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RESEARCH ARTICLE

TEACHER QUALITY AND A PUPIL'S MATHEMATICS ACHIEVEMENT ON THE PRIMARY LEAVING EXAMINATIONS IN UGANDA: MULTILEVEL MODELING

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ABSTRACT

The Purpose of the study was to examine the relationship between teacher quality and a pupil's achievement in Mathematics on the Primary Leaving Examinations (i.e., 7th grade) in Uganda. The study employed a cross- sectional survey design. Data were from the Uganda National Examinations Board (UNEB) Primary Leaving Examinations (PLE) Mathematics results, 2018 (N = *952*). Mathematics teachers who taught the seventh grade were also part of the study participants (n = 18). A Two-Level Hierarchical Linear Model (HLM) was used to investigate the question "What is relationship between teacher quality and pupils' achievement on (PLE) achievement in mathematics controlling for prior achievement/knowledge. The result show that the effect of the Teacher Quality Measure (TQM) on mathematics PLE scores controlling for the pretest was statistically significant (γ_{11}= -.01, t = -2.17, df = 16, p = .045). That is, for every one-point increase in teacher TQM scores, the effect of the pretest on mathematics PLE scores decreases by .01 point. Additionally, statistically significant variability in the mathematics PLE means exists (τ_{00} = 1.72, X^2= 336, df = 16, p = .000), as well as statistically significant variability in the effect of the pretest (τ_{11} = .02, X^2= 40.85, df = 16, p = .000).

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INTRODUCTION

Since the release of the Coleman report in 1966, and its 1990 update, many studies have examined the impact of teacher quality on student achievement. The majority of these studies have concluded that teachers are one of the most critical factors that predict the variation in student test scores, preceded only by individual and family background characteristics (Goldhaber and Brewer, 1997). Research has noted instructional strategies indicative of quality teaching that facilitate students' achievement and learning experiences. For example, some strategies include setting tasks that are appropriately challenging, assigning work that is weighty and meaningful, building a variety into content and assessment tasks, and utilizing material that arousecuriosity and is fascinating to young people (Covington, 1998; Martin, 2002a; 2003a; McInerney, 2000). Studies further contend that quality teachers focus on the needs of the contextual dimension of the subject matter and emphasize the relevance of what is learned (Eccles, 1983; Elliot, 1997; 1999; McInerney, 2000; Wigfield &Tonks, 2002). Moreover, all the above research containing these concepts and strategies are consistent with Danielson's framework of teaching (1996), which informs the measurement of teacher quality in this study.

Interestingly, Châu (1996) examined the importance of subject content on teacher performance and noted that the formal level of education of the teacher is not necessarily synonymous with quality or competence. Additionally, Châu's classroom observations in different countries show that certain teachers have insufficient mastery of the subject matter that they teach. The author also found out that many teachers lack the pedagogical knowledge required for good presentation of the material. Therefore, besides professional training, subject knowledge plays a crucial role in teacher performance and has an impact on the quality of teaching and the teacher.

METHODS AND MATERIALS

The study employed a cross – sectional survey design. Eighteen teachers who instruct mathematics were selected. Mathematics teachers were used because one of the main purpose of basic education in Uganda is the achievement of numeracy. In addition, a larger number of teachers are Math teachers, and a large sample size was needed for multi-level analysis. Finally, the importance that is attached to Mathematics in Uganda's education system was noticed from the fact that the subject, unlike others, appear daily on the class schedule. Mathematics performance data were from UNEB Primary Leaving Examinations Mathematics results, 2018 (N = *952*). Diversity was considered and teachers were selected from rural and urban settings. Teachers were surveyed in mathematics, and those teaching other subjects were excluded (e.g., English, Music, Art, Religion, Science, Social Studies). The reason for exclusion of non-Mathematics teachers was that Mathematics is one of the subjects considered as essential knowledge base in Uganda, and other subjects, apart from English, are not the main focus of the PLEs. The study also excluded teachers from higher levels of education because the importance attached to basic education in Uganda is great. In addition, the measure created (i.e., the TQM) focuses on teacher quality in and around the 7th grade level, not older and younger grade levels.

RESULTS

The Research Question stated, "What is the relationship between teacher quality and a pupil's achievement on the PLE (i.e., 7th grade) in Uganda?" This was analyzed using a Two-Level Hierarchical Linear Model (HLM). HLM was used to investigate the relationship between teacher quality and pupils' achievement on PLE achievement in mathematics controlling for prior achievement/knowledge. Student scores in mathematics on the PLE, as well as the teacher scores from the Teacher Quality Measure (TQM) were used.

The HLM modeling procedure had three steps. First, the analysis included the null model (i.e., the One-Way Random Effects ANOVA) with only the pupil-level outcome variable (i.e., mean PLE achievement). Second, a pupil-level model was developed (i.e., the Unconditional Model) including the effects of prior achievement on the DV (i.e., PLE scores). Teacher variables were added to the pupil model at the third step (i.e., the Contextual Model). Table 1 is the common model-building procedure used in HLM, although the third step (i.e., the Contextual Model) is the one that specifically addresses Research Question. The teacher-specific intercepts, which are treated as random at the second level, were adjusted (Raudenbush and Bryk, 2002) with grand-mean centering. The method of estimation used was Restricted Maximum Likelihood (REML).

Descriptive: An outlier analysis was conducted on all variables in the full model and none were found (i.e., $z > \pm 1.96$). Thus, the final analysis sample contained all 952 students. For the data, the descriptive statistics for the level 1 variables included higher pretest means of 6.78 (*SD* = 2.35) compared to the posttest of 4.49 (*SD* = 2.59). The level 2 variable (i.e., the TQM) sample contained 18 teachers with an average TQM score of 90.47 (*SD* = 12.08). The scores ranged from 50 to 110.

Table 1. One-Way Random Effects ANOVA Model with the Mathematics Primary Leaving Examination (PLE)

Fixed Effects	Coefficient (*SE*)	*t* (*df*)	*p*
Model for Mean Teacher PLE Math Scores (β_0)			
Intercept (γ_{00})	4.76 (.44)	10.98(721)	.000

Random Effects	Variance	*df*	X^2	*p*
Variation in Teacher Means (τ_{00})	3.46			
Variation within Teachers (σ^2)	3.05	17	1174.77	.000

Note. Deviance (REML) = 3832.86; 2 estimated parameters

Table 2. Unconditional Model with the Mathematics Primary Leaving Examination (PLE)

Fixed Effects	Coefficient (*SE*)	*t* (*df*)	*p*
Model for Mean Teacher PLE Math Scores (β_0)			
Intercept (γ_{00})	4.61 (.40)	11.66(17)	.000
Model for Pretest Slopes (β_1)			
Intercept (γ_{10})	.36 (.06)	8.31 (17)	.000

Random Effects	Variance	*df*	X^2	*p*
Variation in Teacher Means (τ_{00})	2.91	17	738.08	.000
Variation in Pretest Slopes (τ_{11})	.03	17	57.13	.000
Variation within Teachers (σ2)	2.58			

Note. Deviance (REML) = 3679.85; 4 estimated parameters.

Table 3. Contextual (Full) Model with the Mathematics Primary Leaving Examination *(*PLE)

Fixed Effects	Coefficient (*SE*)	*t* (*df*)	*p*
Model for Mean Teacher PLE Math Scores (β_0)			
Intercept (γ_{00})	4.62 (.30)	15.55(16)	.000
Teacher Quality Measure (TQM; γ_{01})	-.08 (.02)	-3.74(16)	.002
Model for Pretest Slopes (β_1)			
Intercept (γ_{10})	.36 (.04)	8.82 (16)	.000
Teacher Quality Measure (TQM; γ_{11})	-.01 (.01)	-2.17(16)	.045

Random Effects	Variance	*df*	X^2	*p*
Variation in Teacher Means (τ_{00})	1.72	16	336	.000
Variation in Pretest Slopes (τ_{11})	.02	16	40.85	.000
Variation within Teachers (σ2)	5.58			

Note. Deviance (REML) = 3687.50; 4 estimated parameters

Assumptions

Normality was tested for all variables (i.e., pretest mathematics, posttest mathematics, as well as the TQM). Histograms and skewness and kurtosis statistics suggested that normality was upheld.

One-Way Random Effects ANOVA: Table 1 above shows the results of One-Way Random Effects ANOVA Model (i.e., the Empty Model). The average student mathematics PLE mean was statistically different from zero ($\gamma 00$ = 4.76, t = 10.98, df = 17, p = .000). Considerable variation in the student mathematics means still exists (τ_{00} = 3.05, X^2= 11.74.77, df = 17, p = .000). The proportion of the total variance in mathematics PLE achievement that can be attributed to the teacher was 48%. That is, 48% of the variability in mathematics PLE achievement can be attributed to teacher quality. Based on the significant amount of unexplained variability, additional Level 1 predictors (i.e., pretest scores) were added to try and reduce the variation within students, as well as adding other Level 2 variables to explain between student differences in the following models.

Unconditional Model: Table 2 above shows the results of the Unconditional Model with the mathematics pretest as the sole predictor at Level 1 and no Level 2 variables. After including the pretest (i.e., grand-mean centered) as a predictor of mathematics PLE achievement, within-teacher variability in mathematics PLE scores was reduced by 47%, relative to the One-Way Random Effects ANOVA Model. Overall, mathematics PLE scores across teachers was still significantly different from zero ($\gamma 00$ = 4.61, t = 11.66, df = 17, p = .000). On average, across teachers, student pretest scores were positively and statistically significantly related to mathematics PLE achievement within teachers (γ_{10}). The average effect (i.e., slopes) across teachers for the pretest is represented as an increase of .36 points on the mathematics PLE for every one-unit increase in pretest scores. Statistically significant differences (variability) in the 18 teacher means still exists (τ_{00}). There was significant variability in both the intercepts and slopes. Statistically significant variability in the mathematics PLE means still exists after considering the pretest (τ_{00} = 2.91, X^2= 738.41, df = 17, p = .000), as well as statistically significant variability in the effect of the pretest (i.e., the slopes) across teachers (τ_{11} = .03, X^2= 57.13, df = 17, p = .000). Based on the significant amount of unexplained variability, a Level 2 predictor (i.e., teacher TQM scores) was added to explain the variation between students.

Table 3 - Contextual (Full) Model: After adding the Level 2 predictor (i.e., teacher TQM scores grand-mean centered) to the model, 41% of the variance in mathematics PLE achievement can be explained by teacher TQM scores (see Table 10 below). Additionally, 33% of the variance in the effect of the pretest (i.e., the slopes) can be explained by teacher TQM scores. Mathematics PLE scores across teachers was still significantly different from zero ($\gamma 00$ = 4.62, t = 15.55, df = 16, p = .000). That is, the average teacher has mean mathematics PLE scores of 4.10 for their students. Teacher TQM score had a statistically significant influence on the intercept for mathematics PLE achievement. The effect of teacher TQM scores on mean PLE mathematics achievement is negative and statistically significant ($\gamma 01$ = -.08, t = -3.74, df = 16, p = .002). The value of -.08 can be interpreted as the decrease in a teacher's mean mathematics PLE achievement to be expected for a one-unit increase in teacher TQM scores, on average. The average teacher, therefore, is predicted to have a mean mathematics PLE achievement, on average, of 4.62 for their students, and with every one-point increase in TQM scores (i.e., increasing teacher quality), the mean mathematics PLE scores would decrease by .08 points. Thus, more quality teachers have students with better mathematics PLE scores on average. Again, the effect of the pretest on mathematics PLE achievement is positive on average and statistically significant ($\gamma 10$= .36, t = 8.82, df = 16, p = .000). Thus, there was a statistically significant effect of the pretest slope (i.e., predicting the mathematics PLE scores) across students and teachers. Specific to the research question, the impact of the TQM on mathematics PLE scores controlling for the pretest was statistically significant ($\gamma 11$= -.01, t = -2.17, df = 16, p = .045). This means that for every one-point increase in teacher TQM scores, the effect of the pretest on mathematics PLE scores decreases by .01 point. Finally, statistically significant variability in the mathematics PLE means still exists (τ_{00} = 1.72, X^2= 336, df = 16, p = .000), as well as statistically significant variability in the effect of the pretest (τ_{11} = .02, X^2= 40.85, df = 16, p = .000).

DISCUSSIONS

This research question (i.e., "What is the relationship between teacher quality and a pupil's achievement on the PLE (i.e., 7th grade) in Uganda?") was analyzed using a Two-Level Hierarchical Linear Model (HLM). HLM was used to investigate the relationship between teacher quality and pupils' achievement on PLE achievement in mathematics controlling for prior achievement/knowledge. Student scores in mathematics on the PLE, as well as the survey scores from the newly developed TQM were used. The study hypothesized that TQM scores would be a significant predictor of PLE scores in mathematics with higher TQM scores predicting higher PLE scores (i.e., a positive relationship). The newly created TQM produced teachers' average score across the four domains: (1) "Planning and Preparation," which incorporates components pertaining to the knowledge and skills needed to plan and orchestrate a day of learning in the life of a child, (2) "Classroom Environment," which covers crucial components such as providing a physically safe environment for all students, (3) "Instruction," which includes items that evaluate teachers' ability to engage students in active learning that promotes critical thinking, decision-making, and problem solving while using a variety of instructional strategies, and (4) "Professional Responsibilities," which contains items critical to teacher education programs such as demonstrating a high level of professionalism in their work with children, families, colleagues, and the school community. The results indicated that with every one-point increase in TQM scores (i.e., increasing teacher quality), the mean student mathematics PLE scores decrease by .01 point. Thus, more quality teachers have students with better mathematics PLE scores on average. It is apparent that although teacher quality is a predictor of increased student achievement, it is only to a small extent. That is, student scores only improved by .01 points on the PLEs. However, it is important to note that more quality teachers have students with better of student mathematics performance. Generally, the HLM results showed that indeed teacher quality, as defined by the four domains in the newly created measure, is a significant predictor of pupil performance in mathematics. This finding is consistent with the findings in the majority of studies that concluded that teachers are one of the most critical factors that predict variation in student test scores (Abbott and Ryan, 2001; Battistich and Hom, 1997; Goldhaber and Brewer, 2000; Nanyonjo, 2007). Moreover, Sanders and Rivers (1996) found that students assigned to ineffective teachers over the course of several years demonstrate significantly lower academic achievement than those pupils that are assigned to high quality teachers.

Implication and Conclusion

In the investigation of the relationship between teacher quality, and pupils' achievement on PLE achievement in mathematics controlling for prior achievement/knowledge, the results show that there is significant relationship. The findings in this research question imply that it is possible to see a relationship between student achievement and teacher quality. Overall, these findings have implications for schools that may use the newly created TQM to identify quality teachers. Identifying quality teachers and more importantly, where there are deficits based on the four domains, can assist school in staging interventions to improve teacher performance. That is, the findings are a guide to the Ministry of Education and Sports (MoES) to identify teachers with performance deficits so as to possibly plan a teacher development program for them. Adding the TQM to a school's accountability system would provide a critical empirical perspective to the multifaceted process of teacher evaluation, which is lacking in Uganda. Also, diagnosing weaknesses, and providing professional development opportunities, can increase the educational success of more students (specifically in mathematics). Studies such as this may help the Ugandan MoES to better understand the link between teacher quality and desirable student outcomes. Moreover, by focusing on the domains of quality teaching outlined in this study, teacher training institutions may be better equipped to educate teachers on the importance of teacher quality related to student performance, and to set meaningful performance expectations once teachers are in classrooms.

REFERENCES

Abbott, J., and Ryan, T. 2001. *The unfinished revolution: Learning, human behavior, community and political paradox*. Alexandria, VA: Association for Supervision and Curriculum Development.

Battistich, V., and Hom, A. 1997. The relationship between students' sense of their school as a community and their involvement in problem behaviors. *American Journal of Public Health*, *87*, 1997–2001.

Châu, G. 1996, June. *The quality of primary schools in different development contexts.* Paper presented at the International Institute for Educational Planning – United Nations Educational, Scientific and Cultural Organization, Paris, France.

Coleman, J. S. 1990. *Equality and achievement in education.* Boulder, CO: Westview Press.

Covington, M. V. 1998. *The will to learn: A guide for motivating young people.* Cambridge, UK: Cambridge University Press.

Danielson, C. 1996. *Enhancing professional practice: A framework for teaching.* Association for Supervision and Curriculum Development, Alexandria, VA.

Eccles, J. 1983. Expectancies, values, and academic behaviors. In J. Spence (Ed.), *Achievement and achievement motive*s (pp. 75–146). San Francisco, CA: Freeman Press.

Goldhaber, D. and Brewer, D. 2000. Does teacher certification matter? High school teacher certification status and student achievement, Educational Evaluation and Policy Analysis, 22(2), pp. 129–145.

Goldhaber, D., and Brewer, D. 1997. Why don't schools and teachers seem to matter? Assessing the impact of unobservable on educational productivity. *Journal of Human Resources*, *332*(3), 505–523.

Martin, A. J. 2002a. *Improving the educational outcomes of boys.* Paper presented at the Australia Capital Territory Department of Education, Youth and Family Services, Australia.

Martin, A. J. 2002b. Motivation and academic resilience: Developing a model of student enhancement. *Australian Journal of Education*, *46*, 34–49.

Martin, A. J. 2003a. Boys and motivation: Contrasts and comparisons with girls'approaches to school work. *Australian Educational Researcher*, *30,* 43–65.

McInerney, D. 2000. *Helping kids achieve their best.* Sydney, Australia: Allen and Unwin.

Nanyonjo, H. 2007. *Education inputs in Uganda: An analysis of factors influencing learning achievement in grade six*. Washington. D.C.: World Bank.

Sanders, W. L., and Rivers, J. C. 1996. *Cumulative and residual effects of teachers on future student academic achievement.* Knoxville: University of Tennessee Value-Added Assessment Center. Retrieved May 29, from http://news.heartland.org/sites/all/modules/custom/heartland_migration/files/pdfs/3048.

Wigfield, A., and Tonks, S. 2002. Adolescents' expectancies for success and achievement task values during the middle and high school years. In F. Pajares and T. Urdan (Eds.), *Academic Motivation of Adolescents* (pp. 53–82). Greenwich, CT: Information Age.

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