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In this issue our readers will find;

Development of gender equality curriculum and it's reflective assessment
by Tuba Acar-Erdol, Fatma Dilek Gözütok

A comparison of mathematics questions in Turkish and Canadian school textbooks in terms of synthesized taxonomy
by Ümit Kul, Eyüp Sevimli, Zeki Aksu

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by Mehmet Tekerek, Betül Tekerek

'Sarajevo' (Fahri Tarhan, 2011)

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Development of gender equality curriculum and it's reflective assessment

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ABSTRACT The purpose of this research is to prepare a gender equality curriculum for pre-service teachers and to make its reflective assessment. The present study followed the "Taba Model" which is one of the curriculum development models. The study group of this research consists of three curriculum developers, two measurement and evaluation specialists and three specialists who are specialized in gender issues Reflective Evaluation Form was prepared as a data collection tool and frequency was used in the analysis of this form. As a result of this research, "Gender Equality Curriculum Draft [GECD]" has been prepared. Based on the results of reflective assessment, it has been determined that learning outcomes, content, learning experiences and measurement and evaluation dimensions of the GECD are suitable for their purposes and consistent with each other. It is recommended that the Gender Equality Curriculum be implemented in Faculties of Education until social awareness on gender equality is gained.

Keywords *Gender, Gender education, Curriculum development, Gender equality, Reflective assessment.*

Toplumsal cinsiyet eşitliği eğitim programının hazırlanması ve yansıtıcı değerlendirilmesi

ÖZ Bu araştırmanın amacı, öğretmen adayları için toplumsal cinsiyet eşitliğine yönelik bir program hazırlamak ve yansıtıcı değerlendirmesini yapmaktır. Araştırma, program geliştirme modellerinden biri olan "Taba Modeli" doğrultusunda hazırlanmıştır. Araştırmanın çalışma grubunu üç program geliştirme, iki ölçme ve değerlendirme ve üç toplumsal cinsiyet konu alanı uzmanı oluşturmuştur. Veri toplama aracı olarak "Yansıtıcı Değerlendirme Formu" hazırlanmış, verilerin analizinde ise frekans kullanılmıştır. Araştırma sonucunda 'Toplumsal Cinsiyet Eşitliği Eğitim Programı Taslağı [TCEEPT]" hazırlanmıştır. Program Taslağına yönelik yapılan yansıtıcı değerlendirme sonucunda TCEEPT'nin kazanımları, içeriği, öğrenme yaşantıları ve ölçme ve değerlendirme boyutları amaçlarına uygun ve kendi içlerinde tutarlı bulunmuştur. Toplumsal cinsiyete yönelik farkındalık kazanılana kadar TCEEP'nin Eğitim Fakültelerinde uygulanması önerilmektedir.

Anahtar Kelimeler *Toplumsal cinsiyet, Toplumsal cinsiyet eğitimi, Program geliştirme, Toplumsal cinsiyet eşitliği, Yansıtıcı değerlendirme.*

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INTRODUCTION

The concept of gender, which refers to society's identification of men and women socio-culturally, its way of differentiating them and the roles it assigns to them (Bhasin, 2003), was discussed extensively at the end of 1970s and at the beginning of 1980s by second wave feminists. Second wave feminists argued that there should be a difference between the term gender and the term sex which refers to physical differences of the body and which is natural and inborn (Arat, 2017; Giddens, 2000). They accepted the fact that gender roles were not natural but learnt and separated the terms sex and gender (Arat, 2017). As a result of this separation, many differences between men and women which seemed to be natural were in fact understood not to be natural, and that these differences caused gender inequalities.

Gender inequality is the situation in which certain individuals cannot benefit from the rights and opportunities – due to their gender - that the individuals from the opposite gender can, or the situation in which the provided opportunities fall short of meeting the individuals' needs. Gender inequality is based on the inequality between the roles of men and women. In other words, men and women access and use social opportunities and resources unfairly.

Women make up the disadvantaged group in many parts of the world as a result of gender inequality. Gender inequality is clearly seen in the distribution of resources in the world as follows (Adaçay, 2014; UNESCO, 2000): (i) Women make up two-thirds (66%) of all the labor force in the world. (ii) Women receive only one-tenth of the world income. (iii) Two-thirds of world's illiterate adults are women. (iv) Women own less than one percent of world property. (v) The rate of women's political participation is very low except in Rwanda, South Africa, Cuba and Scandinavian countries. (vi) 85 million girls are out of school and deprived of educational opportunities. (vii) Women constitute 70% of 1.5 billion people living in poverty line in the world. (viii) Women make up 60% of 550 million working poor who live below "a-dollar-a-day international poverty line". (ix) More than 80 million women are unemployed. (x) Almost 120.000 women and young girls are sold into trafficking into Western Europe each year.

Women outweigh men in terms of being subject to gender inequality in Turkey similar to the one across the world. Evaluations carried out by national (KSGM, 2015; TÜİK, 2017a) and international organizations (European Commission, 2009; Eurydice, 2010; UNICEF, 2003; United Nations Entity for Gender Equality and the Empowerment of Women, 2011; WEF, 2017) and news of violence and abuse against women and girls that often appears in the national press reveal the fact that gender inequality is prevalent in Turkey, too. Turkey is ranked 131st out of 144 countries in the Global Gender Gap Report 2017 while the country ranks 131st in women's participation in working life, 118th in political empowerment and 101st in educational gains (WEF, 2017). According to TÜİK January (2017a) report, 71.5% of men in Turkey participate in the labor force while 31% of the women do so in Turkey. The proportion of seats held by women in the national parliament (The Grand National Assembly of Turkey) is 14.57% (TBMM, 2017). Proportion of female ministers in the cabinet is only 7.4% (Republic of Turkey Prime Ministry, 2017). One of the most important consequences of gender inequality is violence against women. According to the findings of The Research on Domestic Violence against Women, the prevalence of physical violence throughout Turkey has hardly changed in the last twenty years. The prevalence of physical violence was reported to be 36% in the 2014 study. 37% of women living in cities and 39% of those living in the countryside have been subjected to physical and/or sexual violence at some point in their lifetimes. Women are subjected to emotional violence as well. 44% of married women reported to have been subjected to acts of emotional violence such as terrorization, threats, insults, humiliation and degrading (KSGM, 2015).

Education is one of the fields in which gender inequality is prevalent. Illiterate people aged 25 years and over in Turkey in 2015 make up 5.4% of the population. While 1.8% of men in this age group are illiterate, this proportion is 9% among women and five times bigger than that of men. 23.5% of men

and 15.6% of women aged 25 years and over are high school graduates while 17.9% of men and 13.1% of women are university graduates (TÜİK, 2017b). Women are more disadvantaged than men in terms of participation in all educational levels and in literacy. About one-third of women reported to have been prevented from going to school. Their families are in the first place in terms of preventing them from receiving education (KSGM, 2015). The gap between men and women in their rate of participation in education is just the tip of the iceberg in gender inequality in education. Educational policies, teacher attitudes, curriculum, hidden curriculum, school culture, classroom arrangement etc. deepen the gender discrimination and inequality in education (Rutledge, 2005; Tang, 2008).

It was found out in the literature review that gender equality is reproduced, experienced and reinforced both in educational and other social institutions in Turkey. An educational institution is one of the areas with the most socialization. Thus, it is necessary to turn these institutions into an environment in which practices of gender equality are promoted and positive attitudes towards it are encouraged rather than a setting where gender stereotypes are reproduced. Education system is influential in changing attitudes and behavior. Hence, educational institutions should be places that provide equal opportunities for everyone, that develop students by finding and nurturing skills and interests of students and that fight gender stereotypes. Basic Act of National Education of Turkey Article 4 reads *"Educational institutions are accessible to everyone regardless of their language, race, gender, disability and religion",* and Article 8 reads "*Each individual is given equal educational opportunities*". Equal treatment of students and non-discrimination in education regardless of their gender within the framework of Basic Act of National Education are an obligation rather than a step to be taken for progress. Teachers have the biggest role in ensuring democratic gender roles at schools and raising awareness of gender equality. However, in such studies as (Acar, Ayata & Varoğlu, 1999; Acar-Erdol & Gözütok, 2017b; Bağlı & Esen, 2003; Esen, 2013a; MEB, 2016; Sayılan & Özkazanç, 2012; Torun, 2002; Yogev, 2006), teachers themselves were found to practice gender discrimination. Teachers must possess awareness of gender roles and stereotypes so that cases of gender discrimination do not emerge during the application of curriculum and while using teaching materials. However, majority of teachers lack this awareness, or they have no idea how to ensure gender equality at schools (European Commission, 2009).

One of the reasons why teachers keep traditional gender roles is the fact that they did not receive enough pre-service training in gender equality (Aslan, 2015; Cushman, 2012; Tantekin-Erden, 2009). Researches on gender issues with pre-service teachers (Aslan, 2015; Baba, 2007; Nürnberger, Nerb, Schmitz, Keller & Sütterlin, 2016; Schwartz & Sinicrope, 2013; Seçgin & Tural, 2011) suggest that pre-service teachers need to gain gender awareness.

In the "2008-2013 National Action Plan for Gender Equality" and in the "Form of Gender Equality Attitude of Higher Education Council", it was stated that gender equality issues should be included in the undergraduate and graduate programs of Faculties of Education in order to make educators, curriculum and materials sensitive to gender equality. Training of gender equality needs to be given by means of the curriculum at the Faculties of Education (Kalaycı & Hayırsever, 2014). However, no gender equality curriculum, which has been prepared taking contemporary curriculum development approaches into consideration, has been found in practice Faculties of Education. The aim of this research, which was carried out to fill the research gap in this field, is to help to prepare a curriculum about the subject of gender equality based on the needs of pre-service teachers and to develop the curriculum by conducting reflective assessment.

John Dewey suggested that a scientific research must provide solutions to the problems in practice yielding to positive results to enhance the quality of life of the individuals and society (Stone, 1994; Teddlie & Tashakkori, 2015). Similarly, this study aims to provide solutions to ensure gender equality which is an important factor in building social justice as well as producing information. Thus, this study is significant in that it provides solutions to social problems.

Many studies (Acar-Erdol & Gözütok, 2017b; Aslan, 2015; Baba, 2007; Bolsoy, Egelioğlu, Şen, Er-Güneri & Sevil, 2014; Çubukçu & Sivaslıgil, 2007; Esen, 2013a; Esen, 2013b; Kalaycı & Hayırsever, 2014; MEB, 2016; Seçgin, 2012; Seçgin & Tural, 2011; Tantekin-Erden, 2009; Yağan-Güder, 2014; Yaşar, 2011) have emphasized that Faculties of Education should offer a course about gender equality and that the course should be interactive and inquiry-based.

METHODOLOGY

Research Design

The design of this research was shaped in accordance with one of the curriculum models, "The Taba Model". The steps of this model are as follows (Oliva, 1997): a) Diagnosis of needs of learners. b) Formulation of objectives. c) Selection and organization of content. d) Selection and organization of learning experiences. e) Selection and organization of evaluation process. f) The control of the relationships of curriculum's dimensions. The information about the processes carried out at these stages is listed below.

a) Diagnosis of Needs: In the study that was conducted by Acar-Erdol and Gözütok (2017a) in order to diagnose pre-service teachers' needs of training in gender equality, it was found out that pre-service teachers need training in such issues as sex and gender, gender roles, gender stereotypes, gender discrimination in educational settings, gender stereotypes in career decision-making, women's participation in working life, women's participation in decision-making mechanisms and violence against women.

b) Formulation of Objectives: Since teaching is a phenomenon that has aims, goals/aims/learning outcomes have a particular significance (Anderson & Krathwohl, 2010). Learning outcomes refer to what a learner will be able to know, understand and perform by the end of the learning process (Donnelly & Fitzmaurice, 2005). In accordance with educational needs that were suggested in the study carried out by Acar-Erdol and Gözütok (2017a), forty-one learning outcomes under eight themes were written. While writing the outcomes, special attention was paid to the fact that all those outcomes were assessable. Taxonomy was used in order to organize the prerequisite relationships among learning outcomes and, accordingly, to form content, learning experiences, and dimensions of measurement and evaluation. The revised version of Bloom's Taxonomy (revised by Anderson and Krathwohl in 2001) was used in the classification of learning outcomes written within the cognitive domain, while Taxonomy of the Affective Domain (developed by Krathwohl, Bloom and Masia in 1964) was used to classify affective domain learning outcomes.

c) Selection and organization of content: Content refers to the selection of relevant facts, principles, generalization, theories and concepts during curriculum development process. While selecting the content, its benefit for the individual and society, its relevance to learning and teaching and its place in the knowledge structure must be considered carefully (Varış, 1976). The content of Gender Equality Curriculum Draft (GECD), which was designed in line with social and individual benefits, its appropriateness with teaching and participants, its scientific validity and outcomes, is composed of gender and concepts about gender and the topics of gender in education, working life, decision-making mechanisms and violence. The steps below were followed in laying out the content: Information about concepts, relationships between concepts, real-life examples about the concepts, problems about the concepts and solutions to those problems.

d) Selection and Organization of Learning Experiences: By means of GECD, it was targeted that pre-service teachers - by participating in the learning process actively – would realize the gender problems

in the world and in the society, they live in, investigate the causes of those problems and find solutions to them. To realize this goal, the curriculum was based on interactive teaching techniques and methods besides learner-centered teaching experiences. With this method, it was aimed that pre-service teachers would evaluate the status of women and men by using their analytical thinking, problem solving and creative thinking skills. Teaching techniques and methods which allow pre-service teachers to get actively involved in the process, to evaluate their and other students' opinions, to express their ideas in front of a crowd, to work cooperatively, to come up with ideas about controversial topics, to have empathy etc. were emphasized in the curriculum. In the learning experiences, the curriculum employed such methods as presentation, question-answer, case study analysis, conversation cycle, learning stations, brainstorming, role plays, creative drama, independent study, creative writing, opinion development, large group discussions and small group discussions. In the organization of learning experiences, teaching materials were selected and duration of the activities was established.

e) Selection and Organization of Evaluation and Measurement: Evaluation of learning outcomes was planned to be as introduction to curriculum, during the application of the curriculum and after the application of the curriculum. Achievement Test was developed for the evaluations to be carried out before and after the curriculum was applied. Developing Achievement Test started with the analysis of learning outcomes. Once the outcomes were analyzed, it was found out that they were in the cognitive and affective learning domains. By preparing 'table of specifications', the distribution of the outcomes into cognitive and affective domains and which question was aimed at which learning outcome were shown. The test has forty-one questions to test forty-one learning outcomes. Cases that pre-service teachers might encounter in their lives were developed as scenarios. There are seven scenarios, one text and one poem in Achievement Test. The level of realization of certain learning outcomes was measured through open-ended questions aimed at these scenarios, text and poem. In order to determine the compliance of the questions in Achievement Test with the learning outcomes, the opinions of five experts from the fields of gender studies and measurement and evaluation were taken and necessary editing was made. The pilot study of Achievement Test was carried out on 11 pre-service teachers who previously took the course Gender Equality at the Faculty of Educational Sciences at Ankara University. A rubric was prepared in order to do the evaluation of Achievement Test. In order to ensure the scoring reliability of Achievement Test, the questions were graded by three experts from the field of gender studies. Kappa Cohen coefficient of 10 Achievement Tests answered by pre-service teachers was calculated so as to test inter-scorer reliability. Inter-scorer Kappa Cohen coefficient was found as 0.862, 0.872 and 0.833. This proves a perfect compliance between the scorers. Formative evaluation that was carried out during the application of the curriculum aimed to find out whether pre-service teachers achieved certain learning outcomes in each subject area by using worksheets. Special attention was paid to the fact that most of the learning outcomes in the related subject area that were to be evaluated during the application of the curriculum would be placed on top level in the taxonomic classification. In the evaluation of learning outcomes, by giving cases experienced in the past or pre-service teachers might experience in their lives, it was aimed that learning would be encouraged and would continue in the evaluation process as well.

f) The control of the relationships of curriculum's dimensions: Reflective evaluation was performed in this stage. Information about formation of the study group, development of the data collection tool and collection and analysis of the data throughout the reflective evaluation of the curriculum are as follows:

Study Group

The study group of the research was formed according to "maximum variation sampling", one of the sampling methods. The aim of using this sampling is to reflect the variety of individuals that might be a side of the problems studied in this sampling by forming a relatively small sampling (Yıldırım &

Şimşek, 2008). The expert group who carries out the reflective evaluation about Gender Equality Curriculum Draft consists of three curriculum developers (assistant professor), two measurement and evaluation specialists (one assistant professor, one associate professor) and three specialists who are specialized in gender issues (one associate professor, one assistant professor, one doctoral student). While curriculum development and measurement and evaluation experts work at the Department of Educational Sciences, gender experts work at the Department of Public Administration, Sociology and Educational Sciences. The validity of the study was aimed to increase by ensuring expert variation. Since the number of pages of the documents that the experts would analyze was high (100 pages), the number of experts was limited. In the formation of the study group, it was planned that three experts from each area of specialization would analyze GECD. Experts, who were thought to give their opinions about the Reflective Evaluation Form, were asked whether they would participate in the study group contacted via e-mail and phone. Data collection tool was sent to nine experts who accepted to work in the study group. As one of the experts was not punctual in giving the opinion, the study group was composed of eight experts.

Data Collection Tool and Data Collection

To ensure the systematicity of reflective evaluation, forming a structured measurement tool was aimed. Thus, Reflective Evaluation Form (REF) was prepared. Literature was scanned in order to prepare the draft of the form, and twenty-one items were listed within the dimensions of learning outcomes, content, learning experiences and measurement-evaluation. The draft form was submitted for expert opinion (Three curriculum development and one evaluation and measurement experts). Upon getting expert opinions, the number of items in the form was increased, and the latest version of the form had twenty-nine items. For the evaluation of each item, "Comments and Suggestions" section besides "Yes", "Partly" and "No" were included in the form.

Reflective Evaluation Form was emailed to nine experts along with the documents that they would analyze (needs analysis, curriculum draft, Table of Specifications and Achievement Test). Eight experts emailed back their comments about REF and the documents that they analyzed.

Data Analysis

Frequency, a descriptive statistics tool, was used in the analysis of Reflective Evaluation Form. Distribution of experts' comments was displayed via a frequency table.

FINDINGS

Reflective Evaluation Form aimed to find out whether the draft curriculum was ready for application or not. In line with this purpose, opinions of experts of gender, curriculum development, measurement and evaluation about dimensions of outcomes, content, learning experiences and measurement and evaluation and about the consistency among these were taken. Experts' views about outcomes are displayed in Table 1, and their opinions about the content are in Table 2. While their opinions about learning experiences are in Table 3, the ones about measurement and evaluation can be seen in Table 4. Explanations and corrections about outcome, content, learning experiences and measurement and evaluation are shown under the tables. The acronyms in tables "LA", "CD", "ME", "GSA" stand for

"Level of Agreement", "Curriculum Development Experts", "Measurement and Evaluation Experts" and "Gender Subject Area Experts" respectively.

Table 1.
Expert Opinions about Learning Outcomes of the Curriculum

Learning Outcomes	LA	Frequency			
		CD	ME	GSA	Σ
They are in line with the participants' needs.	Yes	3	2	3	8
	Partly	-	-	-	-
	No	-	-	-	-
They are in line with participants' level.	Yes	3	2	3	8
	Partly	-	-	-	-
	No	-	-	-	-
They are expressed in a clear and comprehensible way.	Yes	3	2	3	8
	Partly	-	-	-	-
	No	-	-	-	-
They are in line with the characteristics of the subject area.	Yes	3	2	3	8
	Partly	-	-	-	-
	No	-	-	-	-
They included high-order thinking skills.	Yes	1	1	3	5
	Partly	2	1	-	3
	No	-	-	-	-

As displayed in Table 1, according to the experts, outcomes are in line with the participants' needs and levels, are expressed in a clear and comprehensible way, and are in line with the characteristics of the subject area. Three of the experts pointed that outcomes partly included high-order thinking skills.

Experts also wrote their comments and suggestions about the curriculum besides their responses to the alternatives in Reflective Evaluation Form. The arrangements after taking those comments and suggestions are as follows: (i) Word-based corrections were made on 12 outcomes (3rd, 6th, 7th, 13th, 14th, 22nd, 27th, 31st and 41st). For example, the outcome "…distinguishes between the roles of women and men in politics" was changed into "…distinguishes that men and women have different roles in politics". (ii) The place of the 26th and 27th outcomes were changed considering prerequisite relationships. (iii) The outcome "… argues that career guidance should be done independent of gender stereotypes (in line with individual qualifications)" was moved from the category of Understand to the category of Apply in Table of Specifications.

Table 2.
Expert Opinions on the Content of the Curriculum

Content	LA	Frequency			
		CD	ME	GSA	Σ
It is consistent with the outcomes.	Yes	3	2	3	8
	Partly	-	-	-	-
	No	-	-	-	-
It is in line with participants' needs.	Yes	3	2	3	8
	Partly	-	-	-	-
	No	-	-	-	-
It is scientifically accurate.	Yes	3	2	3	8
	Partly	-	-	-	-
	No	-	-	-	-
Allocated time is sufficient.	Yes	3	1	3	7
	Partly	-	1	-	1
	No	-	-	-	-
The given information is valid.	Yes	3	2	3	8
	Partly	-	-	-	-
	No	-	-	-	-

When the expert opinions are examined, it is clearly seen that the content is consistent with the outcomes, suitable with the participants' needs, scientifically accurate and valid. One of the experts stated that allocated time for the content is partly valid. The amount of allocated time for each theme was increased after the expert opinion.

Table 3.
Expert Opinions of the Learning Experiences of the Curriculum

Learning Experiences	LA	Frequency			
		CD	ME	GSA	Σ
The selected principles and methods of teaching are in line with the outcomes.	Yes	3	2	3	8
	Partly	-	-	-	-
	No	-	-	-	-
Activities are in line with the outcomes.	Yes	3	2	3	8
	Partly	-	-	-	-
	No	-	-	-	-
They are in line with the features of information in the content.	Yes	3	2	3	8
	Partly	-	-	-	-
	No	-	-	-	-
Various teaching techniques and methods were included.	Yes	3	2	3	8
	Partly	-	-	-	-
	No	-	-	-	-
They are in line with participants' levels.	Yes	3	2	3	8
	Partly	-	-	-	-
	No	-	-	-	-
They are in line with participants' characteristics (being pre-service teachers)	Yes	2	2	3	7
	Partly	1	-	-	1
	No	-	-	-	-
They are in line with participants' active participation.	Yes	3	2	3	8
	Partly	-	-	-	-
	No	-	-	-	-
The suggested tools and equipment are suitable.	Yes	3	2	3	8
	Partly	-	-	-	-
	No	-	-	-	-
The allocated time for the activities is sufficient.	Yes	2	1	3	6
	Partly	1	1	-	2
	No	-	-	-	-
Supplementary audio-visual materials were included.	Yes	2	2	3	7
	Partly	1	-	-	1
	No	-	-	-	-
They were expressed in a clear and comprehensible way.	Yes	3	2	3	8
	Partly	-	-	-	-
	No	-	-	-	-
Higher-order thinking skills were included in the activities.	Yes	1	2	3	6
	Partly	2	-	-	2
	No	-	-	-	-

Once Table 3 is analyzed, the following findings were obtained: (i) The activities and selected principles and methods of teaching and are in alignment with the outcomes. (ii) The learning experiences are in line with the features of information in the content. (iii) Various teaching techniques and methods were included. (iv) They are in line with participants' characteristics and active participation. (v) They were expressed in a clear and comprehensible way. (vi) The suggested tools and equipment were suitable. One of the experts stated that learning experiences were partly in alignment with the characteristics of the participants. The reason for this, he explained, was the topic of the scenario called "Ayşe'nin Mücadelesi" (Ayşe's Fight) which was in the theme titled "Women's participation in decision-making mechanisms". This scenario, which was telling the story of the struggle of a woman who was trying to be a member of Hunters Club, was removed from the activities. Instead of that, a scenario which was telling about the problems that a female teacher faced

in her journey to become a school director was included. The allocated time for the activities was found to be sufficient by two experts. The amount of time allocated for the activities was increased to 1515 minutes from 905 minutes. While seven experts replied *Yes* for the expression "Supplementary audio-visual materials were included", one expert answered *Partly*. Activities were supplemented with audio-visuals such as videos, caricatures, photos, songs, etc. Two experts stated that higher-order thinking skills were partly included in the activities. New questions aiming critical thinking, analysis, evaluation and problem-solution were added to the activities such as "What explanation would you come up for your students if you encountered a visual like this in the text book?", "Suppose that you were the teacher that took Beren to the competition. What explanation would you give her on the way home?", etc.

Expert opinions on the learning experiences dimensions of the curriculum and arrangements done are as follows: (i) Giving information about the aim and content of Gender Equality Training Curriculum and explanation of the rationale behind including problems of women in the curriculum were added in the warm-up session. (ii) Sentence limit in some activities for pre-service teachers in the texts they would write was abolished. (iii) Explanations in some activities were revised, and some of the elaborate ones were simplified. (iv) Most of the activities were elaborated with examples, and new explanations were added, or the activities kept going thanks to different principles and methods of teaching. Especially, real-life examples that demonstrate achievements of women were emphasized. (v) In the scenario called Bilim Yarışması (Science Contest), personality traits of the students were rearranged based on expert opinions. (vi) One expert stated that mostly problems of women were included in the activities while problems of men were partly mentioned. Thus, it was suggested that the number of activities including problems of men should be increased. Problems of men and the effects of gender roles and stereotypes were mentioned in the existing activities.

Table 4.
Expert Opinions on the Measurement and Evaluation Aspect of the Curriculum

Measurement and Evaluation	LA	Frequency			
		CD	ME	GSA	Σ
Questions are in alignment with the outcomes.	Yes	3	2	3	8
	Partly	-	-	-	-
	No	-	-	-	-
There is a question for every outcome.	Yes	2	2	3	7
	Partly	1	-	-	1
	No	-	-	-	-
Questions are in line with the level of participants.	Yes	3	2	3	8
	Partly	-	-	-	-
	No	-	-	-	-
Scenarios, text and poem are in line with the questions.	Yes	3	2	3	8
	Partly	-	-	-	-
	No	-	-	-	-
Time of implementation of measurement and evaluation tools is correct.	Yes	3	2	3	8
	Partly	-	-	-	-
	No	-	-	-	-
Diagnostic, formative and summative assessment were included.	Yes	2	2	3	7
	Partly	1	-	-	1
	No	-	-	-	-
Questions were expressed in a clear and comprehensive way.	Yes	3	2	3	8
	Partly	-	-	-	-
	No	-	-	-	-

Once Table 4 is examined, the following findings were obtained: (i) Questions are in alignment with the outcomes and levels of participants. (ii) Scenarios, text and poem are in line with the questions. (iii) Time of implementation of measurement and evaluation tools is correct. (iv) Questions were expressed in a clear and comprehensive way. One of the experts partly agreed with the expression "There is a question for every outcome". It is seen in the Table of Specifications that questions were written to measure each outcome. While seven experts responded *Yes* for the expression "Diagnostic, formative and summative assessment were included", one expert responded *Partly*. Achievement Test was planned to be applied prior to the curriculum for the diagnostic assessment. For formative assessment, with the worksheets of the theme in question at the end of each theme, it was aimed to track the learning of pre-service teachers. For summative assessment, it was agreed that Achievement Test would be implemented at the end of the curriculum.

The arrangements done for the measurement and evaluation dimension of the curriculum in alignment with expert opinions are as follows: (i) Expression "some of" and "most of" were removed from the rubric which would be used to evaluate the worksheets. (ii) The statement "You do not need write names on the test" was added to the test.

In light of these findings, it is understood that the curriculum is ready to be applied. Gender Equality Curriculum Draft is shown in Appendix A.

DISCUSSION and CONCLUSION

Education is one of the ways of fighting for rights in modern societies. It is a vital tool in individuals' examination and evaluation of a subject and in learning the needs and methods of the fight. This study aimed to take a step to ensure gender equality by means of education which is an important way of fight for women's rights. At the end of this study, in accordance with the needs of pre-service teachers' needs, Gender Equality Curriculum Draft was prepared based on curriculum development approach by using interactive principles and methods of teaching. In addition to pre-service teachers' learning new information, activities which aimed their questioning the gender stereotypes they gained during socialization and their evaluation of its effects for both women and men were included.

One result of the study is that learning outcomes, content, learning experiences and evaluation and measurement aspect of GETC are consistent with each other. Learning outcomes are in line with the participants' needs and levels, are expressed in a clear and comprehensible way, and are in line with the characteristics of the subject area. Three of the experts pointed that outcomes partly included high-order thinking skills. When the distribution of the outcomes in Revised Bloom's Taxonomy is analyzed, it is seen that 12.2% of them are in the category of Remember, 65.9% are in Understand, 14.6% are in Apply, 2.4% are in Analyze and 4.9% are in Create. The reason why most of the outcomes are in the category of Understand is that according to the needs analysis results, pre-service teachers lack knowledge and awareness about gender and it was their first participation in such a training about this subject. Cognitive processes in Bloom's Taxonomy are gradually becoming more complicated, and cognitive field is often identified as "lower-order" and "higher-order". While only the category of Remember is considered as "lower-order" by the writers of Taxonomy, the remaining five categories that include "mental skills and abilities" are considered "higher-order" (McMillan, 2015). As a result of this scale, while 12.2% of the outcomes are in "lower-order", 87.2% are in "higher-order". From this point, it can be said that higher-order thinking skills are sufficiently included in the outcomes. Another finding of the research is that the content is in line with the outcomes and participants' needs, scientifically accurate and valid.

Teaching principles and methods and activities that are used in learning experiences are in line with learning outcomes. Learning experiences comply with characteristics, levels and active participation of the participants. Various teaching methods and techniques can be seen in the learning experiences

of the curriculum. Improving different skills of the students by differentiating the teaching methods used was aimed. Specialists suggested increasing the amount of time allocated for the activities. Activities were designed according to the principles of interactive teaching techniques and methods. These methods require longer duration compared to other methods as they involve students' asking questions and participating in the teaching-learning process, expressing their ideas, studying in groups, developing a solution to a problem, etc. and as they require communication between teacher and student, and student and teacher. Thus, the length of time allocated for the activities was increased. It was stated that problems of women were mostly included in the activities while problems of men were partly mentioned. Thus, it was suggested by experts that the number of activities including problems of men should be increased. Since the concept of gender covers both women and men, mainly problems of women were in the activities as their problems are deeper and higher in number. For this reason, the number of activities with the theme of problems of men was not increased, but problems of men and the effects of gender roles and stereotypes were mentioned in the existing activities.

As for the measurement and evaluation dimension of the curriculum, the problems with the evaluation tools are in line with the principles of measurement and evaluation, and various types of measurement were included accordingly. The curriculum was improved by making some adaptations based on expert opinions, making it ready for application.

Recommendations

In the light of findings of the research, following suggestions can be made:

In order to improve pre-service teachers' level of knowledge and awareness of gender equality, the application of Gender Equality Curriculum in Faculties of Education can be suggested.

Until gender blindness, which refers to perceiving gender differences as normal or to a failure to realize difference on the basis of gender, ends, or awareness of gender is raised, it is of priority that gender subjects are taught in Faculties of Education as courses. However, after awareness is raised, the courses on gender should be abolished from the faculties. Instead, subjects of gender should be integrated with all the courses in Faculties of Education, and symposiums, congresses, panels, contents, etc. should be held in order to maintain and improve the awareness. Since it will get more difficult for the individuals to gain gender equality awareness as they get older (Karkıner, 2016) and it will be tougher to change the culture of gender after a new school adopts it, it can be suggested that Gender Equality Training Curriculum is applied in the first year at the Faculties of Education.

This curriculum was prepared in order to give information about gender and raise awareness. Furthermore, it acts as a preventive for gender discrimination. Thus, once necessary adaptation procedures are done with the curriculum, it can be applied in high schools, in all the faculties of universities and in public institutes. In case of its application among participants other than teachers and pre-service teachers, the themes of gender discrimination in educational settings and gender stereotypes in career decision-making can be removed from the curriculum.

Following this curriculum, a curriculum which was prepared in alignment with the principles of society-based curriculum design can be applied. While society-based curriculum design is flexible in terms of content, it is fundamental that the learning experiences of curriculum activate critical thinking, cooperative working, creative thinking and problem-solving skills and happen in a democratic school environment. The steps below can be followed in a future curriculum aimed at gender which will be shaped according to the principles of society-based curriculum design: (1) Students can present problems about gender in their environments in the classroom (Problems must be solvable by students, or students can a take step to solve them). (2) Common problems can be grouped in the same category. (3) Determining the most repetitive or unanimously-selected problem

that will be studied on. (4) Determining the likely stages of solution by developing opinions. In this stage, questions below should be answered: (4.1) What is the source of the problem? (4.2) Who causes the problems? (4.3) Who is going to play a role in the solution of the problem? (4.4) Who can we ask for help to solve the problem? etc. (5) Application of the plan (5.1) Grouping the students in order to find solution to different aspects of the problem. (5.2) Groups' preparation, application and presentation of their projects for their problems.

Only opinions of academicians were asked within reflective evaluation of this study. Taking opinions of pre-service teachers who have received gender training before and officials of non-governmental organizations acting in the field of gender can also be suggested in future studies.

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TÜRKÇE GENİŞLETİLMİŞ ÖZET

2008-2013 Toplumsal Cinsiyet Eşitliği Ulusal Eylem Planında ve Yükseköğretim Kurumları Toplumsal Cinsiyet Eşitliği Tutum Belgesi'nde; eğitimcilerin, eğitim programlarının ve materyallerinin toplumsal cinsiyet eşitliğine duyarlı hale getirilebilmesi için, toplumsal cinsiyet eşitliği konularına, eğitim fakültelerinin lisans ve lisansüstü programlarında yer verilmesinin gerektiği ifade edilmiştir. Ancak Eğitim Fakültelerinde uygulanmak üzere, çağdaş program geliştirme yaklaşımları dikkate alınarak hazırlanmış bir Toplumsal Cinsiyet Eşitliği Eğitim Programı [TCEEP] bulunmamaktadır. Bu alandaki boşluğu gidermek amacıyla yapılan bu araştırmanın amacı, öğretmen adaylarına yönelik toplumsal cinsiyet eşitliği konusunda bir eğitim programının hazırlanması ve yansıtıcı değerlendirmesinin yapılarak geliştirilmesidir.

Araştırma, program geliştirme modellerinden "Taba Modeli" doğrultusunda hazırlanmıştır. Bu modelin gerektirdiği aşamalarda yapılan işlemler şu şekildedir: (a) *İhtiyaçların Belirlenmesi:* Acar-Erdol ve Gözütok (2017a) tarafından, öğretmen adaylarının toplumsal cinsiyet eşitliğine yönelik eğitim ihtiyaçlarını belirlemek üzere yapılan araştırmada, öğretmen adaylarının; cinsiyet ve toplumsal cinsiyet, toplumsal cinsiyet rolleri, toplumsal cinsiyet kalıpyargıları, eğitim ortamında toplumsal cinsiyete dayalı ayrımcılık, meslek seçiminde toplumsal cinsiyet kalıpyargıları, kadının çalışma yaşamına katılımı, kadının karar alma mekanizmalarına katılımı ve kadına yönelik şiddet konularında eğitim ihtiyaçları olduğu ortaya çıkmıştır. (b) *Amaçların oluşturulması*: Acar-Erdol ve Gözütok (2017a) tarafından yapılan araştırmada ortaya çıkan eğitim ihtiyaçları doğrultusunda sekiz tema altında 41 kazanım yazılmıştır. Kazanımlar yazılırken hepsinin ölçülebilir olmasına dikkat edilmiştir. Kazanımlar arasındaki önkoşul ilişkileri düzenlemek ve bu doğrultuda içeriği, öğrenme yaşantılarını ve ölçme ve değerlendirme boyutlarını oluşturmak amacıyla taksonomi kullanılmıştır. (c) *İçeriğin Seçimi ve Düzenlenmesi*: Toplumsal ve bireysel fayda, bilgi yapısında içeriğin işgal ettiği yer, öğrenme ve öğretim ölçütlerine ve kazanımlara göre düzenlenen TCEEP'nin içeriğini; cinsiyet ve toplumsal cinsiyetle ilgili kavramlar, eğitimde, çalışma yaşamında, karar alma mekanizmalarında ve şiddette toplumsal cinsiyet konuları oluşturmuştur. (d) *Öğrenme Yaşantılarının Seçimi ve Düzenlenmesi*: Programda, etkileşimli öğretim ilke ve yöntemlerine dayalı, öğreneni merkeze alan öğrenme yaşantıları düzeni esas alınmıştır. Bu yöntemlerle öğretmen adaylarının, kadının ve erkeğin konumunu, eleştirel düşünme, problem çözme ve yaratıcı düşünme becerilerini kullanarak değerlendirmeleri hedeflenmiştir. (e) *Ölçme ve Değerlendirme Boyutunun Seçimi ve Düzenlenmesi*: Programda kazanımların değerlendirilmesi; programa girişte, programın uygulanması sürecinde ve program uygulandıktan sonra yapılacak şekilde hazırlanmıştır. Programa girişte ve program uygulandıktan sonra yapılacak değerlendirmeler için "Erişi Testi" geliştirilmiştir. Programın uygulaması sürecinde yapılan biçimlendirici değerlendirmede ise çalışma kâğıtları kullanılarak öğretmen adaylarının, her konu alanındaki belli kazanımlara ulaşıp ulaşmadıklarının tespit edilmesi amaçlanmıştır. (f) *Programın Boyutlarının İlişkilerinin Kontrolü*: Bu aşamada yansıtıcı değerlendirme yapılmıştır. Yansıtıcı değerlendirmeye yönelik çalışma grubunu üç program geliştirme, üç toplumsal cinsiyet konu alanı ve iki ölçme değerlendirme uzmanı olmak üzere sekiz uzman oluşturmuştur. Veri toplama aracı olarak Yansıtıcı Değerlendirme Formu [YDF] hazırlanmıştır. Kazanımlar, içerik, öğrenme yaşantıları ve ölçme ve değerlendirme boyutlarından oluşan formda 29 madde yer almaktadır. YDF'den elde edilen verilerin analizinde frekans kullanılmış, frekansların dağılımları tablolar yoluyla sunulmuştur.

Çağdaş toplumlarda hak arama mücadelesinde kullanılan yöntemlerden biri eğitimdir. Eğitim, bireylerin, bir konuyu sorgulayıp değerlendirmesinde, mücadelenin gereklerini ve yöntemlerini öğrenmesinde önemli bir araçtır. Kadın hakları mücadelesinin yöntemlerinden biri olan eğitim yoluyla, toplumsal cinsiyet eşitliğinin sağlanmasında bir adım atmayı hedefleyen bu çalışmanın sonunda; öğretmen adaylarının ihtiyaçları doğrultusunda, program geliştirme yaklaşımı temele alınarak, etkileşimli öğretim ilke ve yöntemleri kullanılarak Toplumsal Cinsiyet Eşitliği Eğitim Programı Taslağı [TCEEPT] hazırlanmıştır. Taslakta öğretmen adaylarının yeni bilgiler öğrenmelerinin yanında, sosyalizasyon sürecinde kazandıkları toplumsal cinsiyet kalıpyargılarını sorgulamalarına ve etkilerini her iki cinsiyet için değerlendirmelerine yönelik etkinliklere yer verilmiştir. Yansıtıcı değerlendirme sonucunda TCEEPT'nin kazanımları, içeriği, öğrenme yaşantıları

ve ölçme ve değerlendirme boyutlarının birbiriyle tutarlı olduğu görülmüş ve uzman görüşleri doğrultusunda bazı düzenlemeler yapılarak program geliştirilmiştir. TCEEP Taslağına Ek 1'de yer verilmiştir.

Araştırmanın sonuçlarından hareketle geliştirilebilecek öneriler şunlardır: Toplumsal cinsiyet ayrımlarını yokmuş gibi görmek ya da normal algılamak anlamına gelen *'toplumsal cinsiyet körlüğü'* son bulana kadar ya da toplumsal cinsiyete yönelik farkındalık kazanılana kadar toplumsal cinsiyet konularının Eğitim Fakültelerinde bir ders olarak yer alması önceliklidir. Ancak bu farkındalık kazanıldıktan sonra toplumsal cinsiyet bir ders olarak verilmemeli, farkındalığı sürekli kılmak ve geliştirmek için; toplumsal cinsiyet konuları Eğitim Fakültelerindeki bütün derslere entegre edilmeli, belirli aralıklarla bu konuda sempozyum, kongre, panel, yarışma vb. çeşitli etkinlikler düzenlenmelidir.

Appendix A

Table 5.
Gender Equality Curriculum Draft

Subject Field	Instructional Objective	Content	Learning Experiences	Evaluation*	Material	Time
Warm Up	Express feelings freely Express ideas freely	Man and Woman Relationship	Preparation, Warm Up		Paper Pen	30 min.
Sex and Gender	1. Define the concept of sex	Sex and Gender	Presentation, Question-Answer	Achievement Test [AT]	Slides Paper Board Board Marker Computer Projector	85 min.
	2. Define the concept of gender		Presentation, Question-Answer			
	3. Explain differences between sex and gender	Differences between Sex and Gender	Presentation, Question-Answer			
	4. Define the concept of gender roles	Gender Roles	Presentation, Question-Answer			
	5. Define the concept of gender stereotypes	Gender Stereotypes	Presentation, Question-Answer			
	6. Differentiate between discrepancies that are based on sex and gender	Differences between Sex and Gender	Whole Group Discussion	AT and Formative Assessment Worksheet [FAW]		
Gender Roles	7. Express acceptable roles for men and women in society	Gender Roles	Whole Group Discussion	AT	Slides Pen Paper Work sheets Computer Maraca Projector	205 min.
	8. Evaluate the effects of gender roles on individuals' lives	The Effects of Gender Roles	Whole Group Discussion			
	9. Explain how gender roles are learned	Learning Gender Roles	Conversation Circle			
	10. List women and men's roles in the house	Gender Roles in Housework Division of Labor	Case Study Analysis	AT and FAW		
	11. Evaluate women and men's division of labor in the house	The Effects of Gender Roles	Case Study Analysis			
	12. Work to raise awareness about gender roles	The Awareness of Gender Roles	Role Play	AT		
Gender Stereotypes	13. Empathize with those who have been affected from gender stereotypes	Gender Stereotypes	Preparation, Warm up	AT	Slides Paper Pen Needle Computer Projector	110 min.
	14. Recognize gender stereotypes		Drama, Case Study Analysis			
	15. Recognize the inequalities that gender stereotypes cause	The Characteristics and Effects of Gender Stereotypes	Drama, Case Study Analysis			
	16. Develop solutions to fight against gender stereotypes		Drama, Case Study Analysis	AT and FAW		

Subject Field	Instructional Objective	Content	Learning Experiences	Evaluation*	Material	Time
Gender Discrimination in Educational Settings	17. Recognize the discriminations in educational environments that have been caused by gender stereotypes	Gender Equality in Education	Case Study Analysis, Whole Group Discussion	AT	Board Board Marker Sticky Papers Paper Computer Projector	210 min.
	18. Empathize with students who have been discriminated against because of gender stereotypes		Case Study Analysis			
	19. Recognize the traditional representations of gender roles in educational materials	Sexist Components in Educational Materials	Small Group Discussions			
	20. Prepare materials that respect gender equality		Small Group Discussions	AT and FAW		
Gender Stereotypes in Choice of Profession	21. Recognize whether they possess gender stereotypes or not in their choice of profession	Choice of Profession Based on Gender	Independent Study and Presentation	AT	Paper Pen Slides Board Board Marker Computer Projector	185 min.
	22. Recognize the gender stereotypes in sports as a profession	Gender and Sports as a Profession	Case Study Analysis			
	23. Advocate the idea that guidance on profession selection should be made independently from gender stereotypes (in line with individuals' abilities)	Choice of Profession Based on Gender	Role Play	AT and FAW		
	24. Produce solutions to having women play a bigger part in science	Gender in Science	Brainstorming	AT		
Involvement of Women in Working Life	25. Empathize with women whose working rights have been prevented	Working Rights of Women	Whole Group Discussion	AT	Slides Computer Projector Maraca	170 min.
	26. Scrutinize the problems women have experienced during the process of finding a job	Women in Work Life: Problems, Precautions, and Solutions	Case Study Analysis			
	27. Explain the reasons why women have not been appropriately represented in working life		Whole Group Discussion	AT and FAW		
	28. Scrutinize the role of the government on women's participation in working life	Working Rights of Women	Conversation Circle			
	29. Recognize the inequalities between women and men in working life	Women in Work Life: Problems, Precautions, and Solutions	Creative Writing	AT		
	30. Produce solutions for the problems that women experience in working life		Creative Writing			
Participation of Women in Decision-Making Mechanisms	31. Recognize that women and men have different roles in politics	Gender in Politics	Whole Group Discussion	AT	Tape Cardboard Colorful Pens Computer Projector Maraca Scissor	215 min.
	32. Empathize with women who have not been able to participate in decision-making mechanisms	Gender in Decision-Making Mechanisms	Conversation Circle			
	33. Question the reasons why women have not been able to participate in decision-making processes	Problems and Solutions in Women's Participation in Decision-Making Mechanisms	Conversation Circle, Role Play	AT and FAW		
	34. Evaluate the application of quota in including women in decision-making mechanisms		Opinion Development	AT		

Subject Field	Instructional Objective	Content	Learning Experiences	Evaluation*	Material	Time
	35. Provide solutions for increasing women's participation in decision-making mechanisms		Station Teaching			
Violence Against Women	36. Define the concept of violence against women	Violence Against Women	Whole Group Discussion	AT	Slides Computer Projector	185 min.
	37. Exemplify different types of violence against women	Types of Violence Against Women	Whole Group Discussion			
	38. Make inferences about the reasons why violence against women has increased	Fighting Against Violence Against Women	Whole Group Discussion			
	39. Empathize with women who have been exposed to violence	Individual and Societal Effects of Violence Against Women	Case Study Analysis			
	40. Explain the individual and social outcomes of violence against women		Conversation Circle			
	41. Produce solutions for fighting violence against women	Fighting Against Violence Against Women	Conversation Circle	AT and FAW		

*Achievement Tests (AT) will be used for summative assessment and formative assessment worksheets (FAW) have been used for formative assessment.

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A comparison of mathematics questions in Turkish and Canadian school textbooks in terms of synthesized taxonomy

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ABSTRACT The present study offers a comparative analysis of mathematics questions placed in Turkish and Canadian school textbooks in terms of cognitive process and knowledge dimension as well as the question types. In order to get the required data, eight textbooks were analyzed respectively. Document analysis was conducted to collect the data from these textbooks. In order to compare the differences and similarities between the questions found in these textbooks as well as their levels of cognitive learning, these questions were analyzed and classified according to the types of cognitive processes and knowledge dimensions they address. Mathematics questions existing in Turkish and Canadian textbooks showed a similar tendency in terms of cognitive learning domain. However, compared to the Turkish textbooks, it was found that the questions provided in the Canadian textbooks contained more constructed response questions that required higher-order cognitive abilities. It is recommended that the number of higher order thinking questions should be increased in accordance with international examinations.

Keywords *Mathematics textbook, Comparative education, Synthesized taxonomy,*

Türkiye ve Kanada matematik ders kitaplarındaki soruların sentezlenmiş taksonomiye göre incelenmesi

ÖZ Bu çalışmanın amacı, Türkiye ve Kanada'da kullanımda olan ortaokul matematik ders kitaplarındaki soruları bilişsel öğrenme düzeylerine ve soru türlerine göre inceleyip karşılaştırmaktır. Bu bağlamda Türkiye'de kullanımda olan ortaokul matematik ders kitapları ile Kanada'da kullanımda olan "Math Makes Sense" adlı ders kitapları içerik analizine tabi tutularak karşılaştırılmıştır. Araştırmanın amacına uygun olarak veriler toplanıp doküman analizi yapılmıştır. Her iki ülke ders kitaplarında yer alan matematik soruları, Sentezlenmiş Bloom Taksonomisi üzerinden bilişsel süreç ve bilgi boyutlarına göre kodlanmış ve soruların bilişsel öğrenme düzeylerine göre benzerlik ve farklılıkları karşılaştırmalı olarak incelenmiştir. Türkiye ve Kanada ders kitaplarında yer alan soruların bilişsel süreç ve bilgi boyutu açısından benzer özellikler gösterdiği tespit edilmiştir. Ancak Kanada ders kitabında bilişsel beceri gerektiren açık uçlu soru türlerine daha çok yer verildiği belirlenmiştir. Ders kitaplarının içeriği oluşturulurken uluslararası sınavlarla uyumlu üst bilişsel beceri gerektiren sorulara daha fazla yer verilmesi önerilmektedir.

Anahtar Kelimeler *Matematik ders kitabı, Karşılaştırmalı eğitim, Sentezlenmiş taksonomi*

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INTRODUCTION

Considering its role in the development of the individual and society, it is possible to claim that mathematics is one of the fundamental subjects that should be taught at all levels of educational systems. Due to the multitude of large-scale examinations and their impact on the lives of individuals, the way in which mathematical knowledge is measured becoming more and more important each day. Recent studies have shown substantial differences between the mathematical achievements of student across the worldwide. These difference have been expressed by international examinations like Trends in International Mathematics and Science Study [thereafter TIMSS] and the Programme for International Student Assessment [thereafter PISA]. According to the TIMSS 2015 report, in terms of 8th grade mathematics success, Canada is ranked as 8th with the highest mathematics success among English-speaking countries, and Turkish students ranked 24th with a score of 458. In the PISA mathematics result, Canadian students are ranked as 7th with a score of 516, and Turkish students are ranked as 52nd with a score of 420. When the results of TIMSS and PISA are compared, it is revealed that the mathematics success of Turkey was below the mean of the participating countries (ÖDSGM, 2016).

One of the significant instruments employed in clarifying the possible reasons for the differences in achievement determined through a large-scale examination is the comparison of textbooks (Alajmi, 2012; Son, 2012). The quality of the textbooks used in a class contributes to the effectiveness of the teaching and learning process, and one can compare countries' mathematical achievement ranks and textbook quality according to international-scale examinations (Delil & Tetik, 2015; Fan, Zhu & Miao, 2013; Kulm & Capraro, 2008; Sevimli & Kul, 2015). Additionally, there are studies showing that there is a strong correlation between the mathematical achievements of students and the quality of the textbooks used (Fan, Zhu & Miao, 2013; Kulm & Capraro, 2008). The majority of textbooks and lesson notes generally focus on shaping the content of mathematical knowledge to be taught and learned and have the quality of a guidebook (Haggarty & Pepin, 2002; Hirsch, Lappan, Reys & Reys, 2005; Thomson & Fleming, 2004). In their study, Alajmi and Reys (2007) stated that if a topic is not included in the textbook, most probably this topic will not be mentioned in class. Hence, while preparing textbooks, relevant parties' attention should be on the selection of content appropriate to the characteristics of the behavior to be measured.

One prominent argument in this debate may be on the quality of textbooks used in the classrooms and how this quality might and should be used as a criterion to compare the ability of educational systems which compete internationally in today's world. The quality of the textbooks might be assessed by looking at the questions provided in the textbook and this study offers this kind of analysis. The present study offers a comparative analysis of mathematics questions placed in Turkish and Canadian school textbooks in terms of cognitive process and knowledge dimension as well as the question types. Questions addressing higher cognitive thinking levels increase the conceptual learning level of students and may aid in the consolidation process (Duman et al., 2001). Considering with other factors influencing the low mathematics achievement of countries, the role of compatibility or incompatibility between teaching content and examination content in success or failure is undeniable. Textbooks with time and duration incompatibility between classes make the end result, examination important in terms of cognitive processes and knowledge dimensions of mathematics lesson content at the same level in different countries and schools. Investigating the cognitive characteristics of activities used in the mathematics education of countries having different success rankings may help to identify the strengths and weaknesses of textbooks used in countries. The purpose of this research is to reveal the differences in mathematics achievements of Turkish and Canadian students, hence contributing to the international comparative studies in this area. In this study, we have not only discussed the comparative educational research focusing the educational systems, teaching content and teacher practices in different countries, but also have provided comparisons of teaching practices among Turkey and Canada.

The examination of textbooks might illustrate how teaching and learning occurs in a large population (Li, Chen & An, 2009). As a result, the examination of these textbooks will identify the kinds of learning

opportunities that the Canada and Turkey provide their students, and it will elicit the differences and similarities in their teaching process. These findings might contribute to the development of teaching materials. In the current research, selected Canadian and Turkish mathematics textbooks were compared by concentrating on their cognitive level of the mathematics questions at the end of units. It is important for researchers to determine the differences in student achievement and learning opportunities between different countries. In this study, evaluation questions at the end of units in mathematics textbooks used in both Turkey and Canada are assessed in terms of components of Synthesized Bloom Taxonomy (SBT) such as 'cognitive processes' and 'knowledge dimension'. With this aim, the following research questions guided our study: 1) What is the level of mathematics questions in middle school mathematics textbooks in Turkey and Canada according to the Synthesized Bloom Taxonomy? 2) Are there differences between the types of mathematics questions in middle school mathematics textbooks in Turkey and Canada? The results obtained from this study are important because of that a comparative assessment was made on the cognitive field taxonomy, taking into account the content of the students' learning process and countries' mathematical achievement ranked in the large-scale examinations (Haggarty & Pepin, 2002; Törnroos, 2005).

The Context of Study

The Turkish education system consists of kindergarten, primary, secondary and higher education. Primary education level defines and is limited to the teaching of pupils aged from 6 to 14 and is compulsory for all citizens, whereas the higher education level is optional. Both the state and the private primary schools are governed and monitored by an official branch representing the Turkish Republic, and this branch is called as the Ministry of National Education (thereafter MONE). The regulations issued by MONE promote and define a standard mathematics curriculum, and all teachers serving the relevant grade level have to follow this curriculum. As a result of reform movements, which took place in mathematics education globally, there was a need to review national educational policies, learning outcomes and teaching paradigms in Turkey and prepare a new curriculum that would meet this need. In this direction, there has been a transition from a behavior-focused system and rote based learning system in mathematics curriculum to an in-class learning-focused system emphasizing upper level skills and aiming to improve conceptual understanding (Babadağ & Olkun, 2006; Baki, 2008; Bulut, 2007; Sriraman, 2010). Thus, changes that took place in the Turkish mathematics curriculum of 2005 were organized modelling the curriculum programs implemented in countries such as England, the United States of America, Canada and Singapore (Olkun, 2006). The basic aims of this curriculum may be listed as to ensure effective student participation in the learning program, present the opportunity for students to construct their own mathematical knowledge, improve the mathematical thinking skills of students as well as helping them to gain problem-solving skills (Bulut, 2007; MONE, 2017). In Canada, each one of the provinces and territories has one or two departments responsible for education, headed by a minister. These departments concentrate only on the guiding the education of the country. Unlike the education system present in Turkey, authority and responsibility were given to the local authorities.

Canadian children under the age of six and 16 must attend school and most of them go to public schools. Similar to Turkey, elementary and high schools usually start in early September and end in late June. The curricula in Canada is prepared by one of the official organizations of education departments linked to this ministry. In order to enter to university in some provinces of Canada, such as British Columbia, students must have a high school diploma and have been successful in the University Entrance Exams in addition to school examinations. The Canadian mathematics curriculum follows a conceptual approach which concentrating on the processes of critical thinking, problem solving and real-world applications. The similarities in the educational process, semesters and program paradigms between Turkey and Canada provide the opportunity to compare the two countries with a descriptive approach.

As such, it is necessary to discuss the developmental properties of the mathematics textbooks from Turkey and Canada. In both countries, private publishers may prepare textbooks in accordance with the national curricula with permission of the ministry or department of education. In Turkey, an enormous investment was made in providing textbooks for all subjects and distributing them to schools free of

change. In Canada, there is no requirement for teachers and students to use and follow previously determined textbooks (Mullis, Martin, Foy & Arora, 2012). Compared with Canada, variation and updating studies of the curriculum and textbooks are performed more often in Turkey. The textbooks in Turkey must be designed accordingly with the previously announced curricula, and the weekly distribution of topics is pre-determined while the teachers are expected to teach these topics. However, teachers in Canada have more flexibility in terms of the elements to be followed during teaching using textbooks. Textbooks have a significant effect on learning and teaching as content must reflect the content of the curricula (Stein, Remillard & Smith, 2007; Pepin & Haggarty, 2001).

Conceptual Framework

In the educational policies in countries, measurement and assessment are dealt with as part of instruction. With the aim of measurement and assessment, a variety of taxonomies are used to reflect the content and quality of questions. The Bloom's taxonomy is one of the most widely accepted systematic classifications used for classification not only in the field of cognitive learning, but also in many other areas including mathematics. The taxonomy developed by Bloom (1956) is about the cognitive learning field and suggests there are six hierarchical levels of knowledge, comprehension, application, analysis, synthesis and evaluation (Bloom, 1956). In their work, Smith, Wood, Coupland and Stephen (1996) noticed some limitations of Bloom's taxonomy and defined the MATH taxonomy, a variation of Bloom's taxonomy specific designed to the field of mathematical learning, with the aim of assessing students' understanding of mathematics. When the levels of both taxonomies are investigated in detail, it is possible to see the "application" stage in Bloom's taxonomy is divided into 3 different stages respectively and they are discussed more thoroughly compared to the MATH taxonomy. The "synthesis" level of Bloom's taxonomy is determined to be equivalent to the "inferences, estimations and comparisons" stage in the MATH taxonomy. The most important characteristic separating two taxonomies is that the MATH taxonomy developed by Smith and his colleagues pays more attention to the content relatedness among mathematical concepts. Porter (2002) assessed the stages of "knowledge" and "comprehension" under the name "memorizing" to assess teaching content (curriculum and textbooks).

Anderson and Krathwohl (2001) reorganized Bloom's classification and dealt with two different dimensions of the "knowledge dimension" and the "cognitive processes dimension". These constitute the knowledge dimension showing the content of learning outputs/questions and the cognitive processes dimension showing how these targets are achieved. Thus, this two-dimensional revised taxonomy allows the opportunity to assess cognition, not just in terms of knowledge, but simultaneously in terms of processes (Krathwohl, 2002). The knowledge dimension comprises the *factual*, *conceptual*, *procedural* and *metacognitive* levels with detailed information about their definitions and contents available in the study (*ibid*). The cognitive processes dimension increases in complexity and scope moving from left to right, while the knowledge dimension increases from top to bottom. To increase the complexity, scope and abstraction, it is necessary for educators to perform detailed investigations about the levels of questions. Instead of just correlating knowledge to one content, an attempt is made to deal with knowledge accumulation that aids in completing cognitive processes at the same time. However, it may not always be possible to determine definite boundaries between the dimensions and the levels within these dimensions.

The questions on TIMSS are classified in terms of skill levels in three cognitive areas of knowing, applying and reasoning. This framework is only used to assess cognitive learning domains of problems However, the study by Rivzi (2007) compared and synthesized some taxonomies to develop a new taxonomy. This new taxonomy provides an opportunity to assess cognition in terms of knowledge cognitive processes dimension. According to Rivzi, there are similarities between some levels in Bloom's taxonomy and this situation makes classification difficult. This particular study stated the cognitive process stages in available taxonomies (Biggs, 1995; Bloom, 1956; Smith et al., 1996; Porter, 2002) overlapped and identified different levels to develop a new taxonomy called the Synthesized Bloom Taxonomy (SBT). According to the SBT, the first stage of the cognitive learning field specific

to mathematics is "assimilation". At the first domain, the student knows the definitions of basic mathematical concepts, facts and formulae, can make sense of familiar situation and activities and use these to solve routine problems. After the assimilation domain, the student is expected to reach the "transformation". A student at the transformation level can understand the solutions to non-routine mathematical problems or adapt themselves to new situations due to the accumulation of knowledge gained during the previous stage. Questions in the transformation stage should test the ability to transform knowledge from one form to another, from verbal to numerical. The second domain concentrates on the skills of learners to apply knowledge and conceptual understanding to solve questions. Finally, the "creation and validation" stage is reached where the individual should be able to estimate mathematical relationships, prove, confirm, make generalizations, assess and reconstruct knowledge as a new unit. The last stage, reasoning, goes beyond the solution of routine questions to comprehend unfamiliar circumstances, complex contexts, and multi-step problems. The creation and validation stage in SBT is equivalent to the combination of the evaluation and synthesis belongs to stages of the revised Bloom taxonomy. In the SBT the questions in the curriculum and textbooks are analyzed in two dimensions of the cognitive processes and the knowledge dimension (Rivzi, 2007). The dimensions and sub-dimensions of the SBT used in this study are shared in detail in the data analysis section (see Table 2 and 3).

Relevant Research

Textbooks are seen an essential material for both students and teachers. According to Pepin and Haggarty (2001), the subject of mathematics in the classroom is intensely affected by the existing textbooks, since most teachers prefer to use them as their main teaching materials. This argument is supported by a study conducted by Rezat in 2009. In this study, Rezat (2009) emphasized the importance of using textbooks in the teaching and learning process. According to the tetrahedron model developed specifically for the field of mathematics education by Rezat (2009), the interaction between teachers, learners, textbooks and mathematical knowledge should be used to explain the quality of the teaching and learning processes. In recent years, various studies have explored the textbooks because of their important position in the process of teaching and learning. When comparative studies in the relevant literature are investigated thoroughly, it has been noted that the context of design, language, content, teaching activities and questions in textbooks from two or more countries are assessed in terms of similarities and differences (Erbaş, Alacacı & Bulut, 2012; Haggarty & Pepin, 2002; Kar, Güler, Şen & Özdemir, 2017). For example, Haggarty and Peppin (2002) completed a study comparing the most popular mathematics textbooks in England, Germany and France. The results of their study found that English textbooks had a tendency to show mathematics as a discipline where learning was mandatory, with accuracy simply accepted and comprised of rules and processes. German textbooks had lower levels of difficulty in mathematics questions compared to textbooks from other countries, while the questions in French textbooks included mathematical activities mainly based on daily life. Another study comparing the mathematics questions in middle school 8th grade level of mathematics textbooks on a country basis was conducted by Özer and Sezer (2014), and they stated that compared to textbooks from Singapore, there was more overlap between American and Turkish mathematics textbook contents. Their study observed that in American and Singaporean textbooks questions addressing to the higher levels of comprehension were more frequent, while the questions in Turkish books generally addressed the lower levels of comprehension as they focused on answering the question rather than the solution method. Kar et al. (2017) investigated the methods used for multiplication of fractions in Turkish and American textbooks. The result of this study showed that the mathematics questions provided in American textbooks had a style requiring more high-level cognitive skills. The basic difference revealed in this study is that the primary aim of American textbooks is to develop conceptual understanding primarily followed by procedural skills, while in Turkish textbooks the aim is to develop both simultaneously.

When studies in Turkey are investigated, they appear to focus mainly on student and teacher opinions of the choice or lack of choice in the use of learning and teaching in textbooks. Within this scope, the focus has been on qualities like the technical properties of the textbooks, activities in the textbooks and

problem state or application principles (Bingölbali, Gören & Arslan, 2016; Erbaş, Alacacı & Bulut, 2012; Kurtulmuş, 2010; Sevimli, 2016; Taşdemir, 2011). There are a limited number of studies available that assess questions in textbooks in terms of knowledge and cognitive processes dimensions of the cognitive learning field (Biber & Tuna, 2017; Karadeniz et al., 2015). Ubuz and Sarpkaya (2014) observed that while the algebraic tasks in 6th grade textbooks required high levels of cognitive thinking, the levels of applications in class were low. Another study relevant to the issue at hand is conducted by Biber and Tuna (2017), and in this study they stated that the number of questions belonging to the analysis, synthesis and evaluation levels among the exercise questions found in Turkish textbooks were very low. There is no study investigating the cognitive level of the mathematics questions in Turkish textbooks along with those from another country in terms of SBT dimensions. The present study compares Canada and Turkey on how they sustained mathematical success in international examinations. This study provides insights into the similarities and differences in the cognitive learning levels of questions in Canadian textbooks, with proven student success, and Turkish textbooks. In this way, it is important for researchers to determine the differences in student achievement and learning opportunities between different countries.

METHODOLOGY

In accordance with the aim of the research, data were collected with document analysis. Document analysis, known as the investigation process based on cases with the research focus on written material, records or documents, is generally used in educational studies when textbooks and curricula are the data source (Yıldırım & Şimşek, 2008). The documents in this research are available middle school mathematics textbooks from Turkey and Canada and the exercise questions within these documents were analyzed accompanied by their relevant conceptual frameworks. While completing comparative document analysis, it is important to explain the context of the written sources from which data are obtained (Bowen, 2009).

Selection of Textbooks

According to the examination results of the international TIMSS (2015), as the mathematical achievement of 8th class students in Turkey was below the mean success points and Canada was among countries with success above the mean points, the textbooks from these two countries were compared. Data were gathered from the mathematics questions at the end of the units in four Turkish and four Canadian textbooks. In Turkey, there are two types of textbooks available to be used by all teachers and students in schools with ministry approval, prepared by commissions and government-authorized textbooks. All textbooks are checked by Ministry of National Education (MONE) since the centralized nature of Turkish educational system that is based on a curriculum.

The middle school mathematics textbooks are available for all students, educators and parents and listed on the MONE official website for the 2016-2017 academic year included in the study (Table 1). These books were accepted as textbooks for a five-year duration from the year of publication by decision of the Board of Education. These books are recommended for use in many Turkish state schools; so they reach many students. The fact that textbooks are published in similar years in terms of updating are also factors affecting book selection. Four textbooks (Aydın, 2016; Aydın & Gündoğdu, 2016; Keskin, 2016; Yaman, Akkaya & Yeşilyurt, 2016) were examined in the present study. These textbooks do not contain any additional material.

Math Makes Sense for 5, 6, 7 and 8 grades textbooks series (Appel et al., 2008; Appel et al., 2009; Baron, et al., 2008; Garneau et al., 2007) were included in the content analysis (Table 1). One of the reasons for this book selection is that researchers can easily access and obtain these textbooks. These

textbooks are compatible with Canadian mathematics curriculum and used in a variety of grade levels across the provinces in Canada. Authors of these textbooks assert to develop creative thinking, problem solving and understanding of mathematical ideas. The exercise questions in the evaluation sections at the end of the units in these books were used as the data tool. This study including middle school level textbooks was deemed necessary as there is no study analyzing the contents of mathematics textbooks used at this level in both countries and as the education stage is a target group for international examinations like TIMSS.

Table 1.
Content analysis of middle school textbooks

Grade	Turkey	Number of Ques.	Canada	Number of Ques.
5	Koza Publication (2016)	106	Math Makes Sense 5 (2008)	101
6	Koza Publication (2016)	154	Math Makes Sense 6 (2009)	74
7	Koza Publication (2016)	105	Math Makes Sense 7 (2007)	129
8	Koza Publication (2016)	174	Math Makes Sense 8 (2008)	184

Analysis of Data

To assess the mathematics textbooks from both countries in terms of SBT in this study, the exercise questions at the end of each unit and content where students may display their performance were used. Descriptive statistical methods were used in the analysis of data. Investigation of questions in middle school mathematics textbooks was completed in 3 stages. These stages are shown in Figure 1 and explained in order.

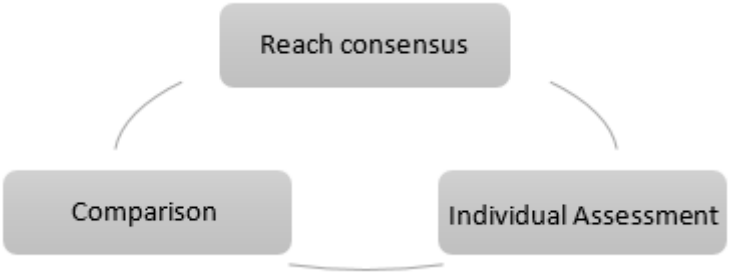


Figure 1. Stages of investigation of questions according to synthesized Bloom taxonomy

In the first stage, evaluation questions from a random unit in the textbooks from both countries were selected. Questions related to the topic were inserted on a taxonomy table by three researchers. For this, the mathematics textbooks from both countries were investigated.

Later the basic principles to be used to insert the questions from the textbooks on the taxonomy table were determined by the researchers. After keywords regarding level of questioning such as level 1 (recalling, defining, showing, classifying, recognizing), level 2 (applying, drawing, interpret, solving, analyse, generating) and level 3 (predicting, estimate, decide, criticize, justify, evaluating) were obtained in this process, the row relating to the knowledge dimension and the column relating to the cognitive processes dimension for evaluation questions at the end of units in textbooks from Turkey and Canada were identified and the location of the mathematics questions on the SBT was determined (Krathwohl, 2002).

In the second stage, the mathematics questions were independently coded by each researcher. In the third stage, the reliability between the coders was determined. In this stage the researchers met again and identified inconsistencies in the locations on the taxonomy table. These three stages continued cyclically. Later the inconsistent questions coded by researchers were discussed and a consensus was reached. During this process, if necessary, opinions were sought from an expert in measurement and

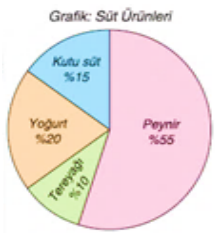
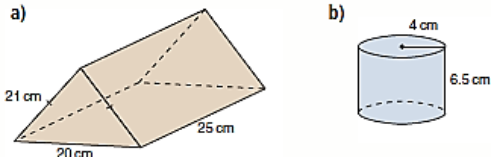
assessment. It should be stated that each mathematics question in textbooks may be evaluated more than one cells but in this study we assume each question, evaluated just one cell.

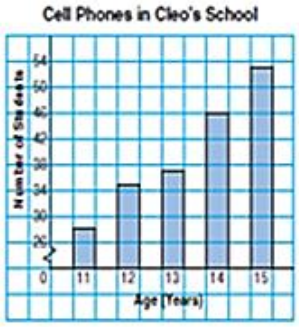
Table 2.
Synthesized Bloom taxonomy

Knowledge dimension	Cognitive Process		
	1. Assimilation	2. Transformation	3.Creation and Validation
A. Factual			
B. Conceptual			
C. Procedural			
D. Meta-cognitive			

The horizontal axis of the SBT dimensions presented in Table 2 shows the cognitive processes dimension, while the vertical axis contains the knowledge dimension (Rivzi, 2007). Numbers on the horizontal axis are used to code levels on the cognitive processes dimension, while letters on the vertical axis code levels of the knowledge dimension. Thus, for example a while a question in B1 category requires assimilation of basic mathematical concepts, a question in the A2 category includes the skills of investigating a case in a new situation and selection of the appropriate method. Some question samples related to coding of questions in middle school mathematics textbooks used in both countries are given in Table 3. For example, the main activities in A1 category involved knowing and recalling about definitions of a triangle and a quadrilateral and its properties. The question in the A2 category includes constructing meaning from the pie chart and selection of the appropriate graph type. The question in the seventh grade of Canadian textbook may expect from students to draw a net for triangular prism and cylinder in order to identify their faces, edges and vertices. Conceptual knowledge that students need to know and use them in solving this question, therefore it is in the category of A2. Next example, using algebra tiles allow students to better understand ways of algebraic thinking and the concepts of algebra. The same cognitive level of question (B1), it is expected that students should be able to relate a percent expression to a fraction and a decimal concept and convert such concepts between each other. The first level of mathematical thinking involves solving routine questions using rule based algorithms. Another mathematics questions in the both textbooks have been categorized as B2 since it is a conceptual knowledge for students to find a rooted number, close value, or to find the range of numbers given from within the root. The student at this stage can apply his/her previous knowledge to new situations. The question in the category of B3, it is expected from student that after having conceptual knowledge about construction of triangle, it will make a judgment about whether a triangle is constructed based on a given data.

Table 3.
Coding examples of questions in Turkish and Canadian textbooks

Code	Turkey	Canada
A1	Please fill in the blanks below. A quadrilateral has …… interior angles. A triangle has three ……. and…. ……. .	Describe the value of each digit in 3.675.
A2	The percentages of the milk products collected from the dairy farms are shown in the pie chart on the right. Which of the following is appropriate to show the data on the pie chart? **A.** Histogram **B.** Binary line graph **C.** Line chart **D.** Column chart 	Draw a net for each object. Identify and name each face. a) b) 
B2	$\sqrt{75}$ and $\sqrt{136}$ estimate the approximate values of the numbers up to the nearest tenth.	Use guess and test to estimate each square root to two decimal places. Record each trial. a) $\sqrt{17}$ b) $\sqrt{108}$ c) $\sqrt{33}$ d) $\sqrt{79}$

B3	A triangle cannot be constructed with either of the following data. **A.** |BC| = 7 cm, m(B̂) = 64°, m(Ĉ) = 78° **B.** |DF| = 6 cm, |EF| = 9 cm, m(F̂) = 90° **C.** m(Â) = 56°, m(B̂) = 38°, m(Ĉ) = 86° **D.** |LM| = 14 cm, |KL| = 10 cm, |KM| = 9 cm	Cloe concluded that the number of 15-years old students with cell phones is about 5 times the number of 11 years old students with cell phones. Is Cleo's conclusion correct? If yes, justify her conclusion. If not, explain how the graph may have led to the incorrect conclusion. 
C3	The below table show that the sales prices of same kind of products in different quantities belongs to the four companies and the discount applied to these prices are given. According to the table, which product is better to buy? Evaluate your decision with friends. ***Company*** / ***Quantity (kg)*** / ***Sales (TL)*** / ***Discount (%)*** X: 5, 7, 10 Y: 8, 11, 15 Z: 12, 14, 20 T: 15, 24, 25	Carlton evaluated this expression: His work is below shown. $2\frac{4}{5} \div (\frac{2}{3} + \frac{1}{12}) = ?$ Where did Carlton go wrong? What is the correct answer? $2\frac{4}{5} \div (\frac{2}{3} + \frac{1}{12}) = 2\frac{4}{5} \div (\frac{8}{12} + \frac{1}{12})$ $= \frac{14}{5} \div (\frac{9}{12}) = \frac{14}{5} \times \frac{9}{12}$ $^{7}\frac{\cancel{14}}{5} \times \frac{\cancel{9}^{3}}{\cancel{12}_{\not 2}}$ $= \frac{7}{5} \times \frac{3}{2} = \frac{21}{10} = 2\frac{1}{10}$
D2	7, 12, 17, 22 ..... the number pattern is given. According to this; a) Model and discuss this pattern. b) The "number of representatives" of the pattern rule express yourself using. c) Find out the 48th step of this pattern.	An area rug is rectangle. Its dimensions are 3.4 m by 2.7 m. Discuss and show different strategies you can use to find the area of the rug. Which strategy is best? Justify your answer.

The sample question taken from the Canadian textbook and assessed as C3 category is expected to develop the students' skills of mathematical processing (procedures) and identifying errors in mathematical procedures. As a result, the aim is that the student can reach the correct generalization. According to information given in a C3 question from the Turkish textbook, the student is expected to choose the most advantageous from a choice of the same product offered by four companies. As a result, the student is required to assess and calculate the discounts applied to prices.

According to D2 question in Canadian 5th grade textbook, in the given case, the student has the ability to make an estimation about area of the rug and to discuss their ideas with peers. The student also in this level of question has the ability to make comparison, evaluation and judgment based on a given situation. According to information in the D2 question, students are expected to form a correlation using algorithms supporting algebraic thinking structures to determine the relevant pattern. The questions in the textbooks were classified according to cognitive learning area with each question coded according to the SBT. More coding examples are presented in the study by Rivzi (2007).

Based on the consideration that different question types may be required to present content with appropriate levels of cognitive competence, this study also analyzed the textbook content according to the composition of question types. When classifying the content according to question type, characteristics such as constructed response (open-ended), fill-in-the-blanks, multiple choice, true/false, matching and table filling were noted.

Validity and Reliability of Data

Expert opinion was sought under the scope of the validity of the research. Three experts in the field of mathematics education determined that the levels and learning areas in the textbooks from the compared countries were similar and included all middle school mathematics textbooks and stated that there was no problem in terms of the opinions and validity of scope.

The coefficient for reliability between evaluators was used within the scope of validity of the research. In calculation of the consistency percentage between three coders, the reliability coefficient formula of Miles and Huberman (1994) of reliability = consensus / (consensus + dissidence). According to this formula, the reliability coefficient between the coders in this research was calculated as 0.84 (*452/ (452+85)*). This result means the study is accepted as reliable (Miles & Huberman, 1994).

FINDINGS

In the present study, 1027 mathematics questions at the end of units where students may display their performance in 5th, 6th, 7th and 8th class mathematics textbooks used in Turkey and Canada are investigated according to the SBT and question types.

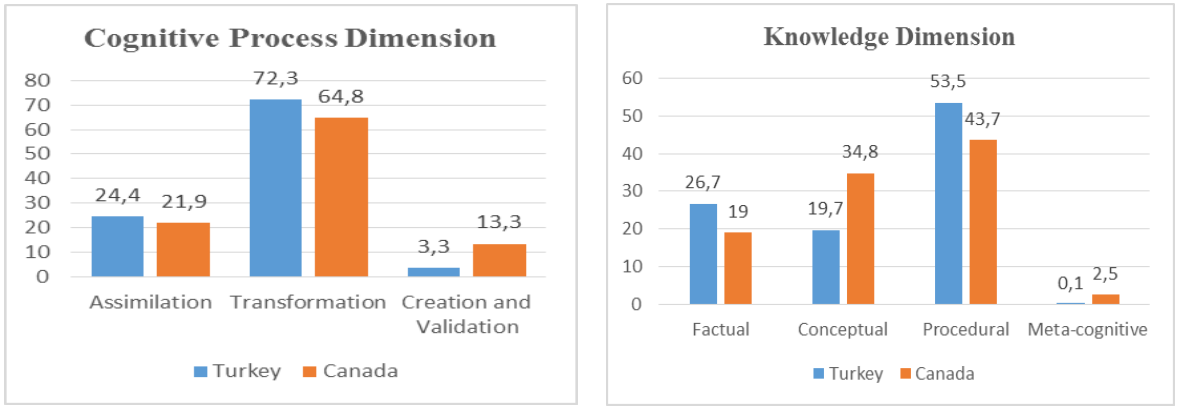
The questions in the textbooks are investigated in detail in terms of the knowledge dimension and the cognitive processes dimension and the obtained data are presented in Table 4. The evaluation questions at the ends of units in Turkish textbooks are determined to be numerically higher compared to Canadian textbooks (Turkey: n=539, Canada: n=488). Additionally, the textbooks in both countries are similar with no content observed that could be assessed within the A3, C1, D1 and D3 categories.

Table 4.
Distribution of question in Turkish and Canadian textbooks according to SBT

		A1	A2	A3	B1	B2	B3	C1	C2	C3	D1	D2	D3	Total
TR	f	103	40	-	28	67	11	-	282	7	-	1	-	539
	%	19,2	7,5	-	5,2	12,4	2,1	-	52,3	1,2	-	0,1	-	100
CN	f	48	45	-	59	78	33	-	181	32	-	12	-	488
	%	9,8	9,2	-	12,1	16	6,7	-	37,1	6,6	-	2,5	-	100

Bar graphs are used to descriptively compare the dimensions in the SBT between the countries. The percentage rates obtained from analysis of questions in Turkish and Canadian middle school mathematics textbooks according to the sub-dimensions of the cognitive processes dimension are presented in Figure 2-A. Of questions in Turkish middle school textbooks, 390 are in the "transformation" stage (72.3%), 131 are in the "assimilation" stage (24.4%) and 18 are in the "creation and validation" stage (3.3%) of the cognitive processes dimension.

In Canadian middle school textbooks, 316 questions are in the "transformation" stage (64.8%), 107 are in the "assimilation" stage (21.9%) and 65 are in the "creation and validation" stage (13.1%) of the cognitive processes dimension. In terms of the cognitive processes dimension, the questions in Turkish and Canadian textbooks are dominantly identified to be at the "transformation" level. Generally, while the textbooks from both countries contained similar cognitive processes dimension questions, it is noteworthy that Canadian textbooks contained more questions at the "creation and validation" level.



A B

Figure 2. Cognitive processes dimension of questions in textbooks from Turkey and Canada (A) and distribution according to sub-levels of the knowledge dimension (B)

In Figure 2-B the questions in Turkish and Canadian middle school mathematics textbooks are analyzed according to the sub-dimensions of the knowledge dimension. Accordingly, Turkish middle school textbooks included 289 questions requiring "procedural knowledge" (53.5%), 143 requiring "factual knowledge" (26.7%), 106 requiring "conceptual knowledge" (19.7%) and 1 requiring "metacognitive knowledge" (0.1%). Canadian middle school textbooks included 213 questions requiring "procedural knowledge" (43.7%), 170 requiring "conceptual knowledge" (34.8%), 93 requiring "factual knowledge" (19%) and 12 requiring "metacognitive knowledge" (2.5%). In both countries it appears that content is dominantly at the "procedural knowledge" level for questions in middle school mathematics textbooks (Figure 2-B). Generally, while the textbooks from both countries included questions with similar knowledge dimensions, Canadian textbooks are identified to include more questions at the "metacognitive knowledge" level. Additionally, while the questions in Canadian textbooks focused on "conceptual knowledge", Turkish textbooks are identified to focus on "factual knowledge". Samples commonly encountered in both textbooks and coded as C2 are presented in the following examples.

From a Canadian 7th class mathematics textbook: *Find the surface area and volume of each rectangular prism. Evaluate and compare these three shapes.*

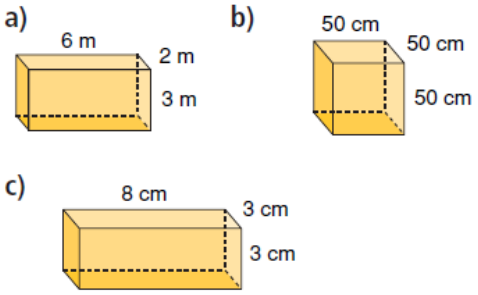


Figure 3. Sample question in a Canadian textbook from C2 level

As formula knowledge is required to calculate the area and volumes of the prisms given in this example, it is at the "procedural" level of the knowledge dimension, while as there is a transition between different shapes during the calculation process it is at the "transformation" level in terms of the cognitive processes dimension.

From a Turkish 8th class mathematics textbook at C2 level: *For the figures given in the following coordinate systems, draw the image of the triangle formed by offsetting to the left by 4 units along the x axis and rotation clockwise around the origin by 270 degrees and draw the image of the quadrilateral formed by reflection in the x axis and also clockwise rotation 90 degrees around the origin.*

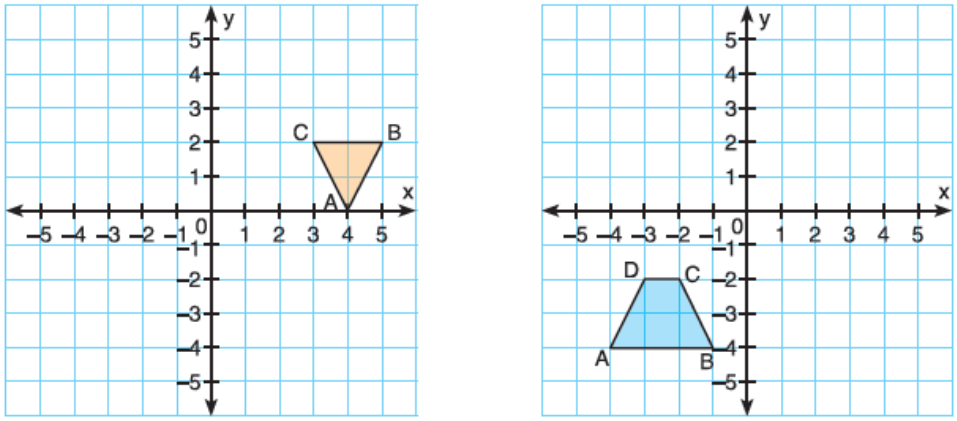


Figure 4. Sample question in a Turkish textbook from C2 level

This question is at the procedural level of the knowledge dimension and the transformation level of the cognitive processes dimension as there is a need to know the rule for offset and rotation of the shapes given and because a new geometric shape is formed in this process.

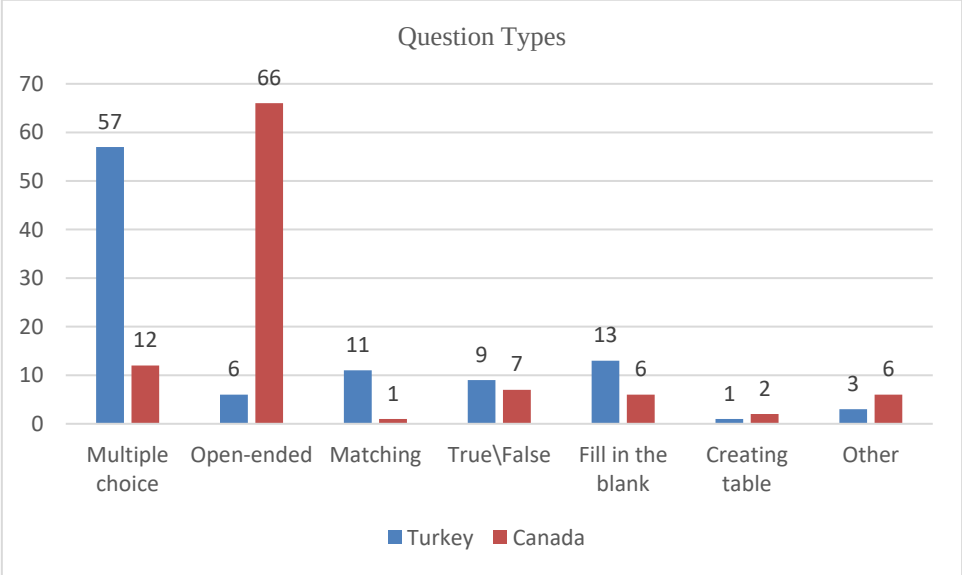


Figure 5. Distribution of question types in Turkish and Canadian textbooks

The results relating to the question types in middle school mathematics textbooks from both countries are given in Figure 4. Of the 539 mathematics questions in Turkish middle school textbooks, 311 are multiple choice (58%), 71 are fill-in-the-blanks (13%), 58 are matching (11%), 47 are true/false (9%), 31 are open-ended (6%), 16 are other (3%) and 5 are table fill (1%). For Canadian middle school textbooks of 488 mathematics questions, 325 are open-ended (66%), 57 are multiple choice (12%), 34 are true/false (7%), 29 are fill-in-the-blanks (6%), 28 are other (6%), 10 are table fill (2%) and 5 are matching (1%). The majority of questions in Turkish textbooks are multiple choice type questions, while the majority of questions in Canadian textbooks are determined to be open-ended. In addition, it appears that open-ended question types are not commonly found in Turkish textbooks, with more multiple choice question types used. According to these results of the study, the majority of open-ended questions in Canadian textbooks (68%) are at the level of conceptual knowledge. Turkish textbooks commonly use fill-in-the-blanks and matching type questions and the majority of these question types are determined to be in the knowledge dimension.

DISCUSSION and CONCLUSION

Content analysis of textbooks and comparison studies between countries actually provide hints about the educational system of a country and the instructional cycle of knowledge. The focus of the study was on cognitive level of questions in mathematics textbooks as potentially contributing to understanding the differences in the mathematical achievement of Turkish and Canadian students.

The results of this study show that in terms of the cognitive processes dimension, textbooks from Turkey and Canada most commonly include questions at the "transformation" level with fewer questions at the "creation and validation" level (see Figure 2-A). Additionally, according to the knowledge dimension, mathematics questions in textbooks from both countries are most commonly at the "procedural" level with fewer questions at the "metacognitive knowledge" level (Figure 2-B). This suggests that textbooks from both countries include questions dominated mainly by application. Similarly, when the questions in the both mathematics textbooks are compared with respect to knowledge dimension, eighth textbooks included questions that required mainly procedural knowledge. According to the cognitive process and knowledge dimensions, textbooks contain mainly average level stages which may be explained by choosing content that will communicate comprehensible messages to the majority of students in the target audience. In fact, previous researchers have shown that the teaching activities and examination questions used mainly contain content that can be understood by students at the average level (Arslan & Özpınar, 2009; Biber & Tuna, 2017; Güler, Özdemir & Dikici, 2012; Köğce & Baki, 2009; Karadeniz et al., 2015; Riazi & Mosalanejad, 2010; Vincent & Stacey, 2008).

For example, Biber and Tuna (2017) investigated middle school mathematics textbooks and identified that the number of questions in the upper level stages (analysis, synthesis, evaluation) are very low, and that questions generally had to be at low cognitive levels. Similarly, Delil and Tetik (2015), in a study analyzing the TIMSS-2015 cognitive areas of mathematics questions on 8th class central examinations, determined that the large majority of 8th class mathematics lesson questions are at application level. In fact, for students to gain higher level cognitive skills, it is necessary for the learning outcomes of the middle school mathematics program to focus on the higher level the cognitive processes dimension. However, a study by Kaplan, Baran and Hazer (2013) investigating the learning outcomes of the middle school mathematics curriculum, determined that there are fewer learning outcomes from the higher level stages, with behavior generally focused on the comprehension and application stages. On the basis of this result, it may be said that the content of textbooks is prepared to reflect the cognitive levels of learning outcomes from the current curriculum. NCTM (2000) intensely supports the skill of learner to elucidate and validate their mathematical ideas. However, the learner themselves frequently have little motivation or skill to produce high quality justifications deprived of the external aid (Ding & Li, 2010). Students should be needed to solve a question so as to be able to validate and clarify their mathematical ideas. Likewise, for students to gain higher-level cognitive skills, there is a need for more activities and preparation of questions based on the higher-level cognitive dimensions (Zorluoğlu, Kızılaslan & Sözbilir, 2016).

While the results of the study generally show that the textbooks from both countries contain questions with similar cognitive qualities, the basic differences between the two countries are that Canadian textbooks contain more "metacognitive knowledge" questions, while Turkish textbooks contain more "factual knowledge" questions. Some researchers have found that countries with textbook content in accordance with the international examination questions requiring metacognitive skills are more successful (Törnroos, 2005). Similarly, there are studies showing that there is a strong correlation between the mathematics achievements of students and the quality of the textbooks used (Fan, Zhu & Miao, 2013; Kulm & Capraro, 2008). Textbooks may be described as being a source of self-regulation for students and of guidance for teachers (Schmidt, McKnight & Raizen, 1997; Işık, 2008; Thomson & Fleming, 2004). Undoubtedly there are many factors affecting the mathematics success of countries and it is not realistic to limit the success or failure to only the quality of the textbooks. İf the teacher does not teach the content, the learner do not have the opportunity to acquire it. Therefore, any lack of learning

cannot be blamed merely on the textbook as stated by Usiskin (2013). Yet the proportion of the textbook content and how it is communicated to the students are important.

Additionally, Sevimli (2016) stated that educators even at higher level, relied on textbooks, while using different resources. As textbooks head the list of tools used in completing the internal transformation process, it may be said that the quality of the teaching materials used affect educators' behavior. Additionally, Airasian and Miranda (2002), discussing the role of measurement and evaluation in taxonomy, stated that the taxonomy's transformation to a two-dimensional structure may be beneficial in creating more open links between targets, learning processes and measurement and evaluation duties, in addition to determination of targets and more transparent planning of the learning process. The conceptual framework created with the constructivist theory led the way for student-centered applications aiming to develop higher-level thinking skills, especially. With the aim of measuring upper level thinking skills related to the creation and validation stage of the cognitive processes dimension, alternative evaluation methods such as the "degree point key" and "degree scales" for performance observation may be used.

However, the result of comparisons between the question types in textbooks determined that questions in Turkish textbooks were mainly of the multiple choice type, while open-ended type questions were more commonly used in Canadian textbooks. Students who encounter questions with content where alternative solution approaches may be used in Canadian textbooks may raise awareness about examinations like TIMSS and PISA. These international-scale examinations include constructed response questions requiring alternative solution pathways and reasoning types. A study by İncikabı (2012) comparing the content of TIMSS and placement tests (in Turkish "Seviye Belirleme Sınavı" SBS) found no significant differences in terms of learning areas, but the SBS exam did not use open-ended questions as the TIMSS exam did and contained more application questions and fewer reasoning questions.

Two-dimensional taxonomy gives an opportunity to assess cognition not just in terms of knowledge but simultaneously in terms of processes (Krathwohl, 2002). This study is used two dimensional taxonomies to gather detailed information about the characteristics of textbook questions. The findings provide an opportunity for readers to think of textbooks from a broad perspective. However, three important abilities of knowing, applying, and reasoning in the cognitive learning field are more concentrated in TIMSS (ÖDSGM, 2016). Similarly, the questions in our study are classified in terms of skill levels in three cognitive areas such as 'assimilation', 'transformation' and 'creation and validation'. The classification of cognitive skills in TIMSS is equivalent to dimensions of cognitive process of SBT respectively. Two-thirds of the questions in TIMSS examinations call for the abilities of applying and reasoning. The answer of the question in the applying category concentrates on displaying conceptual understanding.

The last category involves constructed response and multi-step questions and requests learners to rationalize the solutions and employ different approaches. The results of the study suggested that the questions in Turkish and Canadian textbooks showed similar characteristics in terms of the cognitive processes and knowledge dimensions. It was found that middle school mathematics textbooks from both countries most commonly contained questions at the "transformation" stage of the cognitive processes dimension and the "procedural" level of the knowledge dimension. However, the clearest differences were that Canadian textbooks included slightly more "creation and validation" questions in terms of the cognitive processes dimension, while Turkish textbooks included more "factual" level questions in terms of the knowledge dimension. In other words, Canadian textbooks comprise more questions that require higher order thinking skill. It can be said that Canadian textbooks prioritize the improvement of higher order thinking and give learners more opportunities to explore mathematical relationships and use different approaches. Additionally, while Turkish textbooks included more multiple choice questions requiring procedural skills, Canadian textbooks more commonly used open-ended questions requiring cognitive skills. Therefore, the questions in Canadian textbooks slightly meet the cognitive domains highlighted in the TIMSS, which might be another factor that Canadian students are more successful than Turkish.

Implications

The results of this research could help, for educators, policy makers, and teachers to consider textbooks from a different standpoint. Mathematics textbook authors should be supported to develop questions for mathematics textbooks in terms of cognitive learning. Consideration of the content of international-scale examination questions while preparing textbook content may ensure questions with higher quality are written which may then increase student awareness. When the mathematics questions in high school entrance exam of 2017-2018 in Turkey are taken into consideration, it has been seen that there is a more place given for questions types that students should read, analyze and interpret using mathematical reasoning. It is therefore recommended that the number of constructed response questions and questions requiring interpretation be increased in exercise questions in textbooks in Turkey. As this study was only completed to investigate the cognitive levels of the content of textbooks, future studies in this field should investigate different aspects of the interaction between teacher-textbook and student-textbook.

The present study has some limitations; first the examination of textbooks was limited to only mathematics questions at the end of units. Therefore, future study is needed to explore more questions in text using different taxonomy so as to gather comprehensive results regarding mathematics textbooks. Another limitation of this study was derived from the selection of four Turkish and four Canadian textbooks. Future research should examine a large number of textbooks to acquire detailed results regarding cognitive process level of mathematics questions available at textbooks utilized in different countries. Such research might contribute to clarifying the causes of the differing levels of achievement detected in past international comparative studies. Lastly, although the examination of textbooks offers evidences regarding what and how countries teach, the teaching and learning process employed in countries cannot be demonstrated in such analyses.

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TÜRKÇE GENİŞLETİLMİŞ ÖZET

Bu çalışmanın amacı, Türkiye ve Kanada'da kullanımda olan ortaokul matematik ders kitaplarındaki soruları bilişsel öğrenme düzeylerine ve soru türlerine göre inceleyip karşılaştırmaktır. Milli Eğitim Bakanlığı Talim Terbiye Kurulunca onaylanan ders kitapları, öğrenciler için öz düzenleme, öğretmenler için ise bir rehber kaynak olarak tasvir edilebilir (Schmidt, McKnight & Raizen, 1997; Işık, 2008; Thomson & Fleming, 2004). Ders kitapları, Uluslararası Matematik ve Fen Eğilimleri Araştırması ve Uluslararası Öğrenci Başarılarını Değerlendirme Programı gibi geniş ölçekli değerlendirme sınavlarında, öğrencilerin başarılarındaki farklılıkları tespit etmek amacıyla kullanılmaktadır (Alajmi, 2012). TIMSS (Trends in International Mathematics and Science Study) 2015 değerlendirme raporuna göre 8. sınıf düzeyi matematik başarısı anlamında 527 puanla 8. olan Kanada, İngilizce konuşan ülkeler arasında da en yüksek matematik başarısına sahip ülkedir. Aynı sınavda Türkiye, 458 puan ile 39 katılımcı ülkelenin ortalama başarı puanı olan 500 puanın altında kalarak 24. sırada yer almaktadır (ÖDSGM, 2016). Öğretme-öğrenme sürecinin etkililiğine katkı sağlayan bileşenlerden biri ders kitapları olup, uluslararası düzeydeki merkezi değerlendirme sınavlarına göre ülkelerin matematik başarıları ve ders kitabı kalitesi arasındaki ilişkileri sorgulayan çeşitli araştırmalar mevcuttur (Delil & Tetik, 2015; Erbaş, Alacacı & Bulut, 2012; Fan, Zhu & Miao, 2013). Bu çalışmada Türkiye ve Kanada'da kullanılmakta olan ortaokul matematik ders kitaplarında yer alan ünite sonu değerlendirme soruları 'bilişsel süreç' ve 'bilgi boyutu' bağlamında değerlendirilmiştir. Bu amaç doğrultusunda aşağıdaki iki soruya cevap aranmıştır: *(1)* Türkiye ve Kanada ortaokul matematik ders kitabında yer alan matematik sorularının Sentezlenmiş Bloom Taksonomisi (SBT)'ne göre düzeyi nedir? *(2)* Türkiye ve Kanada ortaokul matematik ders kitabında yer alan matematik soruların türleri arasında bir farklılık var mıdır?

Bilimsel bilgilerden hangilerinin öğretilecek bilgiler olduğunu belirten kaynaklardan biri ders kitapları olup (Chevalard, 1991), ders kitaplarındaki içeriklerin bilişsel alan taksonomisindeki yeterlikler bağlamında değerlendirildiği bu araştırmada (Rizvi, 2007) ulusal içerikler uluslararası bir perspektiften karşılaştırıldığından çalışma üzerinden elde edilecek sonuçların önemli olduğu düşünülmektedir (Haggarty & Pepin, 2002; Törnroos, 2005). Bu doğrultuda, Türkiye'de kullanılan 5, 6, 7 ve 8. sınıf matematik ders kitapları ile Kanada'da kullanılmakta olan "*Math Makes Sense"* adlı ders kitapları seti içerik analizine tabi tutularak karşılaştırılmıştır. Araştırmanın amacına uygun olarak veriler toplanıp doküman analizi yapılmıştır. Her iki ülke ders kitaplarında yer alan matematik soruları, Rizvi (2007) tarafından geliştirilen SBT değerlendirme çerçevesine göre bilişsel süreç ve bilgi boyutlarına bağlamında kodlanmış, soruların benzerlik ve farklılıkları karşılaştırmalı olarak incelenmiştir. Bu çalışmada iki ülkeye ait matematik ders kitaplarının SBT açısından değerlendirilebilmesi için ünite sonunda yer alan alıştırma ve değerlendirme soruları kullanılmıştır. Verilerin analizinde betimsel istatistik (yüzde/frekans) yöntemlerinden yararlanılmıştır. Ortaokul matematik ders kitaplarındaki soruların incelenmesi 3 aşamada gerçekleşmiştir. Birinci aşamada, her iki ülke ders kitabından rastgele bir üniteye ait değerlendirme soruları seçilmiştir. Konuyla ilgili sorular, üç araştırmacı tarafından taksonomi tablosuna göre yerleştirilmiştir. Bunun için öncelikle iki ülkenin matematik ders kitapları yüzeysel olarak incelenmiştir. Daha sonra ders kitabındaki soruların taksonomi tablosuna yerleştirilmesinde kullanılacak temel prensipler araştırmacılar tarafından belirlenmiştir. Buna göre, matematik sorularındaki ifadelerin bilişsel süreç boyutunu yansıtan fiilleri ile bilgi boyutunu yansıtan ad bölümleri detaylı bir şekilde konuşulmuş, ortak fiiller ve adlar (anahtar kelimeler) belirlenmiştir. Bu süreçte elde edilen anahtar ifadelerin (gösterme, anlama, tahmin etme ve karşılaştırma vb.) ardından, Türkiye ve Kanada ders kitaplarında yer alan ünite sonu değerlendirme sorularının her birinin bilgi boyutunun bulunduğu satır ile bilişsel süreç boyutunun bulunduğu sütunun kesişimi olan hücre tespit edilerek matematik sorularının SBT'deki yeri belirlenmiştir (Krathwohl, 2002). Örneğin, 6. sınıf ders kitabında "Aşağıdaki şekillerden hangisinde bir çemberin yarıçapı gösterilmiştir?" sorusunda "göstermek" fiil ifadesi özümseme basamağında, "şekillerden hangisinde bir çemberin yarıçapı" ad ifadesi temel kavram içerdiğinden olgusal basamakta (A1) yer almaktadır. İkinci aşamada matematik soruları araştırmacıların her biri tarafından bağımsız olarak kodlanmıştır. Üçüncü aşamada ise kodlayıcılar arası güvenirlik belirlenmiştir. Bu aşamada araştırmacılar tekrar bir araya gelerek

taksonomi tablosunda uyuşmayan yerleri tespit etmiştir. Daha sonra araştırmacılar tarafından kodlamada uyuşmayan sorular tartışılarak ortak bir görüşe varılmıştır. Bu süreçte gerekli görülen yerlerde yine ölçme ve değerlendirme ana bilim dalındaki öğretim üyelerinden uzman görüşü alınmıştır.

Türkiye ve Kanada ders kitaplarında yer alan soruların bilişsel süreç ve bilgi boyutu açısından benzer özellikler gösterdiği tespit edilmiştir. Ancak Kanada ders kitabında bilişsel beceri gerektiren açık uçlu soru türlerine yüzde 60 daha fazla yer verildiği belirlenmiştir. Bu çalışmadaki bulgular, bilişsel süreç boyutu bağlamında Türkiye ve Kanada ders kitaplarında "dönüştürme" düzeyindeki soruların daha sık, "özümseme" düzeyindeki soruların ise daha az yer aldığını göstermiştir (Şekil 2-A). Ayrıca, bilgi boyutuna göre her iki ülke ders kitabındaki matematik sorularında, en çok "işlemler" düzeyinde, en az ise "üstbilişsel bilgi" düzeyinde sorulara yer verildiği belirlenmiştir (Şekil 2-B). Şekillerden de anlaşılacağı üzere her iki ülke ders kitaplarında daha çok uygulama ağırlıklı sorular yer almaktadır. Ders kitaplarında bilişsel süreç ve bilgi boyutlarının orta düzeydeki basamaklarına daha sık yer verilmesi daha geniş bir öğrenci kitlesi tarafından anlaşılabilecek içeriklerin tercih edilmesi ile açıklanabilir. Nitekim önceki araştırmalarda kullanılan öğretim etkinliklerinde ve sınav sorularında ortalama düzeydeki öğrencilerin anlamlandırabileceği türdeki içeriklere daha fazla yer verildiğini göstermektedir (Arslan & Özpınar, 2009; Biber & Tuna, 2017; Güler, Özdemir & Dikici, 2012; Köğce & Baki, 2009; Karadeniz, Baran, Gökçek & Güç, 2015; Riazi & Mosalanejad, 2010; Vincent & Stacey, 2008). Ders kitabı içeriği hazırlanırken uluslararası ölçekli sınav sorularının içeriklerinin de göz önünde bulundurulması, söz konusu sınavlarla daha uyumlu soruların yazılmasını sağlayabilir ve bu durum, öğrencilerin başarısını arttırabilir. Ülkemizde bu yıl gerçekleştirilen liselere giriş sınavındaki matematik soruları göz önüne alındığında, öğrencilerden okuduğunu anlamasını, analiz etmesini ve yaptığı çıkarımlarla çözüme ulaşmasını sağlayan soru türlerine daha çok yer verildiği görülmüştür. Bundan dolayı birincil kaynak olarak kullanılan ders kitaplarında öğrencilerin üst düzey düşünmelerini sağlayan açık uçlu ve yorum gerektiren soru türlerinin sayısı arttırılabilir. Bu araştırma sadece ders kitabındaki içeriklerin bilişsel düzeylerini incelemek üzere yapılmış olduğundan, ilgili alanda yapılacak gelecek çalışmalar için öğretmen-ders kitabı ve öğrenci-ders kitabı arasındaki etkileşimi farklı yönlerden inceleyen çalışmalara yer verilebilir.

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Integrated instructional material and development processes

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ABSTRACT

Instructional models form based on the needs. To satisfy the needs specific targeted instructions are presented. Teaching how a vehicle is used, is an example for specific targeted courses. This study suggests and defines a new concept namely "integrated instructional material". Integrated structures are applications and structures which contain integration for a specific purpose in a system approach. Accordingly, integrated instructional material is an assistant system for instruction. In other words, it is a supportive tool for teaching subjects of different disciplines as a whole by integrating them. 33 Preservice teachers, enrolled engineering class of Pedagogical Formation Education at a Faculty of Education of a state university in the Mediterranean Region of Turkey, performed the development process of integrated instructional material in the context of Instructional Technology and Material Design course. Data were collected through observation notes, open ended questionnaires, and clinical interviews. Content analysis was used in order to analyze data.

Keywords *Integrated instructional material, Integrated teaching, Instructional material development, STEM Education, Integration of disciplines*

Bütünleşik öğretim materyali ve geliştirme süreçleri

ÖZ

Öğretim modelleri ihtiyaçlara göre şekillenmektedir. İhtiyaçların karşılanması için özel amaçlı öğretimler gerçekleştirilmektedir. Bir cihazın kullanımının öğretimi, özel amaçlı kurslara örnek olarak verilebilir. Bu çalışmada "bütünleşik öğretim materyali" kavramı ortaya atılmakta ve tanımlanmaktadır. Bütünleşik yapılar bir sistem yaklaşımı içerisinde belirli bir amaca yönelik olarak ilişkilendirilmiş uygulama ve yapılardır. Buna göre bütünleşik öğretim materyali öğretime yardımcı bir sistemdir. Bütünleşik öğretim materyali, belli bir amaca yönelik olarak öğretilmek istenen iki veya daha fazla farklı disipline ait konuların birbiri ile ilişkilendirilerek bir bütün olarak öğretilmesini destekleyici bir araçtır. Akdeniz Bölgesinde bir devlet üniversitesinin Eğitim Fakültesi Pedagojik Formasyon Eğitimi Mühendislik sınıfındaki 33 öğretmen adayı, bütünleşik öğretim materyali geliştirilmesi sürecini Öğretim Teknolojileri ve Materyal Tasarımı dersi kapsamında gerçekleştirmişlerdir. Veriler gözlem notları, açık uçlu sorular ve klinik mülakatlar yoluyla toplanmıştır. Elde edilen verilerin analizinde içerik analizi kullanılmıştır.

Anahtar Kelimeler *Bütünleşik öğretim materyali, Bütünleşik öğretim, Öğretim materyali geliştirme, FeTeMM Eğitimi, Disiplinlerin ilişkilendirilmesi*

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INTRODUCTION

Achieving the goals set for the students easily in teaching programs is possible by using effective instructional materials (Karamustafaoğlu, 2006). "*Using materials in education facilitates perception and learning. It encourages students' participation into the subject and it arouses reading and research desire*" (Aslan & Doğdu, 1993, s:40). The importance of using material is obvious. Moreover, material development and evaluation are among the teacher competences that a teacher should have (Çelikkaya, 2017). For this purpose, preservice teachers have Instructional Technology and Material Design course during their undergraduate studies (Çalışoğlu, 2015). Thanks to Instructional Technology and Material Design course, preservice teachers gain experience in not only how to use instructional technology effectively but also how to prepare materials that they will use in their professional life (Çalışoğlu, 2015). The materials developed by instructional technology can be listed as worksheets, presentations, videos and computer-aided course materials (Kolburan Geçer, 2010). Preservice teachers have the opportunity to experience how instructional materials developed in Instructional Technology and Material Design course contributes learning to be effective, permanent, efficient and enjoyable (Çalışoğlu, 2015).

Integrated curriculum has a long history (Badley, 2009). STEM (Science, Technology, Engineering and Maths) as modern educational approach aims to teach two or more STEM disciplines by integrating or associating (Çolakoğlu & Günay Gökben, 2017). The four principles of integrated teaching are defined as equity, relevance, interdisciplinarity and rigor. (Aşık, Doğança Küçük, Helvacı & Corlu, 2017) Furthermore, STEM can be described as a kind of approach where these disciplines are integrated with each other (Wang, Moore, Roehrig & Park, 2011) and daily situations so that they are conveyed to students in a meaningful way (Yılmaz, Yiğit Koyunkaya, Güler & Güzey, 2017). Components of STEM education include integration of knowledge, skill, and beliefs belong to at least two STEM disciplines (Corlu, Capraro, & Capraro, 2014). STEM education also argue for overlapping the STEM disciplines with each other and by this way, it aims to develop students' competition skills and literacy in these fields (Eroğlu & Bektaş, 2016). Students are expected to generate solutions for problems by using 21th century knowledge and skills (Tekerek & Karakaya, 2018). To make the boundaries of the STEM disciplines nearly imperceptible is also one of the purposes of the STEM education (Wang, et al., 2011).

There is a relation among the STEM disciplines. For instance, Berry, Chalmers, and Chandra (2012) explained this relation by using the ratio concept in mathematics. They stated that ratio is a common concept among STEM disciplines. They exemplified that it places in density of solutions in science, in mixing the components of a healthy meal in technology, and investigation of different concrete mixture in engineering. Additionally, the researchers emphasized that individuals should make connections among the ideas of STEM fields in order to reveal real life products. They suggested to concerning people with STEM to make collaboration and integrate the knowledge to build the best bridge through the example of designing and building the bridge. Many researchers indicated that integrated disciplinary is necessary for students to see the connections between the subjects and make sense of disciplines (Badley, 2009). Karakuş and Aslan (2016) assert that integrated disciplinary is a need to develop students' higher order skills, to see and evaluate the events as a whole and to make the learning meaningful. DeZure (1998) also states that integrated disciplinary is important and necessary. He continues to explain the reasons; life itself is interdisciplinary, we meet so many problems that we cannot solve by using only one discipline, students and educators need more integrated and consistent teaching programs and employers want graduates who can meet multi-discipline needs in business world. Teaching with integrated disciplinary can take place by putting a specific a concept in the centre according to some disciplines' aims and by integrating other disciplines' knowledge and skills in a meaningful way while teaching (Yıldırım, 1996). Badley (2009), states that integration process includes teaching that integrates different disciplines' contents to recognize the connections between them, makes them coherent and encourages the students. Brophy and Alleman (1991) emphasize integrated disciplinary can be applied in teaching and it is a desired approach but this should be

applied not to all contents but to some situations. For this reason, they propose two criteria regarding integrated disciplinary. The first criterion is; integrated activities should be important in terms of education. Namely, if the content that will be used for integration is not suitable for this aim, then it shouldn't be used. The second criterion is; integrated activities in each discipline should contribute to its main aims.

How integration process in STEM fields will be reflected in teaching environment is an important issue. Using material can be effective in curriculum integration and conveying integrated lessons to students in a meaningful way. However, in related literature there are not any studies regarding material development process in integrated curriculum and "integrated instructional material". Considering the importance of STEM education and using material during lessons, the materials to be used in integrated instruction in classes are significant for students' gaining desired objectives. As a result, it can be concluded that there is a need for a material supporting the connection between the disciplines in STEM education and at the same time every teacher can use in their own lessons to achieve their lessons' aims. Besides, this study has significance in that preservice teachers of STEM disciplines who will apply integrated curriculum in the future develop integrated instructional materials. This study aims to define "integrated instructional material" concept that can be used in integrated instruction programs so that it contributes to the literature.

In literature, there are a number of studies related to teachers' opinions about Instructional Technology and Material Design course. Namely, Kolburan Geçer (2010) investigated views of 3rd and 4th grade students in Technical Education Faculty, Öztürk and Zayimoğlu Öztürk (2015) and Çelikkaya (2017) preservice teachers from history department taking pedagogical training education and Çalışoğlu (2015) second grade students in primary school teacher education department. However, there aren't any studies about the preservice teachers' material development process from different departments for integrated instruction. In this study, preservice teachers from different disciplines designed integrated instructional materials in Instructional Technology and Material Design course. "Integrated instructional material" concept is defined by exploring the components of integrated instructional material development process. This study contributes to the field by introducing a new concept.

Purpose of the study

In the study; it is aimed to raise a new concept "integrated instructional material" for the first time and to describe it which was developed based on integration paradigm in STEM education. Moreover, factors that compose the process were determined by examining development processes of the material by preservice teachers.

At the end of the study, based on the integration of different disciplines, integrated instructional material concept and its' development processes were described. Consequently, it was planned to form the framework of integrated instructional material as a STEM integration tool.

The research questions for the study were determined as given below:

1. What is integrated instructional material?
2. What are the factors that compose the integrated instructional material development process?

METHODOLOGY

This study was designed as a qualitative study in order to examine the process of development of integrated instructional material by preservice teachers educated in STEM disciplines. Qualitative

studies are used to obtain deeper information about a phenomenon, an event or a situation to be researched (Cresswell, 2003). In this study the concept which will be focused on is "integrated instructional material". Moreover, the development process of integrated instructional material was also aimed to obtain deep information. Specifically, basic qualitative research design was used as research design. According to Merriam (1998), experiences of the people for a situation and how they interpret it are important in basic qualitative research. In this study; the development process of integrated instructional material by preservice teachers educated in STEM disciplines and how they interpret integrated instructional material were investigated and finally, to define "integrated instructional material" concept was aimed.

Context of the study

In the study, development process of integrated instructional material by preservice teachers from mathematics and several engineering disciplines was investigated. Preservice teachers, enrolled engineering class of Pedagogical Formation Education at Kahramanmaraş Sütçüimam University Faculty of Education, performed the development process of integrated instructional material in the context of Instructional Technology and Material Design course. Instruction about how the integrated instruction should be and designing teaching material was given to the preservice teachers, and then they were asked to develop integrated instructional material. In the development process they were wanted to form groups including different field members. This process continued through an academic semester and at the end of the semester process was completed.

Participants

33 engineer preservice teachers were the volunteer participants as integrated instructional material developers during Instructional Technology and Material Design course. Purposive sampling strategy was used for selecting participants. Groups were formed including 3-4 members by the researchers. In each group, each member has to be from different discipline. For this condition, discipline matching was done for construction of the groups. Each group was responsible to develop one integrated instructional material. Preservice teachers in each group tried to integrate the disciplines belong to the group members' field. The integrated instructional material will be used in all disciplines that were integrated in the development process. Demographics of the participants were given in Table 1.

Table 1.
Demographics of the participants

	Property	N
Gender	Female	22
	Male	11
Age	20-28	23
	30-36	9
	36+	1
Graduated department	Food engineering	13
	Textile engineering	6
	Mathematics	9
	Electric engineering	4
Employment status	No work	15
	Textile engineer	4
	Mathematics teacher	3
	Food engineer	2
	Electric engineer	2
	Other	7
Teaching experience	Yes	10
	No	23

As in Table 1, most of the participants were 20-28 years old and female preservice teachers. Moreover, nearly half of them were graduated from food engineering and have no work when the study was conducted. Additionally, more than half have no teaching experience before.

Data Collection Tool

First, teaching material development processes of the participants were observed in the center of integrated instruction through an academic semester. At the end of the process, 10 open ended questions developed by the researchers were asked them in order to explain how integrated instructional material was developed. Moreover, by using these questions clinical interviews were conducted to 10 participants in order to obtain detail information. The 10 participants were selected by interpreting the answers of the open ended questionnaires. 4 of them were answered positively, 3 of them answered negatively and 3 of them were undecided ideas about the process. By the help of clinical interviews more detailed information was obtained from the participants. Open ended questions were presented to four different field experts' opinions from program development, science education, mathematics education, social studies education. In line of the experts' opinions, questions were revised by clarifying. Duration of the implementation of the questionnaire took approximately 30 minutes. Each clinical interview took 35-45 minutes.

Data Analysis

In order to analyze data content analysis was used. Yıldırım and Şimşek (2008) stated that content analysis aims to reveal and define the reality embedded in data set. Moreover, in content analysis; similar data gather in the title of meaningful code and themes and they are presented in certain way. Similarly, Krippendorf (2004) indicate that content analysis can be used by the purpose of interpreting repeater statements meaning in transcribed data.

The documents obtained by open ended questions and clinical interviews were transcribed verbatim. Transcriptions were used in data analysis process. First, a code list was prepared in the light of the research questions. By the help of this code list, transcribed data were analyzed. Meaningful data groups were determined as analysis unit (Merriam, 1998), then data were coded and themes were detected.

After coding processes were completed, the researchers came together to evaluate the interrater reliability. Consistency between the researchers was calculated as 95%. This value is higher than the value (80%) that was suggested by Miles and Huberman (1994). The parts which the researchers coded differently were discussed and recoded again.

FINDINGS

Findings revealed the main steps of development process of integrated instructional material. These are; integrating different disciplines, making collaboration, and taking support. These main steps were given respectively and explained by supporting with preservice teachers' statements.

Integrating different disciplines

Preservice teachers expressed that the first and necessary thing for developing integrated instructional material is to integrate the related disciplines. However, they had different ideas through the integration process.

Most of the preservice teachers had positive ideas about integration of the disciplines. On the other hand, some of them figured that integration is a very difficult thing to do. Some of the preservice teachers stated that integration could be possible when the topics that will be integrated are in a harmony for integration. Clinical interviews also showed similar findings. For example, Preservice Teacher (PT) 1 expressed that integration is useful with the following statements.

PT1: Integration of different disciplines will help students to answer the question that 'where the information they learned will be used'. Integration will also help to learn efficiently and permanently. It will provide both students and teachers to think broadly.

Similarly, PT10 stated that they first focused on integrating the disciplines for integrated instructional material and they aimed to make clearer the topics be taught by this way. He explained this as given below.

PT10: Our purposes were to make the topics that are integrated clearer and help students to understand easily.

PT6, one of the preservice teachers thought integration is a very difficult thing to do, express this as given the following statements.

PT6: To integrate different disciplines is very difficult task. It also requires racking one's brain.

As explained before some of the preservice teachers stated that integration can be conducted if the disciplines are in a harmony for integration. PT3 and PT18 expressed this by the following statements respectively.

PT3: Some of the topics in the curricula can be integrated. Especially some topics cannot be integrated to any other topics, I think. In an academic year, several topics can be integrated. It will be better for students to have positive ideas about the integration.

PT18: Yes, the disciplines can be integrated however; suitable topics should be selected for this. If irrelevant topics are used, integration will not be helpful.

Although some preservice teachers thought that integration is a very difficult task and cannot be used for each topic, they concluded that it is necessary to integrate different disciplines as a first step to develop integrated instructional material.

Collaboration

Another main issue for development of integrated instructional material was determined as collaboration of experts from different disciplines. Many of the preservice teachers stated that collaboration is a must for the process and collaboration has positive contributions to the process. Preservice teachers who think collaboration is positive for integration process expressed this idea in three titles. These are; being helpful for integration, enhancing motivation and filling the deficiencies in their content knowledge of the other disciplines. For example, PT2 and PT19's following statements reflected the positive views through collaboration issue.

PT2: collaboration provided to notice where one discipline was necessary in the other discipline.

PT19: …we learned more about different disciplines.

Preservice teachers' negative views of collaboration during integration process were categorized in three titles. These are forming stress source, time deficiency problem about studying together and

problem in integrating the disciplines content. Preservice teachers' example statements were given respectively according to these titles.

PT20: If I did this integration on my own, I would make better. Because we had problems with the other group members. I can say with all my heart that making group work is a hell raising.

PT32: We had problems because one of our friends was living in another city and one of them was a student in another university. Thus we had difficulty to be in the same place.

PT26: Lack of content knowledge in other disciplines and to find the common issues of disciplines were the problems for collaboration during integration.

Preservice teachers indicated that collaboration is a necessary issue for developing integrated instructional material. However; they concluded that this collaboration had both positive and negative reflection to the process.

Taking support

Another necessary main point in development process of integrated instructional material is determined as taking support from the other disciplines' experts. They stressed that they take different types of support. These are determined as support from other group members in content knowledge of other disciplines, pedagogical knowledge and motivation issues. Related to content knowledge support, PT3's statements were given below.

PT3: for example, I took support about solving equations to use numerical data from the group member of mathematics discipline. I also learned properties of textile materials and where they are used by the help of the group member from textile engineering discipline.

PT31 stated that they took support from other group members in terms of pedagogical knowledge, as given in the following statement.

PT31: We predicted and tried to integrate the topics by the help of curricula or textbooks. However, we have no sufficient background and experience how we will transfer theoretical knowledge to practice. Other group members helped us in terms how we will teach the topics.

Preservice teachers also took support in development of integrated instructional material in terms of motivation from the other group members. For example, PT6 explained this by the following statements.

PT6: The other members of the group gave support us. They especially supported us morale and motivation support when we got stuck.

Support from other disciplines' members becomes another main issue in the development process of integrated instructional material.

DISCUSSION and CONCLUSION

The aim of the study was to define the concept of integrated instructional material and its development processes. 33 preservice teachers developed integrated instructional material by integrating different disciplines in groups during Instructional Technology and Material Design course.

Most of the preservice teachers have positive views about integrating different disciplines since it will provide an efficient teaching and learning tool. On the other hand, some of them stated that integration is a very difficult work and it is possible when there are appropriate topics. Similarly, Wang, Moore, Roehrig, and Park (2011) reached the finding that teachers have positive ideas about integration of STEM disciplines in terms of providing students to see the big picture and make meaningful learning.

Preservice teachers considered several points while integrating disciplines in groups. These are relevancy of the disciplines, make the subject meaningful, and usefulness of integration. It can be concluded here; usefulness of integration is in the center of development strategy of integrated instructional material.

In integrated instructional material development process, preservice teachers take support from other group members in content knowledge of other disciplines, pedagogical knowledge and motivation issues. Therefore, it can be said that integrated instructional material development process need to include collaboration. Moreover, preservice teachers stated positive views about the collaboration they did in the process. They explained these positive views in terms of being helpful for integration, enhancing motivation and filling the deficiencies in their content knowledge of the other disciplines. In addition, they stated negative views for the collaboration in terms of forming stress source, time deficiency problem about studying together and problem in integrating the disciplines content. This reveals that there is a need to make special regulations for time and process management through collaboration.

Development processes of teaching materials are certain. These processes are explained by Seferoğlu (2006), as making target analyzing, determination of properties of target group, conducting content analysis, and integrating content and tool. Different point of integrated instructional material from teaching material is including special processes beyond developing teaching material. Integrated structures are integrated applications and structures for a specific purpose in a system approach. It means that integrated instructional material is an assistant system for teaching. As a concept, integrated instructional material is a supportive tool for teaching subjects of different disciplines as a whole by integrating them. Its development can be possible by integrating teaching including different disciplines' topics. Integration can be by making the boundaries vague and transitive among targeted disciplines' teaching.

The integrated instructional material that was aimed to describe through the preservice teachers' statements can be modeled as in Figure 1.

<table>
<tr><td>Integrating topics belong to different disciplines</td><td rowspan="3">Integrated instructional material</td></tr>
<tr><td>Collaboration</td></tr>
<tr><td>Taking support</td></tr>
</table>

Figure 1. *Main factors that compose integrated instructional material development process*

These factors are in a certain hierarchy. Before integrating different disciplines, making collaboration cannot be mentioned. Similarly, it is not meaningful to mention about support exchange without collaboration. Thus, it can be concluded that there is an order among these factors top to bottom.

In the process, according to observation notes, sub factors/steps were determined that can be added to development process of integrated instructional material. If these steps were added, the whole development process can be as in the Table 2.

Table 2.
Integrated instructional material development process

Steps	Process
1	Forming project groups including members from different disciplines
2	Examining the curricula of the disciplines of the members
3	Matching the topics and the objectives that will be integrated
4	Collaboration of the group members from different disciplines
5	Integrating the topics of the disciplines
6	Taking support from field experts mutually
7	Determining process of integrated instruction
8	Completion of designing integrated instructional material through integrated instructional material design process

In line with these descriptions, studies can be conducted for validating development processes of integrated instructional material. To see the effect of integrated instructional material to teaching and learning process, experimental studies can be designed and conducted. Badley (2009) stated that one of the concerns about the application of integration of disciplines is problems in teacher education. Moreover, he emphasized curricula and applications of teacher education programs should be revised in order to implement integration efficiently. Therefore, integrated instructional material can contribute to make this revision and to make the teaching process efficiently.

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TÜRKÇE GENİŞLETİLMİŞ ÖZET

FeTeMM alanlarında ilişkilendirme sürecinin öğretim ortamına nasıl yansıyacağı önemli bir noktadır. Derslerin ilişkilendirilmesinde ve ilişkilendirilmiş derslerin öğrencilere anlamlı şekilde aktarılabilmesinde materyal kullanımı etkili olabilir. Fakat, ilgili alanyazında bütünleşik öğretimde kullanılabilecek bir materyal geliştirme sürecinden ve "bütünleşik öğretim materyali" kavramından söz edilmemektedir. FeTeMM eğitiminde öğretim materyali kullanımının önemi düşünüldüğünde, sınıflarda ilişkilendirilmiş öğretimin uygulanmasında da kullanılacak materyaller, öğrencilerin elde etmesi istenilen kazanımlar açısından da oldukça önemli bir yere sahiptir. Dolayısıyla, FeTeMM disiplinlerinin öğretiminde disiplinleri ilişkilendirmeye yardım edecek, aynı zamanda her öğretmenin kendi dersinin amacı için bireysel olarak da kullanabileceği bir materyale ihtiyaç olduğu sonucuna ulaşılabilir. Ayrıca, bütünleşik öğretim materyallerini geleceğin sınıflarındaki öğretim programlarının gerçek uygulayıcıları olacak FeTeMM alanlarından öğretmen adaylarının geliştirecek olması da bu araştırmayı önemli hale getirmektedir. Bu çalışmada ilişkilendirilmiş öğretimde kullanılabilecek bir materyal olarak "bütünleşik öğretim materyali" kavramı ortaya atılarak alan yazına katkı sağlamak amaçlanmaktadır.

Alan yazında farklı disiplinlerden öğretmen adaylarının bir araya gelerek ilişkilendirilmiş öğretimi amaçlayan bir materyal geliştirme sürecine yönelik bir çalışmaya rastlanmamıştır. Bu çalışma, pedagojik formasyon eğitimi alan farklı disiplinlerden öğretmen adaylarını biraraya getirerek, onlara Öğretim Teknolojileri ve Materyal Tasarımı dersinde bütünleşik öğretim materyali tasarlamaları fırsatını vermiştir. Bu süreç incelenerek bütünleşik öğretim materyali geliştirme sürecini oluşturan unsurlar belirlenerek "bütünleşik öğretim materyali" kavramı tanımlanmıştır. Çalışmanın bu anlamda alan yazına katkı sağlayacağı düşünülmektedir.

Bu çalışmada; FeTeMM eğitiminde ilişkilendirme paradigması temele alınarak geliştirilen bütünleşik öğretim materyali kavramının ilk defa tanımlanması amaçlanmaktadır. Ayrıca bu materyalin öğretmen adayları tarafından geliştirilmesi süreci de incelenerek bu süreci oluşturan unsurlar belirlenmiştir.

Araştırma sonucunda, disiplinlerin ilişkilendirilmesi temelinde bütünleşik öğretim materyali kavramı ve geliştirme süreçlerinin tanımlanması hedeflenmektedir. Sonuç olarak, bütünleşik öğretim materyalinin bir FeTeMM ilişkilendirme aracı olarak çerçevesinin oluşturulması planlanmaktadır.

FeTEMM disiplinlerinde eğitim almış öğretmen adaylarının bütünleşik öğretim materyali geliştirmeleri ile ilgili süreci inceleyen bu çalışma bir nitel araştırma olarak tasarlanmıştır. Burada araştırılmak ve tanımlanmak istenen kavram "bütünleşik öğretim materyali" kavramıdır. Geliştirme süreçleri konusunda da derinlemesine bilgi edinmek amaçlanmaktadır. Özel olarak, nitel araştırma desenlerinden temel nitel araştırma yöntemi çalışmaya uygun bulunmuştur. FeTEMM disiplinlerinde eğitim almış öğretmen adaylarının bütünleşik öğretim materyali geliştirmeleri süreci ve bu süreci nasıl anlamlandırdıkları incelenerek "bütünleşik öğretim materyali" kavramı tanımlanmaya çalışılmıştır.

Araştırmada matematik ve farklı mühendislik disiplinlerinden mezun olmuş öğretmen adayları bütünleşik öğretim materyali geliştirilmesi sürecinde yer almıştır. Kahramanmaraş Sütçüimam Üniversitesi Eğitim Fakültesi Pedagojik Formasyon Eğitimi Mühendislik sınıfındaki öğretmen adayları, bütünleşik öğretim materyali geliştirilmesi sürecini Öğretim Teknolojileri ve Materyal Tasarımı dersi kapsamında gerçekleştirmişlerdir. Dersi alan 33 mühendis öğretmen adayı bütünleşik öğretim materyali geliştiricileri olarak çalışmaya katılmışlardır. Öğretmen adaylarına bütünleşik öğretimin nasıl olması gerektiği ve öğretim materyali tasarlama ile ilgili bilgiler verildikten sonra, bir bütünleşik öğretim materyali geliştirmeleri istenmiştir. Süreç bir akademik yarıyıl boyunca devam etmiş ve yarıyıl sonunda tamamlanmıştır.

Öğretmen adayları 3-4 kişilik gruplara ayrılmışlardır. Grupların oluşturulmasında her bir grup üyesinin farklı disiplinlerden oluşması sağlanmıştır. Bunun için disiplin eşleştirilmesi yapılmıştır. Her grup kendi öğretmenlik alanı ile ilgili disiplinleri ilişkilendirmişler ve ilişkilendirilen alanların tamamında kullanılabilecek öğretim materyali olarak kullanılabilecek tek bir öğretim materyali geliştirmişlerdir. Katılımcıların çoğu 20-28 yaş aralığında ve kadın öğretmen adaylarından oluşmaktadır. Ayrıca öğretmen adaylarının neredeyse yarısı gıda mühendisliği mezunu ve çalışmanın yapıldığı zaman diliminde herhangi bir yerde çalışmamaktadır. Öğretmen adaylarının büyük çoğunluğunun öğretmenlik deneyimine sahip olmadığı görülmektedir.

Öncelikle öğretmen adaylarının bütünleşik öğretim merkezinde öğretim materyali geliştirme süreçleri gözlemlenmiştir. Sürecin sonunda araştırmacılar tarafından geliştirilmiş olan açık uçlu sorularla bütünleşik öğretim materyalinin nasıl geliştirildiği açıklanmaya çalışılmıştır. Ayrıca, aynı açık uçlu sorular kullanılarak öğretmen adaylarından 10 tanesiyle klinik mülakatlar gerçekleştirilerek konu ile ilgili daha detaylı bilgi edinilmeye çalışılmıştır. Oluşturulan açık uçlu sorular program geliştirme, fen eğitimi, matematik eğitimi ve sosyal bilgiler eğitimi alanından dört uzmanın görüşüne sunulmuştur. Uzman görüşleri doğrultusunda sorular daha açık ve anlaşılır hale getirilerek veri toplama aracına son şekli verilmiştir. Açık uçlu soruların uygulanması yaklaşık 30 dk ve klinik mülakatların her biri yaklaşık 40 dk sürmüştür.

Verilerin analiz edilmesi için içerik analizi yöntemi kullanılmıştır. Öğretmen adaylarına uygulanan açık uçlu sorularla elde edilmiş dokümanların ve yapılan klinik mülakatların çözümlemesi bilgisayar ortamında yapılmıştır. Verilerin analizi sürecinde oluşturulan çözümlemeler kullanılmıştır. Öncelikle araştırma soruları ışığında bir kod listesi oluşturulmuştur. Bu kod listesi kullanılarak deşifre edilen veriler analiz edilmiştir. Anlamlı ifadeler içeren veri yığınları analiz birimi olarak belirlendikten sonra veriler kodlanmış ve temalar belirlenmiştir. Kodlamanın tamamlanmasından sonra kodlayıcılar arasındaki güvenirliğin hesaplanması için araştırmacılar bir araya gelmişlerdir. İki araştırmacının arasındaki tutarlılık %95 olarak hesaplanmıştır.

Elde edilen bulgular bütünleşik öğretim materyali geliştirilme sürecini oluşturan basamakları ortaya koymaktadır. Bunlar (1) farklı disiplinlerin ilişkilendirilmesi, (2) işbirliği yapma ve (3) destek alma olarak ortaya çıkmıştır. Bütünleşik öğretim materyali geliştirme sürecini oluşturan basamaklar aşağıda sırasıyla verilmiş ve öğretmen adaylarının ifadeleriyle desteklenerek açıklanmıştır. Öğretmen adayları her ne kadar ilişkilendirmenin zor ve her zaman yapılamayacağını da düşünüyor olsalar da, bütünleşik öğretim materyalinin geliştirilmesindeki ilk aşama olarak farklı disiplinlerin ilişkilendirilmesi gerektiği sonucuna ulaşmışlardır.

Bütünleşik öğretim materyalinin geliştirilebilmesi sürecinde olması gereken diğer bir unsur da farklı disiplinlerdeki uzmanların birbiriyle işbirliği yapması olarak belirlenmiştir. Öğretmen adaylarının çok büyük bir kısmı işbirliği yapmanın sürecin olmazsa olmazı olduğunu belirtmiş ve bu sürece olumlu katkılarının olduğunu ifade etmişlerdir. Öğretmen adayları bütünleşik öğretim materyalinin geliştirilebilmesi için işbirliğinin olması gerektiğini söylemişler fakat bu işbirliğinin sürece hem olumlu hem de olumsuz yansımaları olacağını düşünmektedirler.

Öğretmen adayları bütünleşik öğretim materyalinin geliştirilmesinde diğer disiplinlerin alan uzmanlarından alınacak desteğin gerekli olduğunu ifade etmişlerdir. Bu desteği farklı şekilllerde aldıklarını vurgulamışlardır. Destek aldıkları bu konular alan bilgisi, öğretmenlik bilgisi ve motivasyon olmak üzere üç ana başlıkta toplanmıştır. Diğer disiplinlerin alan uzmanlarından alınacak destek, bütünleşik öğretim materyali geliştirme sürecini oluşturan diğer bir unsur olarak ortaya çıkmıştır.

Sonuç olarak Bütünleşik öğretim materyali geliştirme, bir öğretim materyali geliştirmenin ötesinde özel süreçleri barındırmaktadır. Bütünleşik yapılar bir sistem yaklaşımı içerisinde belirli bir amaca yönelik olarak ilişkilendirilmiş uygulama ve yapılardır. Buna göre bütünleşik öğretim materyalinin aynı zamanda öğretime yardımcı bir sistem olduğu söylenebilir. Kavram olarak bütünleşik öğretim

materyali, belli bir amaca yönelik olarak birbiri ile ilişkilendirilerek öğretilmek istenen farklı disiplinlere ait konuların bir bütün olarak öğretilmesini destekleyici bir araçtır. Geliştirilmesi farklı disiplinlere ait konulardan oluşan öğretimin ilişkilendirilebilmesi ile mümkün olabilir. İlişkilendirme ise öğretimi hedeflenen disiplinler veya konular arasındaki sınırların belirsizleştirilmesi ve geçişli hale gelmesi ile gerçekleşebilir.

Öğretmen adaylarının ifadeleri doğrultusunda tanımlanması amaçlanan bütünleşik öğretim materyali geliştirme süreci, farklı disiplinlerin ilişkilendirilmesi, işbirliği yapma ve destek alma süreçlerinin uygulanarak bütünleşik öğretim materyali geliştirilmesi şeklinde modellenebilir.

Bu süreçlerin belli bir hiyerarşi içinde oldukları görülmektedir. Farklı disiplinleri ilişkilendirmeden bir işbirliği yapmaktan söz edilemeyeceği gibi, işbirliği olmadan uzmanlar arası bir destek alışverişinden bahsetmek de anlamlı olmayacaktır. Dolayısıyla bu unsurlar arasında yukarıdan aşağı doğru bir sıralama olduğu sonucuna varılmıştır.

Süreç içerisinde yapılan gözlemlerde ise öğretmen adaylarının ifadeleri dışında bütünleşik öğretim materyali geliştirme sürecini oluşturan unsurlara eklenebilecek ara unsurlar olduğu sonucuna da varılmıştır. Bu unsurlar da eklendiği zaman bütünleşik öğretim materyali geliştirme süreçleri aşağıdaki şekilde uygulanabilir.

1. Farklı disiplinlerden öğretim materyali geliştirme proje gruplarının oluşturulması,
2. Proje gruplarında yer alan üyelerin karşılıklı olarak öğretim programlarını incelemesi,
3. Öğretim programları arasında ilişkilendirilebilecek konu ve kazanımların karşılıklı olarak eşleştirilmesi,
4. Farklı disiplinlerden alan uzmanlarının işbirliği yapması,
5. Disiplinlere ait konuların ilişkilendirilmesi,
6. Alan uzmanlarından karşılıklı olarak destek alınması,
7. Bütünleştirilmiş öğretim süreçlerinin belirlenmesi,
8. Bütünleşik öğretim materyali tasarımının öğretim materyali tasarım süreçleri uygulanarak tamamlanması.