

On the Multidimensionality of Teachers' Qualities, Personal Achievement, and their Role in Students' Achievement in General Mathematics

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Abstract:

This study was conducted to develop a valid and reliable tool that can be used to measure teachers' qualities and create a robust ordinal logistic regression model that predicts students' achievement in General Mathematics based on teachers' qualities and achievements as independent variables. The statistical tools used were the Reliability Test, Exploratory Factor Analysis, and Ordinal Regression Analysis. The researcher interviewed ten experienced mathematics teachers and ten senior high school students who recently finished General Mathematics. Their responses were then converted to measurable variables to construct an initial questionnaire. The initial questionnaire was pilot-tested on 300 student respondents for reliability and was found reliable. Based on the results under Exploratory Factor Analysis, there are five latent variables/dimensions of teachers' qualities. These dimensions are Instructional Competencies, Personal Qualities, Procedural Fairness on Tests, Handling Learners' Response, and Compassionate Discipline. Moreover, the result of ordinal regression analysis explained five explanatory predictors that have significantly improved the Logistic Ordinal Regression Model. These five explanatory predictors were the Teacher's Years of Experience, the Teacher's Highest Educational Attainment, Personal Qualities, Procedural Fairness on Tests, and Handling Learners' Responses. With the highest Wald value of 5.842, Teachers' Personal Qualities significantly influenced student achievement in General Mathematics. Hence, teachers' attitudes in dealing with students should be seriously considered when aiming to increase the level of students' achievement in mathematics.

Keywords: Teachers' Qualities and Achievements, Reliability Test, Exploratory Factor Analysis, Ordinal Regression Analysis

Introduction

Teachers make a difference in students' lives in classrooms worldwide. As US President Barack Obama said, "We know that from the moment students enter a school, the most important factor in their success is not the color of their skin nor the income of their parents—it is the teacher standing at the front of the classroom" (Montopoli, 2009). Aaronson et al. (2007) noted that quality educators are the key to increasing student achievement.

Several studies have examined how teacher qualities affect student achievement. According to Marzano (2012), teacher qualities affect teacher behavior, affecting student achievement. For instance, a study by the American Council on the Teaching of Foreign Languages (as cited in Moore, 2007) found that students appreciated teachers who cared about them, made new content relevant and entertaining, and mastered their subject matter. It concluded that teachers should focus on their personal qualities towards the content as much as the content itself.

King (2017) proposed that certain qualities of teacher effectiveness have yet to be nearly as extensively studied. Available tools today measuring teacher qualities are products of research done abroad and might be culture-sensitive when used by Filipino teachers. This study aims to develop a tool that would measure teacher qualities. The tool would be more appropriate for Filipino teachers because the participants in developing the tool are Filipino students and teachers. After the tool development, this study links teacher qualities to student achievement. Also, this study considers linking teacher personal achievements (measured by professional rank, years of experience, highest educational attainment, and participation in professional development activities) to student achievement. The result helps determine the weight of the role of teacher qualities compared to teacher personal achievements on student achievement in General Mathematics.

In 2005, Gallup (as cited in Fleming, 2019) conducted a poll that asked students to name the school subject they considered the most difficult. Not surprisingly, mathematics came out on top of the difficulty chart. As mathematics educators for more than a year, the researchers experienced and observed challenges in dealing with students because most of them do not like Mathematics and find it difficult, resulting in poor performance in the subject. Patience and love for students are demanded at work. This study aimed to prove teacher qualities' significant role in student achievement.

Literature Review

Teacher Qualities

Teacher qualities refer to a teacher's characteristics (Perez, 2013). The two distinct characteristics of an effective and efficient teacher are professional qualities and personal qualities (Paunlagui-Gacelo, 2012). Professional attributes refer to the teacher's knowledge of the subject matter to be taught, their understanding of the psychological and educational principles, and their understanding of the teaching profession. On the other hand, personal qualities refer to the qualities that stem from the teacher's personality, interests, attitudes, and beliefs.

According to different authors, King's "Teacher Affective Inventory" (2017) listed aspects of positive teacher-student relationships and affective qualities of teacher attitudes. These include caring for the students, providing constructive feedback, treating students with respect and fair judgments, preventing conflict with students, creating a supportive classroom environment through effective classroom management, balancing student empowerment and teacher control, and maintaining high expectations among all students. Also, pleasant, supportive, and challenging teachers produce better results than harsh, unsupportive, and unchallenging teachers. Teachers should encourage exchanging ideas and respect students to foster a sense of community (Moore, 2007). Significantly, several measures of teacher qualities have been developed. While each of these existing measures supports some aspect of the dimensions of teacher qualities, none of them is sufficient by themselves to measure teacher qualities that are important for positive student outcomes such as empowerment, engagement, and academic success (Chang & Muñoz, 2006; Hughes, 2011; Kyriakides, 2005; Wilkins, 2008; Yoon, 2002). This study intends to develop a tool to measure teacher qualities through exploratory factor analysis of data gathered from the participants, which would also identify the dimensions of teacher qualities.

Teachers' Achievement

Personal achievements refer to a teacher's academic progress over time, as measured from the beginning to the end of the period (Glossary of Education Reform, 2013). In this study, teacher personal achievements are measured in terms of their professional rank, teaching experience, highest educational attainment, and participation in professional development activities.

Professional Rank. Professional rank refers to teachers' relative standing or position, an essential indicator of their professional capacity. The professional ranking of teachers makes teachers more enthusiastic and effective (Yoyou & Wenjing, 2018). Furthermore, they studied the impact of professional rank on teacher salaries, career development, and school duties across a broad sample of compulsory education teachers in rural and urban areas. They found the following: (a) It is more difficult for rural schoolteachers to reach senior rank; (b) Salaries varied widely between rural and urban teachers of the same rank and between

teachers of different ranks. (c) Rural teachers have less access to high-level training and are given³⁹⁸ more classroom hours and essential school duties.

Teaching Experience. Teaching experience refers to the years the teacher has served in the teaching workforce. It plays several vital roles in education policy, including teachers' raises and transfer/layoff policies, promotions, and teacher distribution across schools (Albert Shanker Institute, 2010; Rice, 2010). Research shows that years of experience affect teacher effectiveness, although only sometimes linearly (Kitgaard & Hall, 1974; Murnane & Phillips, 1981). Years of experience count most in a teacher's early career but countless later (Rivkin et al., 2000). Filipino teachers' experience can range from 2 to 47 years, with a median of 25 years (Reyes, 2004). Research also shows that while teachers with more than 20 years of experience are generally more effective than teachers without experience, they are not significantly more effective than those with five years of experience (Ladd, as cited in Rice, 2010).

Highest Educational Attainment. The highest educational attainment refers to the highest academic degree obtained by a teacher (Zhang, 2008). Hiebert et al. (2002) found that teachers need to keep growing their knowledge base to grow in effectiveness steadily. Graduate education can improve teaching skills in Philippine higher education. Graduate studies demand significant reading, research, discipline, perseverance, diligence, and motivation. It can enhance the teacher's self-confidence and energy (Reyes, 2004). Regarding teachers' educational attainment, some studies showed positive effects of advanced academic degrees (Betts et al., 2003; Ferguson & Ladd, 1996; Wayne & Youngs, 2003), while others showed adverse effects (Ehrenberg & Brewer, 1994; Kiesling, 1984). However, despite the vast amount of research on this topic, there is surprisingly no consistent empirical evidence supporting the link between teacher education level and student achievement (Wayne & Youngs, 2003), as the existing studies have produced mixed findings (Goldhaber, 2000).

Statement of the Problem

This study explored the role of teachers' qualities and personal achievements in students' achievement in General Mathematics. Specifically, the study sought to answer the following questions:

1. What are the results in the factor exploration of the teachers' qualities in terms of the following:
 - 1.1 the factor solution in the initial stage of factor exploration?
 - 1.2 the observed variables that converge to the factors extracted?
 - 1.3 the factor loadings of the observed variables?
 - 1.4 the descriptive indices of the factors extracted?
 - 1.5 the vocabulary of the factors extracted?
2. With students' achievement in General Mathematics as the dependent variable measured in ordinal scale, which among the following variables significantly improves the Logistic Ordinal Regression Model
 - 2.1 Teachers' Achievements
 - 2.1.1 Professional Rank
 - 2.1.2 Years of Experience in Teaching Mathematics
 - 2.1.3 Highest Educational Attainment
 - 2.1.4 Participation in Professional Development Activities
 - 2.2 Teachers' Qualities, together with its Subscales
3. What factor has the most significant influence on students' achievement in General Mathematics?

Methods

Research Design

Considering the cultural sensitivity of research tools, this study utilized the exploratory sequential mixed methods research design of Creswell (2014) to broadly explore the dimensions of teacher qualities. It intends to generate a tool that can be used as a subscale in understanding teacher qualities. This design is based on the premise that exploration is needed for several reasons: Measures or instruments are unavailable, the variables are unknown, or there is no guiding framework or theory. This study relied on the exploration

model to establish the framework after exploring the qualitative data to examine the participants' views, develop the themes from the findings, develop the taxonomy or theory for testing, and then proceed to a second quantitative phase. Because this design begins qualitatively, it is best suited for exploring the phenomenon (Creswell & Plano Clark, 2007). The data gathered from the second phase were based on the results of the initial data taken from the qualitative database. This approach intends to develop better measurements with specific samples of populations and analyze the qualitative data to create new variables, quotes, and themes that will be explored quantitatively.

A mixed-method research design involves collecting, analyzing, and integrating qualitative and quantitative research. In this study, the qualitative research approach in tool development occurs when cohesion variables are gathered, and Likert-type statements are constructed, considered the observed variables. These observed variables underwent a data reduction procedure via Exploratory Factor Analysis, a quantitative research approach.

During the ordinal regression analysis, a quantitative research approach was used to establish the relationship between students' achievement in general mathematics and teachers' qualities and personal achievements.

Research Locale

The study was conducted in eight schools in Dipolog City that offered senior high school curricula. Dipolog City is the educational center of Zamboanga del Norte, Northwestern Mindanao, and the Sub-Convention Center of Region IX. The Dipolog City Department of Education Division is one of the best-performing divisions in Region IX, considering its achievements in past years.

Participants

The researcher needed participants for the tool development which has two phases. In the first phase, the researcher picked 10 experienced mathematics teachers and 10 senior high school students who recently finished a General Mathematics subject following the recommendation of an expert in statistics. The researchers interviewed them to gather information about teachers' qualities. Their responses were considered when formulating the initial questionnaire on teachers' qualities. On the other hand, the researchers randomly selected 300 students for the second phase using stratified sampling. They were asked to answer the initially developed questionnaire, in which their responses were subjected to a data reduction procedure to establish a valid and reliable tool that measures teachers' qualities. According to Comrey and Lee (1992), 300 is a good sample size that will likely produce a reliable factor solution that closely matches a population factor solution.

One of the two research instruments used in this study was the valid and reliable tool developed to measure teacher qualities. The teacher respondents were all mathematics teachers from the eight schools in Dipolog City offering a senior high school curriculum. Moreover, the student respondents who were randomly selected were the General Mathematics students of the teacher respondents. Following the recommendation of an expert in statistics, five student respondents were randomly chosen from each of the teacher respondents.

Research Instruments

The researcher used a researcher-made interview protocol to gather information about teachers' qualities by interviewing 10 teacher and 10 student participants. The information collected from the interview served as the cohesion variables for the tool development. The tool development process involved two phases and was subjected to a reliability test and exploratory factor analysis. The tool that was developed served as the final research instrument used in this study, and it measures teacher qualities. The second instrument is a researcher-made questionnaire, which was used to gather data about the teacher's professional rank, the number of years the teacher has taught, their highest educational attainment, the number of CPD units they acquired for the past three years, and the average grade of their five randomly selected students in General Mathematics.

The data-gathering procedure for the tool development involved two phases: gathering cohesion variables and administering an Item-List scale questionnaire subjected to a data reduction procedure.

Phase I: Gathering of the Cohesion Variables

In this phase, the researcher picked 10 experienced mathematics teachers and 10 senior high school students who recently finished General Mathematics subject. They were interviewed using a voice recorder. The interview was semi-structured. The participants were asked the following open questions:

For teachers

“How do you deal with your students during classroom discussions, activities, and evaluation?”

For students

“How does your teacher deal with you and your classmates during classroom discussions, activities, and evaluation?”

*The participants' responses were analyzed and used to construct Likert-type statements, the observed variables. These observed variables were collected through a structured questionnaire assumed to have a dimension equal to the number of items. Exploratory factor analysis always believes that, before analysis, the number of factors is equal to the number of observed variables. Hence, the multidimensional structured questionnaire will be called **NFENIQ**, which is short for "number of factors equals the number of items questionnaire."*

Phase II: NFENIQ Administration

In the second phase of the data gathering, *NFENIQ* was administered to 300 randomly selected students who had recently finished a General Mathematics subject. The data gathered in this phase were subjected to a data reduction procedure to develop a valid and reliable tool for measuring teachers' attitudes toward students.

Results And Discussion

Tool Development

A. Phase I: Gathering of Cohesion Variables

One phase in the tool development was gathering cohesion variables from 10 experienced mathematics teachers and 10 senior high school students interviewed. Then, the responses were converted to measurable variables. Cohesion variables are how the study subjects (students and teachers) perceive or assess their behavior and performance. These may provide ideas for the observed variables (Bollen & Hoyle, 1990). On the other hand, measurable or observed variables are the altered cohesion variables, which will be the items in the initial questionnaire for dimension reduction (Manifest Variable, 2018). The responses collected in Phase 1 were converted into measurable variables to form an initial questionnaire. With this, the researcher was able to construct a 53-item questionnaire.

B. Phase II: NFENIQ Administration

After the initial questionnaire was constructed, a reliability test and Exploratory Factor Analysis (EFA) were administered. Table 1 displays the reliability test results.

Table 1: Reliability Statistics

Cronbach's Alpha	Number of Items
0.980	53

Table 1 shows the internal consistency of the initial questionnaire administered to the 300 student respondents. The result indicates that the internal consistency of the questionnaire is **excellent** based on Cronbach's Alpha, which is 0.980, which is greater than 0.9, following the scale presented in the previous

chapter. Therefore, the 53-item questionnaire is reliable and ready to undergo the following statistical tool: the exploratory factor analysis (EFA).

C. Exploratory Factor Analysis (EFA)

The factors of teacher quality and the variables under each factor were determined. The Kaiser-Meyer-Olkin Measure of Sampling Adequacy and Bartlett's Test of Sphericity presented in Table 6 indicate the suitability of the data for structure detection. According to Dardas and Ahmad (2004), a KMO value greater than 0.50 is acceptable. Moreover, correlations between variables are better if the KMO value is closer to 1.0. The KMO value of 0.966 (marvelous), as shown in Table 6, is above the recommended value of 0.6 (mediocre). This indicates that there are enough variables/items in every factor extracted.

Table 2: KMO and Bartlett's Test Result

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.966
Bartlett's Test of Sphericity	Approx. Chi-Square	14055.427
	Df	1378
	Sig.	.000

Legend: 0.00 – 0.49 (unacceptable), 0.50 – 0.59 (miserable), 0.60 – 0.69 (mediocre), 0.70 – 0.79 (middling), 0.80 – 0.89 (meritorious), 0.90 – 1.00 (marvelous)

Bartlett's test for Sphericity tests whether the variable-to-variable correlation is equivalent to the identity matrix, which would mean that the variable is correlated to itself alone and no factor can be extracted. It is based on two hypotheses:

Th correlation matrix is the identity matrix

The correlation matrix is not the identity matrix

As shown in Table 2, the value of the significance level is .000, which is less than 0.05. Therefore, the null hypothesis is rejected, and the correlation matrix is not the identity matrix. Hence, some items were not correlated to themselves only but significantly correlated to other observed variables. Thus, a factor analysis can be performed. Communalities indicate the amount of variance in each variable that is accounted for. Initial communalities are estimates of the variance in each variable that accounts for all components or factors. Values of the communalities must be greater than 0.5 to be acceptable in further analysis MacCallum et al. (1999). Small values indicate variables that do not fit well with the factor solution and should be dropped from the study.

Table 3: Communalities of the Initial Questionnaire

Question	Extraction	Question	Extraction	Question	Extraction
Q1	.760	Q19	.677	Q37	.652
Q2	.724	Q20	.728	Q38	.652
Q3	.717	Q21	.780	Q39	.534
Q4	.768	Q22	.683	Q40	.622
Q5	.735	Q23	.738	Q41	.579
Q6	.735	Q24	.709	Q42	.648
Q7	.806	Q25	.757	Q43	.669
Q8	.717	Q26	.612	Q44	.664
Q9	.591	Q27	.704	Q45	.643
Q10	.750	Q28	.736	Q46	.627
Q11	.655	Q29	.738	Q47	.696

Q12	.769	Q30	.601	Q48	.697
Q13	.766	Q31	.743	Q49	.723
Q14	.807	Q32	.743	Q50	.557
Q15	.579	Q33	.726	Q51	.615
Q16	.709	Q34	.693	Q52	.621
Q17	.699	Q35	.716	Q53	.603
Q18	.648	Q36	.712		

Table 3 presents the commonalities of the initial questionnaire, in which the extraction values were all above 0.5. This confirms that each item shared some common variance with other items. Furthermore, this implies that all the items in the questionnaire fit well with the factor solution.

Table 4 explains the sum of variances of all components. The first section presents the initial eigenvalues indicating the total value, the % of variance, and the Cumulative Percentage. The total column contains the eigenvalues. The first factor or component always accounts for the most variance, and the next factor will account for as much of the leftover as it can, and so on. The Percent (%) of the variance contains the Percent of the total Variance accounted for by each factor. The cumulative % column contains the cumulative percentage of variance accounted for in the count and all preceding factors.

Table 4: Total Variance Explained

COMPONENT	Initial Eigenvalues			Extraction Sum of Squared Loadings			Rotation
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Sums of Squared Loadings
							Total
1	26.901	50.756	50.756	26.901	50.756	50.756	20.586
2	2.892	5.458	56.214	2.892	5.458	56.214	17.519
3	1.740	3.284	59.498	1.740	3.284	59.498	11.027
4	1.464	2.761	62.259	1.464	2.761	62.259	7.986
5	1.315	2.482	64.741	1.315	2.482	64.741	12.752
6	1.195	2.254	66.995	1.195	2.254	66.995	10.521
7	1.037	1.958	68.953	1.037	1.958	68.953	4.178

Eigenvalues that are more significant than one indicate how many factors will be retained. The first seven factors or components explained 50.76%, 5.46%, 3.28%, 2.76%, 2.48%, 2.25%, and 1.96% of the variance, respectively. All 7-factor solutions have eigenvalues greater than 1. Thus, they must be retained for further investigation. These seven factors explained about 69% of the variance. The minimum explained variance to be acceptable in factor analysis is 60%. If the variance explained is less than 60%, there is a higher likelihood of more factors showing up than the expected factors in a model (Akhtar, 2020). Therefore, the seven factors are acceptable for further investigation.

The extraction sum of squared loadings shows the number of rows corresponding to the number of components retained. These seven factors are retained for further investigation. Moreover, solutions for the factors were examined using Direct Oblimin Rotation since it was assumed that the factor solutions were uncorrelated.

Table 5: Pattern Matrix

1	2	3	4	5	6	7
Q23 (.542)	Q5 (-.581)	Q47 (.523)	Q39 (.696)	Q1 (-.815)	Q16 (.899)	
Q24 (.597)	Q6 (-.803)	Q49 (.676)	Q44 (.541)	Q3 (-.652)		
Q25 (.737)	Q7 (-.726)	Q50 (.665)	Q45 (.560)	Q4 (-.830)		
Q27 (.752)	Q9 (-.508)					
Q28 (.724)	Q10 (- .611)					
Q29 (.717)	Q11 (- .656)					
Q30 (.582)	Q12 (- .663)					
Q31 (.506)	Q13 (- .768)					
Q32 (.689)	Q14 (- .594)					
Q33 (.571)						
Q35 (.577)						
Q36 (.663)						
Q38 (.571)						

Table 5 presents the pattern matrix, which contains the coefficients for the linear combination of the variables.

The pattern matrix coefficients are the given component's unique loads into the variables. The items that fall on every component are labeled with the same construct. Table 9 indicates that seven-factor solutions were extracted. However, there are only five-factor solutions recommended due to the following reasons:

- i. Items Q2, Q8, Q15, Q17, Q18, Q19, Q20, Q21, Q22, Q26, Q34, Q37, Q40, Q41, Q42, Q43, Q46, Q48, Q51, Q52, and Q53 were deleted since they are weakly correlated to the extracted factors.
- ii. Factor 7 was deleted because no variable is loaded to this factor.
- iii. Factor 6 was also deleted because only one variable was loaded to this factor. This factor is considered under-identified because it has below three variables (Clark & Watson, 1995).
- iv. Factors 1, 2, 3, 4, and 5 have three or more factor loadings.

The correlated values of the factor loadings under factors 1, 3, and 4 were all greater than +0.5. This means that all items have a moderate positive correlation with the factor and a direct relationship with this factor. On the other hand, factors 2 and 5 have a negative sign. This means the items have a strong negative correlation and an inverse relationship with their factors.

Table 6: Final Questionnaire on Teachers' Qualities

<p>Directions: The following items are statements describing the teacher's qualities. Please put a check (/) inside the box of your response relative to your experience using the scale below:</p> <p>1 – Never 2 – Occasionally 3 – Sometimes 4 – Often 5 – Always</p>					
	5	4	3	2	1
Instructional Competencies					
1. The teacher motivates their students to do well in class.					
2. The teacher praises students for their efforts and good work.					
3. The teacher is creative and considers students' interests when giving class activities.					
4. The teacher divides the class into groups during activities to encourage collaboration among students.					
5. The teacher ensures that those who perform well in class are evenly distributed to each group during class activities.					
6. The teacher closely supervises each group throughout the class activity to check whether they are on the right track.					
7. The teacher integrates technology into the activities they gives to motivate students to participate.					
8. The teacher monitors each student to ensure everyone actively participates during activities.					
9. The teacher gives activities that are relevant and entertaining to ensure student participation.					
10. The teacher provides clear instructions for the activities they give.					
11. The teacher facilitates the class well during classroom activities.					
12. The teacher makes sure they have spare materials for activities in case students fail to provide for themselves.					
13. The teacher provides complete and clear instructions for the exams they give.					
Personal Qualities					
14. The teacher provides a class environment where students feel included and comfortable.					
15. The teacher is approachable.					
16. The teacher is patient.					
17. If the teacher senses that students are becoming bored, they find ways to regain the students' attention.					
18. The teacher ensures that everybody in the class understands the lesson, e.g. by asking each student whether they understood.					
19. Students are permitted to interrupt and ask questions to clarify anything they do not understand.					
20. The teacher ensures that the questions/clarifications asked by students are answered.					
21. The teacher is student friendly.					
22. The teacher makes the students feel that they are always there to help them learn.					

Procedural Fairness on Tests					
23. The teacher ensures that no one cheats during exams.					
24. The teacher sets exams that are based on the lessons they have been taught.					
25. The teacher gives challenging exams.					
Handling Learners' Response					
26. The teacher does not entertain questions during the exam.					
27. The teacher extends their time to ask students about their personal problems.					
28. The teacher asks the students for feedback on how to improve their teaching.					
Compassionate Discipline					
29. The teacher does <u>not</u> use harsh words/actions to discipline unruly students.					
30. The teacher gives just and fair sanctions to unruly students.					
31. The teacher does <u>not</u> humiliate students in front of their classmates.					

After having a valid and reliable tool to measure teacher qualities, the responses of the student-respondents of the tool, together with the information gathered for teachers' achievements (measured by professional rank, years of experience, highest educational attainment, and participation in professional development activities) and students' academic achievement measured in an ordinal scale, were analyzed using Ordinal Regression Analysis.

Ordinal Regression Analysis

Table 6: Model Fitting Information

Model	-2 Log Likelihood	Chi-square	df	Sig.
INTERCEPT ONLY	166.922			
FINAL	152.774	14.147	9	.000

The model fitting information in Table 6 contains the -2 log-likelihood of the only model and final model. The likelihood ratio chi-square test indicates whether there is a significant improvement in the fit of the final model over the intercept-only model. In this case, there is a substantial improvement in the fit of the final model over the intercept-only model [$\chi^2(9) = 14.147, p < .05$].

Table 7: Goodness-of-Fit

	Chi-square	df	Sig.
Pearson	181.297	192	.699
Deviance	150.002	192	.989

Table 7 displays the Goodness-of-Fit, which contains the Pearson and Deviance chi-square tests. These tests are useful in determining whether a model exhibits a good fit to the data. Non-significant test results indicate that the model fits the data well (Petrucci, 2009). The Pearson chi-square test [$\chi^2(192) = 181.297, p > .05$] and Deviance chi-square test [$\chi^2(192) = 150.002, p > .05$] were both non-significant. These results suggest a good model fit.

Table 8: Parameter Estimates

	Estimate	Std. error	Wald	df	Sig.

Threshold location	[Student Achievement = 2]	1.054	2.318	.207	1	.649
	[Student Achievement = 3]	2.579	2.313	1.244	1	.265
	[Student Achievement = 4]	4.397	2.356	3.484	1	.042
	Professional Rank	-.592	.652	.822	1	.365
	Years of Experience	.42	.059	.508	1	.047
	Highest Educ. Attainment	.946	.421	5.036	1	.025
	CPD Units	-.006	.004	2.045	1	.153
	FACTOR 1	-.978	.751	1.696	1	.193
	FACTOR 2	1.301	.538	5.842	1	.016
	FACTOR 3	1.72	.437	.154	1	.046
	FACTOR 4	.551	.350	2.474	1	.026
	FACTOR 5	-.218	.240	.827	1	.363

Legend of Student Achievement (1 = Did Not Meet Expectations, 2 = Fairly Satisfactory, 3 = Satisfactory, 4 = Very Satisfactory, 5 = Outstanding)

Table 8 presents the regression and significance tests for each of the independent variables in the model. The regression coefficients are the predicted change in log odds of being in a higher group/category on the dependent variable per unit increase on the independent variable. An optimistic estimate means that for every one-unit increase on an independent variable, there is a predicted increase in the log odds of falling at a higher level of the dependent variable. This generally means that as values increase on an independent variable, there is an increased probability of losing at a higher level on the dependent variable. On the other hand, a pessimistic estimate indicates that as scores increase on an independent variable, there is a decreased probability of falling at a higher level on the dependent variable. Furthermore, the Threshold estimates are interpreted as the "log odds of being in a particular group or lower when scores on the other variables are zero" (Osborne, 2017).

Conclusion

Based on the results of the Exploratory Factor Analysis (EFA) and Ordinal Regression Analysis of this study, the factors under teachers' qualities in dealing with students, namely, Personal Qualities, Procedural Fairness to Tests, and Handling Learners' Responses to teachers' achievements, specifically the Years of Experience and Highest Educational Attainment influence the level of students' achievement in General Mathematics. Furthermore, Teacher Personal Qualities significantly affect students' achievement in General Mathematics. Hence, teachers' qualities in dealing with students should be seriously considered when aiming to increase the level of students' achievement in Mathematics.

Recommendations

The researcher proposes that school officials leverage the study's findings to identify and implement pertinent training and seminars for mathematics teachers to enhance student performance. This study can be a resource for mathematics educators to design techniques to improve student performance. Students are urged to examine the study to have a deeper comprehension of the pivotal function of educators in their academic achievement. Future scholars may regard this study as a basis for analogous research utilizing Exploratory Factor Analysis (EFA) and Ordinal Regression Analysis. Moreover, additional research is

recommended on subjects including the impact of teacher attributes on student learning behavior, the association between teacher attributes and effectiveness, the incorporation of teacher attributes into professional development, the connection between teaching experience and teacher characteristics, and the application of Structural Equation Modeling in tool development.

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