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An Investigation of Pre-Services Mathematics Teachers' Performances on Systems of Linear Equations within the Context of Self-Efficacy Levels

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ABSTRACT

The aim of this research is to investigate preservice mathematics teachers' performances on systems of linear equations within the context of self-efficacy on systems of linear equations. The research uses a case study methodology which follows from the qualitative paradigm. 42 second year pupils from the department of primary mathematics education in 2009-2010 academic year were chosen for the study by using the convenience sampling strategy. Performance Test of Systems of Linear Equations was used to assess of the preservice mathematics teachers' performances on solving systems of linear equations and Systems of Linear Equations Self-efficacy Test (m=n, m≠n) was developed and used to determine the levels of efficacy. In the analysis of the quantitative qualitative and data, inferential and descriptive statistics were used respectively. While the majority of preservice mathematics teachers showed medium-level performance, more than half of the participants had high-levels of self-efficacy. The presence of a significant positive medium level correlation between performance and self-efficacy is an indicator of the fact that self-efficacy affects performance.

Keywords:
Linear algebra, Systems of linear equations, Self-efficacy, Teacher education
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Extended Summary

Linear algebra is a mathematical domain encountered by students in all levels of education from primary school, not only at the university level. The attainment related to the solution of linear equations with two unknown involved in primary school mathematics curriculum can be stated as the starting point of the systems of linear equation.

Learning and teaching of the systems of linear equations have been the focus of many studies (Kardeş, 2010; Trigueros, Oktaç and Manzanero, 2007; Cutz, 2005, cited in Oktaç, 2008; Harel and Tall, 1989). The aim of this research is to investigate preservice mathematics teachers' performances on systems of linear equations within the context of self-efficacy theory.

The research uses a case study methodology which follows a qualitative paradigm. 42 second year pupils of the department of primary math education participated in the study, Participants were chosen by using the convenience sampling strategy. Qualitative and quantitative methods were used together to collect the relevant data. Performance Test of Systems of Linear Equations was used to assess of the preservice

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mathematics teachers' performances on solving systems of linear equations. The test consists of 13 questions which were selected by using various criteria relevant to the topic. In addition, to determine the level of efficacy levels Systems of Linear Equations Self-efficacy Test (m=n, m≠n) was developed, in which m denotes the number of equations and n shows the number of variables. For the situation m=n, which consists of 17 items, the coefficient of alpha is 0.86, for the m≠n one, which consists of 12 items, Cronbach-alpha is 0.83. In the analysis of the quantitative data, predictive statistics were used; in the analysis of the qualitative data, descriptive statistics were used.

When preservice mathematics teachers' overall performance levels on a systems of linear equations are investigated, findings indicated that the majority of participants showed medium-level performance (76%). High-level (17%) and low-level (7%) performance were less frequent. Results on preservice mathematics teachers' overall self-efficacy levels on the systems of linear equations showed that 59,52's% had high-level, 33.33's% had medium-level, and 9,52's% had low-level self-efficacy. Very high-level and very low-level self-efficacy levels were not observed and that more than half of the participants had high-level self-efficacy levels.

In the investigation of the relationship between preservice mathematics teachers' performances and their self-efficacy levels, both correlational and descriptive statistics were used to obtain a brighter picture. A significant positive correlation was found between preservice mathematics teachers' performances and their self-efficacy levels ($r=0.46$; $p<.05$). As for the descriptive comparisons between different levels of two variables, it was observed that 20% of participants had high level self-efficacy and high level performance, 24% of participants had medium level self-efficacy and medium level performance, 4% of participants had low level self-efficacy and low level performance.

The performance test and self-efficacy scale are investigated in terms of subscales, It can be stated that participants' performances and self-efficacy in solving systems of linear equations by using ranks (m=n), inverse matrices and determinants showed parallel results. Preservice mathematics teachers who see themselves competent in making row operations (m≠n) and algebraic interpretations showed medium level performance; participants who see themselves mediocre in making correct geometric interpretations showed low level performance in solving a system in the performance test.

Matematik Öğretmen Adaylarının Lineer Denklem Sistemleri Çözüm Performanslarının Öz-Yeterlik Algı Düzeyleri Bağlamında İncelenmesi

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ÖZ

Bu araştırmada, matematik öğretmen adaylarının lineer denklem sistemleri konusunda sergiledikleri performanslarının lineer denklem sistemleri öz-yeterlik algı düzeyleri bağlamında incelenmesi amaçlanmaktadır. Ölçeğin konu bazında geliştirilerek performansla ilişkisinin araştırılması çalışmanın özgünlüğünü ortaya koymaktadır. Özel durum deseninin benimsendiği araştırmada katılımcılar, olasılıksız örnekleme yöntemlerinden amaçlı örnekleme tekniği ile belirlenmiş olup 2009-2010 eğitim öğretim yılında, bir devlet üniversitesi eğitim fakültesi ilköğretim matematik eğitimi lisans programına kayıtlı 42 lineer cebir öğrencisinden oluşmaktadır. Çalışmada veri toplama araçları olarak, araştırmacılar tarafından geçerlik ve güvenirlik çalışmaları yapılarak geliştirilen Lineer Denklem Sistemleri Öz-yeterlik Algısı Ölçeği ve Lineer Denklem Sistemleri Performans Testi kullanılmıştır. Elde edilen nicel veriler kestirimsel, nitel veriler ise betimsel istatistik kullanılarak analiz edilmiştir. Araştırmada, öğretmen adaylarının lineer denklem sistemleri konusunda orta düzeyde performans sergilerken öz-yeterlik algılarının yüksek düzeyde olduğu görülmüştür. Sergilenen performans ile öz-yeterlik algı düzeyleri arasındaki pozitif yönde orta düzeyde anlamlı ilişkinin varlığı öz-yeterlik algısının performansı etkilediğinin bir göstergesidir.

Anahtar Kelimeler:
Lineer denklem sistemleri, performans, öz-yeterlik algısı, öğretmen eğitimi

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