TÜRK FEN EĞİTİMİ DERGİSİ
Yıl 12, Sayı 2, Haziran 2015

Journal of
TURKISH SCIENCE EDUCATION
Volume 12, Issue 2, June 2015

http://www.tused.org

Alignment between Turkish Middle School Science Curriculum Standards and High School Entrance Examination

Emine ÇİL[1]

[1] Assist. Prof. Dr., Muğla Sıtkı Koçman University, Faculty of Education, Muğla-TURKEY

Received: 24.07.2014 **Revised:** 22.01.2015 **Accepted:** 24.04.2015

The original language of article is English (v.12, n.2, June 2015, pp.33-48, doi: 10.12973/tused.10139a)

ABSTRACT

The standards-based approach to science education has been implemented worldwide. The standards-based approach requires developing content standards and examinations to measure students' mastery of the content standards. Alignment between curriculum standards and examinations is crucial for providing accurate information about achievement of students, teachers, schools and educational reforms. The aim of this study is to examine the alignment between Middle School Science Curriculum Standards and High School Entrance Examination in Turkey. In this study Porters' alignment model was used. It was found that there was a moderate alignment between the examination and science curriculum standards. This study indicated that both curriculum standards and examination mostly emphasizes understanding at cognitive level. The examinations generally require higher level cognitive skills such as applying, analysing, and evaluating than curriculum standards. The findings of this study can provide some quantitative evidence and instructive information for Turkish standards based education. Also they can be used to compare curriculum standards and assessment systems in different countries.

Keywords: Alignment; Science Curriculum; High School Entrance Examination; Porter Model.

INTRODUCTION

Science education in many countries all over the world has adopted a standards-based approach for two decades. For example, in the United States No Child Left Behind Act (2001), *Benchmarks for Science Literacy* (American Association for the Advancement of Science [AAAS], 1993), the *National Science Education Standards* (National Research Council [NRC], 1996) and *Next Generation Science Standards* (NRC, 2013) support a standards-based education. Many countries such as South Africa (Edwards, 2010), Nigeria (Akınbobolo & Afolobi, 2010), China (Ministry of Education of the People's Republic of China, 2002), Canada (Council of Ministers of Education of Canada [CMEC], 1997), Turkey (Ministry of National Education [MNE], 2013) revised or developed their curriculum according to a standards–based education apart from the USA. In standards-based education, the Standards define what students should know and be able to do at each level. All the components of education system such as assessment, instruction, professional development,

Corresponding author e-mail: enimeonyedi@hotmail.com

are expected to align with the learning outcomes suggested for the students (Herman & Webb, 2007).

To support implementation of a standards-based curriculum it might be needed to design a standards-based assessment. Standards-based assessment focuses on which learning outcomes defined in the curriculum students attained. Generally, large-scale examinations such as national and/or state wide are carried out in the countries which have adopted standards-based curriculum. The scores students get from the large scale examinations are used either to decide their graduation from the schools or in which school they are going to continue their education. These examinations not only provide information about the students' performance but also they are used to reward the teachers and the schools and evaluate the success of the state or national education reforms. For example, merit pay scheme is offered to teachers in the USA. Merit pay scheme provides a temporary or permanent pay rise for the teachers according to their performances in the class. One of the indicators of teachers' good a performance in the class is the students' state wide test scores (Leigh, 2013). Alignment between curriculum standards and examination is crucial for accurate inferences about achievement of students, teachers, schools and education reforms. Alignment can be defined as "the extent of agreement between curriculum standards and assessment(s) used to measure students achievements these standards" (Bhola, Impara & Buckendahl, 2003:21). In many countries, studying the alignment between curriculum standards and national/state wide examinations has been ongoing for the past decade. For example; Liang and Yuan (2008) examined alignment between Chinese National Physics Curriculum and 12th grade exit examinations. The findings of this study indicated that the Chinese National Physics Curriculum and 12th grade exit examinations mostly emphasized students' understanding of fundamental principles and concepts of physics. Their study also indicated that examinations emphasize high level cognitive skills such as application and analysis more than curriculum. Liu and Fulmer (2008) analysed alignment between New York State core curriculum and New York State Regents Exams. They found that there was a high alignment between New York State curriculum and tests. Liu, Zhang, Liang, Fulmer, Kim and Yuan (2009) compared the alignment between physics curriculum and physics tests among three education systems: Jiangsu (China), New York State (United States), and Singapore. The results of their study show that different education systems have different emphases on both topics and cognitive skills. Also, they found that there was a statistically significant alignment between the New York content standard and the standardized test for physics, but there was not a statistically significant alignment for Chinese and Singapore physics. Edwards (2010) calculated alignment index for physics curriculum and examinations in South Africa. Also the researcher examined alignment between chemistry curriculum and examinations. The researcher found that there was a good alignment for physics, but there was a moderate alignment for chemistry. Another study which was conducted by Lu and Liu (2012) showed that there was a low alignment between the national High School Biology Curriculum standard and the standards-based High School Exit Exam in China. Çepni and Kara (2011) investigated alignment between Turkish Biology curriculum and University Entrance Examination. Their study indicated that the exam questions were not fully aligned with curriculum standards. Most of the alignment studies were carried out for the curricula and the test at high school level. However, students sit for a large scale examination at younger ages in many countries of the world. For example, In England, the students in their last year of primary school take an examination which is called eleven plus exam. In Turkey eighth grade students sit for a national examination. There are very few studies in literature which examine the alignment between exams and curriculum at middle school level. This study examined the alignment between High School Entrance Examination which the eighth grade students sit and was implemented for the first time in Turkey in 2013 and middle school science curriculum. The

findings of this study can provide some quantitative evidence and instructive information for Turkish standards based education. Also, alignment studies can be used to compare curriculum standards and assessment systems in different countries.

Turkish Middle School Science Curriculum

The Turkish education system is centralized. All curricula are designed by a committee of experts at the Ministry of National Education. These curricula are implemented across the nation. The middle school science curriculum has been reformed three times since the early 2000s. The latest science curriculum was revised in 2013. Enhancing the scientific literacy of students is the central goal for curriculum. The curriculum standards are concerned with four domains of students' achievement: knowledge and cognition, skills, affective and science-technology-society and environment. The curriculum focuses on students' learning instead of teachers' teaching. Finally, constructivist learning theory has been proposed as a learning and instruction way. Science subjects are taught four hours and each lesson lasts 40 minutes (MNE, 2013).

High School Entrance (HSE) Examination

In Turkey, the schooling consists of four main components: Elementary School (four year), Middle School (four year), High School (four year) and University. The Turkish education system is highly examination centred. The students do not take national wide examination when they finish elementary school and move on to middle school. A student who completes elementary education continues his/her education in any middle school s/he wants. However, students have to sit the national standardized examinations in order to be admitted to the upper educational levels.

Students in Turkey have to take national examinations in the eighth grade. The eighth grade students are about to complete their middle school and move on to high school. There are many types of high school such as science, anatolian, social science, technical in Turkey. However, they can be categorized into two main categories. One of them is the schools which give academic education and the other one is the vocational training schools. Most of the vocational training schools are not popular between the students and their families. Due to the limited capacities of the high schools which give academic education, a competition among the students who want to be accepted to these schools has been continuing for years. In order to be accepted to these schools, the students must attain good scores in a nationwide examination.

The Turkish government announced a new nationwide examination called HSE Examination in 2013. HSE Examination consists of multiple choice questions in the disciplines of Turkish, Mathematics, Science, Foreign Languages, History, and Ethic. Ministry of National Education prepares the exam questions. An item bank included questions written by the assessment and evaluation experts of the Ministry of National Education. Teachers can give their exam questions to this bank. After the questions are analysed by the experts, they could be added to the bank. HSE Examination questions are chosen from this item bank. Eight grade students sit this examination twice (one of them is in the fall term, the other is in the spring term) in an academic year.

The Turkish Ministry of Education determines the schedule of the examinations in the autumn and spring terms at the beginning of the education year. Moreover, they announce content areas and learning outcomes of the science curriculum the examinations in autumn term and spring term will cover. The Ministry of Education also prepares a work programme for the teachers. This work programme includes a syllabus and it presents the subjects and learning outcomes in the curriculum according to the weeks and months when the teachers are

required to teach their students. This programme is published on the web site of Ministry of Education. Moreover, this programme is also sent to the schools. You can reach 2013-2014 academic year HSE Examination programme on http://ttkb.meb.gov.tr/www/merkezi-sistem-ortak-sinav-calisma-takvimleri/icerik/188.

The purpose of this study is to explore the alignment between Turkish Middle School Science Curriculum and HSE Examination. The research questions of the study are:

1. What is the alignment between High School Entrance Examination in fall term and Middle School Science Curriculum?
2. What is the alignment between High School Entrance Examination in spring term and Middle School Science Curriculum?

METHODOLOGY

There are several alignment models (e.g. La Marca, Redfield, Winter, Bailey & Despriet 2000 alignment model, Achieve 2001 alignment model, Porter 2002 alignment model; Webb 2007 alignment model) in the literature. Bhola et al. (2003) reviewed the model on alignment. You can see the clear definition and brief summaries for each alignment model in their study. However, Porter's alignment model is the most commonly used model in literature (e.g. Edwards, 2010; Liang & Yuan, 2008; Liu & Fulmer, 2008; Liu et al., 2009; Lu & Liu, 2012). Liu and Fulmer (2008:375) argued that Porter's alignment model has two advantages: (a) it adopts a common language to describe curriculum, instruction and assessment; and (b) it produces a single number as the alignment index.

In this study, Porters' alignment model was used (Porter, 2002). In order to determine alignment between Turkish Middle School Science Curriculum standards and High School Entrance Examination, two tables were designed. One of the tables represents Science Curriculum; the other represents High School Entrance Examination. In these tables, rows represent the topics and columns represent the level of cognitive demands. The cognitive demands categorized into revised Bloom's taxonomy (remembering, understanding, applying, analyzing, evaluating and creating). The cell values in the tables were based on the number of major understanding corresponding to a main topic and cognitive demand. To compare the two tables, all cell values were standardized, that is, converted into ratios totalling to 1. Then Porter alignment index (P) was calculated using the following formula:

$$\mathrm{P} = 1 - \frac{\sum_{i=1}^{n} |(X_i - Y_i)|}{2}$$

where n is total number of cells in the table and i refers to specific table cell, ranging from 1 to n. For example, for a 3 × 4 table, there are 12 cells, thus n = 12. *Xi* refers to the i^{th} cell of *Table X* (e.g., the standardized test table) and *Yi* refers to the corresponding cell (i^{th} cell) in *Table Y* (e.g., the content standard table). Both *Xi* and *Yi* are ratios with a value from 0 to 1. The sum of X_1 to *Xn* is equal to 1, so is the sum of Y_1 to *Yn*. The discrepancy between the i^{th} cells of the test table and the standard table can be calculated as *Xi – Yi.* The total absolute discrepancy is then calculated by summing the absolute discrepancies over all cells (Liu et al., 2009:781-782).

Subtotal cells in curriculum and examination tables are not used to calculate Porter Alignment Index. Porter alignment model can provide valuable data for each row to compare content areas emphasised by subtotal curriculum standards and examination. It can also be used for each column to compare cognitive demands emphasized by subtotal curriculum standards and examination. Subtotal values of rows and columns in curriculum standards tables and examination tables can be presented visually, such as using graphics (Porter, Blank & Zediner, 2007).

The Porter alignment index ranges from 0 to 1. If index is closer to 0, it means that alignment is lost. If index is closer to 1, this means that alignment is perfect. However, there is not a clearly defined level to decide whether the degree of alignment is acceptable or not (Näsström, 2008). In other words, Porter has not clearly specified an index in order to assert a good alignment between the curriculum and the examination. The studies conducted state that the value around 0.50 is considered moderate, the value of 0.60 and over is considered high alignment index. For example, Liu and Fulmer (2008) considered 0.60 as high alignment index.

a) Content Areas and Learning Outcomes of Science Curriculum and HSE Examination

This study explored the alignment between Middle School Science Curriculum standards and HSE Examination. In the study, the alignment indexes of HSE Examination in the fall term and HSE Examination in the spring term in 2013-2014 academic year were calculated. The fall term examination was held in November and the spring term examination was held in April in 2013-2014 academic year. Explanations about the science content areas and learning outcomes in HSE Examinations in 2013-2014 academic year were announced with the act of Ministry of National Education dated 13 September 2013 and numbered 68128140/480/2463603. It was stated in this official document that Heredity and Buoyancy subjects in science curriculum would be included in HSE Examination which would be held in the fall term during 2013-2014 academic year. Table 1 presents the sub-themes and the number of the learning outcomes which these content areas include.

Table 1. *2013-2014 Education Year Content Areas for Fall Term*

Content Areas	Sub-themes in Content Areas	Number of Learning Outcomes in Curriculum
Heredity	Mitosis	4
	Mendel Laws	9
	Meiosis	3
	Deoxyribonucleic acid	9
	Adaptation and evolution	4
Buoyancy	Buoyant force in liquid	11

Ministry of Education stated that spring term HSE Examination in 2013-2014 academic year would include six science content areas in science curriculum. These subject areas are: Heredity, Buoyancy, Matter, Sound, Heat and Temperature, Photosynthesis and Respiration. Table 2 presents the sub-themes and the number of the learning outcomes which these content areas include.

Table 2. *2013-2014 Education Year Content Areas for Spring Term*

Content Areas	Sub-themes in Content Areas	Number of Learning Outcomes in Curriculum
Heredity	Mitosis	4
	Mendel Laws	9
	Meiosis	3
	Deoxyribonucleic acid	9
	Adaptation and evolution	4
Buoyancy	Buoyant force in liquid	15
	Pressure	7
Matter	Periodic Table	5
	Chemical Bonds	5
	Chemical Reactions	7
	Acid and Bases	11
	The Chemistry of Water	3
Sound	Sound of Wave	2
	Characteristic of Sound	7
	Musical Instruments	2
	The Energy of Sounds	2
	Speed of Sound	3
Heat and Temperature	Differences between heat and temperature	6
	Heat Transfer	5
	Changing State of Matter	4
	Melting and Freezing	7
	Evaporation	3
	Heating and Cooling Curves	2
Photosynthesis and Respiration	Food Chain and Aerobic Respiration	12

In this study general content areas were used instead of more specific sub-themes to calculate alignment index in this study because general content areas are usually preferred more than specific subjects in alignment studies in literature. Liu et al (2009) explains the benefits of using general content areas depending on three reasons: reliability (analysis of specific subjects can be unreliable), pedagogical (curriculum, instruction, and assessment are likely to focus on big ideas) and practical (general content areas are required to be used so that the results obtained from the alignment studies can be used for international comparisons).

b) Cognitive Demands

The cognitive demands of learning outcomes in science curriculum and science questions in HSE Examination were categorised into revised Bloom's taxonomy. Revised Bloom's taxonomy includes six levels which are *Remembering, Understanding, Applying, Analyzing, Evaluating and Creating.* The following key words were used while learning outcomes and questions into each of the cognitive demands were being categorized (Anderson & Krathwohl, 2001; Krathwohl, 2002):

Remembering: Recognizing, listing, describing, retrieving, naming. For example, listing the most common genetic diseases in human beings is at remembering level.

Understanding: Interpreting, summarising, paraphrasing, classifying, and explaining. For example, classifying the substances whose pH are well known as acid or base is at understanding level.

Applying: Implementing, carrying out, using, executing. For example, preferring metals for heat transfer is at applying level.

Analyzing: Comparing, organizing, deconstructing, interrogating, finding. For example comparing the similarities and differences between mitosis and meiosis is at analyzing level.

Evaluating: Checking, hypothesising, critiquing, experimenting, judging. For example testing the factors required for photosynthesis is at evaluating level.

Creating: Designing, constructing, planning, producing, inventing. For example, designing and making a simple musical instrument which produces sounds at different frequencies is at creating level.

A 2 x 6 table (2 major topics x 6 cognitive levels) were formed in order to calculate the alignment between science curriculum standards and HSE Examination for the fall term. A 6 x 6 (6 major topics x 6 cognitive levels) table were formed in order to calculate the alignment between science curriculum standards and HSE Examination for the spring term.

The two coders with science education background examined curriculum standards and examination items. The two coders first independently designed their tables. And then they compared their tables. The small differences (less than 5%) between the two coders were agreed via negotiations.

FINDINGS

The findings of the study were presented under two sub-titles. First, alignment between HSE Examination in the fall term and science curriculum standards in 2013-2014 education year were explained. Second, the findings obtained for the alignment between HSE Examination held in the spring term and curriculum standards were presented.

a) Alignment between HSE Examination and science curriculum standards for the fall term

Ministry of National Education announced the content areas of science curriculum which HSE Examination would cover in the fall term at the beginning of 2013-2014 academic year. When these parts of the curriculum were examined, the findings in Table 3 were obtained. Curriculum covers two subjects: Heredity and Buoyancy. There are total 40 student learning outcomes about these two subjects in the curriculum. 29 of the student learning outcomes are from Heredity. Most of the learning outcomes (24) are at understanding level. Seven of the learning outcomes were at analysing level. Four of the learning outcomes are at applying level. Three of the learning outcomes are at remembering level and the other two learning outcomes are at evaluating level. The value in each cell was divided into 40 and the cell values were converted into ratios. In Table 4, the ratios obtained for science curriculum are presented.

Table 3. *Science Content Standard Based on Number of Understandings for Fall Term*

Topics	Remember	Understand	Apply	Analyze	Evaluate	Create	Subtotal
Heredity	2	20	1	4	2	0	29
Buoyancy	1	4	3	3	0	0	11
Subtotal	3	24	4	7	2	0	40

Table 4. *Science Content Standards in Ratios for Fall Term*

Topics	Remember	Understand	Apply	Analyze	Evaluate	Create	Subtotal
Heredity	0.05	0.5	0.025	0.1	0.05	0	0.725
Buoyancy	0.025	0.1	0.075	0.075	0	0	0.275
Subtotal	0.075	0.6	0.1	0.175	0.05	0	0.1

HSE Examination held in the fall term in 2013-2014 academic year consists of 19 science questions. When Table 5 is analysed, it is revealed that more than half of the questions (11) are about Buoyancy. Most of the questions are at understanding level. The six questions are at the analysing level. The three questions require applying cognitive skill. Only

one of the questions is at remembering level. There are no questions at evaluating and creating levels. The value in each cell was divided into 19 and the ratios were obtained. Table 6 presents the ratios.

Table 5. *High School Entrance Science Examination Based on Points for Fall Term*

Topics	Remember	Understand	Apply	Analyze	Evaluate	Create	Subtotal
Heredity	1	7	0	0	0	0	8
Buoyancy	0	2	3	6	0	0	11
Subtotal	1	9	3	6	0	0	19

Table 6. *High School Entrance Science Examination in Ratios for Fall Term*

Topics	Remember	Understand	Apply	Analyze	Evaluate	Create	Subtotal
Heridity	0.05	0.37	0	0	0	0	0.42
Buoyancy	0	0.10	0.16	0.32	0	0	0.58
Subtotal	0.05	0.47	0.16	0.32	0	0	1.00

The Porter alignment index was calculated using cell values in the Table 4 and Table 6 for the fall term. The Porter alignment index was found to be 0.67 for the fall term.

Figure 1 presents the comparison between the content areas emphasized in science curriculum standards and HSE Examination.

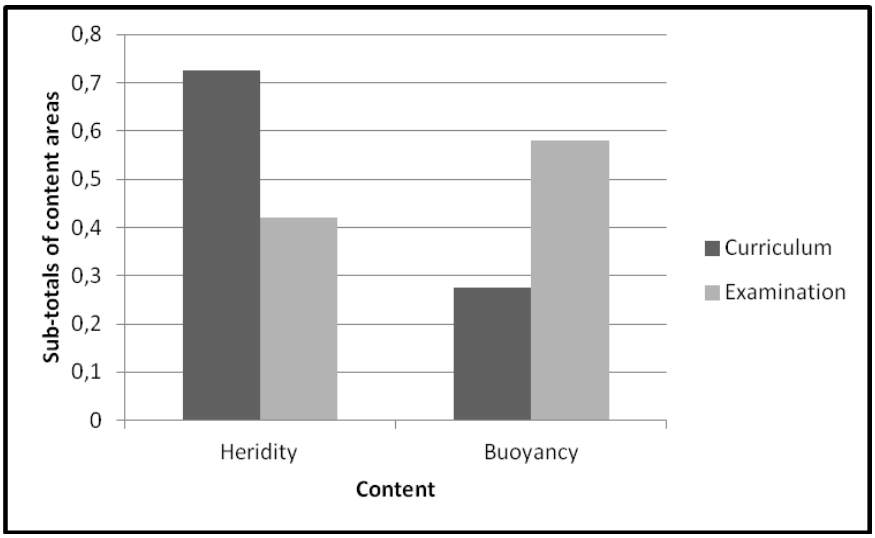

Figure 1. *Comparison between the content emphasised in curriculum and HSE Examination for the fall term*

There are differences between the content areas emphasised in HSE Examination held in the fall term in 2013-2014 academic year and curriculum standards. Although curriculum consisted of more learning outcomes about Heredity, most of the examination questions tested what students learned in Buoyancy. Figure 2 presents the differences between the cognitive domain emphasized in curriculum standards and the HSE Examination.

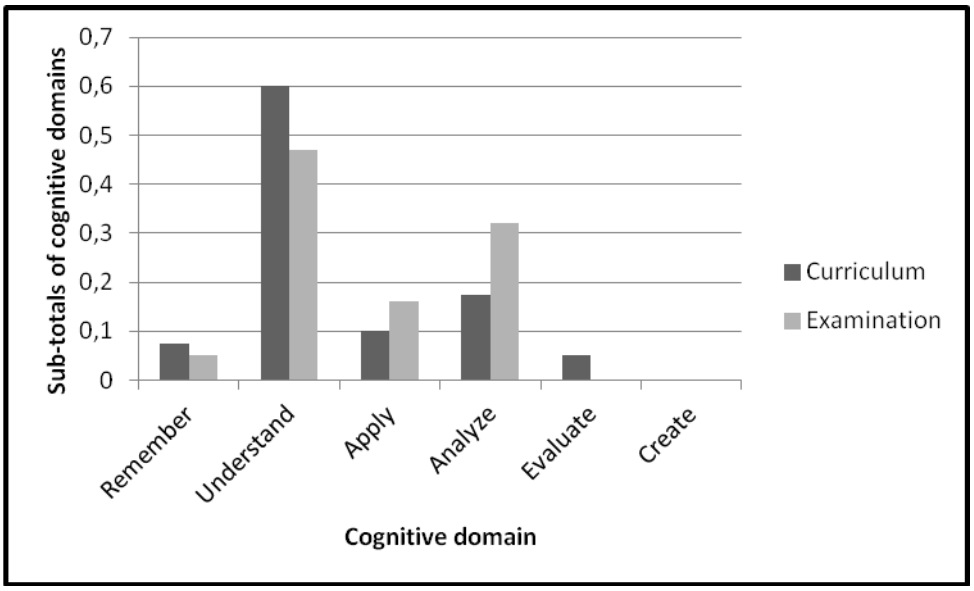

Figure 2. *Comparison between the cognitive domains emphasised in curriculum and HSE Examination for the fall term*

Understanding level was frequently emphasised both in science curriculum standards and the HSE Examination in the fall term of 2013-2014 academic year. Applying and analysing levels were emphasised more in the HSE Examination than in the curriculum standards. Curriculum standards included evaluate cognitive skill at a very low degree, but HSE Examination did not require this cognitive skill. Both curriculum standards and the HSE Examination did not include creating level.

Alignment between HSE Examination and science curriculum standards for the spring term

HSE Examination held in the spring term in 2013-2014 academic year consists of six science content areas. The science content areas are: Heredity, Buoyancy, Matter, Sound, Heat and Temperature, Photosynthesis and Respiration. Student learning outcomes of these six content areas in science curriculum were analysed by the revised Bloom's Taxonomy. The findings obtained were presented in Table 7. The numerical data in each cell of Table 7 were divided into 137 and then converted into ratios (See Table 8).

Table 7. *Science Content Standard Based on Number of Understandings for the Spring Term*

Topics	Remember	Understand	Apply	Analyze	Evaluate	Create	Subtotal
Heredity	2	20	1	4	2	0	29
Buoyancy	5	8	6	3	0	0	22
Matter	13	8	7	2	1	0	31
Sound	8	3	0	4	0	1	16
Heat and Temperature	8	12	2	4	0	1	27
Photosynthesis and respiration	4	4	0	0	2	2	12
Subtotal	40	55	16	17	5	4	137

Table 8. *Science Content Standard in Ratios for Spring Term*

Topics	Remember	Understand	Apply	Analyze	Evaluate	Create	Subtotal
Heredity	0.015	0.146	0.007	0.029	0.015	0	0.21
Buoyancy	0.036	0.058	0.044	0.022	0	0	0.16
Matter	0.095	0.058	0.051	0.015	0.007	0	0.23
Sound	0.058	0.022	0	0.029	0	0.007	0.12
Heat and Temperature	0.058	0.088	0.015	0.029	0	0.007	0.19
Photosynthesis and respiration	0.029	0.029	0	0	0.015	0.015	0.09
Subtotal	0.291	0.401	0.117	0.124	0.037	0.029	1.00

HSE Examination held in the spring term in 2013-2014 academic year consists of 20 science questions. Heat and Temperature was the topic from which most questions were asked. One quarter of the questions was about Photosynthesis and Respiration. Less than a quarter of the questions tests what the students learned about Matter. Table 9 presents the findings obtained from the analysis of science questions asked in the examination according to Bloom's taxonomy. 11 questions out of 20 questions were categorized at understanding level. The three questions were categorized at applying level, and the other three questions were categorized at evaluating level. The two questions were categorized at the remembering level. Only one question was categorized at analyzing level. The numerical data in each cell of Table 9 was divided into 20. Therefore, each cell was converted into ratios. The findings obtained were presented in Table 10.

Table 9. *High School Entrance Science Examination Based on Points for the Spring Term*

Topics	Remember	Understand	Apply	Analyze	Evaluate	Create	Subtotal
Heredity	0	1	0	0	0	0	1
Buoyancy	0	0	0	1	0	0	1
Matter	1	1	1	0	1	0	4
Sound	0	2	0	0	0	0	2
Heat and Temperature	1	4	2	0	0	0	7
Photosynthesis and respiration	0	3	0	0	2	0	5
Subtotal	2	11	3	1	3	0	20

Table 10. *High School Entrance Science Examination in Ratios for the Spring Term*

Topics	Remember	Understand	Apply	Analyze	Evaluate	Create	Subtotal
Heredity	0	0.05	0	0	0	0	0.05
Buoyancy	0	0	0	0.05	0	0	0.05
Matter	0.05	0.05	0.05	0	0.05	0	0.2
Sound	0	0.1	0	0	0	0	0.1
Heat and Temperature	0.05	0.2	0.1	0	0	0	0.35
Photosynthesis and respiration	0	0.15	0	0	0.1	0	0.25
Subtotal	0.1	0.55	0.15	0.05	0.15	0	1.00

The alignment index between science curriculum standards and HSE Examination in the spring term was calculated using the cell values of Table 8 and Table 10. The Porter alignment index was found to be 0.47.

The differences between the content areas emphasised by the science curriculum standards and examination in the spring term in 2013-2014 academic year were presented in Figure 3.

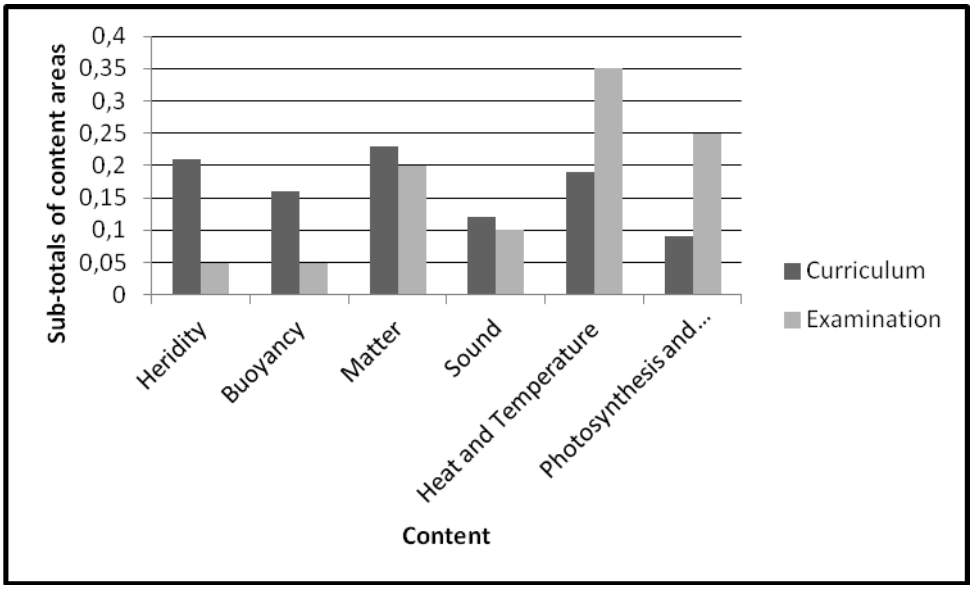

Figure 3. *Comparison between the content areas emphasised in curriculum and HSE Examination for the spring term*

The topics of Matter and Sound were emphasised at similar ratios in curriculum standards and the examination. The examinations mostly emphasise the topics of Heat and Temperature and Photosynthesis and Respiration. Figure 4 presents the cognitive domain emphasised by High School Entrance Examination held in the spring term and curriculum standards.

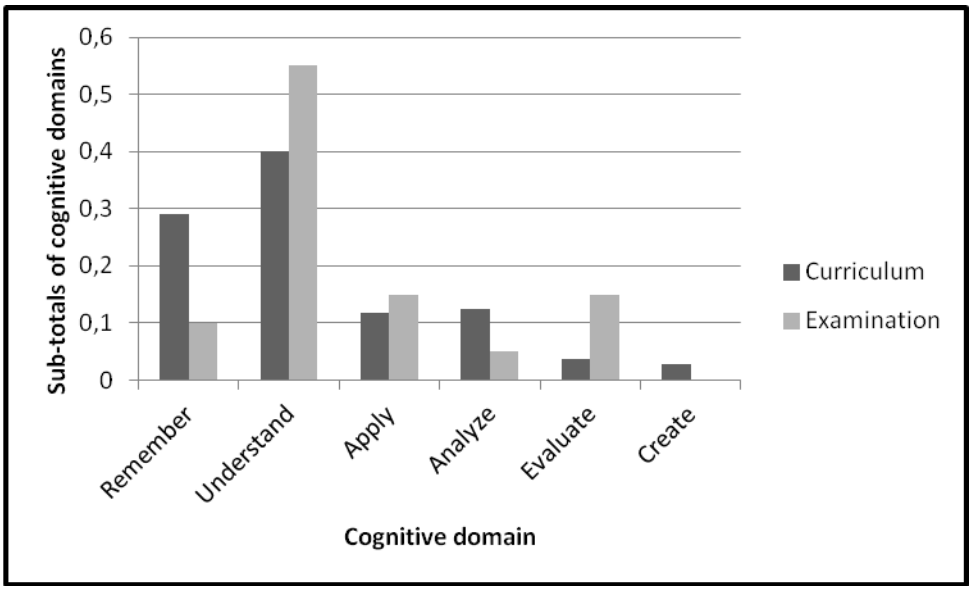

Figure 4. *Comparison between the cognitive domains emphasised in curriculum and HSE Examination for the spring term*

The examination held in the spring term in 2013-2014 academic year and curriculum standards mostly required understanding cognitive skill. The curriculum standards emphasised remembering level more than HSE Examination. Applying cognitive skill was emphasised at a similar degree in both science curriculum standards and HSE Examination. The curriculum standards required analyzing and creating cognitive skills more than examination. The examination emphasised evaluating cognitive skill more than the curriculum standards.

DISCUSSION and CONCLUSION

The Porter alignment index for the fall term examination and the spring term examination has been calculated to be 0.67 and 0.47 for respectively. It can be stated that the alignment between HSE Examination held in fall term and science curriculum is high. On the other hand, the alignment between HSE Examination held in spring term and science curriculum is moderate. The studies in the literature indicate that the USA, China, Singapore, and South Africa provided high alignment between the curriculum standards and large-scale examinations. Moreover, the alignment between the curriculum and large-scale examinations in the USA is much better than the other countries which are mentioned above (Edwards, 2010; Liang & Yuan, 2008; Liu & Fulmer, 2008; Liu et al. 2009; Lu & Liu, 2012). Therefore, it can be implied that Turkey is similar to the countries such as China and Singapore in terms of providing alignment between the curriculum standards and examination.

The findings of this study indicated that Turkish middle school science curriculum and HSE Examination include similar science contents. The examination does not include any topics which are not included in the curriculum. However, curriculum and examination have different emphasis in science content. HSE Examination held in the fall term included the topics of Heredity and Buoyancy in science curriculum. Learning outcomes for Buoyancy is 27.5% of the total learning outcomes. Despite this, 58% of the exam questions test learning about Buoyancy. HSE Examination held in the spring term included six topics. Heredity, Matter, Heat and Temperature subject*s* were more emphasized in the science curriculum. However, matter, heat and temperature, photosynthesis subjects were more emphasized in the HSE Examination. 19% of total student learning outcomes in the curriculum consisted of Heat and Temperature, although 35% of the exam questions tested students' learning related to this subject. 9% of total student learning outcomes in the curriculum consisted of Photosynthesis and Respiration, although 25% of exam questions tested students' learning related to this subject. The main reason for this situation might be the administration of HSE Examination throughout an academic year just like the examinations carried out by the teachers in their classes. Eighth grade science teachers administer six written exams throughout an academic year in Turkey. Three of these exams are carried out in the fall term and three of them are done in the spring term. In fact, HSE Examination is a national examination. However, these examinations are done as the third exams which each teacher administered in their classes during the fall and spring terms of the academic year. Teachers in Turkey ask a few questions from the previously learned topics but they ask a lot of questions from the recently learned topics. Therefore, the recently learned topics could have been emphasized more in HSE Examinations. The students learned Buoyancy as the last topic in the examination held in the fall term. This topic is emphasized less than Heredity in the curriculum. However, more questions were asked from the topic of Buoyancy in HSE Examination administered in the fall term. Before students sat for HSE Examination in the spring term, they had learnt the topics of Heat and Temperature and Photosynthesis and Respiration. More than half of the questions included in HSE Examination in the spring term tested the learning outcomes from these two topics. Emphasising science contents differently in the curriculum and HSE Examination might result in misinterpretation of student achievement. Some students could

have learnt some topics better. A student who could not learn science content well can learn other science content better. It can be stated that some content areas more should be emphasized more according to curriculum standards in the examination which is held at national level and will have an effect on the students' educational life in the future.

Both science curriculum standards and HSE Examinations mostly emphasize students understanding of fundamental concepts and principles of science. However, there are differences between cognitive demands of curriculum and HSE Examinations. HSE Examinations generally require higher level cognitive skills such as applying, analysing, and evaluating than curriculum standards. Emphasising high level cognitive skills differently in the examination and the curriculum causes the degree of alignment to drop. However, positive arguments can be made for the requirement of high level cognitive skills of the examinations. The questions of large scale examinations affect the students' mind because the students get prepared for the examination by studying the questions of the previous years. While low order questions lead the students to memorization, high order questions can support the students to analyse, synthesise, and transfer knowledge (Brualdi, 1998; Liang & Yuan, 2008; Özsevgeç & Çepni, 2006; Vendlinski, Nagashima, & Herman, 2007).

Lower degree of alignment between the curriculum and examinations can cause an inaccurate representation of student achievement (Lu & Liu, 2012). HSE Examination in Turkey does not seem to reveal correctly what the students have learned in their schools. Eighth grade students are about to finish middle school and their scores from this examination are used to make decisions about which high school they are going to attend. Therefore, HSE Examination held in Turkey in 2013 may have brought up the issue of injustice in Turkey.

A big debate has continued about the effects of large scale examinations on teachers' instructional activities. According to Bishop (1998) and Wößmann (2005), these examinations provide useful benefits for the teachers to renew themselves and increase the quality of education they give. Contrary to this belief, some researchers (Bjork & Tsuneyoshi, 2005; Lisle, Smith & Jules, 2005; Youell, 2005) argue that large scale examinations may have negative effects on teachers' teaching methods. Teachers give up student-centred teaching and active learning techniques in order to make their students answer more questions correctly in the national exams and teach them test techniques because teachers' achievements are directly related to how many questions their students answer correctly at the central examinations. However, many teachers know that without understanding real meaning of the concepts, students are able to answer the test questions by memorizing the certain rules. Large scale examinations are one of the obstacles for implementation of curriculum in the class because teachers and students spend most of their time and energy to get prepared for large scale examinations (Kasanen & Raty, 2008). In Turkey many curricula have been accepted unsuccessful due to the same or similar reasons (Ayas, Çepni & Akdeniz, 1993; Çepni & Çil, 2009). The high alignment between the curriculum standards and examinations may help to deal with these problems. If the examination and the curriculum are compatible with each other, teachers can make an effort to teach what are described in the science curriculum to their students. While teachers are designing and implementing their in-class instructions, they can use the curriculum as their guide. It can be stated that there is a need to reinforce the relation between the curriculum and national wide examinations so that teachers can implement the standards-based education reforms in a pleasing way in Turkey.

Large scale examinations provide important information for the policy makers. Hamilton, Stecher and Klein (2002) summarize the benefits of the examinations for the policy makers: Policy makers can use the reports of large scale examination results in order to judge the effectiveness of the education reforms. Large scale examinations can improve the policy makers' ability to monitor the performance of the school systems. Moreover, large scale exam results can enable the policy makers to share the sources fairly. If the relation between the

curricula and the examinations are not strong, the test results may provide incorrect information to the policy makers (Lu & Liu, 2012). Thus, item writers must consider alignment concepts further so that policy makers can do correct evaluations and make right decisions in Turkey.

We have very little data about the alignment between the curricula which the middle school students learn and the large scale examinations which they sit in Turkey and the other countries. Therefore, we do not know much about the other countries' curriculum and assessment systems and also we cannot make comparisons between the countries. It can be suggested that more studies should be conducted on this issue.

Acknowledgement

A part of this study was presented at the 1st Eurasian Educational Research Congress in Istanbul, Turkey between 24-26 April, 2014.

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