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Investigation of middle school teachers' open-ended question writing skills

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Abstract

In this study, the skills of middle school teachers to write open-ended questions that measure higher-order mental skills were examined. For this purpose, 18 middle school teachers who worked in Artvin, Turkey and volunteered to participate in the study were asked to write questions. Teachers wrote open-ended questions for a total of 4 courses (Sciences, Mathematics, Turkish, and Social Studies) in accordance with the specified outcomes. In the study designed in the document review pattern of qualitative research methods, questions were analyzed using an evaluation form. As a result of the evaluations, it was observed that teachers were more concerned with the content dimension of the outcomes while writing questions but disregarded the cognitive level of the outcome. It was also found that teachers were inadequate in terms of language and expression in all branches, showed a tendency to copy questions from a source, or could not move away from the question writing style they adopted. However, it was determined that there were especially expression errors, subject-verb agreement problems, and punctuation marks were not used correctly in the questions written.

Keywords: Higher order thinking skills, In-class measurement and evaluation, Open-ended question, Assessment instruments, Question type appropriateness.

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Ethical: This study followed all ethical practices during writing.

Contents

Contribution of this paper to the literature
In Turkey, there are not many studies examining teachers' ability to write open-ended question and higher-order thinking skills. In addition, there is no study related to the review titles discussed in this study. In this respect, it is thought that the study will contribute to the field.

1. Introduction

In the current information era, societies have switched from a teacher-centered to a student-centered approach to education. In this regard, many countries have updated their curriculum and embraced methodologies like the constructivist approach, which places a strong emphasis on learning and the student. In line with the updates and innovations, it is now crucial to link learning outcomes with life skills in the curriculum and to emphasize higher order thinking skills such as reading comprehension, research, questioning, critical thinking and problem solving.

As a result of globalization, education programs in Turkey have also been revised to adapt to the changing world and raise qualified individuals. These changes in the curricula have led to changes in measurement and evaluation activities, which are the controlling elements of education.

The changes reflected in the measurement and evaluation process have gained importance in points such as using various evaluation approaches (written exams, portfolios, performance evaluations with open-ended questions, self-assessment, etc.) that focus more on the process rather than the outcome and vary according to the purpose. In this context, a prominent feature of the renewed primary education programs when evaluated in these two dimensions is the development and measurement of higher-order thinking skills by establishing a connection with daily life (Demirtasli, 2010). Higher-order thinking skills, which is one of the concepts emphasized in the association of questions with life skills is defined as the individual's use of multiple skills in relation to their individual abilities (Kutlu, Doğan, & Karakaya, 2010). Higher-order thinking skills are defined in the new taxonomy, conducted by Bloom and updated under the leadership of Anderson and Krathwohl (2001) as behaviors at the analysis, evaluation, and creation stages. Moreover, Miri, David, and Uri (2007) characterize questions that examine higher-order thinking skills as those involving real-life situations, discussion, problem-solving, critical thinking, and content based on experiences (Zoller et al., 2000). In relation to this concept, one of the emphasized points in the new program is the examination of cognitive levels of questions used in the measurement and evaluation process with appropriate question types.

In the literature, it is emphasized that the use of open-ended questions in measuring higher-order cognitive skills and using information (Badger & Thomas, 1991) is more effective than other question types. Open-ended questions are defined as a question style where students freely answer questions conveyed in a question mode or command mode according to their cognitive levels and writing skills (Erkus, 2006). Brookhart (2015) states that open-ended questions help individuals apply higher-order cognitive skills and provide an environment for expressing their thoughts freely.

Some researchers (Friborg & Rosenvinge, 2013; Hadenfeldt, Bernholt, Liu, Neumann, & Parchmann, 2013) emphasize that one of the most effective assessment and evaluation methods for determining students' mathematical literacy and verbal expression skills, in situations where the desired product needs to be presented by the student, like as problem solving as well as measuring qualities such as creative thinking power, the ability to organize information, and evaluating the internal and external consistency of thoughts is through open-ended questions.

It has been observed that students who were examined by using open-ended questions, have higher awareness about their own learning situations (Cooney, Sanchez, Leatham, & Mewborn, 2004) and that many real-world problems can be measured with this question type (Boaler, 1998). According to O'Neil Jr and Brown (1998), the use of an open-ended question format requires the use of more cognitive strategies and better reveals the learning process.

It is stated that open-ended questions are more advantageous in measuring higher-order thinking skills than other question types (Bahar, Nartgun, Durmus, & Bıçak, 2012), and they allow individuals to present results using their reasoning power and creative thinking skills in solving problems with multiple solutions but lacking information (Akay, Soybaş, & Argün, 2006).

Open-ended questions are an effective type of evaluation for measuring many higher-order cognitive processes, such as critical thinking, problem-solving, and generating new ideas (Wright, 2010). Additionally, open-ended questions reveal different aspects of the feature or achievement to be measured and allow for the development of individuals' writing, speaking, and reading comprehension skills (Hancock, 1995).

There are several points to consider when writing open-ended questions (Cooney et al., 2004). These include:

- Being open to interpretation.
- Providing context.
- Allowing for multiple solution paths, not just a single one.
- Being clear and understandable.
- Using a graded scoring key during the evaluation process.

There are some disadvantages to using open-ended questions in examining school learning alongside their numerous advantages. One of these is that the implementation and scoring of open-ended questions take more time compared to other question types (Dogan, 2013). Additionally, if this question type is not well-prepared, it can fall short in ensuring content validity (Ozcelik, 2011; Romagnano, 2001). Furthermore, there are disadvantages in an exam composed of open-ended questions such as effective time usage, limited number of questions, and scoring objectivity (Atılgan, 2004; Kan, 2013).

Given the advantages and disadvantages highlighted above, field experts stress that the open-ended questions used to measure higher order thinking skills in educational institutions should be written correctly. Therefore, this study aimed to examine the open-ended question writing skills of secondary school teachers working in Artvin province used to measure high-level mental skills. To this end, the authors selected previously defined learning outcomes in the curricula for the subjects taught by the teachers who volunteered for the study and asked them to

write appropriate open-ended questions. They then analyzed the questions under four main headings in line with the principles of measurement and evaluation, and sought answers to the following questions:

Questions written by teachers; in the perspective of,

- Language and expression.
- Compliance with the content and cognitive level of the skill to be acquired.
- Relevance to question type.
- Originality.

Are written in accordance with the principles of measurement and evaluation?

2. Method

2.1. Research Model

In this study, middle school teachers were asked to write open-ended questions from a total of 4 courses, namely Sciences, Mathematics, Turkish and Social Studies in accordance with the learning outcomes and the questions were examined by field, language and measurement and evaluation experts in line with measurement and evaluation rules, grammar rules and open-ended question writing principles. This research was designed in the document analysis pattern, which is one of the qualitative research methods. Yildirim and Simsek (2011) defined document analysis as the examination of visual materials containing information about the phenomena or events to be investigated.

In the study designed in qualitative research design, the questions were analyzed by preparing an evaluation form. The results were summarized with graphs.

2.2. Working Group

For this purpose, 20 questions written by 18 teachers who voluntarily participated in the question writing study were analyzed. Table 1 shows the distribution of the teachers who wrote questions and the questions they wrote by courses.

Table 1. Distribution of teachers and the questions they wrote.

Courses	Number of teachers	Number of questions
Turkish	6	6
Science	5	5
Mathematics	5	6
Social studies	2	3
Total	18	20

2.3. Data and Analysis

The data of the study were analyzed using the review form developed by the researcher for the evaluation of teachers' questions. In this form, there are themes of language and expression, conformity to the learning outcome, conformity to the question type and originality. The items under these themes were evaluated by marking "yes" (1) and "no" (0). In the process of analyzing the data.

Each teacher was given the achievements in his/her own field, which are included in the curriculum and allow the measurement of high-level cognitive processes. They were asked to write questions appropriate to these achievements. Some of the achievements given to the teachers are as follows:

- Analyzes and distinguishes types of texts.
- Generates different solutions to problems.
- It makes inferences about the characteristics of its states.
- Discusses the causes and consequences of migration in societies.
- Compare the densities of liquids by experimenting.
- Relates the cause of the refraction of light to the change of environment.
- It poses problems that require four operations.
- Recognizes and associates area measurement units.

Each teacher wrote one or two questions from his/her own field (Science, Mathematics, Turkish and Social Studies) in accordance with the learning outcomes. There were 20 questions in total. The questions were analyzed by two measurement and evaluation experts. In analyzing the data, common points were identified in the evaluations made by the experts and these points were compared with graphs according to the courses.

The harmony between the evaluations of the experts was determined using the Kappa statistics (α). The results are given in Table 2.

Table 2. Evaluation process and kappa statistics results.

Assessment themes	Kappa (α) statistics
Language and expression	0.93*
Eligibility for benefits	0.95*
Question type eligibility	0.97*
Originality	0.92*

Note: *p<0.05.

As a result of the Kappa statistics in Table 2, all themes showed harmony ranging from 0.92-0.97 (p<0.05).

3. Results/Findings

Figure 1 shows the results of the analysis of the questions written by the teachers in terms of *language and comprehension* (Spelling error, poor punctuation, subject-verb mismatch, unnecessary word use, and lack of clarity).

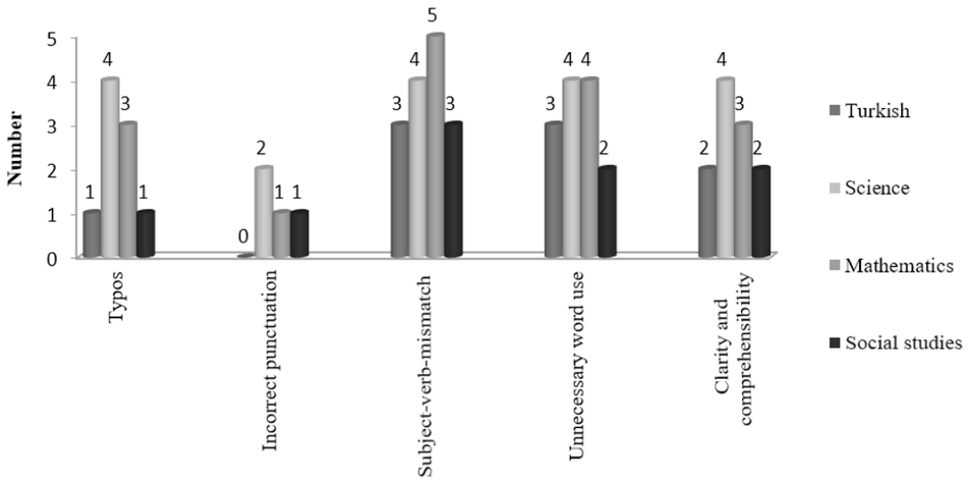

Figure 1. Analysis of questions in terms of language and comprehension.

It can be seen that the vast majority of the questions written by the teachers contain narrative errors. In addition, the experts found almost all of the questions written for science to be unclear and incomprehensible. Most of the teachers paid attention to punctuation. However, most of the science and mathematics teachers made spelling mistakes in their questions. Figure 2 shows the results of the analysis of the teachers' written questions in terms of being appropriate for the required learning outcome.

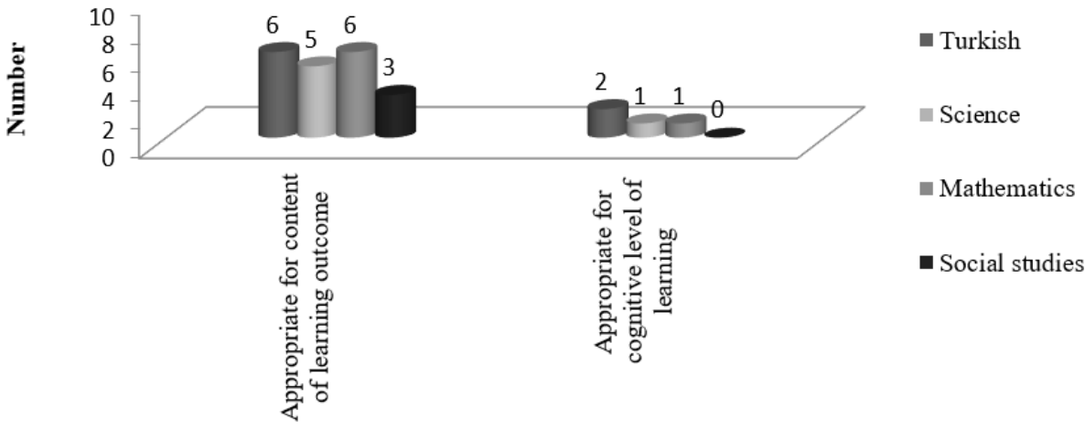

Figure 2. Analysis of questions in terms of learning outcome appropriateness.

While almost all of the questions written by the teachers are appropriate for the learning outcome in terms of content, the number of questions appropriate for the required outcome at a cognitive level is low.

Figure 3 shows the results of the analysis of the teachers' questions in terms of being appropriate for the type of question.

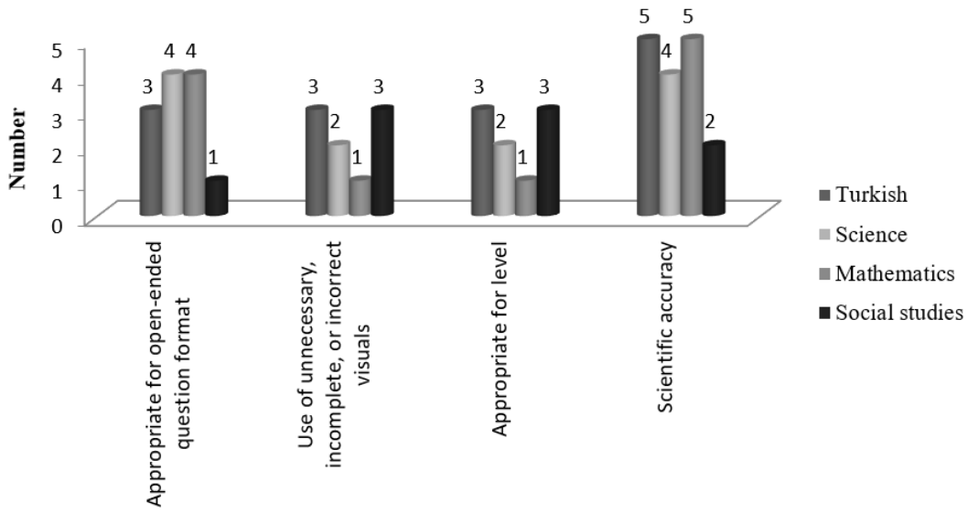

Figure 3. Analysis of questions in terms of being appropriate for the type of question.

The vast majority of the questions written by science and mathematics teachers were not found appropriate for the level. No branch showed any problems in terms of scientific accuracy. Half of the questions written for Turkish and Social Studies used unnecessary visuals.

Figure 4 shows the results of the analysis of the teachers' written questions in terms of originality.

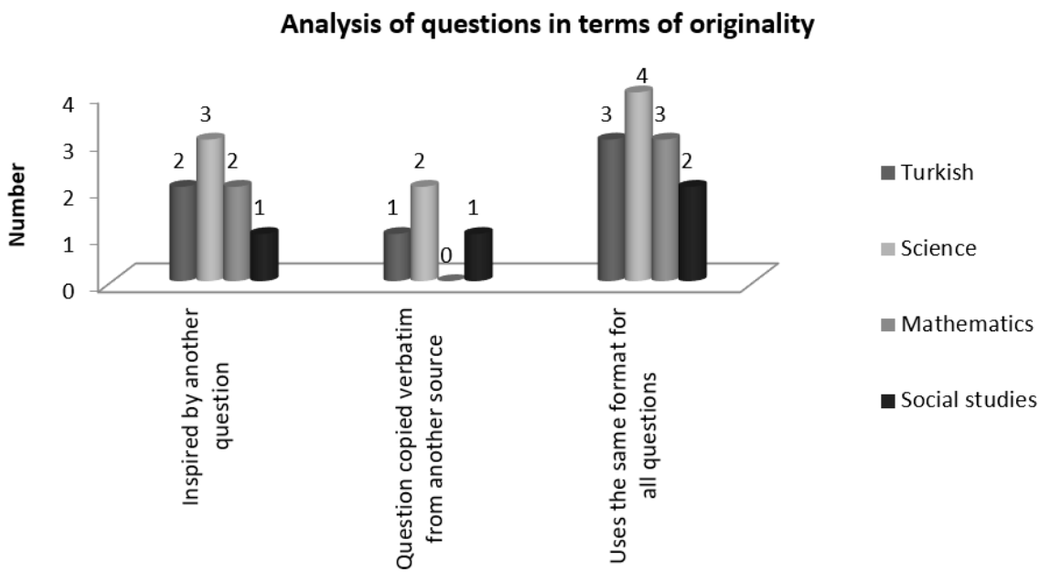

Figure 4. Analysis of the teachers' written questions in terms of originality.

In all branches, it was seen that teachers wrote some of the questions inspired by another question. More teachers in the science branch than in the other branches were found to have copied the questions they wrote from other sources verbatim. Moreover, it was observed that most of the teachers tended to write the questions in the same way.

4. Conclusion and Discussion

As a result of the analysis, it was seen that the teachers were only interested in the content dimension of the learning outcomes while writing questions, but they ignored the cognitive level. In the studies conducted, it is seen that teachers mostly use the first two steps of Bloom's taxonomy, recall and comprehension, when writing questions and do not prefer to write questions that examine higher level cognitive skills (Aslan, 2011; Karaman, 2005). In parallel with these results, Usta (2022) stated in his study that teachers had difficulty in understanding the cognitive levels of the questions and that they had problems in writing questions that associate higher-order cognitive skills with learning outcomes. The relationship between the questions asked and their cognitive levels is very important in the development of students' higher-order thinking skills (Savage, 1998). Therefore, eliminating these deficiencies of teachers is an important point in improving the quality of education.

In the researches (Aydın, 2019; Khan & Inamullah, 2011; Maden & Durukan, 2013), it is seen that teachers generally use exams in which different question types (short answer, multiple choice, open-ended, matching, etc.) are used together in line with a recommendation made by the Ministry of National Education (MEB, 2003) without looking at the cognitive levels of the achievements while writing questions (Özen, 2020). And herein, the use of question types that measure lower-level skills while testing the acquisitions for higher level cognitive skills will cause learning level of the students to be measured with an exam that is not valid and decisions will be made accordingly. In this respect, it is important that the exam questions are examined with a valid question type in terms of content and cognitive level.

In the study, it was found that instructors in all areas had very poor language and expressive skills. Particularly expression abnormalities, subject-predicate inconsistencies, and poor punctuation were seen in the written questions. Moreover, the fact that Turkish teachers made grammatical errors just like other branch teachers, is an important finding that needs to be emphasized. Although there is not much research on this finding in the literature, Arıcı (2021), in his research examining the general writing skills of pre-service teachers, found that errors related to content, main idea, coherence, expression disorder, title, information mistakes, grammar mistakes, word repetitions, spelling and punctuation were made in the texts written regardless of the branches. As a result of the findings of the research, it should be emphasized that the ability to use written language correctly should be acquired both during university education and while working as a teacher.

Another conclusion of this study is that teachers prefer to duplicate questions from sources when creating open-ended questions, are not particularly creative, or are limited by the question-writing style they have chosen (similar to the one in another source). These findings lead to the recommendation that teachers get in-service training in order to understand the significance of creating accurate questions and employing accurate language when evaluating their students and to remedy their shortcomings in this area.

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