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Comparison of the 7th Grade Students' Accomplishments in Skill and Acquisition Based Assessment-Evaluation

Ali Kolomuc[1]*, Zafer Karagölge[2]

[1]Faculty of Education, Artvin Coruh University, Turkey
[2]Faculty of Education, Atatürk University, Turkey

*Corresponding Author. alikolomucscr@artvin.edu.tr

ABSTRACT This study compares the successes of numbers 94 7th grade students in science education with assessment-evaluation questions based on skill and acquisition. Assessment-evaluation achievement tests based on skill and acquisition were developed by researchers towards the measurement of force and acquisitions in friction units taking place in the 7th-grade curriculum. While skill-based questions are being prepared, High School Entrance Exam (HSEE) and international exams such as Programme for International Student Assessment (PISA) were developed due to inspiration from Trends in International Mathematics and Science Study (TIMSS) exam questions and acquisition-based assessment and evaluation questions were taken from pre-exam books. It was found that the reliability coefficient for the traditional test is 0.70 and for the skill-based test is 0.72. At the same time, students' opinions were taken to detect students' perspectives against skill and acquisition-based questions after application. According to the statistical results gathered from research, the academic achievements of students who are prepared with the same acquisitions and applied with skill and acquisition-based assessment-evaluation questions were analyzed. It was determined that despite the lack in solving skill-based questions, students were successful in acquisition-based assessment-evaluation. The students' average success in the acquisition-based test was 76 out of a hundred, and the average score in the skill-based test was 44. Besides, it can be considered to extend skill-based questions for Turkey to go beyond successes.

Keywords Science, Context-Based Assessment, Gain Based Assessment, and Assessment, Force and Energy

1. INTRODUCTION

In our rapidly growing information age, countries spend lots of effort increasing science education quality and benefiting from its results (Kaya, Balay & Göçen, 2012). For this reason, while some countries are reviewing their current program and restructuring them in line with developments, others are leading their way to the development of new science programs (Şenel, Çepni, Yıldırım & Er Nas, 2007). In parallel with this purpose, in our country, Primary Education Science Teaching Program that was put into action in 2000 was changed to Science and Technology Teaching Program in 2004-2005 school years. One of the main reasons for this change is the failure of our countries in international exams Ministry of Education (Bakanlığı, 2018); Organisation for Economic Co-operation and Development, 2016). It can be indicated that similar situations are valid for other countries' education systems (Breakspear, 2012; Bonal & Tarabini, 2013; Harus & Davidovitch, 2019; Jürges, Schneider, & Büchel, 2005; Woessmann, 2018). For example, Hopkins, Pennock, Ritzen, Ahtaridou & Zimmer (2008) put forward the idea that PISA has a strong influence on the educational policies of countries such as Honk Kong-China, Spain, Canada, Norway, and Poland. Therefore, countries are giving importance to the skills assessed through PISA. The most important reason for students' failure is the result of the education and evaluation of students. Students can't relate the science and math terms with real life, so they have hard time-solving questions in these exams. Teachers think that current teaching programs do not adequately guide both teachers and students about solving skill-based questions. In this manner, teachers draw attention to the dimensions of assessment-evaluation of Turkish, math, and science teaching programs and remarking that these dimensions contain weaker content compared to the other dimensions of program (Erden, 2020). In both teaching and evaluation process, relating the science topics with real life can lead the success with it in global scale exams at the

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same time, it can increase the quality of teaching and contribute meaningful and long-termed information as well (Bellocchi, King, & Ritchie, 2016; Nentwig, Demuth, Parchmann, Gräsel & Ralle, 2007; Sak & Kaltakçı Gürel, 2018). As a consequence of the change in our countries' programs, our country slowly but indeed starts to climb the steps of success in these exams (PISA, TIMMS).

In Turkey's 2023 Education Vision document, activities about reforming the education system and the purpose of all exams, content, and structure according to question types and their benefit are planned for rearrangement. Moreover, it is aimed to test reasoning, critical thinking, exposition, guessing, and related mind skills (Erden, 2020). In the meantime, it is aimed to switch from an assessment perceptiveness including various concepts, facts, and memorization of formulas to an assessment perceptiveness including basic mind skill quantification (MEB, 2016). Hence, it can be referred that the Ministry of Education took steps in the direction of two goals with the "High School Entrance Exam." Ministry of Education, in its recent year exams, started to concentrate on skill-based questions. When skill-based questions are compared with previous exam questions, significant distinctness can easily be mentioned (Güler & Ülger, 2018). While previous exam questions are asked mostly in the level of knowledge and comprehension (Özden et al., 2014), on the other hand in the high school entrance exam, questions are asked in advance level (Batur, Ulutaş & Beyrut, 2018; Berber & Anılan, 2018; Ekinci & Bal, 2019; Kılkapan & Nacaroğlu, 2019). Within this scope, the Ministry of Education aims at measuring high-level skills such as reading comprehension, exposition, deduction, problem-solving, analysis, critical thinking, and scientific process skills through skill-based questions. Furthermore, it can be stated that questions are being prepared on a hard ground by relating with daily life.

Ministry of Education slowly begins to adapt secondary school students by publishing skill-based questions. Ministry of Education tries to popularize these questions by preparing courses for teachers aiming for skill-based questions. Because of skill-based evaluation methods, educators draw attention to the rise of students' successes in relating their cognitive development through critical thinking, communication, and content with real-life facts. Using skill-based questions in assessment-evaluation activities is quite important from the point of using the information on real-life issues and problem-solving (Elmas & Eryılmaz, 2015; İlhan & Hoşgören, 2017; Sak & Kaltakçı Gürel, 2018). Skill-based questions involve short stories, including reasons for calculations about real objects or facts (Heller & Hollabaugh, 1992). In these short stories, enriched questions from real life, experiences, and attractive issues are directed to students. In this way, when students try to solve by relating the problem with their life or facts under observation, they will be able to look for different solutions while thinking at a high cognitive level and improve their approach toward problem-solving in real life (Rennie & Parker, 1996; Tekbıyık & Akdeniz, 2010).

Science educators also point out different evaluation methods by defining that traditional evaluation tests aren't enough for assessing science education success. Another feature of skill-based assessment and evaluation approaches focuses on high-level cognitive learning and problem-solving skills. Thus, contextual questions measure deeper understanding instead of remembering the information, and this ensures the research of more detailed information about students' learning of the topic (Akpınar, 2012; Ültay & Usta; 2016). While traditional problem necessitates the knowledge's remembrance, the contextual problem requires deeper understanding (Wilkinson, 1999; Ültay & Usta; 2016). In addition to that, students can find contextual problems more interesting and tempt them to solve problems. In educational fields, it was observed that students have more attention to skill-based questions. It was observed that students with less attention to class try to answer skill-based questions.

As it is seen in the previous researches, both teachers and candidate teachers are insufficient for the use of skill-based questions. When the literature was examined, limited researches were obtained related to skill-based evaluation. This research aimed to compare students' academic achievement by developing skill-based and acquisition-based evaluation questions appropriate with the same acquisitions of the topic "force and energy" found in science education course program. In continuation of the research, students' views were taken to detect their perspectives against skill-based questions. It was considered that this research would contribute to the field and fill the gap in the assessment and evaluation field.

2. METHOD

2.1. Sample

The Sample of this research was 94 students studying in 7th grade in Artvin, a small province situated in the northeastern part of Turkey. Among the respondents, 54 were female, and 40 were male. The socioeconomic conditions of students are at a medium level, and the average age was 13.

2.2. Conducted researches

In this research, while skill-based questions were developed by the inspiration from SBS, PISA, TIMMS, and postgraduate students, as for traditional assessment and evaluation questions, they were developed by investigating high school entrance exam (HSEE) books. Postgraduate students developed Skill-based questions, and pilot studies gave their final shape. While preparing the tests, 20 pieces of the same subject were prepared for the same gains. The same teacher gave the subject to all classes, and after the end of the subject, the students were given an exam. The students had not seen the exam questions before, and it was their first time in the exam. Acquisitions of skill-based and

Table 1 Learning outcome of the subject

Learning outcome	Name of the subject
1. Measurement of Force	
1.1. It measures the magnitude of force by a dynamometer. Newton (N) is used as the absolute unit of force.	
1.2. It designs a dynamometer by using simple devices.	
2. Friction Force	**Measurement of Force and Friction**
2.1. It gives Daily life examples of friction force.	
2.2. It explores by experience the movement effect of friction force in various places. Experiments are done about the movement effect of friction force in rough and slippery surfaces.	
2.3. It generates new ideas about increasing or decreasing friction in daily life.	

Table 2 Success rates in students' tests

Classes	Context-Based Assessment Success rates (%)	Traditional assessment Success rates (%)
A	44	76

Table 3 Group statistics

Tester	N	Mean	Std. Deviation	Std. Error Mean	t	p
Traditional Test	94	75.74	18.96	2.76	27.37	.000
Skill Based Test	94	44.04	17.21	2.51	17.54	

traditional assessment and evaluation questions in the test were shown in Table 1. As with the last given shape, the test was investigated under five teachers and five academicians regarding its content validity. This kind of proceedings increases the test's validity and reliability (Çalık & Ayas, 2002; Ayas & Demirbaş, 1997; Peterson & Treagust, 1989). The reliability score of the test was found as 0.72. LGS preparation books prepared traditional assessment and evaluation questions with 20 questions, and the reliability score of this test was found as 0.70. Sample questions suitable for the skill-based assessment questions used in the study are shown in Appendix A. Questions which are appropriate to traditional assessment and evaluation used in the research are given in Appendix B

3. RESULT AND DISCUSSION

As a consequence of skill and acquisition-based tests applied to the students, average points out of 100 based on class were shown in Table 2. According to the statistical process; it was seen in Table 3 that in all classes success rate in the skill-based test was lower compared to the traditional test. According to the independent t-test results, when students' success scores were compared, there was no significant difference between tests. Depending on these results, it was observed that students were less successful in the skill-based test ($p < 0.001$).

3.1. Perspectives of Students toward Skill-based Questions

Another aim of the research was to determine the perspectives of students toward skill-based questions. Findings of students' thoughts in skill-based questions were given in Table 4. When findings were examined, it was seen that students were more successful in traditional tests. When students' opinions about skill-based evaluation questions were examined, between students, additional comments were revealed.

The average time of finishing the acquisition based test was 8 to 9 minutes. For a skill-based test, it was 35 to 40 minutes. Students mostly had difficulty in the skill-based test, but they found the question style entertaining even though the success rate was lower than the acquisition-based test.

The common result of many studies in the literature show that assessment-evaluation deeply affected the learning process (Metin & Demiryürek, 2009; Bellocchi, King, & Ritchie, 2016; Sak & Kaltakçı Gürel, 2018) and when assessment-evaluation activities used properly, it became effective in the direction of increasing learning level and quality of students (Clarke, 2001; Black & William, 2002). In consequence of reformed programs, in several studies related to the application process, it was stated that there becomes a problem in the application of the assessment-evaluation process in terms of time issue and knowledge deficiency. Students expressed the lack of teachers in skill-based assessment-evaluation. S16, S67, S73, and S87 underlined the situation as, in my opinion, these questions are mind-confusing and never seen before. I think these questions are non-sense ". In this sense, it is easy to conclude that teachers didn't use this type of question. Failure of students in skill-based assessment-evaluation can be related to the lack of teachers in this topic. This defect can be fulfilled by taking teachers into seminars about skill-based assessment-evaluation. Thus, it was observed that the Ministry of Education sometimes opened courses about preparing and applying this kind of question. In parallel with this result, in Erden's (2020)

Table 4 Perspectives of students toward skill-based questions

Students	Students' thoughts about skill-based questions
S2, S25	Skill-based questions were difficult. Acquisition based tests were much more comfortable.
S34, S63	In my opinion, skill-based questions were much more difficult.
S9, S17, S78	The acquisition-based test was easy. I liked both tests.
S33,S49	Questions are right in this way. Interpretation questions being integrated with knowledge questions are excellent to begin. Even interpretation questions should be increased in number.
S22, S64	The acquisition-based test was easy and knowledge-focused. Skill-based questions compelled me a little bit, and it was more interpretation less knowledge involved.
S22, S64	The acquisition-based test was easy and knowledge-focused. Skill-based questions compelled me a little bit, and it was more interpretation less knowledge involved.
S41, S49 S55, S79	I think this kind of question should be asked, both good for interpretation and visual quality.
S5, S37	Questions were strange, straightforward, and surprising. In these questions, the possibility of making a mistake is very high. These questions are mind-confusing and never seen before. In this test, more logic and calculation were seen. In my opinion,
S84	All of the questions were interpretational and figurative. However, questions were asked straightforwardly. Thus we need to know the topic thoroughly.
S5, S78 S83, S86	Questions are both interpretational and knowledge-focused. I think they were right.
S77, S89	Questions were comfortable but needed lots of attention. We solve questions with many operations. However, in this test, there was none.
S2, S21, S33,S43	I think skill-based questions were so simple, but I always fail at straightforward win at difficult questions. I liked the exam very much, and the acquisition-based questions were easy. Questions can be qualified, but a form of asking was what I didn't like. Questions were right nonetheless.

study, teachers found course books inadequate for not including the recent topics, being simple at theme evaluation, not having rich visual content, and being inadequate to prepare students for LGS (Çarkıt, 2019). Conducted researches state that students also want to see lecturing and tests in coursebooks toward central exams (Fidan, 2018). According to Kutlu (2018) and ERG (2019), the quality of questions placed in coursebooks is confronted as one of the education issues in today's world.

In teaching science education concepts within structural learning, one of the most important aims is to help students develop an understanding at a conceptual level and make them use them in new situations (Çalık, 2003; Ward & Herron, 1990). Solving mathematical and formula-based questions may not prove that students understand the concept (Prima, Putri & Rustaman, 2018). The solution to some problems may end up at the final of instrumental learning (Ayas, Çepni, Johnson & Turgut, 1997; Çepni, 2019). Therefore, questions should be given which involve numerical operations to a bare minimum to improve students' scientific discernment and give prominence to concept teaching. When viewed from this aspect, numerical operations weren't given in the skill-based assessment-evaluation test. As students coded as S33, S49, S22, S64 mention, "Questions are good in this way. Interpretation questions being integrated with knowledge questions are excellent, to begin with. Even interpretation questions should be increased in number. The acquisition-based test was easy and knowledge-focused. Skill-based questions compelled me a little bit, and it was more interpretation less knowledge involved" in their sayings, it also matches with the aspect above. In this way, the problem-solving and scientific discernment skills of students will burst into prominence. Depending on the skill-based test development, it was paid attention to whether students can build a bond between daily life experiences and microscopic level of events. Hence, systems including the microscopic level of demonstrations were given in the test. When students can revive microscopic operations in sciences, they can structuralize the knowledge more meaningfully and maintain the learning permanently. Also, they can easily conceptualize other knowledge types and build an appropriate bond between them. As it is known, to detect the actions in science, macroscopic, microscopic, and symbolic levels are used (Özmen, Ayas & Coştu, 2002; Maulidah & Prima, 2018; Kızkapan & Nacaroğlu, 2019; Çepni, 2019). Actions under the macroscopic process are direct observations of students. Science actions at a microscopic level are explained using molecules, atoms, theoretical concepts, and models. Science actions under symbolic level are shown with symbols, numbers, formulas, equations, and structures (Özmen, Ayas & Coştu, 2002; Güler & Ülger, 2018; Batur, Ulutaş & Beyrut, 2018). Thus for understanding a concept

adequately, it is necessary to develop a connection according to these three levels. When considered from this point, students' failures in questions prepared according to skill-based assessment-evaluation methods are higher than usual because of the traditional education they take. Students raised under traditional education have their assessment-evaluation with traditional tests. Result in this, the reason for staying at the bottom of international exams such as PISA and TIMMS is traditional assessment-evaluation. One of the failures is that they face this kind of questions for the first time (Ö16, Ö67, Ö73, and Ö87) (Table 4). Also, it can be related to the lack of application teachers possess for a skill-based assessment-evaluation topic.

4. CONCLUSION

This study aims to prepare skills and acquisition-based assessment and evaluation questions suitable for the same gains of the "force and energy" unit in the science course program and compare students' academic achievements in these tests. Another aim of the study is to determine the thoughts of the students about skill-based questions. When looking at the results of two different tests applied to students to compare their academic achievements in the tests, the students' moderate success in the acquisition-based test was 76 out of 100, and the average score in the skill-based test was 44. According to these outcomes, the students' success rate in the skill-based test was found to be lower. For the students' thoughts about skill-based questions, students' opinions are recorded and shown in Table 4. The students' opinions stated that they had just encountered skill-based questions (S16, S67, S73, S87) (Table 4). One of the reasons students fail the skill-based test can be attributed to their new encounters with questions. When results gained from the test and application are considered, there are suggestions for fulfilling the purpose of planning the education being more systemized.

Rather than teaching based on mathematical operations and formulas, concept teaching should be brought front to understand the courses better. A thus more in-depth understanding of concepts by students can be provided. Questions related to concept studies in the data collection tool can be provided clear enough to qualify microscopic thinking and intellectual discernment. By applying skill-based assessment-evaluation questions into other units, teachers can be resourceful in terms of assessment-evaluation. Furthermore, teachers can be taken into seminars about the assessment-evaluation topic to be informed about skill-based assessment-evaluation.

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