



## Effect of Gender on Levels of Curiosity towards Scenarios Prepared within the Scope of the “Matter and Change” Unit at the 5th Grade<sup>1</sup>

### 5. Sınıf Madde ve Değişim Ünitesi Kapsamında Hazırlanan Senaryoların Merak Edilme Düzeylerine Cinsiyetin Etkisi

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• Geliş Tarihi: 07.12.2017 • Kabul Tarihi: 30.04.2018 • Yayın Tarihi: 01.07.2018

#### Abstract

This study aims to determine students' levels of curiosity towards the problem-based scenarios prepared with the support of teacher candidates for the “Matter and Change” Unit under the 5th grade curriculum. It was also investigated whether gender influences the level of curiosity of fifth grade students. To this end, correlational-research design was used, which is a non-empirical research design among quantitative research methods. The research sample consisted of 425 (196 girl, 229 boy) 5th grade students who studied at six different state schools in Bartın in the spring term, 2015-2016. In the context of the study, a questionnaire prepared by the researcher -determining the curiosity levels- was used. The data obtained was analyzed with the descriptive analysis technique from quantitative data analysis techniques. In addition, Pearson-correlational analysis was used in order to determine whether gender influences the level of curiosity of fifth grade students. It has been found out that gender has a significant effect on students' curiosity levels about the solution of some scenarios.

**Keywords:** 5th grade students, curiosity, matter and change, PBL and scenarios

#### Öz

Bu çalışmada üzerinde durulan problem durumu beşinci sınıf düzeyinde madde ve değişim ünitesi kapsamında öğretmen adaylarının desteğiyle hazırlanan problem senaryolarının merak edilme düzeylerini belirlemektir. Ayrıca beşinci sınıf öğrencilerinin senaryoları merak etme düzeyleri üzerinde cinsiyetin etkisi olup olmadığı da araştırılmıştır. Bu amaçla çalışmada nicel araştırma yöntemlerinden deneysel olmayan araştırma desenlerinden ilişkisel araştırma deseninden faydalanılmıştır. Araştırmanın örneklemini Bartın'da altı farklı devlet okulunda 2015-2016 öğretim yılı bahar döneminde öğrenim görmekte olan toplam 425 (196 kız, 229 erkek) ortaokul öğrencisi oluşturmaktadır. Araştırmacı tarafından hazırlanan senaryoların merak edilme düzeyini belirleme anketi kullanılmıştır. Ankete öğrencilerin verdikleri cevaplardan elde edilen veriler nicel veri analiz tekniklerinden betimsel analiz tekniği kullanılarak analiz edilmiştir. Ayrıca senaryoların merak edilme düzeyleri üzerinde cinsiyetin etkisi olup olmadığını belirlemek için ise Pearson-korelasyon analizi tekniğinden faydalanılmıştır. Sonuç olarak cinsiyetin bazı senaryoların çözümü konusunda öğrencilerin merak düzeyleri üzerinde istatistiksel olarak anlamlı bir etkisinin olduğu sonucuna ulaşılmıştır.

**Anahtar sözcükler:** Beşinci sınıf öğrencileri, madde ve değişim, merak, PDÖ ve senaryo

#### Önerilen Atıf Bilgisi:

Tosun, C. (2018). Effect of Gender on Levels of Curiosity towards Scenarios Prepared within the Scope of the “Matter and Change” Unit at the 5th Grade. *Pamukkale Üniversitesi Eğitim Fakültesi Dergisi*, 44, 1-14.

<sup>1</sup>A part of this study was presented as an oral presentation in the I. International Academic Research Congress, 3-5 November 2016, Side-Antalya, Turkey.

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## Introduction

A investigation-based learning approach has been adopted in teaching science curriculum. Planning and applying the lessons in relation to this approach has resulted in the need to prepare suitable learning environments in which students are active, whereas teachers are guides and moderators, and in which active learning methods are used such as problem-based learning, project-based learning, argumentation, and cooperative learning etc. (Ministry of National Education-MNE 2013). It is of great significance that problem scenarios must be developed to fit the Problem-Based Learning (PBL) method –among all the other active learning methods- and it is highly essential to raise individuals who can research, investigate, solve problems and communicate easily, and who are self-confident and cooperative, by means of these problem scenarios in organizing teaching environments.

In literature, PBL is presented with a variety of definitions such as being a method that requires group work and cooperation (Duch, 2007), a student-based curriculum approach which is used for developing practical solutions about a specific problem (Savery, 2006), and a teaching approach that requires self-research for real world problems (Sonmez & Lee, 2003). Based on these definitions, PBL may be defined as a method that serves to achieve the objectives related to finding solutions to problem scenarios that are brought into classroom environment, and which are or may be encountered in daily life.

Being different from end-of-unit problem questions, the most important feature of problem scenarios is that they are prepared in such a way that they involve the relevant objectives and arouse the students' sense of curiosity (Duch, 2001). Provided that the scenarios do not arouse any the students' sense of curiosity, they will prevent students from doing research and gathering information about the solution. The problem focused on in this study is to determine the curiosity levels of students on the problem scenarios.

It is difficult for teachers to try to prepare and apply problem scenarios and evaluate the process on the basis of theoretical information that they obtain from available resources. It is, therefore, highly necessary that the teachers who are to apply such problem scenarios should be trained to be able to prepare, apply and evaluate them. It is also important to involve prospective teachers actively in the preparation processes of PBL scenarios so as to enable them to come up with solutions in advance that they may face while trying to get their students to obtain the objectives via the PBL method. To this end, the study not only developed problem scenarios with the assistance of prospective teachers but it also aimed to determine the levels of curiosity towards the scenarios. The studies in literature have stated that more research is needed to show how teachers can specify students' interests to draw their attention in order to direct them to develop problem scenarios (Butler, 1998).

This study aims to determine students' levels of curiosity towards the problem scenarios prepared with the assistance of prospective teachers for the "Matter and Change" unit under the 5th grade curriculum. There are five learning objectives about this unit, which involve the key words about the states of matter such as melting, freezing, evaporation, condensation, sublimation and deposition. Similarly, other key words such as heat and temperature, heat exchange, boiling, expansion and shrinkage are also dealt under the context of this unit. Literature shows that the concepts of evaporation and boiling, and heat and temperature are used interchangeably, that concepts such as evaporation, condensation, vapour pressure, evaporation rate and boiling are not learned conceptually by students at different education levels (Canpolat, 2006; Chang, 1999; Costu & Ayas, 2005; Johnson, 1998; Gopal, Kleinsmidt, Case & Musonge, 2004; Pınarbası & Canpolat, 2003; Canpolat, Pınarbası & Sozbilir, 2006) and that students feel difficulty in understanding and discriminating the concepts of heat and temperature (Baser & Geban, 2005; Carlton, 2000; Zacharia, Olympiou & Papaevripidou, 2008). The fact that the concepts within the framework of the change of state in matter, one of the fundamental concepts of chemistry, are not learned at conceptual level will lead to a weak basis in terms of understanding further concepts. This fact is considered as the justification of the importance of this study.

### **Effect of Gender on Levels of Curiosity towards Scenarios Prepared within the Scope of the “Matter and Change” Unit at the 5th Grade**

There are many factors that affect learning in the science education. One of these is a curiosity. Curiosity is the prerequisite for learning (Carlin, 1999). Many events in our everyday life have the potential to attract our curiosity. Curious people ask questions and try to find their answer. What is the trail left behind by planes when flying in the sky? How do hot air balloons work? What do you think is the reason for the guitar’s strings looseness left next to the heater core? What is the reason why the mercury level in the thermometer rises and falls? What is the reason for the feeling of coldness of the cologne? Why do gasoline cars work more easily than diesel cars on cold winter days? Such questions and events can attract students and awaken their curiosity. It is necessary to incorporate the curiosity of the students into the teaching process. In the literature, there are studies investigating the relationship between grade level (Campell, 1972) and gender (Harty & Beall, 1984) and students’ curiosity. In another study, the relationship between curiosity and academic achievement was investigated (Harty, Beall & Scharmann, 1985). The problem focused on in this study is to determine the curiosity levels of students on the problem scenarios. The answers to the following research questions will be sought within the framework of the above-mentioned research problem:

- What are the levels of curiosity among 5th grade students towards problem scenarios?
- Are there any effects of gender on the 5th grade students’ the curiosity levels towards the problem scenarios.

### **Method**

The study aimed to determine students’ level of curiosity towards problem scenarios prepared with the assistance of prospective teachers within the scope of the study. It was also investigated whether gender influences the level of curiosity of fifth grade students. To this end, correlational- research design was used, which is a non-empirical research design among quantitative research methods. In correlational-research design, whether there is a correlation between two or more groups or phenomena is examined. The researcher determines the level of the relationship between two or more variables using statistical techniques. This design is preferred to see if the variables influence each other (McMillan & Schumacher, 2010).

### **Participants**

In this study, data was collected with 468 5th grade students. While the curiosity levels were being evaluated, it was observed that different scenarios were graded with the same scores or some scenarios were not scored in terms of the curiosity levels. Accordingly, the data obtained based on the answers given by 43 students about the curiosity levels towards the scenarios in the questionnaire was excluded from the analysis. The research sample consisted of 425 5th grade students (196 girls, 229 boys) who studied at six different state schools in Bartın in the spring term, 2015-2016. Students’ level of curiosity was determined for every problem scenario prepared within the scope of each objectives and opinions were taken from students studying at different schools (scenarios prepared within the framework of the objectives no 5.3.3.1. were applied in two different schools). Of all the students, 46.1% of them were girl, whereas 53.9% were boy.

All of the students participating in the study were volunteers. The sample was selected according to the fit-for-purpose sampling technique, which is among non-random sampling techniques (Fraenkel & Wallen, 2006; p.99). To this end, accessibility between the researchers and the students involved in the survey and students’ suitability to the purpose of the study were taken into account. Table 1 shows how many students were included in each group to which problem scenarios prepared within the scope of each objectives were administered.

**Table 1. Demographic Information**

Objectives	Number of prepared scenarios	The number of participants		
		Girl(f)	Boy(f)	Total (f)
5.3.1.1	S1-S13	50	44	94
5.3.2.1	S14-S20	44	49	93
5.3.3.1	S21-S26	21	48	69
5.3.3.2	S27-S32	47	29	76
5.3.4.1 ve 5.3.4.2	S33-S40	34	59	93
Total		196	229	425

S1= Scenario-1; S40= Scenario-40

### Data Collection Tools

In the context of the study, a questionnaire- determining the curiosity levels- was used to reveal the curiosity levels of the 5th grade students towards problem- scenarios, which have been prepared for the “Matter and Change” unit. The questionnaire was prepared by the researcher separately taking each objective into consideration. The questionnaire involves the names of the problem scenarios prepared within the context of each objective and how the students rated the levels of curiosity towards the problem scenarios. Besides, experts who science education were consulted during the preparation of the questionnaire. Science education experts expressed their views about the face validity of the questionnaire.

### Procedure

The preparation process of problem scenarios was carried out in the elective course given by the researcher. The elective course called Problem-Based Learning and Scenario Writing in Science Education had been carried out by the researcher two hours a week for 14 weeks. The scenarios were prepared on the basis of six objectives mentioned under the “Matter and Change” unit, which is taught at the 5th grade science classes. Much attention was paid on the scenarios to make sure that they were designed in such a way that involved objectives no 5.3.4.1 and 5.3.4.2, jointly. 40 separate scenarios were written for each of the other objectives. 15 prospective teachers who took the class worked in groups of 2 to 4 during the scenario preparation process. Other groups and faculty members were consulted by each group for their opinions about the scenarios. In accordance with the suggestions, necessary amendments were completed to improve the scenarios. The scenarios that did not conform with the objectives or that were not prepared in line with the level of students were excluded from the questionnaire.

In the scope of the “Matter and Change” unit, item no “5.3.1.1: The students do experiments about the change of state with the influence of heat, and make inferences based on what they obtain from the experiment (It is explained that liquids evaporate in every temperature; however, they boil at certain temperatures to reveal the main difference between evaporation and boiling)”, 13 scenarios (S1-S13) were prepared by all groups. One of the 13 scenarios prepared about the change of state is given as follows:

#### S4. Vapour trails

On hearing a very loud noise, Emre turns his head up to the sky perplexedly. Even though he has seen a plane before, it is the first time he has seen the vapour trails so clearly. It looks as if a kite was to the earth with a white ribbon on its tail. Then his father comes up him to see his bedazzled son who is gazing the trails along the horizon. A couple of questions comes to Emre’s mind.



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to

- How can a plane leave such a white trail behind? What is the reason for these trails?

Key words: Deposition

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This scenario was prepared to set an example for the situations in which PBL method could be chosen among the active learning methods in teaching 5th grade students the concept of deposition, which is one of the changes of state.

Seven scenarios (S14-S20) were prepared in the scope of the objective “5.3.2.1: The students determine the melting, freezing and boiling points, which are discriminatory features of pure substances, as a result of the experiments they have conducted.” The following scenario can be set as an example as one of the problem scenarios prepared for this objective.

#### S16. Why was it not frozen?



A hot summer day, Ahmet and his father sit in the living room. Ahmet heads to the kitchen to drink some cold fruit juice. Seeing this, his father also asks him to bring a glass of cold water. When Ahmet gets to the kitchen, he sees that the fruit juice and water is on the counter. He pours the fruit juice and water into identical glasses with similar amounts and puts them into the freezer to make them cool faster. After a while, on opening the freezer he finds that the fruit juice is cold but water has got frozen. Ahmet does not understand the reason why one of the two liquids has got frozen while the other has not, though both liquids are the same amount contained in similar glasses.



one

- How would you explain it to Ahmet?

Key words: Freezing point, pure substances and impure substances

On the other hand, six scenarios (S21-S26) were prepared for the following objectives: “5.3.3.1: The students explain the fundamental differences between heat and temperature”. Six scenarios (S27-S32) were prepared in the scope of the objective “5.3.3.2: The students do experiments to observe that there is a heat exchange as a result of mixing the liquids with different temperatures, and interprets their results”.

Finally, eight PBL scenarios (S33-S40) were written to involve the following objectives jointly, “5.3.4.1: The students do experiments to observe that substances expand and shrink with the influence of heat and discusses the results” and “5.3.4.2: The students realize the relationship between expansion and shrinking with examples from daily life.” The following scenario can be set as an example for problem scenarios prepared according to the above-mentioned objectives.

#### S36. The apprentice guitarist

Yusuf has bought a beautiful guitar for his son, whose birthday be celebrated within hours. Yusuf gives his son, Eren his gift when he home in the evening. After the birthday party, Eren starts to open his excitingly. Finally, he opens his father’s gift and likes it very much. leans his new guitar on the heater right next to his bed, and falls asleep. When he gets up in the morning, he finds that all strings have become loose, lost their tension and accord. He decides to figure it out.



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- What do you think is the reason for this?
- How could the heater core have affected the guitar’s strings?
- What would happen if we put the guitar in a cold place?

Key Words: Shrinking and Expansion

This scenario has been prepared to make sure that the concepts of expansion and shrinking could be better understood. The names of the scenarios prepared in line with this objective and other objectives can be found in the results section.

It took 12 weeks to prepare the problem scenarios for all objectives, after which the curiosity levels of the 5th grade students were determined by using the scenarios. This procedure took about two weeks. The scenarios prepared for each objective are presented to the students in their own classroom or laboratory. Projectors were used in the presentation of the scenarios. In addition, scenarios were read by science teachers to the students. Students are asked to think after you read scenarios. A questionnaire- determining the curiosity levels- distributed to students. When students fill out the questionnaires, they are asked to evaluate the scenario in which the solution is most the curiosity with the highest score and the least curiosity with the lowest score (If 13 problem scenarios are prepared on the basis of the related objectives, the least curiosity scenario is 1 point and the most curiosity scenario is 13 point). A different number of scenarios were presented for each student group (See table 1).

### Data Analysis

The curiosity level of the scenarios prepared in the 5.3.1.1 objectives varies between 1 and 13 point. The curiosity level of the scenarios prepared in the 5.3.2.1 objectives varies between 1 and 7 point. The curiosity level of the scenarios prepared in the 5.3.3.1 and 5.3.3.2 objectives varies between 1 and 6 point. The curiosity level of the scenarios prepared in the 5.3.4.1 and 5.3.4.2 objectives varies between 1 and 8 point. The data obtained was analysed with the descriptive analysis technique from quantitative data analysis techniques. Frequency and mean values were calculated. In addition, pearson-correlation analysis technique was used in order to determine the effect of gender on the curiosity levels towards the problem scenarios.

### Results

13 problem scenarios (S1-S13) were prepared with the assistance of prospective teachers in the framework of the objective expressed as “The students do experiments to observe that matters can change with the effect of heat, and interprets based on the data they obtained”. A descriptive analysis was conducted on the level of curiosity of 94 fifth grade students towards the prepared scenarios, and the results are presented in Table 2.

**Table 2. The Curiosity Levels Towards the Scenarios Prepared For The Change of State in Matter**

Scenarios	Minimum (f)	Maximum (f)	M
S1. The water in the bathroom	24	1	5.13
S2. If not snow then what?	6	2	5.55
S3. Science laboratory	6	5	6.19
S4. Vapour trails	1	11	7.40
S5. Tomato	11	2	5.54
S6. Flying perfume	3	1	6.44
S7. Arda's uniform	6	6	7.24
S8. Birol's excitement	7	6	7.29
S9. Water in the air	6	1	6.96
S10. Ice-cream journey	4	17	9.25
S11. Drying clothes	16	2	6.74
S12. Curious Ahmet	4	10	7.85
S13. Coloured water	6	30	9.36

When Table 2 is examined, it was observed that fifth-grade students found the problem scenario called "S13. Coloured water is the most curiosity-arousing scenario (f = 30; M= 9.36) among the 13 problem scenarios. “Ice-cream journey” (f=17; M=9.25) and “vapour trails” (f=11; M= 7.40) scenarios were also found by the fifth-grade students to be among the most curiosity-arousing scenarios. It is understood that “the water in the bathroom” (f=1; M=5.13) scenario did not attract students' attention.

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Seven problem scenarios (S14-S20) were prepared with the assistance of prospective teachers in the scope of the objective expressed as “The students determine the melting, freezing and boiling points, which are discriminatory features of pure substances, as a result of the experiments they have conducted.” A descriptive analysis was conducted on the obtained levels of the curiosity levels towards the prepared scenarios by 93 fifth grade students, and the results are presented in Table 3.

**Table 3. The Curiosity Levels Towards the Scenarios Prepared For The Discriminatory Features of Pure Substances**

Scenarios	Minimum (f)	Maximum (f)	M
S14. Snowman and rabbit	28	17	3.46
S15. Curiosity of the frozen lake	13	6	3.83
S16. Why was it not frozen?	12	7	3.79
S17. Non-frosted cologne	6	21	4.59
S18. Alcohol or water?	8	8	4.05
S19. A winter day in Erzurum	9	18	4.24
S20. Thermal water	17	16	4.01

Table 3 shows that among the seven problem scenarios, the problem scenario called . “Non-frosted cologne” was found to be the most curiosity-arousing scenario (f = 21; M= 4.59) in terms of its solution among the fifth-grade students. Another problem scenario called “A winter day in Erzurum” (f=18; M=4.24) was also observed to be one of the most curiosity-arousing scenarios for the fifth-grade students. The problem scenario called the “curiosity of the frozen lake” (f=6; M=3.83) did not seem to be attracting students’ attention.

Six problem scenarios (S21-S26) were prepared with the assistance of prospective teachers on the basis of the objective expressed as "The students explain the fundamental differences between heat and temperature". A descriptive analysis was performed on the data obtained for the levels of curiosity among 69 fifth-grade students, and the results are presented in Table 4.

**Table 4. The Curiosity Levels Towards the Scenarios Prepared For Differences Between Heat and Temperature**

Scenarios	Minimum (f)	Maximum (f)	M
S21. Fill in the blanks	27	4	2.49
S22. Cold skin	7	10	3.44
S23. Picnic	6	15	3.91
S24. Documentary	7	20	4.34
S25. Heat or temperature?	2	13	3.78
S26. Coffee pot	20	7	2.97

Table 4 shows that among the six problem scenarios "Documentary" was found to be the most curiosity-arousing scenario (f = 20; M= 4.34) by the fifth-grade students in terms of its solution. The scenarios called “picnic” (f=15; M=3.91) and “heat or temperature” (f=13; M=3.78) were also observed to be one of the most curiosity-arousing scenarios among the fifth-grade students. It is understood that the scenario called “fill in the blanks” (f=4; M=2.49) did not attract students’ attention.

Six problem scenarios (S27-S32) were prepared with the assistance of prospective teachers in the framework of the objective expressed as “The students do experiments to observe that there is a heat exchange as a result of mixing the liquids with different temperatures, and interprets their

results". A descriptive analysis was conducted on the level of curiosity of 76 fifth-grade students towards the prepared scenarios, and the results are presented in Table 5.

**Table 5. The Curiosity Levels Towards the Scenarios Prepared For Heat Exchange**

Scenarios	Minimum (f)	Maximum (f)	M
S27. Mehmet's Breakfast	34	---	2.26
S28. A hot summer day	6	2	3.35
S29. The water in the bathroom	7	6	3.60
S30. Watermelon	3	64	5.59
S31. Tea	13	3	2.86
S32. Cooling food, warming water	13	1	3.31

Table 5 shows that among the six problem scenarios, the problem scenario called . "Watermelon" was found to be the most curiosity-arousing scenario (f=64; M= 5.59) in terms of its solution among the fifth-grade students. On the other hand, the problem scenario called "Mehmet's breakfast" (f=0; M=2.26) did not attract students' attention.

Finally, eight problem-based scenarios (S33-S40) were prepared with the assistance of prospective teachers in the framework of the objective expressed as "The students do experiments to observe that substances expand and shrink with the influence of heat, and discusses the results" and "The students realize the relationship between expansion and shrinking with examples from daily life". A descriptive analysis was performed on the data obtained for the levels of curiosity among 93 fifth-grade students, and the results are presented in Table 6.

**Table 6. The Curiosity Levels Towards the Scenarios Prepared for Expand and Shrink**

Scenarios	Minimum (f)	Maximum (f)	M
S33. Balloon tour	25	8	3.50
S34. Spectacle glasses	25	6	3.36
S35. A car tyre	2	28	5.68
S36. The apprentice guitarist	9	9	4.15
S37. Termtime	4	10	4.69
S38. Elif's weekend adventure	8	14	4.81
S39. Playing thermometer	7	3	4.73
S40. Cemil's weekend	13	15	5.04

Table 6 shows that among the eight problem scenarios, the problem scenario called " A Car Tyre" was found to be the most curiosity-arousing scenario (f=28; M= 5.68) in terms of its solution among the fifth-grade students. Similarly, "Cemil'sweekend" (f=15; M=5.04) and "Elif's weekend adventure" (f=14; M=4.81) were also found to be among the most curiosity-arousing scenarios among students. On the other hand, the problem scenario called the "spectacle glasses" (f=6; M=3.36) did not seem to attract students' attention.

The secondary question of the research was whether there any effects of gender on the 5th grade students' the curiosity levels towards the problem scenarios. Pearson correlation analysis was conducted to identify the effect of gender in terms of students' the curiosity levels towards the problem scenarios. The data obtained are given in Table 7.

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**Table 7. Pearson Correlation Analysis for The Effect of Gender on Students’ Curiosity Levels**

Objectives 5.3.1.1	Gender	Objectives 5.3.2.1	Gender	Objectives 5.3.3.1	Gender	Objectives 5.3.3.2	Gender	Objectives 5.3.4.1 and 5.3.4.2	Gender
S1	-.374**	S14	.022	S21	-.052	S27	.163	S33	.011
S2	-.208*	S15	-.083	S22	-.031	S28	.059	S34	-.045
S3	-.182	S16	-.036	S23	.023	S29	-.184	S35	.339**
S4	-.095	S17	-.082	S24	.244*	S30	.019	S36	-.169
S5	.038	S18	-.056	S25	-.034	S31	.165	S37	-.199
S6	-.036	S19	.232*	S26	-.154	S32	-.202	S38	-.002
S7	.231*	S20	-.025					S39	-.128
S8	.266**							S40	.142
S9	.145								
S10	-.152								
S11	.183								
S12	.285**								
S13	-.079								

\*\*Correlation is significant at the .01

\*Correlation is significant at the .05

On observing the results, gender show a statistically significant relationship with students’ the curiosity levels towards the S1 ( $r=-.374$ ;  $p=.000$ ), S2 ( $r=-.208$ ;  $p=.044$ ), S7 ( $r=.231$ ;  $p=.025$ ), S8 ( $r=.266$ ;  $p=.010$ ), S12 ( $r=.285$ ;  $p=.005$ ), S19 ( $r=.232$ ;  $p=.026$ ), S24 ( $r=.244$ ;  $p=.043$ ) and S35 ( $r=.339$ ;  $p=.001$ ). A statistically significant difference was observed in favour of girl students for the scenarios called the “water in the bathroom” and “if not snow then what”, whereas a statistically significant difference was found in favour of boy students for “Arda’s uniform”, “Birol’s excitement” and “curious Ahmet”, “a winter day in Erzurum”, “documentary” and “a car tyre” in terms of the scenarios prepared in the frame of the related objectives.

Girl students’ the curiosity levels ( $N=50$ ;  $M=6.42$ ;  $SD=3.55$ ) is higher than boy students’ the curiosity level ( $N=44$ ;  $M=3.68$ ;  $SD=3.25$ ) towards the problem scenarios called the “water in the bathroom”. Girl students’ the curiosity levels ( $N=50$ ;  $M=6.24$ ;  $SD=3.62$ ) is higher than boy students’ the curiosity level ( $N=44$ ;  $M=4.77$ ;  $SD=3.29$ ) towards the problem scenarios called the “if not snow then what”. On the other hand, boy students’ the curiosity levels ( $N=44$ ;  $M=8.11$ ;  $SD=3.35$ ) is higher than girl students’ the curiosity level ( $N=50$ ;  $M=6.48$ ;  $SD=3.58$ ) towards the problem scenarios called the “Arda’s uniform”. Boy students’ the curiosity levels ( $N=44$ ;  $M=8.25$ ;  $SD=2.98$ ) is higher than girl students’ the curiosity level ( $N=50$ ;  $M=6.46$ ;  $SD=3.50$ ) towards the problem scenarios called the “Birol’s excitement”. Boy students’ the curiosity levels ( $N=44$ ;  $M=9.00$ ;  $SD=3.56$ ) is higher than girl students’ the curiosity level ( $N=50$ ;  $M=6.84$ ;  $SD=3.73$ ) towards the problem scenarios called the “curious Ahmet”. Boy students’ the curiosity levels ( $N=49$ ;  $M=4.69$ ;  $SD=2.02$ ) is higher than girl students’ the curiosity level ( $N=44$ ;  $M=3.75$ ;  $SD=1.97$ ) towards the problem scenarios called the “a winter day in Erzurum”. Boy students’ the curiosity levels ( $N=48$ ;  $M=4.60$ ;  $SD=1.51$ ) is higher than girl students’ the curiosity level ( $N=21$ ;  $M=3.76$ ;  $SD=1.67$ ) towards the problem scenarios called the “documentary”. Boy students’ the curiosity levels ( $N=59$ ;  $M=6.25$ ;  $SD=2.06$ ) is higher than girl students’ the curiosity level ( $N=34$ ;  $M=4.70$ ;  $SD=2.13$ ) towards the problem scenarios called the “a car tyre”.

When the determination coefficients ( $r^2$ ) are examined, gender explained about 13.9% ( $r=-.374$ ;  $r^2=.139$ ) of the change in the students’ the curiosity levels towards the S1, 11.4% ( $r=.339$ ;  $r^2=.114$ ) of the change in the students’ the curiosity levels towards the S35, 8.1% ( $r=.285$ ;  $r^2=.081$ ) of the change in the students’ the curiosity levels towards the S12, 7.0% ( $r=.266$ ;  $r^2=.070$ ) of the change in the students’ the curiosity levels towards the S8, 5.9% ( $r=.244$ ;  $r^2=.059$ ) of the change in the students’ the curiosity levels towards the S24, 5.3% ( $r=.231$ ;  $r^2=.053$ ) of the change in the students’ the curiosity levels towards the S7, 5.3% ( $r=.232$ ;  $r^2=.053$ ) of the change in the students’ the

curiosity levels towards the S19 and 4.3% ( $r=-.208$ ;  $r^2=.043$ ) of the change in the students' the curiosity levels towards the S2.

## Discussion

In this research, the problem situation under discussion is the levels of curiosity among students towards the problem scenarios prepared within the scope of the, "Matter and Change" unit, taught according to the fifth-grade curriculum. Within the scope of the research, many scenarios were prepared within the framework of the "Matter and Change" unit in the fifth-grade curriculum, and the levels of curiosity of students towards the problem scenarios were determined in a large sample group. The problem scenarios called the "coloured water", "non-frosted cologne", "documentary", "watermelon" and "a car tyre" were found to be the most curiosity-arousing scenarios, whereas the "water in the bathroom", "the curiosity of the frozen lake", "fill in the blanks", "Mehmet's breakfast" and "spectacle glasses" were found to be the least attractive scenario samples. In the study conducted by Serin (2009), the needs analysis was made in the course of the development of the scenarios addressing the interests of the 8th grade students under the Unit- Pressure. It was concluded that students were more interested in health-related subjects.

Another question that needs to be answered within the scope of the research is whether gender influences the level of curiosity towards the scenarios prepared within the scope of each objective of fifth grade students. It has been found out that gender has a significant effect on students' curiosity levels about the solution of some scenarios. It has been found out that there is a significant difference in favour of boys in the scenarios ("Arda's uniform", "Birol's excitement" and "curious Ahmet", "a winter day in Erzurum", "documentary" and "a car tyre") prepared in the framework of the objectives, especially in the cases related to cars and, football, whereas there is a statistically significant difference in favour of girl students in the scenarios ("water in the bathroom" and "if not snow then what") prepared for water and changes of state in water. This can be interpreted as indicative of the fact that boys are interested in cars and football. No studies have been found to determine whether there is any effects of gender on the 5th grade students' the curiosity levels towards the scenarios.

According to Campbell, (2000), one of the most important factors affecting the success of PBL is that the problem scenarios are based on real life conditions and the other one is the extent of curiosity towards the scenarios. If the problem situations presented in the scenarios do not fit the students' daily lives and experiences, they will reduce their willingness to solve problems (Conger, 2001). Students enjoy meeting real life problems, and teachers' use of real-life situations in the preparation process of problem situations increases their interest (Cerezo, 2000).

## Conclusion

The difference in the level of curiosity of boy and girl students towards some scenarios is suggested as an issue that researchers who would like to do research on this issue and teachers who implement/will implement PBL applications in their classes should pay attention. In addition to this unit, ready-made PBL scenarios, whose levels of curiosity have already been determined, are presented for researchers and teachers who would like to do experimental work within the framework of this study. The results of this study are limited to determining whether there are effects of gender on the 5th grade students' the curiosity levels towards the scenarios prepared within the scope of the "Matter and Change" unit. The reasons for the sense of curiosity towards the scenarios can be revealed by data collection techniques such as interviews with students. It is also suggested that the levels of curiosity towards the scenarios to be prepared at different grade levels and within different units should be supported by larger sample groups.

## Acknowledgements

I would like to thank each of the 15 prospective teachers for their contribution to the elective course "Problem-Based Learning and Scenario Writing in Science Education" during the 2015-16 academic year spring semester.

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## Geniştirilmiş Özet

### Giriş

Bu çalışmada beşinci sınıf düzeyinde madde ve değişim ünitesi kapsamında problem senaryoları hazırlanarak senaryoların öğrenciler tarafından merak edilme düzeyleri belirlenmeye çalışılmıştır. Bahsi edilen ünite kapsamında 5 adet kazanım bulunmakta olup, bu kazanımlar maddenin hal değişimleri olan erime, donma, buharlaşma, yoğunlaşma, süblimleşme ve kırılgılaşma anahtar kelimelerini içermektedir. Ayrıca ısı ve sıcaklık, ısı alış veriş, kaynama, genleşme ve büzüşme gibi anahtar kavramlarda bu ünite kapsamında ele alınmaktadır. Alan yazın çalışmaları incelendiğinde buharlaşma ile kaynama ve ısı ile sıcaklık kavramlarının birbirleri yerine kullanıldığı, buharlaşma, yoğunlaşma, buhar basıncı, buharlaşma hızı ve kaynama kavramlarının her öğrenim düzeyindeki öğrencide kavramsal düzeyde öğrenilmediği (Johnson, 1998; Chang, 1999; Pınarbası & Canpolat, 2003; Gopal, Kleinsmidt, Case & Musonge, 2004; Costu & Ayas, 2005; Canpolat, Pınarbası & Sozibilir, 2006; Canpolat, 2006) ve öğrencilerin ısı ve sıcaklık kavramlarını anlamakta ve ayırt etmekte zorlandıkları (Başer & Geban, 2005; Carlton, 2000; Zacharia, Olympiou & Papaevripidou, 2008) ifade edilmektedir. Kimyanın en temel kavramlarından maddenin hal değişimi konusu kapsamındaki kavramların kavramsal düzeyde öğrenilememiş olması ileri düzeydeki kavramların anlaşılabilirliği açısından temel teşkil edecektir. Bu durum çalışmanın öneminin gerekçesi olarak değerlendirilmektedir.

Fen eğitiminde öğrenmeyi etkileyen pek çok faktör vardır. Bu faktörlerden biri de merak duygusudur. Merak duygusu öğrenmenin ön koşuludur (Carlin, 1999). Günlük yaşamda karşılaştığımız pek çok olayın bizim merakımızı çekebilme potansiyeli vardır. Meraklı insanlar soru sorar ve soruların cevaplarını bulmaya çalışırlar. Gökyüzünde uçan bir uçağın arkasında bıraktığı iz nedir? Sıcak hava balonları nasıl çalışır? Kalorifer peteğinin yanına bırakılan gitarın teller neden gevşer? Termometredeki civa seviyesi neden düşer veya yükselir? Kolonyayı vücudumuza sürdüğümüzde neden serinlik hissi verir? Kış aylarında benzinli arabalar, mazotlu arabalara göre neden daha kolay çalışır? Bu gibi sorular öğrencilerin dikkatini çeker ve meraklarını uyandırır. Öğretim süreciyle öğrenci merakını ilişkilendirmek önemlidir. Literatürde cinsiyet (Harty and Beall, 1984) ve sınıf düzeyi (Campell, 1972) ile öğrencilerin merak düzeyleri arasındaki ilişkinin incelendiği araştırmalar vardır. Bir başka çalışmada ise öğrencilerin merak düzeyleri ile başarı düzeyleri arasındaki ilişki incelenmiştir (Harty, Beall & Scharmann, 1985). Bu araştırma da ise üzerinde durulacak problem durumu araştırma kapsamında hazırlanan senaryoların öğrenciler tarafından merak edilme düzeylerini belirlemektir. Yukarıda bahsi edilen araştırma problemi çerçevesinde aşağıdaki araştırma sorularına cevap aranacaktır:

- Senaryoların beşinci sınıf öğrencileri tarafından merak edilme düzeyleri nedir?
- Senaryoların merak edilme düzeyleri üzerinde cinsiyetin herhangi bir etkisi var mıdır?

### Yöntem

Araştırma kapsamında hazırlanan senaryoların öğrenciler tarafından merak edilme düzeyleri belirlenmek istenmiştir. Bu amaçla araştırmada nicel araştırma yöntemlerinden deneysel olmayan araştırma desenlerinden ilişkisel araştırma deseninden faydalanılmıştır. Böylece cinsiyetin öğrencilerin merak düzeyleri üzerinde etkisi olup olmadığı belirlenmeye çalışılmıştır.

### Örneklem

Araştırmanın örneklemini Bartın İl Milli Eğitim Müdürlüğü bünyesindeki altı farklı devlet okulunda 2015-2016 öğretim yılı bahar döneminde öğrenim görmekte olan toplam 425 ortaokul öğrencisi oluşturmaktadır.

### Veri Toplama Araçları

Araştırma kapsamında madde ve değişim ünitesi kapsamında hazırlanan senaryoların beşinci sınıf öğrencileri tarafından merak edilme düzeyini belirlemek için senaryoların merak edilme düzeyini belirleme anketi kullanılmıştır.

### **Veri Analizi**

Senaryoların merak edilme düzeylerini belirlemek için kullanılan ankete öğrencilerin verdikleri cevaplardan elde edilen veriler nicel veri analiz tekniklerinden betimsel analiz tekniği kullanılarak analiz edilmiştir. Yüzde, frekans ve ortalama hesaplamaları yapılmıştır. Ayrıca senaryoların merak edilme düzeyleri üzerine cinsiyetin etkisini belirlemek için pearson-korelasyon analizi tekniğinden faydalanılmıştır.

### **Sonuç ve Tartışma**

Araştırma kapsamında beşinci sınıf düzeyinde madde ve değişim ünitesi kapsamında pek çok senaryo hazırlanmış, büyük bir örneklem grubunun ise bu senaryoları merak etme düzeyleri belirlenmiştir. Her bir kazanım çerçevesinde hazırlanan senaryo örneklerinden; renkli su, donmayan kolonya, belgesel, karpuz ve araba lastiği adlı senaryoların en çok merak edilen, banyodaki su, buz tutan gölün merakı, boşlukları dolduralım, Mehmet'in kahvaltısı ve gözlük camı senaryolarının ise en az merak edilen senaryo örnekleri olduğu belirlenmiştir. Serin (2009) tarafından yapılan çalışmada ise basınç ünitesi kapsamında 8. sınıf öğrencilerinin ilgisine hitap eden senaryoların geliştirilmesi aşamasında ihtiyaç analizi yapılmıştır. Öğrencilerin bu ünite kapsamında sağlıklı ilgili olayları daha çok merak ettikleri sonucuna ulaşılmıştır.

Araştırma kapsamında cevabı aranan diğer bir soru ise her bir kazanım kapsamında hazırlanan senaryoların merak edilme düzeyleri üzerinde cinsiyetin etkisinin olup olmadığıdır? Arda'nın üniforması, Birol'un heyecanı, meraklı Ahmet, Erzurum'da bir kış günü, belgesel ve araba lastiği senaryolarında erkekler lehine banyodaki su ve kar değilse ne? senaryolarında ise kızlar lehine cinsiyetin öğrencilerin merak düzeyleri üzerinde anlamlı bir etkisinin olduğu belirlenmiştir. Kazanımlar çerçevesinde hazırlanan senaryolar incelendiğinde özellikle araba ve, futbol, konularıyla ilgili senaryolarda erkekler lehine anlamlı farklılıkların olduğu sonucuna ulaşılmıştır. Bu durum erkek çocuklarının araba ve futbol meraklarının kız çocuklarından fazla olmasının göstergesi olarak yorumlanabilir. Alan yazın çalışmalarında senaryoların merak edilme düzeyleri üzerine cinsiyetin etkisinin olup olmadığını belirleyici herhangi bir çalışmaya rastlanmamıştır.

Campbell, (2000)'e göre PDÖ'nün başarısını etkileyen en önemli faktörlerden biri problem senaryolarının gerçek yaşamdan olması diğeri ise hazırlanan problem senaryolarının öğrencilerin ilgisini çekebilme düzeyidir. Eğer senaryolarda sunulan problem durumları öğrencilerin günlük yaşamlarına ve deneyimlerine uygun olmaz ise öğrencilerin problemleri çözme isteklerinin azalmasına neden olur (Conger, 2001). Öğrencilerin gerçek yaşam problemleriyle karşılaşmaları hoşlarına gider ve problem durumlarının hazırlık sürecinde öğretmenlerinin gerçek yaşam durumlarını kullanmaları onların ilgilerini artırır (Cerezo, 2000).