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Orginal Article

Multilevel Analysis of the Relationship of Perception of Teachers' Diagnostic Skills, Challenging Level of Class, Quality of Teacher's Teaching and Math Study Skills with Math Performance in Ninth Grade Students

Arash Akhash[*]
Askar Atash Afrouz[**]
Manijeh Shehni Yailagh[***]
Morteza Omidian[****]

Abstract

The aim of this multilevel analysis research was to investigate the relationships of perception of teachers' diagnostic skills, challenging level of the class, quality of teacher's teaching and math study skills with math performance in ninth-grade students. Research method was a correlational type, namely multilevel analysis. The statistical population of this research was all ninth-grade male and female students of first secondary school in Kohgiluyeh city, in Iran, in the academic year of 2022-2023, among them, a sample of 1000 students (500 Male and 500 female) was selected by multi-stage random sampling method. Gartner's Classroom Assessment Questionnaire, Gentry and Springer's Scale of Students' Perception of Classroom Activities, Kyriakides et al.'s Teaching Quality Scale, Hooper's Math Study Skills Scale and students' grades of the first semester of math lessons were used to measure the variables of the research. Data were analyzed using Hierarchical Linear Modeling (HLM) method. The results of multilevel analysis showed that variables of level 1 (math study skills) and level 2 (average math study skills of class, perception of teacher's diagnostic skills, challenging level of class and quality of teacher's teaching) were positively and significantly predicting math performance of students. The interactions of level 2 variables (average math study skills of class, perception of teacher's diagnostic skills and the challenging level of the class) with

* Ph.D. Student Educational Psychology, Department of Psychology , Faculty of Education Sciences and Psychology, Shahid Chamran University of Ahvaz, Ahvaz, Iran..

** Assistant Professor, Department of Psychology , Faculty of Education Sciences and Psychology, Shahid Chamran University of Ahvaz, Ahvaz, Iran. *Corresponding Author*: a.atashafrouz@scu.ac.ir

*** Professor, Department of Psychology, Faculty of Education Sciences and Psychology, Shahid Chamran University of Ahvaz, Ahvaz, Iran.

**** Associate Professor, Department of Psychology, Faculty of Education Sciences and Psychology, Shahid Chamran University of Ahvaz, Ahvaz, Iran.

the slope of the relationship between math study skills and math performance were significant. Also, the difference in math performance among classes and the difference between classes in terms of the slope of math study skills and math performance were significant. Based on the multilevel analysis in this research, it can be concluded that paying attention to the improvement of students' math study skills and class variables (average class math study skills, perception of teacher's diagnostic skills, challenging level of class and quality of teacher's teaching) will lead to the improvement of students' mathematical performance and their positive attitude towards this lesson.

Keywords: Challenging level, teaching quality, diagnostic skills, study skills

Extended Abstract

Introduction

Many students face challenges in learning mathematics. These challenges can stem from the nature of the math course itself or from various external factors. Issues related to the mathematics content often arise due to its abstract nature, while external factors can be categorized as intrapersonal or external-personal. Intrapersonal factors pertain to individual student characteristics, such as mental processing, learning styles, motivation, and attitudes. External-personal factors are influenced by educational elements, including the methods teachers use and their interactions with students. Mathematics, due to its abstract and mental nature, is the most effective tool that can develop and nurture logical structures and mental processes. One of the educational factors affecting mathematics performance is teachers' diagnostic skills, which are related to their students' learning process and are often characterized by teachers' precise and decisive judgments. Challenge is another component of students' perception of the classroom and is referred to as the degree to which students experience complexities in learning and assignments. According to research in the field of education, the result of good teaching quality is student achievement in education, which can have a long-term impact. In addition to the impact of the classroom environment on mathematics achievement, the study methods and skills that students use in studying mathematics are also effective in their academic achievement. Therefore, the current research aims to conduct a "multilevel analysis of the relationship between teachers' diagnostic skills, classroom challenges, teaching quality, and math study skills as they relate to math performance among ninth-grade students."

Method

The research employed a correlational design utilizing multilevel analysis. The target population included all ninth-grade male and female students from first secondary schools in Kohgiluyeh City, Iran, during the academic year of 1401-1402. A sample of 1,000 students (500 male and 500 female) was selected through a multi-stage random sampling method. To measure the research variables, we used several tools: Gartner's Class Evaluation Questionnaire (2010), Gentry and Springer's Scale of Students' Perception of Classroom Activities (2002), Kyriakides et al.'s Teaching Quality Scale (2000), Hooper's Math Study Skills Scale (1993), and students' first-semester math grades. Data analysis was conducted using Hierarchical Linear Modeling (HLM). Hierarchical linear modeling has different models, and the model that is suitable for analyzing the data in this study is called the "width from the origin and slope as outcomes" model.

Results

The multilevel analysis results indicated that Level 1 variables (math study skills) and Level 2 variables (class average math study skills, teachers' diagnostic skills, class challenge levels, and teaching quality) significantly and positively predicted students' math performance. The interactions among Level 2 variables (average class math study skills, teachers' diagnostic skills, and class challenge levels) were significant in relation to the slope of the relationship between math study skills and math performance. Additionally, significant differences in math performance were observed across different classes, as well as variations in the slope of math study skills and performance among those classes.

Discussion

Overall, multilevel analysis in this study showed that students' math performance is dependent on predictor variables at Level 1 (mathematics study skills) and Level 2 (average class math study skills, perception of teacher diagnostic skills, class challenge level, and teacher teaching quality).The findings from this multilevel analysis suggest that enhancing student' math study skills, along with improving class variables (average class math study skills, teachers' diagnostic skills, class challenge levels, and teaching quality), will contribute to better mathematical performance and foster a more positive attitude toward mathematics among students.

Contribution of the authors: In the present study, Askar Atash Afrouz and Manijeh Shehni Yailagh, as supervisors, were responsible for the strategic supervision of the overall research process, compilation and finalization of the corrections of the article. Arash Akhas, Student, was in charge of developing the

research plan, the process of gathering, analyzing and interpreting the findings and writing the text of the article and in general, the conclusion of the findings and the elaboration and interpretation were done jointly and with the discussion and exchange of opinions of all the colleagues and accompanied by Morteza Omidian, as the advisor of the thesis. All authors discussed the results, reviewed and approved the final version of the manuscript.

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