held a "inadequate" understanding about the nature of scientific inquiry.* It has been identified in many studies because there is no specific teaching activities about the nature of science, students and student teachers have inadequate or incomplete knowledge about the sub-dimensions of the nature of science in the world and Turkey (Akerson, Abd-El-Khalick and Lederman, 2000; BouJaoude, 1996; Doğan and Abd-El-Khalick, 2008; Meichtry, 1992).

Table 5: The VNOS-C Results of The Experimental and Control Group

Students' alternative conceptions	Grup	Pre-test		Post-test	
		f	%	f	%
1. Scientific knowledge can only be discovered by using experiment methods	EG	9	31	14	48.3
	CG	1	4.8	5	23.8
2. There is no difference between a scientific theory and a scientific law	EG	4	13.8	0	0
	CG	2	9.52	3	14.3
3. Scientific theories turn into laws with enough *research.*	EG	5	17.2	2	6.9
	CG	3	14.2	0	0
4. Scientists do not use their imagination in their research	EG	2	6.9	0	0
	CG	2	9.52	1	4.8
5. Scientific knowledge is universal and unchanging	EG	10	34.5	6	20.7
	CG	2	9.52	5	23.8
6. Scientists are not affected by each other	EG	7	24.1	1	3.4
	CG	2	9.52	0	0

As seen in Table 5, the most common alternative conception is "*scientific knowledge can only be discovered by using experimental methods*". Number of students in both groups who have this alternative conception increased from the pre-test to the post-test. It is understood that students are coded in their minds that the scientist and the experiment are two inseparable halves that comprise the whole. The alternative conception has also been encountered in studies in the literature (Karaman and Apaydın, 2014; Wening, 2006). In their study of Karaman and Apaydın (2014), they found that some elementary teachers believed that a the only way to produce scientific knowledge is to experiment. McComas (2000) stated that one of the most important tools was to experiment in science, but it's not the only way.

RESULTS AND SUGGESTIONS

The present study investigated the effect of the nature of science instruction based on direct reflective approach on the level of student's understanding on the Hess Law and Thermodynamic Laws and on their beliefs about the nature of science. To achieve the purpose, activities consisting of both chemistry concepts and the nature of science were developed and applied by the authors. The results indicate that teaching based on direct reflective approach was more effective in remedying students' alternative conceptions and on levels of students' understanding about the Hess Law and 1st, 2nd and 3rd laws of Thermodynamic on than traditional instruction. However, the effect of the activities used in the study on students' perceptions of the nature of science was much lower than expected after the treatment. Students' low performance on the nature of science may be originated from their negative views on learning, school, and their future. Also, this result may be due to the lack of general chemistry knowledge of learners and lack of willingness to study. Most of the students do not repeat the concepts they have learned in classroom and do not do the homework given by the teacher. Many of participants do not want to take a responsibility of their learning and asks their teacher everything. This is a limitation for the study. The results of the present study should be evaluated by take into consideration the mentioned limitation. On the other words, the characteristics of the participants significantly affected the results of the study.

Chemistry teachers should directly be taken into consideration the nature and sub-dimensions of science emphasized in the chemistry teaching curriculum in order to grow scientific literate individuals.

To change the perception on any subject is hard and takes time. The present study which is based on only one unit was not effective enough on students' perceptions of the nature of science. For the expected effect, the study should be expanded to other chemistry subjects and done over a longer period.

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BIODATA AND CONTACT ADDRESSES OF AUTHORS

Prof. Dr. Gökhan Demircioğlu currently employed as a Professor at Karadeniz Technical University, Fatih Faculty of Education, Department of Mathematics and Science Education and has been a member of the Fatih Faculty of Education since 1998. He received his master's degree in physical chemistry in 1998, and his Ph.D. in chemistry education in 2003 from the Karadeniz Technical University. He is specifically interested in concept teaching, out-of-school learning environments, computer and instructional technology, secondary science education, teacher training, context-based learning, and technological pedagogical content knowledge (TPACK). He has published over 100 papers in refereed journals and conferences and has collaborated in four books.

Prof. Dr. Gökhan Demircioğlu
Karadeniz Technical University, Fatih Faculty of Education,
Department of Mathematics and Science Education
Akçaabat, Trabzon- Turkey
E. Mail: demircig73@hotmail.com

Özdemir is a graduate student of Chemistry Department in Karadeniz Technical University, Turkey. Her research interests is to contribute to be educated of scientific literate individuals, and to examine the effect of the nature of science instruction based on direct reflective approach on the level of student's understanding on the Hess Law and Thermodynamic Laws and on their beliefs about the nature of science.

Rabia Özdemir
Karadeniz Technical University
Fatih Faculty of Education, Department of Secondary Education
Trabzon- Turkey
E. Mail: r7zdmr@hotmail.com

REFERENCES

Abd-El-Khalick, F. and Lederman, N.G. (1998, April). Improving science teachers' conceptions of the nature of science: A critical review of the literature. *Paper presented at the annual meeting of the National Association for Research in Science Teaching*, San Diego, CA.

Aguirere, J. M., Haggerty, S.M. and Linder, C.J. (1990). Student teachers' conceptions of science, teaching and learning: A case study in preservice science education. *International Journal of Science Education*, 12, 381-390.

Ağlarcı, O. and Kabapınar, F. (2016). Kimya Öğretmen Adaylarının Bilime ve Sözde Bilime İlişkin Görüşlerinin Geliştirilmesi. *Amasya Üniversitesi Eğitim Fakültesi Dergisi*, 5 (1), 248-286.

Akerson, V. L., Abd-El-Khalick, F. and Lederman, N. G. (2000). Influence of reflective explicit activity-based approach on elementary teachers' conceptions of nature of science. *Journal of Research in Science Teaching*, 37, 295-317.

American Association for the Advancement of Science. (1990). Science for all Americans. New York: Oxford University Press.

American Association for the Advancement of Science. (1993). Benchmarks fors cience literacy: A Project 2061 report. New York: Oxford University Press.

Bloom, J.W. (1989). Preservice elementary teachers' conceptions of science: Science, theories and evolution. *International Journal of ScienceEducation*, 11, 401–415.

BouJaoude, S. (1996). Why an issue on science education? (Editorial). Scie-Quest, 6 (1), 4-5.

Demircioğlu, G. and Yadigaroğlu, M. (2014).A comparison of level of understanding of student teachers and high school students related to the gas concept, *Procedia – Social and Behavioral Sciences*, 116, 2890-2894.

Doğan, N. and Abd-El-Khalick, F. (2008). Turkish grade 10 students' and science teachers' conceptions of nature of science: A national study. *Journal of Research in Science Teaching*, 45(10), 1083–1112.

Driver, R., Leach, J., Millar, R. and Scott, P. (1996). Young peoples images of science. Bristol: Open University Press.

Erdoğan, M. N. , Köseoğlu, F. (2015). Kimyasal Denge Konusuna Entegre Edilmiş Açık-Düşündürücü Yaklaşımla Bilimin Doğası Öğretimi. *Eğitimde Kuram ve Uygulama*, 11(2), 717-74.

İyibil, Ü. (2011). A new approach for teaching 'energy' concept: The common knowledge construction model. *Western Anatolia Journal of Educational Sciences*, Special issue, 1-8.

Karaman, A. and Apaydın, S. (2014). "Sınıf öğretmenlerinin bilimsel araştırmanın doğası hakkındaki anlayışlarına astronomi yaz bilim kampının etkisi." *Kastamonu Eğitim Dergisi*, 22(2), 841-864.

Lederman, N.G. (2006). Research on Nature of Science: Reflections on the Past, Anticipations of the Future. *Asia-Pacific Forum on Science Learning and Teaching*, Volume 7, Issue 1, 1-11.

Lederman, N. G., Abd-El-Khalick, F., Bell, R. L. and Schwartz, R. S. (2002). Views nature of science questionnaire: Toward valid and meaningful assessment of learners' conceptions of nature of science. *Journal of Research in Science Teaching*, 39(6), 497-521.

Meichtry, Y.J. (1992). Influencing student understanding of the nature of science: Data from a case of curriculum development. *Journal of Research in Science Teaching*, 29, 389-407.

Mccomas, Z. F. (2000). "The role and character of the nature of science in science education." In W. F. McComas (Ed.), The principal elements of the nature of science: dispelling the myths. Dordrecht, Boston, London: Kluwer Academic Publishers.

Millar, R. and Osborne, J. (Eds.) (1998). Beyond 2000: Science education for the future. London: King'sCollege.

MEB, (2013). Ortaöğretim Kimya Dersi (9, 10, 11 ve 12. Sınıflar) Öğretim Programı, Milli Eğitim Bakanlığı Talim ve Terbiye Kurulu Başkanlığı, Ankara.

National Research Council. (1996). National science education standards. Washington, DC: National Academic Press.

National Science Teachers Association. (1982). Science-technology-society: Science education for the 1980s. (An NSTA position statement). Washington, DC: Author.

Önen Öztürk, F. and Bayram, H. (2017). İki farklı yaklaşıma dayalı bilimin doğası öğretiminin fen bilgisi öğretmen adaylarının kavram yanılgılarının giderilmesindeki etkisi, *Marmara Üniversitesi Atatürk Eğitim Fakültesi Eğitim Bilimleri Dergisi*, 45, 115-136.

Wening, C. J. (2006). "A frame work for teaching the nature of science." *Journal of Phyisics Teacher Education Online*, 3(3): 3-10.

Yıldırım, A. and Şimşek, H. (2000). Sosyal Bilimlerde Nitel Araştırma Yöntemleri. 2. Baskı, Seçkin Yayıncılık, Ankara.

Yürümezoğlu, K., Ayaz, S. and Çökelez, A., (2009). İlköğretim İkinci Kademe Öğrencilerinin Enerji ve Enerji ile İlgili Kavramları Algılamaları. *Necatibey Eğitim Fakültesi Elektronik Fen ve Matematik Eğitimi Dergisi*, 3(2), 52-73.

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PROFESSIONAL EXPERIENCE, TOLERANCE, EMPATHY AND READING INTERESTS AS VARIABLES PREDICTING COGNITIVE FLEXIBILITIES OF PHYSICAL EDUCATION TEACHERS

Assist. Prof. Dr. Zehra Certel
Akdeniz University, Faculty of Sport Sciences - TURKEY

Assoc. Prof. Dr. Ziya Bahadır
Erciyes University, School of Physical Education and Sport- TURKEY

Hatice Ece Kabaca
Akdeniz University, Faculty of Sport Sciences- TURKEY

Ali Sercan Seraki
Akdeniz University, Faculty of Sport Sciences- TURKEY

Abstract
The purpose of this study was to investigate the role of professional experience, tolerance, emphaty and reading interests in predicting cognitive flexibilities of physical education teachers. The participants of this study were 397 physical education teachers working at secondary and high schools in Antalya (n=200) and Kayseri (n=197) in 2017-18 school year. The data were collected by "Cognitive Flexibility Inventory", which was developed by Dennis & Vander Wal (2010) and adapted to Turkish by Sapmaz & Doğan (2013), "Tolerance Scale" developed by Demirci (2017), "Empathy Quotient", which was developed by Lawrence et al. (2004) and adapted to Turkish by Kaya & Çolakoğlu (2015), and "Reading Interests Scale (RIS)" developed by Dökmen (1994). In data analysis, Pearson correlation coefficient was applied to determine relationship between variables and, multiple regression analysis was applied to state the role of professional experience, tolerance, empathy and reading interests with regard to prediction of cognitive flexibility. The results indicate that professional experience, tolerance and empathy predict cognitive flexibility significantly while reading interests do not.

Keywords: Cognitive flexibility, tolerance, empathy, reading interest, professional experience.

INTRODUCTION

In order for an individual to be able to maintain his/her life, to protect his/her psychological health; s/he has several criteria such as self-direction, acceptance of uncertainty, tolerance, participation, self-acceptance, taking risks, realistic expectations, being flexible and carrying own responsibility (Ellis & Dryden, 2007). The flexibility, one of these criteria, is considered to be the most important component of communication competence (Bochner & Kelly, 1974; Martin & Rubin, 1994; Richmond & McCroskey, 1990; Rubin & Martin, 1994; Spitzberg & Cupach, 1984; Wiemann, 1977). Cognitive flexibility is defined as the individual's awareness of communication options, his/her willingness to adapt to the new situation and his/her self-efficacy in being flexible (Martin and Rubin, 1995). Cognitive flexibility is also the ability of individuals to change their cognition according to changing environmental conditions (Dennis & Vander Wal, 2010). Canas et al. (2003) define cognitive flexibility as the ability of one to arrange information processing strategies to face new and unexpected situations occurred in his/her environment, while at the same time indicating that it is a skill that expresses learning processes, that is, it can be gained with experience. As the individual grows and develops, they can learn to cope with an ever-expanding environment and increasing stimulus and make the necessary adjustments, which is called cognitive flexibility or requires

cognitive flexibility (Crone et al, 2004). Those with this skill can put more balanced and harmonious thoughts, produce alternatives, and evaluate difficult situations as more manageable rather than those that challenge and discord them (Gülüm & Dağ, 2012). These people also have a higher level of competence and self-observation skills than those with low levels of cognitive flexibility (Martin & Rubin, 1995) and are willing to try different ways to engage in communication, struggle with unexpected situations, and adapt their behavior according to the type of the situation (Martin et al., 2003).

By these definitions, it can be considered that cognitive flexibility and probabilistic thinking are quite similar. Probabilistic thinking can be explained as the ability to think of all kinds of possibilities at all stages from the beginning to the final phase of an event. While probabilistic thinking can arise when an individual encounters each new problem, cognitive flexibility only makes itself necessary only when the situation changes, that is, when the routine course ends up unexpectedly and an uncertainty situation arises. In other words, when the individual is faced with a problem, s/he first considers his/her experiences and thinks about possible causes and possible solutions for each reason. S/he will apply the best one among them. But, in spite of all experiences and probabilistic thinking skills, if an unexpected situation, an uncertainty, a chaos situation arises, it is expected from the individual to find the best way to get rid of this chaos situation by showing cognitive flexibility (Çuhadaroğlu, 2013).

However, in studies on cognitive flexibility show that as the individual's professional experience increases, a decrease in cognitive flexibility occurs. (Frensch & Strenberg 1989; Anzai & Yokoyama 1984). Of course, being specialized in the profession requires flexibility, but as the person is more automated, s/he is less inclined to change his/her strategy. Once specialists rely on automated performance routines, they tend to analyze less any crash in the system (Canas et al, 2003; Edland et al. 2000; Frensch & Sternberg, 1989). As the individual becomes specialized with the reduction of cognitive flexibility due to the automation, it is seen as an important point for educators. Because, while educators perform their professions that they are specialized, their cognitive flexibility may decrease at the same time, which is an undesired situation.

There have been many studies on cognitive flexibility in the international and national literature screening (Matthew & Anderson, 1998; Dennis & Vander Wal, 2010; Canas et al. 2003, Hillier et al., 2006; Çuhadaroğlu 2013; Akçay Özcan & Kıran Esen, 2016; Zahal, 2014; Asıcı & İkiz, 2015; Çelikkaleli, 2014; Bilgiç & Bilgin, 2016; Alper & Deryakulu, 2008; Yücel, 2011). When the studies made are examined, the common point of these studies is that; it can be said that cognitive flexibility gives positive relations with positive emotions (communication, open for improvement, adaptation, problem solving skills, communication flexibility, attention, self-efficacy, understanding, willingness, happiness, social and emotional competence, critical, creative thinking, etc.) in healthy personality development and negative relations with negative emotions (anger, anxiety, stress, aggression, etc.) in healthy personality development. In addition, Gündüz (2013) conducted a study on attachment styles and irrational beliefs and the power to predict the cognitive flexibility of psychological symptoms. Dağ & Gülüm (2013) have studied on cognitive flexibility as a mediating role of cognitive traits between adult attachment patterns and psychopathological symptoms. Zahal (2014), on the other hand, has prepared a doctoral dissertation on the relationship between learning styles, cognitive flexibility and test success of students in the music teaching program. In this study, unlike other researchers, the variables of tolerance, empathy, interest in reading and professional experience, which are considered to be the predictors of cognitive flexibility, have been discussed.

Variables to be Considered to Predict Cognitive Flexibility

Tolerance

It can be said that tolerance is one of the most important concepts of communication as it is in cognitive flexibility. Büyükkaragöz (1995) defines tolerance as "a functional communication process established by feeling unrelenting love, respect, trust and understanding to people in order to

recognize and accept all kinds of feelings, thoughts and behaviors of them we find close to or far from ourselves". Not every person may think the same way and share the same feelings and beliefs. Kavcar (1995) states that prerequisites for the realization of tolerance are; to react normally against different feelings and thoughts, to allow these feelings and thoughts to be freely expressed, to tolerate differences without applying to force and pressure, and, to love people. Ferrar (1976) emphasizes that three basic dimensions must be considered in order to talk about tolerance: "1) A flexible and understanding perspective that does not subject other groups, beliefs and practices to any categorical assessment, 2) Allowing diversity of rights and differences, 3) Accepting that beliefs, practices and cultures can be diverse, and refusing any belief or culture" (as cited in Dağlı, 1995). As can be seen, it is expected that the individual will have a flexible perspective in order to be tolerant. In this context, it can be considered that there can be a clear relationship between tolerance and cognitive flexibility and they can directly affect each other.

Empathy

Empathy is considered to be a multidimensional competence that has emerged to facilitate the adaptation of the individual to social life and revealed with the contribution of both the emotional and cognitive processes (Davis 1980, Bora & Baysan 2009). Emerged at the beginning of the century, empathy, according to Eisenberg & Strayer (1987), is defined as "a reaction that emerges in response to the emotional and cognitive status of another and is parallel to these situations", and according to Mindes (2006), it is defined as "the capacity to understand a problem or situation from the perspective of other people". It is stated that people with different levels of empathy exhibit behavioral patterns in different forms (Kaukiainen et al., 1999). According to Hoffman (1984), in order for the one to be able to empathize with the person opposite, s/he must first be able to cognitively distinguish the person opposite him/her and make a cognitive distinction to determine the emotional state of the person opposite him/her. In this case, it can be said that the individuals using the cognitive flexibility ability are more advantageous. In order to be able to do this, the individual needs to be able to use cognitive flexibility skills in full. In this context, it is considered that the variable is related with cognitive flexibility.

Interest in reading

Another variable considered to be predictive of cognitive flexibility is interest in reading. According to Özçelebi & Cebecioglu (1990); "Reading is an action that makes life meaningful, offers many possibilities and options to the person". There are a number of general needs that enable people to become interested in the book and reading. Those needs and motivators are listed as follows; "having fun, developing from the spiritual side, realizing oneself, strengthening attitudes, acquiring new information, organizing old information and using psychological defense mechanisms" (Dökmen, 1990). The most important traits that individual acquires from reading are; to contribute to the mental development of the individual, to develop his/her ability of understanding, to enable him/her to criticize and synthesize, and to help develop his/her language skills (Aksaçlıoglu, 2005). If the individual does not have a thinking system to criticize and synthesize, s/he will internalize a situation he or she is in without thinking about its alternatives, and have difficulty adapting to the new situation if he or she encounters a situation that is completely different. In this context, it is considered that individuals who are not interested in reading and habits will be uninformed, non-investigative, non-questioning and unable to express oneself and therefore will not exhibit cognitive flexibility skills.

Objective

The objective of this research is to determine to what extent tolerance, empathy, interest in reading and professional experience variables, that are considered to predict cognitive flexibility, predict cognitive flexibility.

METHOD

Research Model

This study, which examines the contributions of tolerance, empathy, interest in reading and professional experience in predicting the levels of cognitive flexibility of physical education and sport teachers, is a descriptive study carried out in the relational survey model. The dependent variable of research is cognitive flexibility; and its independent variables are tolerance, empathy, interest in reading and professional experience.

Research Sample

The research group constitutes a total of 397 physical education teachers working in secondary and high schools in Antalya (n=200) and Kayseri (n=197) in 2017-2018 school year. Participants' ages range from 21 to 62. The average age of the teachers is =38.10±9.63 and the average of their professional experience is 13.72±9.54. 34.3% (n=156) of the participants are female and 65.7% (n=241) are male. 51.9% (n=206) of the teachers are working in secondary school, 38% (n=151) are in high school and 10.1% (n=40) are in both secondary and high school.

Data Collection Tools

Data were collected through cognitive flexibility inventory, tolerance scale, empathy scale, interest in reading scale and personal information form.

Cognitive Flexibility Inventory (CFI): The CFI, developed by Dennis & Vander Wal (2010) and conducted by Sapmaz & Doğan (2013) on the reliability and validity studies of the Turkish version, was prepared to measure the ability of people to produce alternative, coherent, appropriate, balanced thoughts in difficult situations. The scale, which is comprised of twenty items and five-point Likert Scale, consists of two subscales including alternatives and control subscales. The Cronbach alpha reliability coefficient of CFI was found as .90 for the whole scale, .90 for the "alternatives" subscale and .84 for the "control" subscale. Test-retest reliability coefficient was found as .75 for the whole scale, .78 for the "alternatives" subscale and .73 for the "control" subscale. It is thought that as the score on the scale increases, the cognitive flexibility increases. In this study, the internal consistency coefficient was found as .81 for the whole scale, .84 for the "alternatives" subscale and .78 for the "control" subscale.

Tolerance Scale: As a result of explanatory factor analysis made to evaluate the construct validity of "Tolerance Scale" developed by Demirci (2017), it was found that it has a one-dimensional structure consisting of 6 items with an eigenvalue of 2.511 which explains 41.854% of the total variance. The factor loadings of the scale items range from .57 to .70. For the criterion-related validity of the Tolerance Scale, the relationships between the Portrait Values Questionnaire and universalism, benevolence, tradition and conformity subscales were examined with the data collected from 45 participants. The Tolerance Scale was positively associated with universalism (.38), benevolence (.50), tradition (.36) and conformity (.48). The Cronbach alpha internal consistency coefficient of the scale was found as .72. The test-retest reliability coefficient obtained from re-application of study to the participants at intervals of three weeks was found as .79. In this study, the Cronbach alpha internal consistency coefficient of the scale was found as .82.

Empathy Quotient (EQ) Scale: Kaya & Çolakoğlu (2015) conducted the adaptation studies of the three-factor Empathy Quotient (EQ) Scale, developed by Lawrence, Shaw, Baker, Baron-Cohen & David (2004), into Turkish. Exploratory Factor Analysis and Confirmatory Factor Analysis were used for validity analysis and internal consistency coefficients were calculated for reliability. As a result of the exploratory factor analysis made for construct validity, it is understood that the scale is comprised of 13 items. It has been determined that the model tested in accordance with the results obtained has very good compliance indices. The dimensions obtained correspond to the original shape of the scale. Dimensions obtained are named as follows; Social Skills, Emotional Response and Cognitive

Empathy. In this study, the Cronbach alpha internal consistency coefficient of the scale was found as .77.

Interest in reading Scale: Participants' interest in reading in the research was measured by the tool developed by Dökmen (1994). The test-retest reliability of the five-point Likert Scale that consists of 20 items was found as .78. The sum of the scores of a participant from all the items of the scale is the total score that such individual has received from the interest in reading scale. In the original research, the reliability coefficient was calculated as .76 for teachers. In this research, it was found as .78.

Data Collection and Analysis

Each of the tests used in the research was applied to the participants individually by the researcher. The data obtained before going through the planned statistical analyzes were tested in terms of normality, linearity, homogeneity of the variances which are the basic assumptions of the multivariate statistic and the analyzes were continued after it was found that the dataset met those assumptions. In this context, multiple regression analysis was used in addition to descriptive statistics in the analysis of data.

FINDINGS

Mean scores, standard deviations and correlation coefficients between cognitive flexibility, tolerance, empathy, interest in reading and professional experience are given in Table 1.

Table 1: Mean Scores, Standard Deviations and Correlation Relationships Between Variables

	Mean	Std. D.	1	2	3	4	5
1. Cognitive flexibility	4.04	.57	1				
2. Tolerance	4.28	.59	.380**	1			
3. Empathy	3.92	.44	.420**	.415**	1		
4. Interest in reading	2.66	.61	.042	.091	.205**	1	
5. Professional experience	13.72	9.54	.162**	.150**	.119*	.063	1

*p< .05; **p< .01

As shown in Table 1, the mean score of cognitive flexibility scale was found as (X =4.04±.57), tolerance was (X =4.28±.59), empathy was (X =3.92±.44) and interest in reading was (X =2.66±.61). When the correlation relationships between variables were examined, significant positive correlations were found between cognitive flexibility and independent variables that are tolerance (r=.380), empathy (r=.420) and professional experience (r=.162). On the other hand, there was no statistically significant relationship with interest in reading (r=.042). The results of multiple regression analysis of cognitive flexibility predictions are given in Table 2.

Table 2: Results of Multiple Regression Analysis of Cognitive Flexibility Predictions

Variable	B	Standard error	Beta	t	p
Constant	1.494	.253		5.907	.000
Tolerance	.229	.047	.238	4.877	.000
Empathy	.412	.064	.320	6.489	.000
Interest in reading	-.048	.042	-.051	-1.126	.261
Professional experience	.005	.003	.091	2.040	.042

R=.487, R2=.237
Adj R2=.230, F (4-392)=30.519, p=.000.
*p< .05; **p< .01

As shown in Table 2, it is understood that the modeled independent variables predict cognitive flexibility significantly (R= .49, R2= .24, p< .01).Tolerance, empathy, interest in reading and professıonal experience explain about 24% of the total variance in cognitive flexibility. Relative importance order of predictive variables on cognitive flexibility, compared to the standardized regression coefficient (beta) is; empathy, tolerance, professıonal experience and interest in reading. When the results of the t-test for the meaningfulness of the regression coefficients are examined, it is seen that the variable of empathy, tolerance and professıonal experience is a significant predictor on cognitive flexibility and the interest in reading variable does not have a significant effect on cognitive flexibility.

The regression equation for predicting cognitive flexibility according to the results of regression analysis is given below:
Cognitive Flexibility = 1.494+.229 Tolerance +.412 Empathy -.048 Interest in reading +.005 Professional experience

DISCUSSION AND CONCLUSION

In this research, which aims to reveal the role of the physical education and sports teachers in predicting the cognitive flexibility of tolerance, empathy, interest in reading and professional experience, the following conclusions are reached:

The levels of cognitive flexibility, tolerance and empathy of physical education and sport teachers are quite high, but their interest in reading is moderate. When the coefficients of correlation between the variables were examined, there was a meaningful relationship between cognitive flexibility and empathy, tolerance and professional experience in a positive way, but no significant relationship with the interest in reading. As a result, empathy, tolerance and professional experience are found as predictors of cognitive flexibility, whereas the interest in reading is not a predictor variable.

The teacher is the most important element of the education system. It can be said that the possibility of encountering different people, personality, temperaments and different human behaviors is very high in the profession of teaching. Teachers should be aware of how they will behave when they encounter such different situations and how they can develop different solutions in case of problems. In particular, their ability to adapt in situations of unexpected uncertainty is necessary both for the students to have a great importance in terms of their personal development and to be an impressive and influential teacher in the future.

As mentioned above, one of the most important factors negatively affecting the cognitive flexibility ability in the literature is the automation. This is especially evident when the level of specialization and professional experience of the individual increases. However, the same situation may not apply to the profession of teaching. In particular, the physical education teacher, unlike other teachers or occupational groups, has to provide education with qualitatively and quantitatively inadequate teaching tools in different environments within the framework of the school facilities such as sports facilities, school garden, empty classroom and etc. In this context, they have to deal with various situations throughout their professional career. As the professional experience of the physical education teacher increases, the potential to cope with such situations is expected to increase. In contrast with many professions, this will require the development of cognitive flexibility skills of physical education teachers. As a matter of fact, in our research, the level of cognitive flexibility of the physical education teachers was very high and a positive relationship was found with their professional experience.

In this research, the interest in reading is not a predictor variable of cognitive flexibility. In literature; there are many studies about the lack of interest in reading for the university students and teachers. (Saracaloğlu, 1992; Esgin & Karadağ, 2000, Yamaner & Kartal, 2001; Semerci, 2002). In this study, the interest in reading of physical education teachers was found to be very low. As habits are

acquired at an early age, it may be useful to organize activities that encourage reading for students by parents and educational institutions. Teachers must make individual efforts to spare time for reading and to make reading a part of their lives in order to be able to acquire reading habit.

According to the results of the research, empathy and tolerance are also variables that significantly predict cognitive flexibility. Studies show that there is a positive relationship between cognitive flexibility and adaptation. Martin et al. (1998) found positive relationships between cognitive flexibility and adaptation and tolerance dimensions in a study that they conducted. Öz (2012) points out that the level of cognitive flexibility increases as the level of adaptation in the research that he conducted. In his study conducted together with the students of secondary school, Erden (2009) emphasized that students with higher levels of empathy skill are more tolerant of those around and others' mistakes as well as preferences and display more sympathetic behaviors of those around. This research has also shown that empathy and tolerance have a meaningful relationship in a positive way and predict cognitive flexibility. These studies support our research.

In conclusion, the following suggestions can be made in this research that predictive variables of cognitive flexibility are empathy, tolerance and professional experience:

The development of the individual's cognitive flexibility, especially empathy and tolerance, may increase their ability to cope with other negative factors. When faced with several problems; psychological counseling and guidance studies can be suggested, aiming to give an individual the ability to think alternatively, to produce harmonious, appropriate and balanced thoughts. It is important to determine the levels of cognitive flexibility especially while acquiring teaching profession at university and provide lessons, courses and seminars in terms of early elimination of deficiencies of candidates who will be future teachers. For individuals with low levels of cognitive flexibility, counseling services on variables such as empathy and tolerance can be provided to contribute to improving corrective relationships.

As a suggestion by this research; when literature is examined, it is seen that studies are often conducted on university students. In this context, it is possible to compare the cognitive flexibility of teachers from different branches, individuals in other occupations and individuals in different occupational groups. Studies can also be conducted with other predictive variables that are considered to be predictive of cognitive flexibility.

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BIODATA AND CONTACT ADDRESSES OF AUTHORS

Dr. Zehra Certel was born in İzmir, Turkey in 1960. She started her academic career as a lecturer at Department of Physical Education and Sports in Atatürk University in 1986 and appointed to Akdeniz Üniversity as Assistant Professor in 2011. She has been working at this position for almost seven years.

Zehra Certel
Akdeniz University
Faculty of Sport Sciences
Antalya- Turkey
E. Mail: zcertel@akdeniz.edu.tr

He was born in Kütahya, Turkey in 1978. He is married and has a son. He started his academic career as a lecturer on Physical Education and Sports College, Erciyes University in 2012 and appointed Associate Professor degree in 2015. He has been working this task for almost three years.

Ziya Bahadir
Erciyes University
Physical Education and Sport School
Kayseri-Turkey
E. Mail: zbahadir@erciyes.edu.tr

I was born in Marmaris, Turkey in 1989. I have studied economy at Selçuk University from 2006 to 2011. Now I am studying Physical Education and Sports Education at Akdeniz Universty. I will be finished this summer. Besides this, I am playing volleyball professionally since I was 13 years old.

Hatice Ece Kabaca
Akdeniz University
Faculty of Sport Sciences
Antalya-Turkey
E. Mail: haticecekabaca@gmail.com

I was born in Antalya, Turkey in 1995. I live in Antalya, Turkey. Currently I am a senior student at the department of physical education and sports education in the Faculty of Sport Sciences at Akdeniz University.

Ali Sercan Seraki
Akdeniz University
Faculty of Sport Sciences
Antalya- Turkey
E. Mail: alisercan.seraki@gmail.com

REFERENCES

Akçay Özcan, D. ve Kıran Esen, B. (2016). Ergenlerin bilişsel esneklik düzeyleri ile özyeterliklerinin incelenmesi, *International Journal Of Eurasia Social Sciences*, 7:24, 1-10.

Aksaçlıoglu, A.G. (2005). Öğrencilerin Televizyon İzlemeleri ve Bilgisayar Kullanmalarının Okuma Alışkanlıkları Üzerine Etkisi. Yayımlanmamış Yüksek Lisans Tezi, Hacettepe Üniversitesi, Ankara.

Alper, A. & Deryakulu, D. (2008). Web Ortamlı Probleme Dayalı Öğrenmede Bilişsel Esneklik Düzeyinin Öğrenci Başarısı ve Tutumları Üzerine Etkisi. *Eğitim ve Bilim,* 33(148), 49-63.

Altunkol, F. (2011). Üniversite Öğrencilerinin Bilişsel Esneklikleri ile Algılanan Stres Düzeyleri Arasındaki İlişkinin İncelenmesi. Yayımlanmamış Yüksek Lisans Tezi, Çukurova Üniversitesi Sosyal Bilimler Enstitüsü, Adana.

Anzai, Y. & Yokoyama, T. (1984) Internal models in physics problem solving, *cognition and instruction,* 1:4, 397-450.

Asıcı, E., & İkiz, F. E. (2015). A Pathway to happiness: Cognitive Flexibility. *Mehmet Akif Ersoy Üniversitesi Eğitim Fakültesi Dergisi,* 35, 191-211.

Bora, E., & Baysan, L. (2009). Empati ölçeği-türkçe formunun üniversite öğrencilerinde psikometrik özellikleri*. Klinik Psikofarmakoloji Bülteni*, 19, 39-47.

Bilgiç, R., & Bilgin, M. (2016). Ergenlerin cinsiyet ve öğrenim kademesi düzeylerine göre bilişsel esneklik düzeyleri ile karar stratejileri arasındaki ilişkinin incelenmesi. *Uşak Üniversitesi Eğitim Araştırmaları Dergisi* 2(2), 39-55.

Bochner, A. P., & Kelly, C. W. (1974). Interpersonal communication instructiontheory and practice, a symposium. I. Interpersonal competence: Rationale, philosophy, and implementation of a conceptual framework. *Speech Teacher,* 23, 279-301.

Büyükkaragöz, S. (1995). *Yükseköğretim programlan ve demokratik tutumlar*. Türk Demokrasi Vakfı Ankara.

Cañas, J. Quesada, J., Antolí, A., & Fajardo, I. (2003). Cognitive flexibility and adaptability to environmental changes in dynamic complex problem-solving tasks, *Ergonomics*, 46:5, 482-501.

Certel, Z., Kozak, M., Bahadır, Z. & Çelik, B. (2017). A study on cognıtıve flexıbılıty of candıdates applyıng to specıal talent examınatıon of faculty of sport scıences at Akdenız Unıversıty. Proceeding of MAC. International Conference. 386-393.

Crone, E.A., Ridderinkhof, K.R., Worm, M., Somsen, R.J.M., Molen, M.W. (2004). Switching Between Spatial Stimulus – Response Mappings: A Developmental Study of Cognitive Flexibility. *Developmental Science* 7:4, 443 – 455.

Çelikkaleli, Ö. (2014). Bilişsel esneklik ölçeği'nin geçerlik ve güvenirliği. *Eğitim ve Bilim,* 39(176), 339-346.

Çuhadaroğlu, A. (2013). Bilişsel esnekliğin yordayıcıları. *Cumhuriyet International Journal of Education,* 2(1). 86-101.

Dağlı, R. (1995). Eğitimde hoşgörü. İ. Pehlivan (Yay. Haz.) Hoşgörü ve Eğitim Toplantısı (39-46). Ankara: UNESCO Türkiye Milli Komisyonu ve Ankara Üniversitesi Eğitim Bilimleri Fakültesi Ortak Yayını.

Davis, M. H. (1983). Measuring individual differences in empathy: evidence for a multidimensional approach. *Journal of Personality and Social Psychology*. 44(1), 113-126.

Demirci, İ. (2017). Huzurlu ve mutlu yaşamın değerler ve karakter güçleri bağlamında karma bir araştırmayla incelenmesi (Doktora tezi, Marmara Üniversitesi, Eğitim Bilimleri Enstitüsü, İstanbul).

Dennis, J. P. & Vander Wall, J. S. (2010). The cognitive flexibility inventory: Instrument development and estimates of reliability and validity. *Cognitive Therapy and Research*, 34 (3), 241-253.

Diril, A. (2011). Lise öğrencilerinin bilişsel esneklik düzeylerinin sosyo-demografik değişkenler ve öfke düzeyi ile öfke ifade tarzları arasındaki ilişki açısından incelenmesi. Yayımlanmamış Yüksek Lisans Tezi, Çukurova Üniversitesi Sosyal Bilimler Enstitüsü, Adana.

Dökmen, Ü. (1994). *Okuma becerisi, ilgisi ve alışkanlığı üzerine psikososyal bir araştırma*, MEB Yayınları: İstanbul.

Dökmen, Ü. (1990). "Lise ve Üniversite Öğrencilerinin Okuma Becerileri, İlgileri Okuma ve Kütüphane Kullanma Alışkanlıkları. *Eğitim Bilimleri Fakültesi Dergisi*, s. 23, c. 2, 394-418.

Edland, A., Svenson, O. & Hollnagel, E. (2000). A process for identification of weak spots in a severe incident management sequence, in P. Wright, S. Dekker, and C.P. Warren (eds), Confronting Reality, Proceedings of the Tenth European Conference on Cognitive Ergonomics, 68 - 76.

Eisenberg, N. & Strayer J. (1987). *Critical issues in the study of empathy*. In N. Eisenberg and J. Strayer (Eds.), Empathy and its development. Cambridge studies in social and emotional development. (pp. 3-13). New York: Cambridge University Press.

Ellis, A., Dryden, W. (2007). The practice of rational emotive behavior therapy. NewYork: Springer.

Erken, M. (2009). Empati becerisinin ahlaki davranışlar üzerindeki etkisi. Yayımlanmamış Yüksek Lisans Tezi, Sakarya Üniversitesi Sosyal Bilimler Enstitüsü, Sakarya.

Esgin, A., Karadağ, O. (2000) Üniversite öğrencilerinde okuma alışkanlığı, *Popüler Bilim Dergis*i, s. 82, 19–23.

Frensch, P. A., & Sternberg, R. J. (1989). Ex*pertise and intelligent thinking: When is it worse to know better?* In R. J. Sternberg (Ed.), Advances in the psychology of human intelligence, Vol. 5, pp. 157-188). Hillsdale, NJ, US: Lawrence Erlbaum Associates, Inc.

Gülüm, İ.V. & Dağ, İ. (2012). Tekrarlayıcı düşünme ölçeği ve bilişsel esneklik envanterinin türkçeye uyarlanması, geçerliliği ve güvenilirliği. *Anadolu Psikiyatri Dergisi*, 13, 216-223.

Gündüz, B. (2013). Bağlanma stilleri, akılcı olmayan inançlar ve psikolojik belirtilerin bilişsel esnekliği yordamadaki katkıları. *Kuram ve Uygulamada Eğitim Bilimleri,* 13(4), 2017-2085.

Hillier, A., Alexander, J. K., & Beversdorf, D. Q. (2006) T*he effect of auditory stressors on cognitive flexibility.* Psychology Press, Taylor & Francis Group, 12, 228-231.

Hoffman, M. L. (1987). *The contribution of empathy to justice and moral judgment*. In N.

Kaukiainen, A. A., Bjorkqvist, K., Lagerspetz, K., Osterman, K., Salmivalli, C., Rothberg, S., & Ahlbom, A. (1999). The relationship between social intelligence, empathy, and three types of aggression. *Aggressive Behavior*, 25, 81-89.

Kavcar, C. (1995) Açılış Konuşması. Hoşgörü ve Eğitim Toplantısı. UNESCO Türkiye" Milli Komisyonu ve Ankara Üniversitesi Eğitim Bilimleri Fakültesi Ortak Yayın, No: 2, Ankara.

Kaya, B., & Çolakoğlu, Ö.M. (2015). Adaptation of empathy quotient (EQ) scale*. İnönü University Journal of the Faculty of Education*. 16: 1, 17-30.

Lawrence, E. J., Shaw, P., Baker, D., Baron-Cohen, S., & David, A. S. (2004). Measuring empathy: reliability and validity of the empathy quotient. *Psychological Medicine,* 34, 911-924.

Martin, M. M., & Anderson, C. M. (1998). The cognitive flexibility scale: three validity studies. *Communication Reports*, 11:1, 1-9.

Martin, M. M., & Rubin, R. B. (1994). Development of a communication flexibility scale. *Southern Communication Journal*, 59, 171-178.

Martin, M. M., & Rubin, R. B. (1995). A new measure of cognitive flexibility. *Psychological reports*, 76, 623-626.

Martin, M.M., Anderson, C. M. & Thweatt, K. S. (1998). Aggressive communication traits and their relationship with the cognitive flexibility scale and the communication flexibility scale. *Journal of Social Behavior and Personality,* 13 (3), 34-45.

Mindes, G. (2006). *Teaching young children social studies*. Praeger Publishers. 88 Post Road West, Westport, Greenwood Publishing Group, Inc. USA.

Öz, S. (2012). Ergenlerin cinsiyet, sosyo-ekonomik ve öğrenim kademesi düzeylerine göre bilişsel esneklik, uyum ve kaygı puanları arasındaki ilişkinin incelenmesi. Yayımlanmamış Yüksek Lisans Tezi, Çukurova Üniversitesi Sosyal Bilimler Enstitüsü, Adana.

Özçelebi, O. S. ve Cebecioğlu, N. S. (1990). *Okuma alışkanlıkları ve Türkiye*. İstanbul: Milliyet.

Richmond, V. P., & McCroskey, J. C. (1990). Reliability and separation of factors on the assertiveness-responstveness measure. *Psychological Reports*, 67, 449-450.

Sapmaz, F., & Doğan, T. (2013). Assessment of cognitive flexibility: Reliability and validity studies of Turkish version of the Cognitive Flexibility Inventory. *Journal of Faculty of Educational Sciences*, 46(1), 143-161.

Saracaloğlu, A.S. , Karasakaloğlu, N. & Aslantürk, E. (2010). Sınıf Öğretmeni Adaylarının Okuma İlgi ve Alışkanlıklarının Karşılaştırılması (Adnan Menderes ve Uludağ Üniversitesi Örneği). *Ç.Ü. Sosyal Bilimler Enstitüsü Dergisi*, 19 (3), 457 – 480.

Semerci, Ç. (2002). Türk üniversitelerinde beden eğitimi ve spor bölümü öğrencilerinin okuma alışkanlıkları. *Eğitim ve Bilim*, c. 27, s. 125, s: 36-43.

Spitzberg, B. H., & Cupach, W. R. (1984). *Interpersonal communication competenc*e. Beverly Hills, CA: Sage.

Wiemann, J. M. (1977). Explication and test of a model of communication competence. *Human Communication Research*, 3, 195-213.

Yıldız, A. (2000). Üniversite öğrencilerinin okuma alışkanlıklarını belirleyen etmenler. Yayımlanmamıs yüksek lisans tezi, Marmara Üniversitesi, İstanbul.

Yücel, Ö. (2011). Problem Tabanlı Öğrenme Yaklaşımının Bilişsel Esneklik, Öz Düzenleme Becerileri Ve Öğrenci Başarısı Üzerindeki Etkisi. Yayınlanmamış yüksek lisans tezi. Bahçeşehir Üniversitesi. İstanbul.

Zahal, O. (2014). Özel yetenek sınavına giren adayların öğrenme stilleri ve bilişsel esneklik düzeyleri ile sınav başarıları arasındaki ilişki. Yayınlanmamış doktora tezi. İnönü üniversitesi, Malatya.

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DYNAMICS OF THE ACTIVITIES OF HOSPITAL HEALTH INSTITUTIONS IN BULGARIA

Assoc. Prof. Dr. Rumyana Yaneva
Medical University
Faculty of Public Health
Department of Health Economics
1527 Sofia- BULGARIA

Abstract
The hospital system is the main consumer of healthcare resources. The purpose of this study is to analyze the dynamics of the activity of the hospital medical institutions in Bulgaria. Material and methods: The development of basic planning indicators of the facilities of the individual groups of hospitals in the period 2012-2015 is monitored. Documentary, statistical methods and economic analysis are used. Results: A major problem for our health care is the excessive increase in the number of hospitals, mainly in the private sector. The number of hospitalized patients is particularly worrying, as it is much higher than in other countries. The use of beds at the end of the period under consideration for the sector remains low. A trend of reduction marks and the turnover of the beds. Conclusions: The rationalization of the supply, efficiency and relevance of hospital services and the resulting reduction in unnecessary hospitalization should be a key element of the reform of the organization and the structural configuration of the healthcare system in the country.

Keywords: Dynamics of activity, hospital medical institutions, analysis, basic planning indicators.

INTRODUCTION

Hospital is the most complex institution in the modern healthcare system. Hospital service is the most expensive compared to the other service types. The hospital system is the main consumer of healthcare resources. Its functions restore health, prevent disability, in many cases are life saving, due to its mission and social position, the hospital is the backbone of medical care and a factor that best defines public attitude and opinion about healthcare.

Continuously rising health care funds put to health officials the issue of cost-effective allocation and spending of health resources. The efficiency degree is a ratio between the activity results resources expenses. Achieving the optimum level of efficiency means reaching a certain level of activity with an optimum level of resources. I.e, the cost of resources should be adequate for the activity (Berenguer, 1994).

Management of diagnostic and treatment process in the hospital has to ensure efficient use of personnel labour and the medical equipment, available diagnostic and therapeutic methods, and tools of different nature (including future development in this respect), so as to achieve the most favourable outcome of disease in the most rational use of hospital resources (Nikolova, 1998).

Hospital beds are the main material resources of the hospital. It is necessary to establish a link between the actual use of beds and their theoretical maximum use (Berenguer, 1994). Whether the beds are more or less used, in terms of effectiveness, the stay can be adequate or not. In order to measure the efficiency in the use of hospital beds, one takes the average stay.

The number of bed-days for every single patient is determined by the disease and depends directly on the clinical estimation of the doctor. It depends on outer factors, too, which are different than the doctor's decision itself and are typical for the performance processes in other units (Varela, 1994).

Purpose

The purpose of this study is to analyze the dynamics of the activity of the hospital medical institutions in Bulgaria.

MATERIAL AND METHODS

The development of basic planning indicators of the facilities of the individual groups of hospitals in the period 2012-2015 is monitored. Documentary, statistical methods - analysis of phenomena dynamics, table and graphic analysis (to illustrate the obtained results) and economic analysis are used.

RESULTS AND DISCUSSION

A major problem for our health care is the excessive increase in the number of hospitals, mainly in the private sector. The number of hospitalized patients is particularly worrying, as it is much higher than in other countries. The use of beds at the end of the period under consideration for the sector remains low. A trend of reduction marks and the turnover of the beds. The change in the indicators by type of hospital and type of beds varies widely, which depends mainly on the nature of the hospital's activity. The analysis does not include hospitals to other departments.

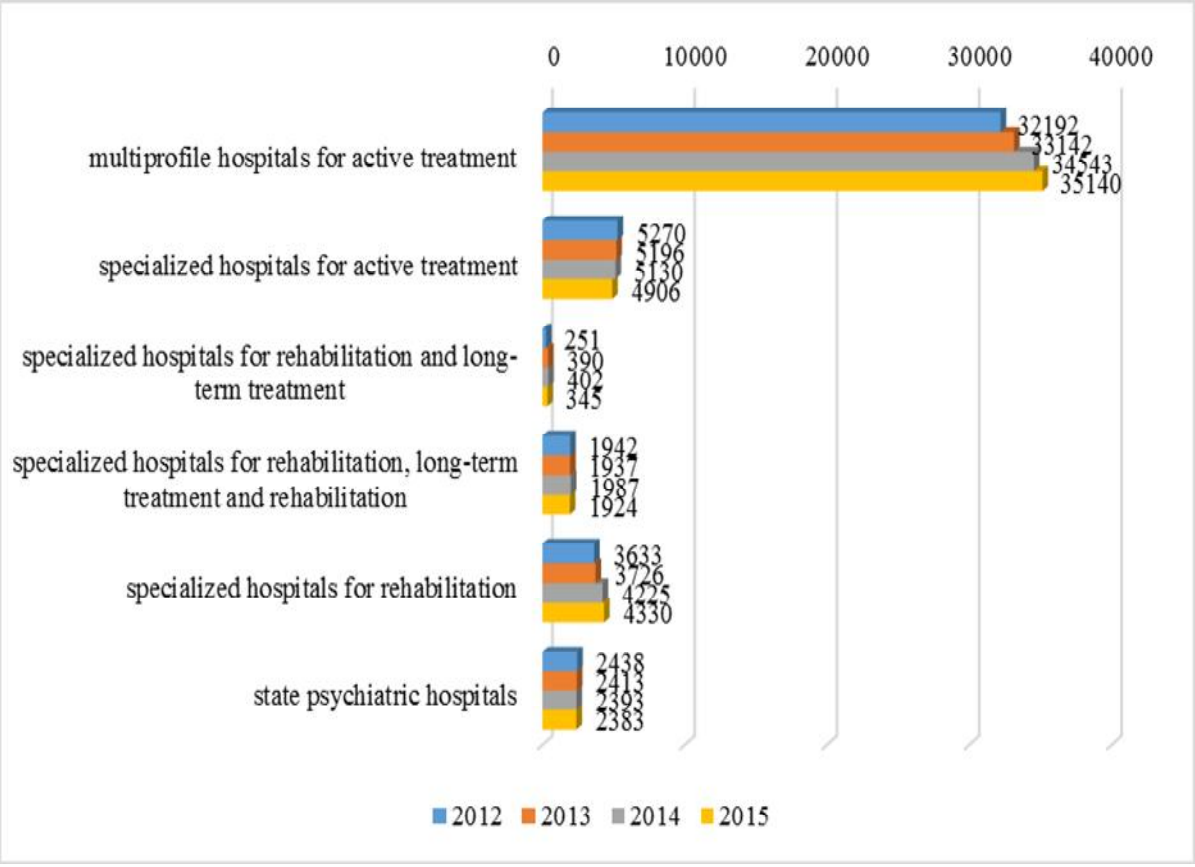

Figure 1: Number of hospital beds

For the period under review, the trend in the number of beds is as follows:

Their total number of 42,021 in 2012, with a provision of 57.7 per 10 000 people, rises to 45 423 in 2015, with a provision of 63.5 per 10 000 people.

We see an increase in beds for active treatment from 32 609 (with a provision of 44.8 per 10,000 people) to 34,907 and a provision of 48.8 per 10,000 people.

For each region of the country, the need for hospital beds should be determined on the basis of European norms, morbidity and demographic profile of the population, specific needs (infectious diseases, neonatology, etc.). The number of beds should be mobile and vary over the years according to the demand for health care according to the quality and the results of control over the medical activities (National Health Strategy 2020, Ministry of Health).

One feature of this superfluous infrastructure is the usability of hospital services, which is much higher than the average. While the data of hospitalizations in the region has either stabilized or decreased over time, an alternative trend in increasing hospital treatment is currently observed in Bulgaria.

The dynamics of hospital admissions for individual types of hospitals is as follows (Figure 2):

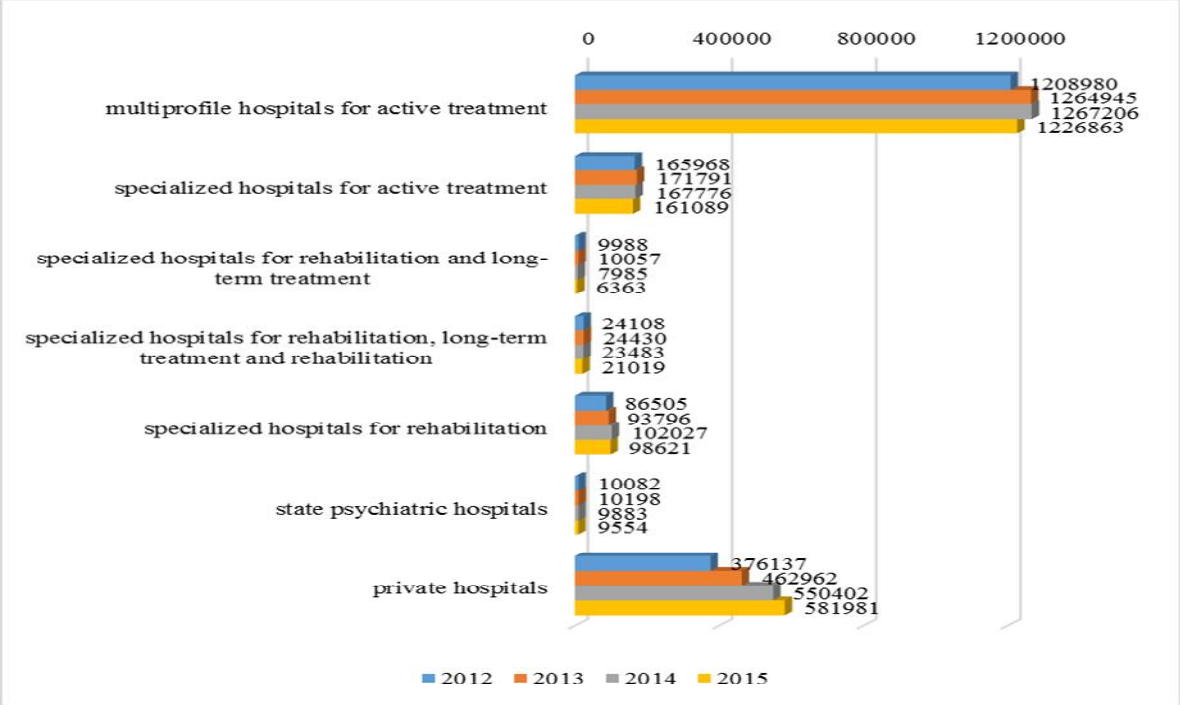

Figure 2: Admitted patients

For the period 2012-2015, the highest relative share of growth was observed in private hospitals - by 54.73%. The number of admitted patients in specialized rehabilitation hospitals also increased by 14.01%, as well as the number of admissions in multi-profile hospitals for active treatment – by 1.48%.

The strongest decrease in the number of patients, with 36.29%, is in the specialized hospitals for further treatment and long-term treatment. A reduction of 12.81% has been reported in specialized hospitals for further treatment, long-term treatment and rehabilitation. The number of admitted

patients in state psychiatric hospitals decreased by 5.25%, and in specialized hospitals for active treatment – by 2.94%.

The number and relative share of hospital admissions is particularly worrying, as they are much higher than in other countries.

An analysis of hospitalizations in Bulgaria in 2013 suggests that at least 20 percent of the procedures there could have been performed under basic out-of-hospital conditions (World Bank, 2013). These admissions for hospital services, most of which do not require to be performed in a hospital, do not even report late-stage conditions such as cancer, congestive heart failure or diabetes-related amputations that should be identified and treated in conditions of primary care (National Health Strategy 2020, Ministry of Health).

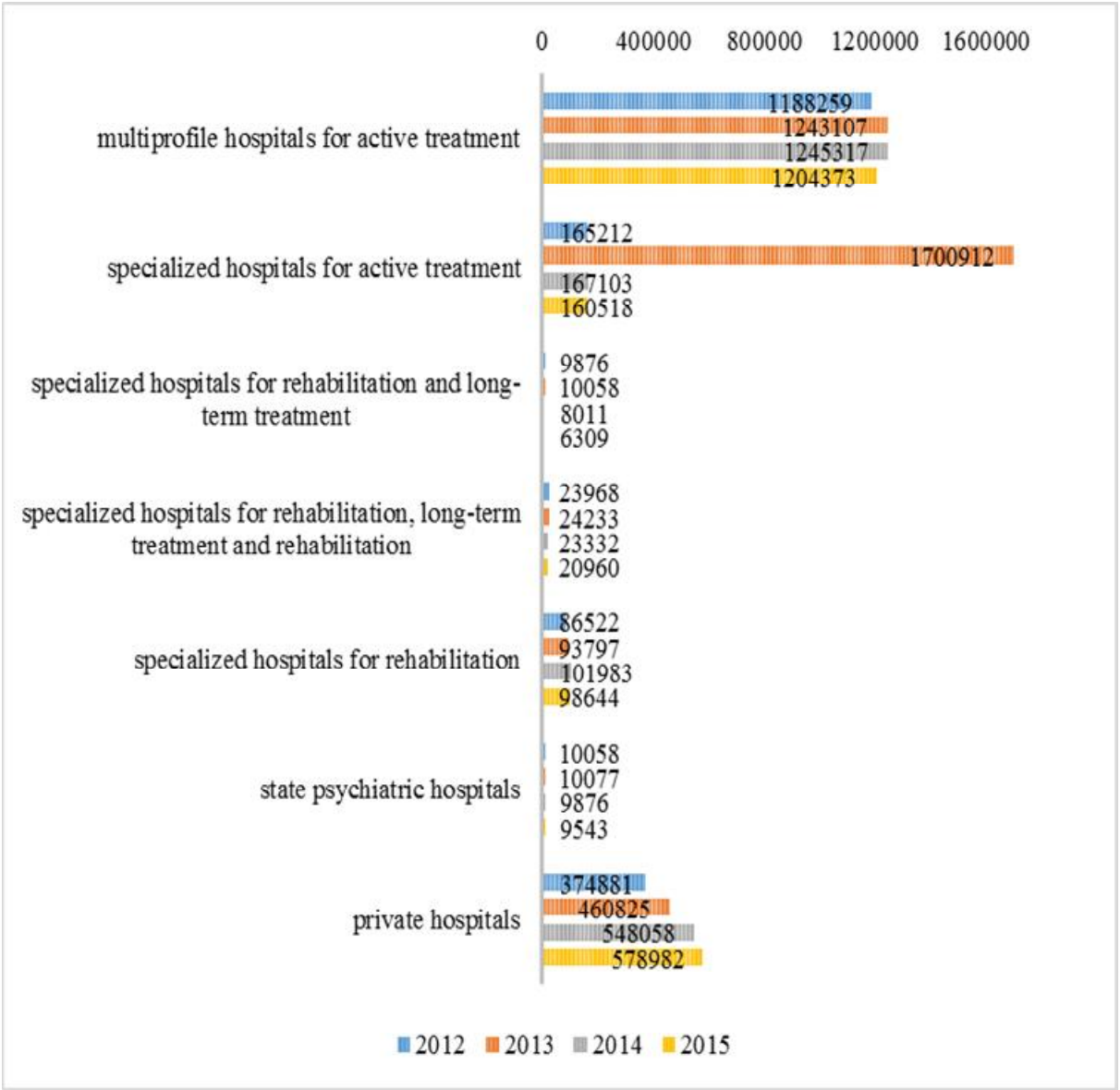

Figure 3: Discharged patients

Similar to the number of patients admitted is the situation with the number of discharged patients for the four-year period considered.

The highest percentage increase was registered in private hospitals (54.44%) following the established trend in recent years to direct the flow of patients to private hospitals.

There is an increase in the number of discharged patients from specialized rehabilitation hospitals by 14.01% and from multi-profile hospitals for active treatment – by 1.36%.

The number of releases from specialized hospitals for further treatment and long-term treatment decreased by 36,12%, and the number of releases from specialized hospitals for further treatment, long-term treatment and rehabilitation – by 12.55%. The number of releases from state psychiatric hospitals decreased by 5.12%, and from specialized hospitals for active treatment by 2.84%.

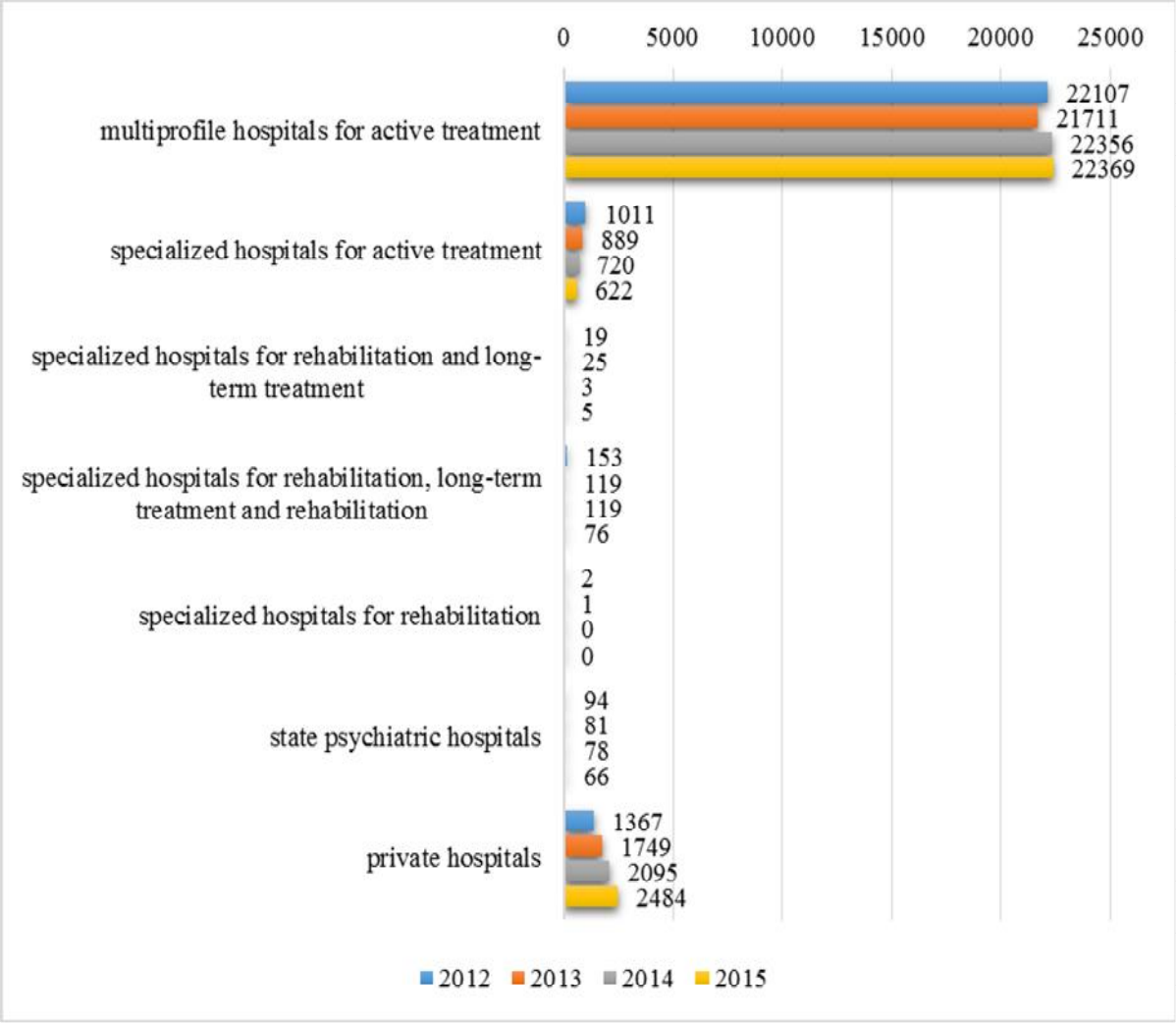

Figure 4. Dead patients

For the period 2012-2015, the highest absolute value and the highest relative share of the increase of dead patients were observed in private hospitals. From 1 367 in 2012, their number increased to 2 484 in 2015, which is a percentage of 81.71%.

There is a slight increase in their number in multi-profile hospitals for active treatment, i.e. 1.19%.

In all other types of hospitals there is a decrease. In the specialized hospitals for rehabilitation and long-term treatment the decrease is 73.68%, in the specialized hospitals for further treatment and rehabilitation the decrease is 50.33% and in the specialized hospitals for active treatment - 38.48%.

Table 1: Bed-days

Medical institutions	2012	2013	2014	2015
Multi-profile hospitals for active treatment	6535483	6680008	6571104	6303764
Specialized hospitals for active treatment	986670	960729	905482	813643
Specialized hospitals for rehabilitation and long-term treatment	82244	108335	100653	93430
Specialized hospitals for rehabilitation, long-term treatment and rehabilitation	245772	269977	263008	238908
Specialized hospitals for rehabilitation	651861	702398	747081	717455
State psychiatric hospitals	690314	684697	662292	621445
Private hospitals	1362959	1670242	2039769	2172469

Source: National Statistical Institute

Most bed-days are reported in multiprofile hospitals for active treatment. In 2012, as shown by Table 1, there are 6 535 483 bed-days reported. After a small increase in 2013, their number gradually started to decrease and in 2015 it reached 6 303 764. For the four-year period, the decrease is by 3.55%.

There is a decrease by 17.54% in the above indicator in specialized hospitals for active treatment, by 9.98% in state psychiatric hospitals and by 2.79% in specialized hospitals for further treatment, long-term treatment and rehabilitation.

The situation in private hospitals, where the tendency is towards a constant increase in the number of bed-days, is radically opposite. From 1 362 959 in 2012, their number reached 2 172 469 in 2015; the increase is by 59.39%.

An increase in the number of bed-days is also observed in specialized hospitals for further treatment and long-term treatment - by 13.60%, and in specialized hospitals for rehabilitation - by 10.06%.

Table 2: Usability of beds in days

Medical institutions	2012	2013	2014	2015
Multi-profile hospitals for active treatment	266	271	266	256
Specialized hospitals for active treatment	278	279	273	258
Specialized hospitals for rehabilitation and long-term treatment	302	297	260	271
Specialized hospitals for rehabilitation, long-term treatment and rehabilitation	260	283	263	268
Specialized hospitals for rehabilitation	235	256	272	262
State psychiatric hospitals	282	282	277	261
Private hospitals	204	217	223	218

Source: National Statistical Institute

The highest is the relative share of increase in the utilization rate of beds in days in specialized hospitals for rehabilitation, i.e. 11.49%. From 260 in 2012, the utilization of beds increased to 268 days in 2015. The indicator also grew by 6.68% at the end of the period under review in private hospitals, as well as by 3.08% in specialized hospitals for further treatment, long-term treatment and rehabilitation.

The utilization rate of beds in days is the most decreased in specialized hospitals for further treatment and long-term treatment – by 10.26%, in specialized hospitals for active treatment – by 7.19%, and in multiprofile hospitals for active treatment – by 3.76%.

The bed utilization rate at the end of the period considered for the sector remains low (67%), which means that 1/3 or 33% of the total bed capacity in the country is not used. This forms 16,000 vacant hospital beds, the maintenance of which costs resources without adequate health needs (Annual report on the health status of the citizens in the Republic of Bulgaria and implementation of the National Health Strategy 2015). The lowest rate is in private hospitals - 218 days.

Table 3:Turnover of beds

Medical institutions	2012	2013	2014	2015
Multi-profile hospitals for active treatment	50	52	52	50
Specialized hospitals for active treatment	47	50	51	51
Specialized hospitals for rehabilitation and long-term treatment	37	28	21	19
Specialized hospitals for rehabilitation, long-term treatment and rehabilitation	26	26	24	24
Specialized hospitals for rehabilitation	31	34	37	36
State psychiatric hospitals	5	5	5	5
Private hospitals	57	60	60	59

Source: National Statistical Institute

The optimum bed utilization rate is considered to be 85%, as it allows a certain number of vacant beds to be accommodated, allowing for flexibility in the admission of planned cases as well.

This important indicator for the organization of hospital care generally shows a downward trend. The most significant is the reduction in specialized hospitals for further treatment and long-term treatment - by 48.65%, followed by specialized hospitals for further treatment, long-term treatment and rehabilitation - 7.69%.

The bed turnover figures show a slight increase in specialized hospitals for rehabilitation, ie. by 16.13%, and in specialized hospitals for active treatment - by 8.5%.

The value in state psychiatric hospitals is constant – 5%.

In multi-profile hospitals for active treatment, following a slight increase in 2013 and 2014, there was again a return to baseline in 2015.

Table 4. Average stay of a treated patient – days

Medical institutions	2012	2013	2014	2015
Multi-profile hospitals for active treatment	5.4	5.2	5.1	5.1
Specialized hospitals for active treatment	5.9	5.6	5.4	5.0
Specialized hospitals for rehabilitation and long-term treatment	8.2	10.6	12.4	14.5
Specialized hospitals for rehabilitation, long-term treatment and rehabilitation	10.1	10.9	11.1	11.2
Specialized hospitals for rehabilitation	7.5	7.5	7.3	7.3
State psychiatric hospitals	58.5	57.8	57.3	55.7
Private hospitals	3.6	3.6	3.7	3.7

Source: National Statistical Institute

The average hospital stay is common information that is provided when presenting data on the activities of a hospital. It is also used when comparing the activity of various hospitals and in analyzing development of a hospital over the years (Varela, 1994).

It should be noted that estimating the average hospital stay is a complex task and cannot be simplified. In Bulgaria, in recent years, there is a trend for any reduction in average stays to be seen as a positive indicator for hospital activity. This one-sided approach can hide certain risks. (Yaneva, 2011)

In the present study, the trend in the average hospital stay of a treated patient in days is as follows:

The highest is the rate of increase in specialized hospitals for further treatment and long-term treatment - 76.83%. Quite lower is the increase in specialized hospitals for further treatment, long-term treatment and rehabilitation - 10.89% and the lowest is in private hospitals - 2.78%.

In other types of hospitals there is a decrease in this indicator. In specialized hospitals for active treatment, the decrease is by 15.25%, in multi-profile hospitals for active treatment – by 5.56%, in state psychiatric hospitals - by 4.79% and in specialized hospitals for rehabilitation – by 2.67%.

PROBLEMS AND POSSIBLE DIRECTIONS FOR OPTIMIZING THE ACTIVITY OF MEDICAL INSTITUTIONS FOR HOSPITAL CARE IN OUR COUNTRY

Outlining the problems

The comparison between the provision of hospital beds in Bulgaria to the EU average indicates that according to this parameter, Bulgarian healthcare should be ranked at least at the medium to high levels. However, the Organization for Economic Cooperation and Development's research on the European Health Consumer Index in recent years has revealed an unfavorable picture for our country. Our country is generally ranked last in terms of quality of healthcare, complex results, coverage and access to health services.

In order to satisfy their economic interests, hospitals, irrespective of their ownership, commit numerous medical violations: admission of patients without sufficient medical grounds, deliberate violation of the proper classification of patients under clinical pathways, severity of the condition, selection of patients for admission according to the expectations of the amount of the cost of their treatment and their re-direction to other hospitals (Annual report on the health status of the citizens in the Republic of Bulgaria and implementation of the National Health Strategy 2015).

As a challenge to modern hospitals, it can be pointed out that hospitals are very difficult to succumb to structural and cultural change. The functions of the hospital itself are traditionally conservative and resistant to change. In the modern health situation, however, there is a need for a high degree of hospital flexibility due to the presence of trends that will continue in the future:

- pressure to reduce the length of stay in hospitals;
- use of market or quasi-market mechanisms to increase the efficiency of medical activities;
- efforts to ensure higher quality of medical care;
- Efforts to achieve high levels of access, as well as close cooperation with primary care and other services located outside the hospital.

Difficulties come from the fact that trends in the health status of the population can be predicted, but it is very difficult to predict technological changes or changes in the healthcare system. Account must also be taken of the existing differences between the countries of the region as a result of differences in the history, culture and political specificities of the countries.

Differences in the funding, organization and management of healthcare systems are reported. Moreover, the term "hospital" covers different types of institutions - from university hospital complexes with several thousand staff to those in condition that would hardly be defined as a hospital environment (Vodenicharov, 2013).

The current state of the hospital system can be synthetically characterized and assessed as insufficiently effective and low-efficacious, i. e. inadequately good medical results obtained at higher costs.

POSSIBLE DIRECTIONS FOR OPTIMIZING THE ACTIVITY OF MEDICAL INSTITUTIONS FOR HOSPITAL CARE

Establishing a balance between the hospitalization needs, the organization of the system, the quantity and quality of resources for their satisfaction

In Bulgaria, as a result of the lack of effective mechanisms for planning and regulating the capacity of hospital structures, the hospital sector is characterized by a large number of hospitals and hospital beds and a disrupted bed structure with a preponderance of active treatment beds.

This superfluous infrastructure is also accompanied by a higher consumption of hospital services than the EU average. An analysis of the hospitalizations in Bulgaria, prepared by the World Bank in 2013, showed that at least 20 percent of hospital-staged procedures could have been be performed in outpatient settings.

At the same time, outpatient examinations are comparatively less.

In this regard, the EU Recommendation on Bulgaria's National Reform Program for 2014 is: *„to provide cost-effective provision of health care, including by improving pricing for healthcare services by linking hospital funding to results, accelerating the optimization of the hospital network and developing opportunities for outpatient treatment"* (Health Goals 2020" Concept, Ministry of Health, 2015).

In this respect, an important strategic task should be to regulate a new type of interaction between outpatient and hospital care.

A key element of the reform of the organization and the structural configuration of the healthcare system in the country should be to streamline the supply, efficiency and relevance of hospital services and the resulting reduction in unnecessary hospitalizations.

The ultimate aim should be to optimize the network of hospitals for active treatment and reduce the number of beds in them, while preserving and increasing their abilities to treat acute illnesses, developing high-tech diagnostic and treatment services and increasing the support role of the outpatient care system, rehabilitation structures, long-term care, long-term care, etc. ("Health Goals 2020" Concept, Ministry of Health, 2015).

It is important to intervene in the introduction of new technologies, including endoscopic and other invasive diagnostic and therapeutic procedures, surgical interventions, drug treatment, etc. that will enable the early and quality diagnostics and the safe and effective treatment of an ever larger number of diseases.

There is a need for the development of criteria (indications) for hospitalization and de-hospitalization in a planned and urgent order, as well as the introduction of quality requirements and criteria for medical activities tied to the end result of hospital treatment as a basis for paying for hospital activities.

It is also important to improve the capacity and conditions in hospitals for long-term treatment and rehabilitation and in hospices, which will allow a significant percentage of patients with chronic illnesses or those in need of palliative care to be hospitalized in them rather than in the costly hospitals for active treatment.

There is a need to discuss and review the model "hospital - commercial company". It is useful for a wide range of activities in a hospital - nutrition of patients, serving units, clinical and other laboratories, diagnostic offices, etc. In practice, however, commercial activity is not an adequate option in treating patients and educating students, doctors and other healthcare professionals.

CONCLUSIONS

1. A major problem for our hospital health care is the excessive increase in the number of hospitals, mainly in the private sector. There is no state intervention and regulation, rules for their territorial location with regard to the population served and the necessary number of hospital beds.

In the general trends of the European Union, the development of hospital systems is highlighted by the reduction in the number of hospital beds, which makes them more intensive.

2. During the analyzed period 2012-2015, in our country there were no significant differences in the indicators for hospitalized patients by type of hospital beds, as well as in the number of beds in hospitals, their structure -% and their availability to 10,000 of the population. Relatively higher values were recorded in the middle of the period – 2014.

3. The highest relative share of increase in hospital admissions was observed in private hospitals - by 54.73%, over the recent trend of directing the flow of patients to private hospitals.

4. Similar to the number of patients admitted is the situation with the number of checked hospitalized patients (discharged + dead). The highest percentage increase in discharged patients (54.44%) and in dead patients (81.71%) is recorded in private hospitals. A slight increase (1.19%) in the deaths of patients is recorded in multi-profile hospitals for active treatment, and there is a decrease in their number observed in all other hospitals.

5. Most bed-days are reported in multi-profile hospitals for active treatment. In 2012, there are 6 535 483 bed-days reported. After a small increase in 2013, their number gradually started to decrease and in 2015 it reached 6 303 764. For the four-year period, the decrease is by 3.55%.

The situation in private hospitals, where the tendency is towards a constant increase in the number of bed-days, is radically opposite. The increase is by 59.39%.

6. The highest is the relative share of increase in the utilization rate of beds in days in specialized hospitals for rehabilitation, i.e. 11.49%. The bed utilization rate at the end of the period considered for the sector remains low (67%), which means that 1/3 or 33% of the total bed capacity in the country is not used.

7. The turnover of beds – an important indicator for the organization of hospital care, generally shows a downward trend. The most significant is the reduction in specialized hospitals for further treatment and long-term treatment - by 48.65%.

8. In the present study, in the average hospital stay of a treated patient, the highest is the rate of increase in specialized hospitals for further treatment and long-term treatment - 76.83%. The

slightest increase is in private hospitals – by 2.78%. In other types of hospitals there is a decrease in this indicator.

The average stay indicator is usually analyzed and evaluated simplistically and schematically in a purely statistical sense. This reduces its cognitive value as a tool for positively impacting the efficiency of hospital beds. The assessment of the average stay should be done together with other indicators for the hospital activity, as well as differentiated by different classes of diseases and nosological units.

10. The state of the hospital system in our country is indicative of one of the major failures of the health reform. The reasons for this failure are of a different nature: legal-normative, economic, organizational-management, inadequate structure of hospital beds in relation to the needs of hospitalizations, poor control of state and public funding organizations on hospitalization processes, quality and efficiency of hospital work, etc.

11. A key element of the reform of the organization and the structural configuration of the healthcare system in the country should be to streamline the supply, efficiency and relevance of hospital services and the resulting reduction in unnecessary hospitalizations.

12. Essentially, hospital resource issues are extremely complex. Each of the activities of training, specialization, qualification and management of healthcare personnel, design, construction, operation, maintenance and renovation of the facilities, provision of normal financing and efficient use of financial resources are a string of complex scientific and practical problems, which are subject to resolution by health managers.

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BIODATA AND CONTACT ADDRESS OF AUTHOR

Assoc. Prof. Rumyana Todorova YANEVA, PhD.
Graduate of the Faculty of Public Health to the Medical University – Sofia. Master of Public Health and Health Management. In 2007 she acquired the educational and scientific degree "PhD" of the scientific major "Social medicine and healthcare and pharmacy organization". Since 2008 on the grounds of competition where she was proclaimed the winner she has been occupying the title "assistant" in the Department of Healthcare Economics, and since 2014 she is an associate professor. She acquired the major "Health Economics" and currently she is attending the major "Legal regulation in healthcare". She was participant in 2 scientific projects. She is the author of "Microeconomics of the hospital institution. Manual for exercises and seminars", co-author of two textbooks, as well as over 120 publications. She participates in numerous Bulgarian and international scientific forums. She has 86 citations. She is member of the National Association of Health Policy and Management, Bulgarian Scientific Society for Public Health, Bulgarian Association for Drug Information, Interdisciplinary Civil Academy, Member of the State Examination Board for acquiring the specialty "Health Economics".

Assoc. Prof. Dr. Rumyana Yaneva
Medical University, Faculty of Public Health
8 Bialo More str., 1527 Sofia- Bulgaria
E. Mail: yaneva.1968@abv.bg

REFERENCES

Annual report on the health status of the citizens in the Republic of Bulgaria and implementation of the National Health Strategy 2015, pp.101-106 /in Bulgarian/.

Berenguer J. (1994*) Gestión de hospitales. Nuevos instrumentos y tendencias Ediciones Vicens Vives*, S.A. (Primera Edición 1994), pp. 310-352.

Gladilov, St., E. Delcheva. (2009) Healthcare Economics, publishing house Princeps, Sofia, pp. 347-352 /in Bulgarian/.

Healthcare 2013, 2014, 2015, 2016, National Statistical Institute [Electronic version], http://www.nsi.bg /in Bulgarian/.

"Health Goals 2020" Concept. (2015) Ministry of Health, pp. 36-39 /in Bulgarian/

National Health Strategy 2020, Ministry of Health, pp. 83-87 /in Bulgarian/.

Nikolova S. (1998) Inpatient medical care. In: *New Public Health*. Reviewed by V. Borisov, Zl. Glutnikova , Ts. Vodenicharov , Akvagrafiks OOD, Sofia, pp.448-454 /in Bulgarian/.

Varela J. (1994) *Gestión de hospitales. Nuevos instrumentos y tendencias Ediciones Vicens Vives,* S.A. (Primera Edición 1994), pp. 269 –309.

Vodenicharov, Ts., S. Popova, M. Mutafova, El, Shipkovenska. (2013) *Social medicine*, publishing house "GorexPress", Sofia, pp. 386-400 /in Bulgarian/.

Yaneva R. (2010) Increase of hospitalizations' number – reasons and opportunities for overcoming, magazine "Medical meridians", volume I, edition 2, pp.27-32 /in Bulgarian/.

Yaneva, R. (2011) *Microeconomics of hospital institution. Textbook for exercises and seminars*, publishing house "Simelpress", Sofia, pp.14-44 /in Bulgarian/.

Zlatanova T., Ts. Petrova-Gotova. (2015) Economic analysis in healthcare, V.: *Methodological approaches towards economic assessment of health programmes*, publishing house GorexPress, Sofia, pp. 18-26 /in Bulgarian/.

Yaneva R.T., Zlatanova, T.Z. , Petrova-Gotova Ts.M. , Popov N.A. , Lazarova M. K. , Dobrilova P.P. , Andonova A.N. Management of public hospitals in modern conditions, "Bulletin of the East-Siberian Open Academy" - № 22, http://vsoa.esrae.ru/188-995 /in Russian/.

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