

Mediation Analysis of Parent-Teacher-Partnership Attitude on Parental Qualification and Students' Mathematics Achievements

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Abstract

One of the many ways of improving achievement in school subjects is to study factors that research have identified as those aiding achievement. This is needed in Mathematics because of the low achievement of learners in both school and public examinations at all levels of education in Nigeria. The study examined the mediating effect of Parent-Teacher-Partnership Attitude on the relationship between parent qualification and children Mathematics achievement. A sample of 4,146 students was drawn from 72 randomly selected private and public schools in 12 Local Government Areas (LGAs) in the three senatorial districts of Oyo State. One rural LGA was purposively picked and three urban LGAs were randomly selected from each senatorial district. The result of the analysis revealed that Parent-Teacher-Partnership Attitude (PTP) partially mediates the relationship between parent qualification and children Mathematics achievement since indirect effects ($PQ \rightarrow PPTPA$, $t=4.423, p=0.000$; $PPTPA \rightarrow \text{Math Ach}$, $t=6.697, p=0.000$) is significant and the direct effect ($PQ \rightarrow \text{Math Ach}$, $t=8.272, p=0.000$) is also significant. Hence, school administrators and policy makers should encourage Mathematics teachers to develop healthy relationship with parents to boost students' achievement in Mathematics.

Key words: Parent-Teacher-Partnership Attitude, Parent qualification, Achievement and mediation analysis.

Introduction

Parents play vital roles in the educational development of their children since they understand their children more than any other person, at least being their children's first teachers. Through interaction with their parents early in life, children acquire diverse experiences which shape their character and set the stage for their academic development. Parents are saddled with the responsibility of training and raising children in the home until they are independent enough to interact with the larger society. The training and learning received from parents at this stage, prepare them for a holistic cognitive, affective and psychomotive development needed for interaction in the larger society. However, parents do not have the monopoly of influence on their children as interaction with the school environment is needed for further development of the child. Teachers need to work with parents to make their work easy because parents are familiar with their children. They know the

children's likes and dislikes, and how to get their attention. This makes parent-teacher relationship a necessary ingredient in ensuring children's academic success. Oladipo-Abodunwa (2019) notes that the attitude and participation of parents greatly influence children's education.

Paswan and Young (2002) stress that children are motivated to learn when they know that their parents and teachers give attention to their academic development. Parental involvement includes assistance in homework, assignments and projects; follow-up on school learning; provision of relevant school needs; prompt payment of fees and levies; attendance at school meetings, and monitoring of home and school activities. Epstein, Sanders, Simon, Salinsa, Jansorn and Voorhis (2009) classify parental involvement under six (6) headings: parenting (having a home environment that facilitates learning), communication (teachers and parents communicating to monitor children's academic progress in school), volunteering (parents

helping and providing academic support for teachers in the classroom), learning at home (parents providing assistance for children at home with homework, projects and assignments), decision making, and collaboration with the community.

Regular communication between parents and teachers on children's learning can lead to the establishment of a strong relationship between parents and teachers. Oladipo-Abodunwa (2019) describe this as a triangular relationship between the child, teacher and parent. Synergy between the three parties in parent-teacher-partnership (PTP) can help in the establishment of the remaining five types of parental involvement in Epstein's (2009) classification. Keyes (2000) asserts that communication between parents and teachers on children's learning makes parents more knowledgeable on how best to assist and support children at home academically. This indicates that communication is the driving force in PTP. As one of the strategies that can be used to ensure steady and sustained high performance in Mathematics (Oladipo-Abodunwa, 2019), PTP gives children consistent messages about the value of education and makes them feel encouraged in their pursuits. PTP transcends just making children pass examinations; it enhances students' academic development by addressing specific learning problems such as, redirecting students' attention to tasks at hand and ensuring smooth transition from one level of education to another.

PTP provides a link between the classroom and the home; it is a tool for the teacher to access parents' active participation in the child's learning, using the two-way flow of information (Loughran, 2008). Wendy, in Owen and Taylor (2010), described PTP as a convergence in which the child, parent and teacher come together to take decisions that will promote the academic development of the child. These literature suggest that a partnership is established by the teacher to create a more family-like school where the individual differences of each learner are taken into consideration to give the children a sense of belonging. Eldridge's (2001) study reveals that

PTP benefits not only the child, but also parents and teachers. Parents, on the one hand, become more knowledgeable on how to help and support children at home to ensure that assignments are done within deadlines. Students are thus motivated to learn and to develop positive attitude to homework, which leads to regular school attendance and improved performance. Teachers, on the other hand, benefit by becoming more focussed on teaching. They get to know more about their students' needs and home environment.

Some factors such as parents' lack of education, inability to communicate with the teacher due to language differences, parents' socio economic status which may result in child rearing practices, and values that conflict with those of the teachers may inhibit communication in PTP (Keyes, 2000). Therefore, PTP in children education can be negative if the involvement does not enhance the cognitive development of learners (Oladipo-Abodunwa, 2019). This may happen if the roles of parents and teachers are not clearly defined or when parties in PTP lack the required knowledge and attitude. Invariably, this will result in bad practice of PTP.

PTP in children education can be negative if the involvement does not enhance the cognitive development of learners. Parents sometimes employ their children's teacher as extra lesson teachers either in school or at home. Such teachers often prepare the children for examinations to justify their pay, but fail to develop the children's conceptual understanding of the topics taught. This they do by concentrating on likely examination questions. Some teachers also organise after-school lessons and make them compulsory. Topics taught in the lessons are not treated during the normal school classes on the pretext that the scheme of work cannot be completed within the term. Students in the lessons often perform better than their counterparts who do not attend such lessons. Some parents engage in sharp practices like purchasing live question papers to make children pass public and school examinations. PTP should not be built around such negative parent-teacher interactions, but on positive

contributions from parents, teachers and students.

As pointed out in the SCAN (2018) annual report, effective PTP may be a major way of enhancing the performance of children in school. When PTP is effective, it can produce a noteworthy achievement in children's education (O'Brien, 2005). This implies that with a healthy and effective PTP in Mathematics, students may attain high academic heights in the subject. Oladipo-Abodunwa's (2019) study identifies three (3) PTP variables that are based on knowledge, attitude, and practice (KAP) and can produce high Mathematics achievement. The theory is based on parent-Teacher-Partnership Knowledge (PTPK), Parent-Teacher-Partnership Attitude (PTPA) and Parent-Teacher-Partnership Practice (PTPP). The KAP theory is premised on the fact that healthy behaviour is possible with the acquisition of right knowledge which engenders the adoption positive and good practice. According to the (KAP) theory, PTPK affects attitude i.e PTPA which is the view of parents and teachers about PTP. Attitudes that can help in building an effective and strong PTP, include monitoring of children's academic progress and home activities by parents through physical and telephone communications. Teachers can advise parents on how the home can complement what has been taught in school or how to get support for home learning. This demands that parents and teachers must regularly discuss feedbacks about the child's academic progress.

Loughran (2008) opines that effective PTP requires trust, respect, time, effort and skill, which place a great demand on the professional competence of the teachers and educational level of parents. This suggests that, the qualification of parents and teachers are important variables in building an effective PTP because, qualification may regulate the knowledge base and views of parents about PTP. Other factors to be considered are parents' occupation and the number of children in the family, as these may affect family income and determine attitude to PTP. Parental education may be a motivating force for a child. Khan,

Iqbal and Tasneem (2015) argue that highly educated parents have significant influence on children's achievement at the secondary school level because the parents are likely to be more responsive to their children's academic needs since they know the possible implications of their actions. In line with this, Jaroslawska (2014) finds a substantial association between parental cognitive ability and children's educational achievement. Squire, cited in West (2012), claims that students' achievement should no longer depend on factors like socio-economic status and gender, but on teachers' ability to design support system, such as PTP, where learners will learn in spite of their backgrounds.

West's (2012) study reveals that, students who received feedback during instruction did well on tests that aligned with the instruction, either in a mastery learning model or other instructional situations. This is an indication that adopting communication between parents, teachers and students through PTP can improve learning outcomes, promote interest and boost achievement in Mathematics. This will bring relief to the teeming population of learners denied admission to science-related and humanities courses in tertiary institutions because they do not have the required level of pass in Mathematics. It is against this background that this study investigates the mediating effect of PTPA on the relationship between parents' qualification and achievement of students in senior secondary school Mathematics in Oyo State.

Research Questions

- 1) How valid and reliable are the data emanating from the measurement models of the latent construct (PTPA) and Mathematics achievement?
- 2) What is the mediating role of PTPA on the relationship between parents' qualification and Mathematics achievement?

Method

A multistage sampling procedure was adopted at the senatorial districts, Local Government Areas

(LGAs), schools and classroom levels. One LGA in the rural areas without basic amenities like electricity, banks, and ATM was purposively selected from each of the 3 senatorial districts in Oyo State. Random sampling procedure was used to choose three urban LGAs with electricity and banks with ATM machines from the remaining LGAs in each senatorial district. This gave a total of twelve LGAs from the three senatorial districts. Rural and urban schools were used to make the sample heterogeneous. Intact classes and one arm of Senior Secondary School three (SSS3) science, arts and commercial classes were sampled from four public and two private schools randomly selected from each LGA. Mathematics teachers teaching those classes and parents of the students were included in the sample for this study.

Two instruments, Mathematics Achievement Test for Students (MATS), Parent-Teacher Partnership Attitude Questionnaire for Parents (PTPAQP), were used to collect data. MATS, with 21 items, was administered to students to collect data on students' achievement in Mathematics, while PTPAQ, with 12 items, was administered to the parents through the students sampled to gather information on the

qualification of parents and their attitude to PTP. MATS, with initial 40 items, was subjected to face and content validities. Twenty-seven (27) items with moderate difficulty indices, between 0.45 and 0.70, were picked. A table of specification was also used to establish the content validity of the instrument while Kuder-Richardson formula 20 (KR-20) was adopted to establish the reliability index which was found to be 0.89. The reliability of PTPAQ was computed using Cronbach Alpha after being subjected to exploratory factor analysis to establish the dimensionality and construct validity of the instrument while Kuder-Richardson formula 20 (KR-20) was adopted to establish the reliability index which was found to be 0.89. The reliability of PTPAQ was computed using Cronbach Alpha after being subjected to exploratory factor analysis to establish the dimensionality and construct validity of the instrument while Kuder-Richardson formula 20 (KR-20) was adopted to establish the reliability index which was found to be 0.89. The reliability of PTPAQ was computed using Cronbach Alpha after being subjected to exploratory factor analysis to establish the dimensionality and construct validity of the instrument while Kuder-Richardson formula 20 (KR-20) was adopted to establish the reliability index which was found to be 0.89.

Results

PLS measurement model built to ensure reliable and valid data were used for analysis in the structural model. The measurement model for this study has two reflectively latent constructs {parent-Teacher-Partnership (PTPAQ) with 12 items and Mathematics Achievement Test with 27 items (MATS)} and an observed variable {parents' qualification (PQC)}. Figure 1 presents the measurement model for the study.

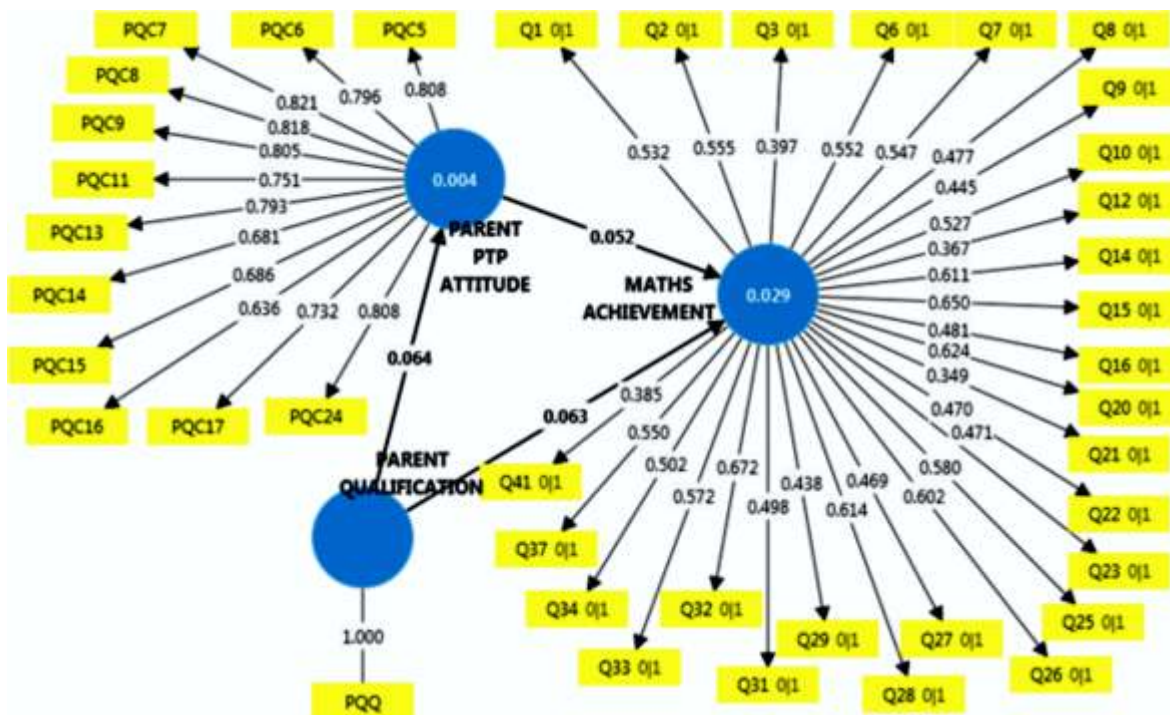


Figure 1: Measurement model for Parent-Teacher-Partnership Attitude (PTPA) and Mathematics Achievement Test

The measurement model was estimated to confirm the validity and reliability of the latent construct in the model. Table 1 shows the results.

Table 1: Summary of the Estimation of the Measurement Model

construct	Convergent validity		Internal Consistency		
	Indicator	Factor loading	AVE	Cronbach Alpha	Composite Reliability
PTPA Parent-Teacher-Partnership Attitude	PQC5	0.808	0.583	0.935	0.943
	PQC6	0.796			
	PQC7	0.821			
	PQC8	0.818			
	PQC9	0.805			
	PQC11	0.751			
	PQC13	0.793			
	PQC14	0.681			
	PQC15	0.686			
	PQC16	0.636			
	PQC17	0.732			
PQC24	0.808				

Results in Table 1 show acceptable reliabilities for the two latent constructs (PTPA & MATS) since the reliability indices are above the benchmark of 0.7 for both composite and Cronbach. The reliability Index for PTPA ranges between 0.93 and 0.94, therefore confirming that the instrument (P-PTPA) used to gather data for parent PTP attitude for this study is reliable. Factor loading is a measure of convergent validity. All the indicators of PTPA have high factor loadings greater than or equal to 0.7 (the lowest being 0.636 and the highest is 0.821) which means that the indicators of PTPA correlate highly with the construct and result in the average variance extracted (AVE) value of 0.583. This establishes the convergent validity of the scale, since it is greater than the threshold value of 0.5 as recommended by Hair, Hult, Ringle, and Sarstedt, (2017).

The 27 items on the Mathematics achievement scale were carefully selected to ensure coverage of the four sections of the Senior Secondary School Mathematics syllabus (i.e. number and numeration, algebraic processes, geometry & mensuration, and statistics & probability) with a table of specification to establish its content validity. Based on the assessment of the measurement model for this study, the data that

emanated from it are valid, reliable and are therefore appropriate for use in building the structural model. The latent scores for the indicators were extracted and used in building the structural model for the study.

Discriminant validity was also established to ensure that the constructs in the measurement model are distinct. The Hetro-Trait-Mono-Trait (HTMT) ratio proposed by Hensler, Ringle and Sarstedt (2015) was adopted in the estimate. Discriminant validity is established if the HTMT ratio of two constructs in a PLS model is less than 0.85. Table 2 presents the results.

Table 2: HTMT Ratio of Constructs in the Model

	MATHS ACH	PARENT PTP ATTITUDE
PARENT PTP ATTITUDE	0.101	
PARENT QUALIFICATION	0.122	0.064

Discriminant validity is established going by the values (ratio of Mathematics achievement & Parent PTP Attitude is 0.101; it is 0.122 for parents' qualification & Mathematics achievement while it is 0.064 for parents' qualification and parent PTP attitude on Table 2. The structural model for the study was built to ascertain the mediating effect of parent PTP attitude (P-PTPA) on the relationship between parental occupation (PQ) and students' achievement MATS. The structural model was tested for significance at 0.05 level with two tails via bootstrapping to know the paths that are significant. There are three paths in the model, path from **PQ→MATH ACH, PQ→PTPA and PTPA→MATH ACH**. The direct path is **PQ→MATH ACH** and the indirect path is **PQ→PTPA→MATH ACH**. Figure 2 presents the structural model for the study.

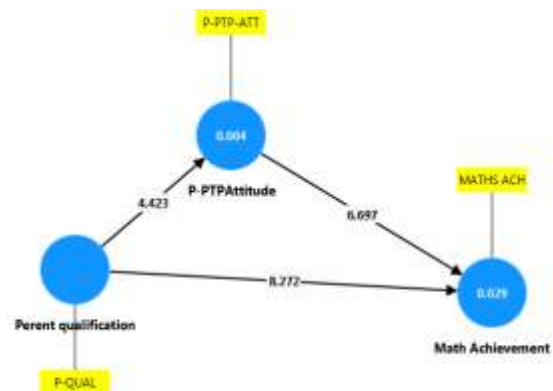


Figure 2: Structural model for Parental Qualification (PQ) Parent-Teacher-Partnership Attitude (PTPA) and Mathematics Achievement Test (MATS) with t-value on each path

Mediation analysis is conducted to study the mediating role of a variable called the mediator variable on the relationship between an independent variable known as the exogenous

variable in structural Equation Modelling (SEM) and the dependent variable referred to as the endogenous variable in SEM. The analysis was run in this write up to specifically study the mediating role of PTPA on the positive relationship between parental qualification and students' achievement (Khan, Iqbal, Tasneem, 2015). The result of the analysis of the structural model in Figure 2 is shown in Table 3 below.

Table 3: Summary of the Assessment of the Structural Model for Significance

	Path coeff	t-value	P values	95% coff interval BCa	Significan ce at 0.05 level
P-PTPAAttitude -> Math Ach	0.107	6.697	0	[0.076, 0.137]	Yes
Parent qual -> Math Ach	0.128	8.272	0	[0.096, 0.157]	Yes
Parent qual -> P-PTPAAttitude	0.064	4.423	0	[0.035, 0.092]	Yes

Results on Table 3 reveal that the three paths in the model are all significant, since the t-values are all [direct path, Parent qualification -> Math Ach (t=8.272); and indirect paths; [Parent qualification -> Parent-PTP Attitude (t=4.423) and Parent PTP Attitude -> Math Ach (t= 6.697)] greater than 1.96 (Hair et. al, 2017)

Discussion

The assessment of the measurement model affirmed the capability of the model in producing valid and reliable data. Acceptable reliability indices (PTPA, $r=0.94$; MATS, $r=0.89$) of above 0.7 reveal that constructs in the model are reliable. This is an indication that the constructs (PPTPA & MATS) have internal consistencies (Herath and Rao, 2009; Hoffmann and Birnbrinch, 2012). This implies that the constructs are stable and strong enough for further analysis in the study. The average amount of variance in an indicator variable that is explained by a construct is referred to as average variance extracted (AVE). If AVE value is greater or equal to 0.5, it means that the explained variance exceeds the unexplained, due to error (Bagozzi and Yi, 1988; Hair et al, 2017). It is a good indication that the latent factors, PTPA (0.586), has convergent validity. In other words, the latent construct (PTPA) is measuring what it is intended to measure. The AVE is not applicable MATS since the scale (MATS) is based on a particular content (Senior

Secondary School Mathematics syllabus) and adequacy of coverage of the syllabus was ascertained with a table of specification to ensure the content validity of the scale. Establishment of discriminant validity for the constructs show that each construct in the model is different from any other construct, so each construct can stand alone.

The assessment of the structural model reveals that both the direct (PQ → MATH ACH, $t=8.272$) and indirect (PQ → PTPA, ($t=4.423$) & PTPA → MATH ACH, $t=6.697$) effects are significant at 0.05 level of significance. It means that Parent-Teacher-Partnership Attitude (PTPA) partially mediates the relationship between parental qualification (PQ) and children's Mathematics achievement, thereby providing empirical evidence for the mediating role of Parent-Teacher-Partnership Attitude (PTPA).

Conclusion

Many students have phobia for Mathematics, but Mathematics is important for the technological development of any nation; hence its requirement for admission in tertiary education for students who wish to study science-related and humanities courses. Parents and teachers need to work together to provide home and school environments that facilitate learning of Mathematics through PTP which is a triangular relationship between the child,

parents and teachers. This may heighten performance in the subject, mitigate the phobia associated with Mathematics instruction and aid sustainable development of the nation.

Recommendations

Consequent upon the finding of this study that Parent-Teacher Partnership Attitude (PTPA) partially mediates the empirical evidence of positive relationship between parents' qualification and students' Mathematics achievement, the following recommendations are made:

- ✓ PTP should be encouraged at all levels of education; it should be intensified if it is already in existence.
- ✓ Sensitisation programmes should be encouraged for parents on the importance of parents and teachers working together for their children.
- ✓ Governments, communities and non-governmental agencies could organise mass literacy programmes to boost the qualification of parents.
- ✓ Government should make education free to ensure that our children, who will become parents in future, are educated to boost the academic achievement of their offspring in the nearest future.

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