



# Bildiri Özetleri Kitabı

ABSTRACTS BOOK

June 8-11, 2023



TÜBİTAK  
TÜBİTAK DESTEKLİ



10. INTERNATIONAL EURASIAN  
EDUCATIONAL RESEARCH CONGRESS

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**8-11 Haziran 2023/ Ted Üniversitesi**

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ANI YAYINCILIK

ANKARA

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EJERCongress 2023 ABSTRACTS

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Tel : 0 312 425 81 50 pbx

Fax : 0 312 425 81 11

[info@aniyayincilik.com.tr](mailto:info@aniyayincilik.com.tr)

[ejercongress@gmail.com](mailto:ejercongress@gmail.com)

[www.http://.aniyayincilik.com.tr](http://.aniyayincilik.com.tr)

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## Undergraduate and Graduate Mathematics Education Students' Ways of Reasoning Addressed in Their Mathematics Lesson Plans

Işıl İşler-Baykal  
ODTÜ

Elçin Erbasan  
ODTÜ

Didem Akyüz  
ODTÜ

### Problem Durumu

Reasoning and proof are important aspects of mathematics (National Council of Teachers of Mathematics [NCTM], 2000). The Principles and Standards for School Mathematics state that programs in preK-12 should help all students “to recognize reasoning and proof as fundamental aspects of mathematics, make and investigate mathematical conjectures, develop and evaluate mathematical arguments and proofs, and select and use various types of reasoning and methods of proof.” (NCTM, 2000, p. 56). In the Turkish mathematics curriculum for Grades 1-8, reasoning is focused on by the specific goal as “In the problem-solving process, they [students] will be able to easily express their own thoughts and reasoning, and will be able to see the deficiencies or gaps in the mathematical reasoning of others.” (Ministry of National Education [MoNE], 2018, p. 9). Even though there has been some focus on reasoning and proof in mathematics curriculum and standards, the teachers' preparedness to integrate reasoning and proof in their lessons is still a question mark. Some studies conducted with mathematics teachers have found that teachers have limited conceptions about the role of proof (Knuth, 2002); the majority of mathematics textbooks designed for preservice teachers have limited opportunities to develop comprehensive understandings related to reasoning and proof (McCrory & Stylianides, 2014), and teachers may not provide enough opportunities for students in the classroom to develop an understanding of valid justifications while implementing proof-related tasks (Bieda, 2010). Further studies are needed, especially for investigating different ways of reasoning addressed by the tasks in mathematics teachers' lesson plans.

This study aims to investigate graduate and undergraduate mathematics education students' ways of reasoning addressed by the tasks chosen in their mathematics lesson plans through an intervention provided as part of an elective course. This research was part of a larger project carried out within the European Project MaTeK with partners from 5 countries (Slovakia, Czech Republic, Italy, Norway, and Turkey). The project consortium defined collaborative research focused on improving the design capacities of future mathematics teachers in relation to R&P (Slavičková et al., 2022). This paper focuses on the Turkish participants' revised lesson plans. The specific research question we aimed to answer for this study is “What are the graduate and undergraduate mathematics education students' ways of reasoning addressed by the tasks chosen in their mathematics lesson plans?”

### Yöntem

This study was a basic qualitative study. This study was conducted in an elective course offered in the scope of Project MaTeK to maximize the (pre-service) mathematics teachers' lesson plan design capacities regarding reasoning and proof. Sixteen students (13 female students, 3 male students) were enrolled in the course. Four of these were graduate students in the mathematics education program, and 12 were pre-service mathematics teachers. Of the 12 pre-service teachers, three were studying to teach at the high school mathematics level, while the rest were enrolled in the middle school mathematics teaching program. The participants worked in groups of 2 or 3 people throughout the course. There were 6 groups in total.

A four-week intervention took place as part of the elective course to help improve participants' lesson plan design capacities regarding reasoning and proof. The participants were first asked to select a task that fosters reasoning and proof for Grades 8 or 9. Then, around that task, they designed lesson plans. They were also asked to write expected responses for their tasks in the lesson plans. After they got feedback from the instructors and peers, the participants revised their lesson plans. The data for this study include six groups' tasks and their expected responses in the revised lesson plans.

Content analysis was used for data analysis since the purpose was to analyze the content of the data source (Merriam & Tisdell, 2016), namely, the participants' mathematics tasks in the lesson plans. In light of the framework developed by Sevinc et al. (2022), the ways of reasoning in tasks in the lesson plans were coded. The framework was developed based on analyzing 8th-grade mathematics textbooks in five countries and included six ways of reasoning with an additional “other” category. These categories were appeal to authority, simple (1-step) deductive reasoning, mathematising, reasoning by analogy, reasoning with empirical arguments/specific cases, which included a) making claims and generalizing, b) justification of a claim, and lastly, developing conclusions/justifying/refuting through deductive reasoning (with special notes, if any, using a generic example, a counterexample, a systematic enumeration). Also, the representations, including graphical, symbolic, verbal, real-world situations, and manipulatives, are coded separately. If digital technology was used in addition to representations, it was noted as well.

Regarding the data analysis, at first, the ways of reasoning in the tasks in the lesson plans were coded individually by the researchers, then all researchers built consensus on the coding by discussing the similarities and differences in their codes.

### Beklenen/Geçici Sonuçlar

The findings showed that the tasks in the lesson plans addressed two categories: reasoning with empirical arguments/specific cases, which included making claims and generalizing, and developing conclusions/justifying/refuting through deductive reasoning (some using a counterexample and systematic enumeration). The task in the lesson plan of Group 6 was categorized using both categories since the different expected solutions addressed different ways of reasoning. Among six tasks, three of them were related to the algebra learning area, one of them was related to the probability learning area, one of them was related to the number and algebra learning area, and one of them was related to the geometry learning area. While the number and algebra learning area task addressed 9th grade, the other tasks addressed 8th-

grade level. The majority of tasks included the use of technology, manipulatives, and different representations such as graphical, symbolic, and verbal. However, only two of the plans contained real-life contexts, and they were related to the algebra learning area. The findings will be discussed by providing implications and suggestions during the presentation.

**Anahtar Kelimeler:** Reasoning and proof, mathematics tasks, undergraduate and graduate mathematics education students

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