Influence of Parent-Teacher Partnership on Students' Academic Engagement and Mathematics Achievement in Nigeria

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Abstract
Many students' dread of mathematics all over the world necessitates efforts to evolve strategies to arouse students' interest, improve students' engagement with the subject, enhance performance and consequently impact positively on the national growth of the country. The provision of home and classroom environments that are conducive to mathematics learning through Parent-Teacher Partnership (PTP) might be a step in this direction. A sample of 4146 SSS3 students with their parents, and 74 mathematics teachers from 72 schools (public=48 and private=24) selected from 12 Local Government Areas (LGAs) in the three senatorial districts in Oyo State, Nigeria provided data used in investigating the causal effect of PTP on student's academic engagement and mathematics achievement. One rural LGA was purposively selected and three LGAs randomly picked from each senatorial district. Intact classes were sampled from the six randomly selected schools from each LGA sampled. Analysis revealed that the PTP (knowledge t= 7.437 & t=6.543 &; attitude t=2.096 & t=4.361; and practice t=6.554 &t=6.604) of parents influenced students' academic engagement and achievement in mathematics. To the mathematics teacher, only PTP (attitude t=6.234 & t=4.817; and practice t=8.009 & t=6.476) influenced students' academic engagement and achievement in mathematics in senior secondary schools in Oyo State, Nigeria while teacher PTP knowledge (knowledge t=1.208 & t=5.787); is significant only for mathematics achievement. In addition, student's mathematics engagement (t=7.260) is significant on mathematics achievement. School authorities and stakeholders in education should, therefore, encourage teachers to partner with parents to heighten achievement in mathematics.

Keywords: Parent-Teacher-Partnership, Academic Engagement, Mathematics Achievement

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Introduction

The need, in the early societies, to feed groups of people, and construct structures for religious purposes and habitation necessitated the emergence of trade and exchange of goods. This translated into counting and calculation which brought mathematics into limelight. Today, mathematics is not only considered a field of study but an essential tool in science, engineering and humanities. It is a prerequisite to understanding the world and innovative technologies around us (The Math Learning Centre, 2023). This explains why the technological advancement of any nation is hinged on the application of mathematical principles to real life situations. Conscious of the relevance of mathematics to national development, the Nigerian government and stakeholders in education, organize regular training programmes through federal and state ministries of education to improve the teaching and learning of mathematics and ensure that students perform well in the subject.

Sa'ad, Adamu and Sadiq, (2014) lamented the poor performance recorded by Nigerian students despite the importance attached to the subject in the country's educational system. The results of students in the West African Senior School Certificate Examination shown on Table 1.1 below confirm the low performance of secondary school students in mathematics in Oyo State between 2016 and 2021, particularly in public secondary schools.

Table 1: *Summary of Mathematics Results of Public and Private School Students for May/June WASSCE 2016 and 2021 in Oyo State, Nigeria*

Year	**School Type**	**Total number that sat for the exam in public senior secondary schools**			**5 credits and above including English & Mathematics**			**Percentage %**
		Male	**Female**	**Total**	**Male**	**Female**	**Total**	
2016	**Public**	34,361	36,679	71,040	12,408	13,199	25,607	36.1
	Private	6934	7080	14,014	1533	1377	2,910	20.08
2017	**Public**	25,148	28,702	53,850	13,755	15,097	28,852	53.58
	Private	5702	5600	11,302	1024	749	1773	15.7
2018	**Public**	31,245	34,095	65,340	11,688	13,054	24,742	37.41
	Private	4478	4568	9046	700	562	1262	13.95
2019	**Public**	24,627	25,455	50,082	10,644	10,866	21,510	42.95
	Private	15,783	17,397	33,180	11,524	12,820	24,344	73.36
2020	**Public**	21,939	23,799	45,738	7,499	8,234	15,733	34.39
	Private	16,159	17,610	33,769	11,217	12,360	23,577	69.81
2021	**Public**	27,040	28,017	55,057	14,381	15,774	30,155	54.77
	Private	18,503	20,200	38,703	14,750	16,187	30,937	79.93

Source: WASSCE results extracted from National Bureau of Statistics (NBS) (2019 & 2022) 2016-2018 and 2019-2021 respectively

Table 1 shows that within six years, public school students had less than 50% credit pass, except in 2017 (53.58) and 2021 (54.77). Private schools suffered a decline in performance between 2016 and 2018. Their performance rate of 20.08 % in 2016, reduced to 15.7% in 2017 and 13.95% in 2018. There was an appreciable improvement in 2019 with 73.36% followed by a slight decrease in 2020 with 69.63%, attributed to COVID '19 pandemic, and picked again to 79.93% in 2021. If the low performance in mathematics in public secondary schools is not addressed on time, it may be difficult for Nigeria to position herself for national and sustainable development in science and technology since most Nigerians cannot afford private schools for their children. Support systems to boost mathematics learning, such as Parent-Teacher-Partnership (PTP), could be adopted to complement classroom mathematics teaching.

Literature Review

Partnership is a cooperative relationship between people or groups who agree to share responsibilities for achieving specific goals (vocabulary.com). Basset (2010) noted that educators who form partnership with parents are among the most successful in their work with children. This notion is reinforced by Oladipo-Abodunwa (2019) and Lekli and Kaloti (2015)'s description of parent-teacher-partnership (PTP) as a relationship characterized by mutual cooperation and responsibilities aimed at achieving specified goals. Therefore, synergy between parents and teachers should enhance academic achievement in mathematics. Loughran (2008) revealed that PTP provides a link between classroom learning activities and home learning engagements. PTP is, according to Owen and Taylor (2010), a convergence on the child, parents and teachers that gives learners a sense of belonging in the classroom and promotes students' classroom participation. Christendon and Sheridan (2001) stressed that parents and teachers have different roles and expectations and the effectiveness of PTP relationship depends on the competence of both parents and teachers in the discharge of their roles. This implies that the knowledge of, attitude to, and the practice of PTP are important factors to consider in the effectiveness of the relationship.

Generally, behaviour is significantly influenced by knowledge as the first step in behaviour change (Digital Response Ability, 2024). The common saying that 'knowledge is power' alludes to the importance of knowledge in making achievements in any aspect of life. (Loewen and Sato, 2017). Hornby (2006) defines knowledge as 'facts, information and skills acquired through experience and education.' This suggests that knowledge is gained through, association and experience. In line with this, Oladipo-Abodunwa, (2019) defined PTP knowledge as awareness of the expected collaboration that exists between parents and teachers. The value that people attach to a particular object or phenomenon is hinged on the sum total of what is known and it determines the behaviour (attitude) to the object or phenomenon. This implies that PTP knowledge, to a great extent, regulates the attitude of parents and mathematics teachers to PTP. PTP attitude is the degree of openness to collaborative activities between parents and mathematics teachers (Oladipo-Abodunwa, 2019). Knowledge of PTP will shape the views, feelings and behaviour tendencies of parents and teachers towards PTP. Part of the attitude expected in PTP is for the parties to see themselves as true partners by being open with each other to discuss concerns and not to see the relationship as a waste of time. PTP transcends parents doing homework, reading together with the child, visiting school on open days, attending school functions or being members of school organizations. It extends to the relationship formed with the teacher that helps the child to function adequately in school, develop life skills and networks, and builds the capacity of parents to participate in their children's learning (Sheridan, 2016).

A phone call from either the parent or the teacher can set the stage for an effective PTP. Loughran (2008), opined that following up with a phone call after a concerned parent has contacted can confirm to the parent that the teacher cares. It means, then, that PTP can be described as a structured form of parental involvement. Within a partnership, the teacher creates more family-like schools where individual differences of each learner is taken into consideration, thereby giving every learner a sense of belonging. The parents, on the other hand, provide a home environment that facilitates mathematics learning. Fredricks, Blumenfield, and Paris (2004) asserted that 'if students are to benefit from what schools offer and acquire the capabilities needed to succeed in the global market, students need to establish a commitment to education in addition to school attendance.' The child must be engaged academically to complement the efforts of the parents and teachers in the partnership.

Deneen, (2010) sees engagement as a strategic process for learning in the classroom while Oladipo-Abodunwa (2019) believes it is the daily commitment to school work in a way that leads to improved academic achievement for students. In other words, it is the duty of learners to acquire additional knowledge. These definitions show that, students need to establish a commitment to education, in addition to school attendance, for academic excellence. Academic engagement establishes a relationship between non-cognitive factors (i.e. motivation, interest, curiosity, responsibility, determination, perseverance, and attitude) and cognitive learning outcomes (improved academic performance, information recall and skill acquisition). Fredricks et al (2004) pointed out that academic engagement can be categorized into behaviour, cognitive and emotional engagements. Behavioural engagement is the participation of learners in roles that may foster behaviour conducive to learning (Deneen, 2010). Cognitive engagement exists when students make personal investment in learning in a focused, strategic and self-regulating manner while emotional engagement deals with positive attitudes and reactions towards school, teacher, learning and peers (Parsons et al, 2011). Orozco, Pimentel and Martin (2009) remarked that behavioural engagement was found to be a robust predictor of academic performance. Against this background, the study investigated the extent to which parent-teacher-partnership can predict achievement of students in senior secondary school mathematics in Oyo State, Nigeria.

Statement of Problem

Many students dread mathematics and find mathematics instruction difficult. As a result, low performance is recorded by Nigerian students (Sa'ad, Adamu and Sadiq, 2014) in spite of numerous studies (Olutola, Ogunjinmi & Daramola, 2021; Oladipo-Abodunwa, 2019 and Owolabi & Etuk-iren, 2014) conducted to mitigate the problem. Existing literature (Basset, 2010; Oladipo-Abodunwa, 2019; Loughran, 2008 & Paswan et al, 2002) reveals that regular communication between teachers and parents promotes academic development and justifies the need to evolve support strategies such as PTP (Lekli and Kaloti, 2015) to promote student academic engagement to enhance and sustain student's performance in mathematics. This study explored the individual and joint causal effects of parent-teacher-partnership (PTP) on students' academic engagement and mathematics achievement in senior secondary schools in Oyo State, Nigeria.

Research Questions

1) How valid and reliable are the data emanating from the measurement models of the latent constructs (PTPK, PTPA, PTPP, SAES and MATS) of the study?
2) What is the causal effect of:
    a. PTPK, PTPA & PTPP on Student Academic Engagement and mathematics achievement?
    b. Student Academic Engagement on mathematics achievement?

Theoretical Framework

The study is guided by the social Cognitive Theory (SCT) which submits that mental processes are influenced by intrinsic and extrinsic factors. SCT considered that the behaviour of an individual is hinged on the interaction between three variables: behavioural patterns, personal attributes and environmental characteristics. The study is based on SCT because cognitive development (achievement), a personal and intrinsic characteristic, is influenced by the interaction between the external factors (students' behaviour referred to as student academic engagement in this study) and the environment (PTP). Figure 1 illustrates SCT with the variables: personal attributes, behavioural patterns and environmental characteristics.

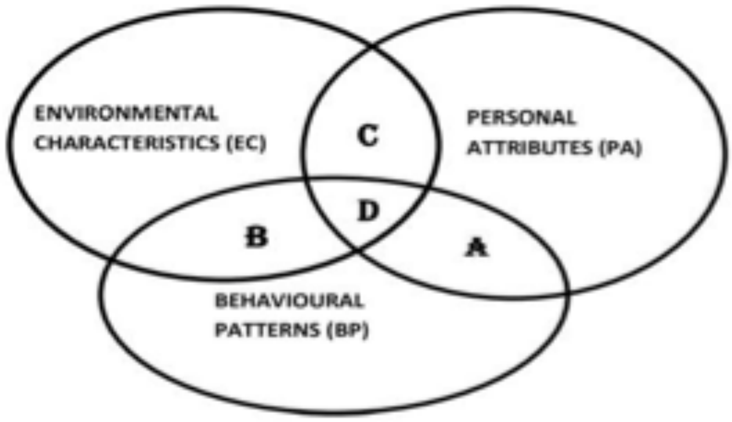

Figure 1: *Pictorial Representation of SCT*
(Source: Wikipedia. https://en.mwikipedia.org>wiki>social)

Figure 1 illustrates that interactions between BP, EC and PA determine D (behaviour of an individual), which also depends on A (interaction between BP & PA)**,** B (interaction between BP& EC) and C (interaction between EC & PA).

Method

a) Sampling and Sample

The study adopted multistage sampling procedure at the senatorial district, Local Government Area (LGA), school and classroom levels. Four (4) LGAs were sampled from each of the three (3) senatorial districts in Oyo State. One (1) rural LGA without basic amenities like electricity, banks without Automated Teller Machine (ATM) was purposively selected and three (3) urban LGAs with the facilities were randomly picked from the remaining LGAs in each senatorial district. Rural and urban schools were used to have heterogeneous groups for the sample. Intact classes of one (1) arm of science, arts and commercial classes of senior secondary school three (SS3) students were sampled from four (4) public and two (2) private schools from each LGA. A total of 4,146 students, their parents from 12 LGAs and 74 mathematics teachers of the classes formed the sample for the study.

b) Instrumentation

Eight instruments were used to collect data for this study. They are: Mathematics Achievement Test for Students (MATS), Students' Academic Engagement Scale (SAES), Parent-Teacher Partnership Knowledge for Parents (PTPKQP), Parent-Teacher Partnership Knowledge for Teachers (PTPKQT), Parent-Teacher Partnership Attitude for Parents

(PTPAQP), Parent-Teacher Partnership Attitude for Teachers (PTPAQT), Parent-Teacher Partnership Practice for Parents (PTPPQP) and Parent-Teacher Partnership Practice for Teachers (PTPPQT) MATS and SAES with 21 and 13 items respectively were administered to students to collect data on students' achievement in mathematics and academic engagement while PTP questionnaires with 8, 12 and 16 items for knowledge, attitude and practice were administered, through the students sampled, to parents and mathematics teachers of the classes sampled to gather information on PTP (knowledge, attitude and practice). A table of specification was used to establish the content validity of MATS while Kuder-Richardson formula 20 (KR-20) was adopted to establish its reliability of 0.89. Cronbach Alpha in SPSS was used to establish the reliability indices of the PTP questionnaires for knowledge, attitude and practice.

Method of Analysis

Model Specification

Partial Least Squares Structural Equation Modelling (PLS-SEM) was adopted for the analysis of data. PLS-SEM uses the measurement and structural models for analysis. Variables/constructs in Structural Equation Modelling (SEM) are specified based on theoretical assumptions, logical reasoning and literature (Hair et al, 2017). Based on theoretical assumptions and literature, it was hypothesized that knowledge may exert influence on attitude and attitude may impact on practice (Digital Response Ability, 2020; Vitello, Greatorex & Shaw, 2021). On this premise, the study hypothesized that, T-PTPK that may exert influence on P-PTPK since, according to Hornby (2006), knowledge can be acquired through education or experience; P-PTPK may have causal effect on T-PTPA. T-PTPA may influence P-PTPA and this (P-PTPA) has causality on T-PTPP which, may also have causal effect on P-PTPP.

Exploratory factor analysis in R was used to establish the factors (academic challenge r=0.79; active learning r=0.78 and determination r=0.81) of Students' Academic Engagement (ENG). The endogenous variables in the study are, PTP knowledge of parent and mathematics teachers (T-PTPK & P-PTPK), attitude of parents and mathematics teachers to PTP (T-PTPA & P-PTPA), practice of PTP by parent and mathematics teachers (P-PTPP & T-PTPP) and Students' Academic Engagement (ENG). The criterion variable is Mathematics Achievement (MATH ACH). Items of mathematics achievement scale cover the four sections (number & numeration, algebraic process, geometry & mensuration and probability & statistics) as contained in the mathematics curriculum for both junior and senior secondary schools in Nigeria.

Results

How Valid and Reliable Are the Data Emanating From the Measurement Models of the Latent Constructs (PTPK, PTPA, PTPP, SAES and MATS) of the Study?

The measurement model (Figure 2) was estimated to ensure the validity and reliability of the latent constructs (PTPK, PTPA, PTPP, SAES and MATS) in the study. Tables 2 presents the results of the analysis.

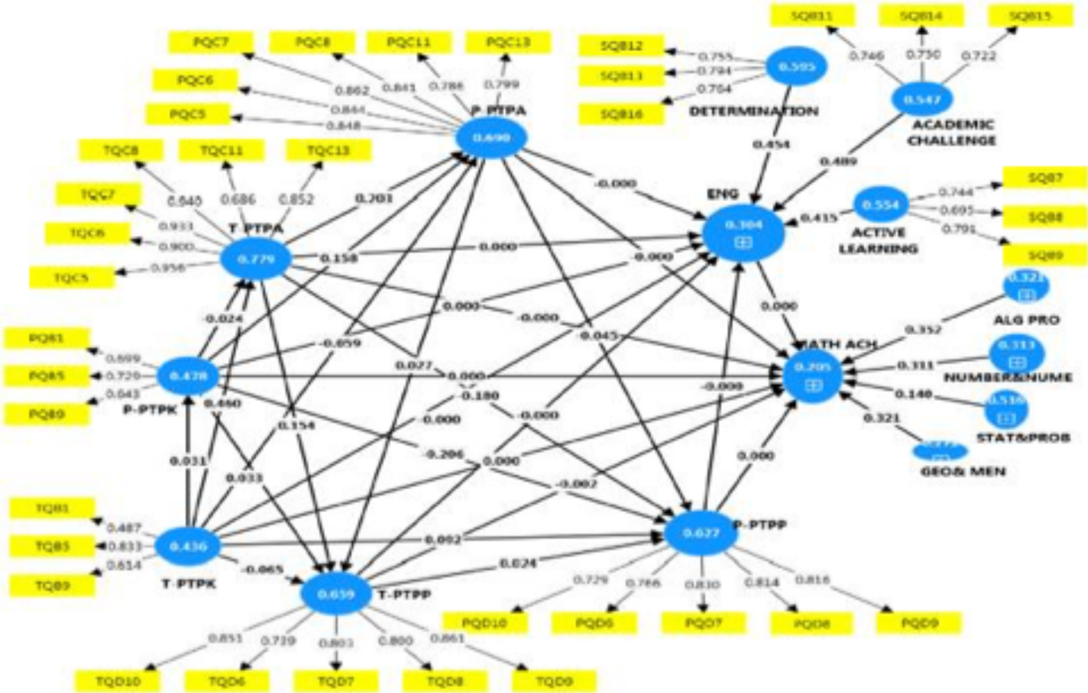

Figure 2: *Reflective Measurement/Outer Model for PTPK. PTPA, PTPP, ENG With AVE on the Endogenous Construct and Factor Loading for Each Indicator on the Arrow Between Each Indicator and Its Construct*

Table 2: *Summary of Assessment of the Reflective Measurement Model for PTPK, PTPA, PTPP and ENG*

	Construct		**Convergent Validity**		**Internal Consistency**		
	Factors	**Indicator**	**Loadings ≥ 0.7**	**AVE ≥ 0.5**	**Cronbach's alpha**	**Composite reliability**	**Construct**
Student Academic Engagement **(ENG)**	Academic Challenge	SQB11	0.746				
		SQB14	0.749				
		SQB15	0.723	0.547	0.59	0.78	
	Active Learning	SQB7	0.744				
		SQB8	0.695				
		SQB9	0.791	0.554	0.60	0.79	
	Determination	SQB12	0.755				
		SQB13	0.794				
		SQB16	0.764	0.595	0.66	0.82	0.71(0.80)
Teacher PTP Knowledge (**T-PTPK)**		TQB 1	0.487				
		TQB 5	0.833				
		TQB 9	0.614	0.44	0.35	0.69	
Parent PTP Knowledge (**P-PTPK)**		PQB1	0.699				
		PQB 5	0.729				
		PQB 9	0.643	0.48	0.45	0.73	
Teacher PTP Attitude (**T-PTPA)**		TQC5	0.956				
		TQC6	0.900				
		TQC7	0.933				
		TQC8	0.940				
		TQC11	0.686				
		TQC13	0.852	0.78	0.94	0.95	

Parent PTP Attitude (**P-PTPA)**	PQC5	0.848				
	PQC6	0.844				
	PQC7	0.862				
	PQC8	0.841				
	PQC11	0.786				
	PQC13	0.799	0.69	0.91	0.93	
Teacher PTP Practice (**T-PTPP)**	TQD6	0.739				
	TQD7	0.803				
	TQD8	0.800				
	TQD9	0.861				
	TQD10	0.851	0.66	0.88	0.91	
Parent PTP Practice (**P-PTPP)**	PQD6	0.766				
	PQD7	0.830				
	PQD8	0.814				
	PQD9	0.816				
	PQD10	0.729	0.63	0.85	0.89	

The internal consistencies of the variables in the study were confirmed with Cronbach Alpha and composite reliabilities as it is considered and reported in PLS since there is a general assumption that Cronbach Alpha over estimates reliability and composite under estimates, hence it is believed in PLS that the true measure of internal consistency lies between them (Hair, Hult, Ringle and Sarstedt, 2017; Hoffman & Birnbrich, 2012 and Herath & Rao, 2009). Table 3 reveals acceptable values of internal consistencies of 0.7 and above for all the endogenous latent constructs in the study except for those of P-PTPK (0.45), T-PTPK (0.35), active learning (0.60) and academic challenge (≈ 0.60) below the bench mark for Cronbach Alpha but their composite indices are all approximately 0.7.

Convergent validity was established by estimating the factor loadings and the AVE for the constructs in the outer model. It can be observed from Table 2 and Figure 2 that nearly all the indicators of the construct loaded above 0.708 bench mark (Hair et al, 2017) on their corresponding constructs; except SQB 8(0.695≈0.7); TQB1(0.487), TQB9(0.614), PQB1(0.699≈0.7), PQB(0.643) and TQC11(0.686≈0.7). Factor loading of 0.7 and above suggests a very strong positive relationship between a construct/factor and its indicators. In other words, the indicators reflect the construct effectively. Indicators with low factor loading (< 0.7) were retained since a scale is only viable if it has at least three indicators/ items. In addition, Ping (2009), opined that indicators with low factor loading may be retained if the variables are important to the study. In line with this view, PTP knowledge of both parents and teachers is germane to its practice and also important in determining attitude to it (Oladipo-Abodunwa, 2019) since according to Willingham (2017), the richer the knowledge base, the easier the operation. To establish convergent validity of the indicators of a construct in the model, the AVEs were also estimated.

The discriminant validity of the constructs in the model was also estimated using the Hetro-Trait Mono-Trait (HTMT) ratio proposed by Henseler (2015). In PLS-SEM, discriminant validity is established, if the HTMT ratio between every pair of latent constructs in a reflective measurement model is less than 0.85. Table 3 displays the HTMT ratios for all pairs constructs in the measurement model.

Table 3: *HTMT Ratios of Pairs Constructs in the Measurement Model*

	Academic challenge	Active learning	Determi nation	P-PTPA	P-PTPK	P-PTPP	T-PTPA	T-PTPK
Active learning	0.623							
Deter mination	0.604	0.283						
P-PTPA	0.12	0.16	0.101					
P-PTPK	0.354	0.253	0.121	0.237				
P-PTPP	0.181	0.103	0.109	0.113	0.334			
T-PTPA	0.037	0.044	0.102	0.184	0.044	0.144		
T-PTPK	0.049	0.089	0.056	0.102	0.109	0.053	0.605	
T-PTPP	0.093	0.073	0.154	0.064	0.062	0.044	0.152	0.28

Results on Table 3 show that the ratios are below the cut-off of 0.85 (Henseler, 2015, therefore establishing the discriminant validities of the constructs in the reflective measurement model. The assessment of the measurement model shows that the scales are valid and reliable, hence data emanating from them can be used for further analysis in the structural model. The latent scores for all the constructs were therefore obtained and used in building the structural model for the study. Figure 3 presents the structural model for the study.

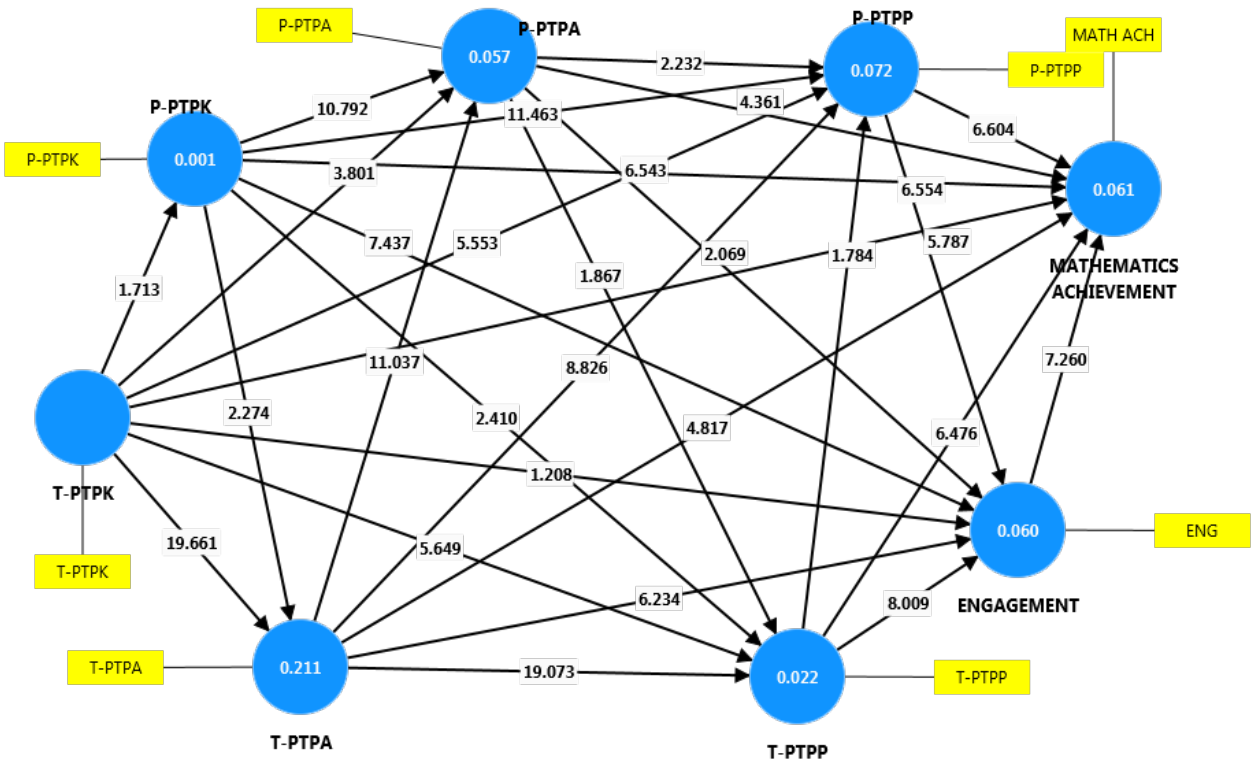

Figure 3: *Structural Model for T-PTPK, P-PTPK, T-PTPA, P-PTPA, T-PTPP, P-PTPP, Engagement & Math Achievement With T-values*

What Is the Causal Effect of:

a) PTPK, PTPA & PTPP on Student Academic Engagement and Mathematics Achievement?

Paths in a structural model may be distorted, if there are strong positive relationships between constructs in the model. High correlations among constructs in a model will result in collinearity (Hair et al, 2017); as a result it is important to estimate the Variance Inflation Factor (VIF) to ascertain that collinearity between all pairs of predictor variables (constructs listed on the first column) in the model are not at critical (i.e. VIF value ≥ 5). Table 4 presents the VIF values for all predictor variables in the model.

Table 4: *VIF Values of All Pairs of Predictor Variables in The Model*

	Engage Ment	Math Ach	P-PTPA	P-PTPK	P-PTPP	T-PTPA	T-PTPP
Engage ment		1.064					
P-PTPA	1.064	1.065			1.062		1.061
P-PTPK	1.075	1.096	1.002		1.029	1.001	1.028
P-PTPP	1.078	1.091					
T-PTPA	1.371	1.383	1.268		1.336		1.311
T-PTPK	1.286	1.286	1.269	1	1.277	1.001	1.272
T-PTPP	1.023	1.037			1.022		

Collinearity is established between two predictor variables if the VIF value is greater than or equal to 5. Results on Table 4 range between 1.002 and 1.191, which are all less than the critical point of 5 (Glenn, 2015 & Bock, 2019), confirming that collinearity among the constructs in the structural model is not at critical level. The result implies that each construct in the structural model is unique, independent and perfectly different from each other. Each construct can stand alone. Hence, paths in the model are not biased. The structural model was subjected to test of significance at 0.05 level with two tails to assess the level of relationship among the constructs. Table 5 shows the path coefficients in the model.

Table 5: *Significance of Path Coefficients in the Structural Model*

	Paths	Path Coeff β-Values	Standard deviation	t-Values	P-values	95% confidence interval BCa	
1	ENGAGEMENT -> MATHEMATICS_ACHIEVEMENT	-0.108	0.015	7.26	0	[-0.137, -0.078]	YES
2	P-PTPA -> ENGAGEMENT	-0.035	0.017	2.069	0.039	[-0.066, -0.001]	YES
3	P-PTPA -> MATHEMATICS_ACHIEVEMENT	0.068	0.016	4.361	0	[0.038, 0.099]	YES
4	P-PTPA -> P-PTPP	-0.045	0.02	2.232	0.026	[-0.084, -0.006]	YES
5	P-PTPA -> T-PTPP	0.027	0.014	1.867	0.062	[-0.001, 0.054]	NO
6	P-PTPK -> ENGAGEMENT	-0.142	0.019	7.437	0	[-0.180, -0.107]	YES
7	P-PTPK -> MATHEMATICS_ACHIEVEMENT	0.097	0.015	6.543	0	[0.068, 0.125]	YES
8	P-PTPK -> P-PTPA	0.158	0.015	10.792	0	[0.13, 0.186]	YES
9	P-PTPK -> P-PTPP	-0.206	0.018	11.463	0	[-0.241, -0.172]	YES
10	P-PTPK -> T-PTPA	-0.024	0.011	2.274	0.023	[-0.045, -0.003]	YES

11	P-PTPK -> T-PTPP	0.033	0.014	2.41	0.016	[0.005, 0.059]	YES
12	P-PTPP -> ENGAGEMENT	0.11	0.017	6.554	0	[0.078, 0.144]	YES
13	P-PTPP -> MATHEMATICS_ACHIEVEMENT	0.11	0.017	6.604	0	[0.077, 0.142]	YES
14	T-PTPA -> ENGAGEMENT	0.108	0.017	6.234	0	[0.072, 0.14]	YES
15	T-PTPA -> MATHEMATICS_ACHIEVEMENT	-0.098	0.02	4.817	0	[-0.138, -0.058]	YES
16	T-PTPA -> P-PTPA	0.203	0.018	11.037	0	[0.167, 0.239]	YES
17	T-PTPA -> P-PTPP	-0.18	0.02	8.826	0	[-0.219, -0.139]	YES
18	T-PTPA -> T-PTPP	0.154	0.008	19.073	0	[0.137, 0.169]	YES
19	T-PTPK -> ENGAGEMENT	-0.021	0.017	1.208	0.227	[-0.055, 0.012]	NO
20	T-PTPK -> MATHEMATICS_ACHIEVEMENT	0.098	0.017	5.787	0	[0.064, 0.13]	YES
21	T-PTPK -> P-PTPA	-0.059	0.016	4.361	0	[-0.088, -0.028]	YES
22	T-PTPK -> P-PTPK	0.031	0.018	1.713	0.087	[-0.001, 0.071]	NO
23	T-PTPK -> P-PTPP	0.092	0.017	5.553	0	[0.06, 0.124]	YES
24	T-PTPK -> T-PTPA	0.46	0.023	19.661	0	[0.412, 0.504]	YES
25	T-PTPK -> T-PTPP	-0.065	0.012	5.649	0	[-0.088, -0.043]	YES
26	T-PTPP -> ENGAGEMENT	-0.116	0.015	8.009	0	[-0.143, -0.088]	YES
27	T-PTPP -> MATHEMATICS_ACHIEVEMENT	0.106	0.016	6.476	0	[0.073, 0.139]	YES
28	T-PTPP -> P-PTPP	0.024	0.014	1.784	0.074	[-0.002, 0.052]	NO

It can be observed from Table 5 that, parent knowledge of PTP (P-PTPK) is significant on both mathematics achievement (t=6.543) and engagement (t=7.437) while T-PTPK is not engagement (t=1.208) but significant on mathematics achievement (t=5.787). Parent attitude to PTP (P-PTPA) is significant on both mathematics achievement (t=4.361) and engagement (t=2.069). In like manner, T-PTPA is significant on both engagement (t=6.234) and mathematics achievement (t=4.817). In the same vein, practice of PTP by both parents (P-PTPP {ENG t=6.554; Math ach t=6.604}) and teachers (T-PTPP {ENG t=8.009; Math ach t=6.476}) are significant both on engagement and mathematics achievement.

b) Student Academic Engagement on mathematics achievement?

Table 5 further reveals that, student academic engagement is significant of mathematics achievement (t=7.26). In all out of the 28 paths in the structural model, 24 are significant while 4 are not (Table 5).

Discussion

How valid and reliable are the data emanating from the measurement models of the latent constructs (PTPK, PTPA, PTPP, SAES and MATS) of the study?

Acceptable values of 0.7 and above for reliability (Hoffmann and Birnbrinch, 2012 & Herath,, & Rao, 2009) confirm that endogenous constructs (***T-PTPK, P-PTPK, T-PTPA, P-PTPA, T-PTPP, P-PTPP, Engagement***) in the model all have internal consistencies even for those with low Cronbach Alpha reliabilities (i.e. P-PTPK, 0.45; T-PTPK,0.35; active learning, 0.60; & academic challenge, ≈ 0.60) but composite reliabilities above 0.7. This is because the true reliability of a variable lies between Cronbach Alpha, as the lower bound, and composite index, as the upper bound (Hair, Hult, Ringle and Sarstedt, 2017). The finding therefore means that the factors/constructs in the model for this study are stable, strong and reliable.

Constructs in the measurement model for the study all have Average Variance Extracted (AVE) values above the threshold of 0.5 (50%), excluding T-PTPK with AVE value of 0.44< less than 0.5. This is still acceptable because slightly low AVE might be acceptable for first time studies (Ping (2009) if it will not create major discriminant validity issues. Fortunately, as shown in the result section of this write-up, this is not a problem. The construct (T-TPTK) is therefore retained for relevance and significance as the parent version of the construct has AVEs above the cut-off. An AVE of 0.5 means that the indicators share at least 50% of the variance in the construct, hence each subscale is measuring what it is intended to measure. Factor loading of 0.7 and above is an indication that there is very strong relationship between that indicator and the attached construct and that the indicators of a construct correlate highly. This affirms the convergent validities of the indicators of all the constructs since the indicators loaded on or above 0.7 and are with acceptable AVEs (Bagozzi & Yi, 1988).

Constructs in the measurement model were assessed for discriminant validity using the HTMT ratio (Henseler et al, 2015). Results of the estimates show that the ratio among every two constructs in the model are below 0.85 bench mark. This affirms the uniqueness and independence of each latent construct in the measurement model for this study.

What Is the Causal Effect of:

a) PTPK, PTPA & PTPP on Student Academic Engagement and Mathematics Achievement?

Two out of the findings of this study show that P-PTPK & T-PTPK have influence on P-PTPA & T-PTPA and T-PTPA, and that P-PTPA has causal linkages with P-PTPP, and T-PTPP. These findings agree with the view of Willingham (2017) that the richer the knowledge base, the easier the operation. This means that knowledge helps a person to be the best version of oneself (Loewen and Sato, 2017), helps in developing positive attitude, and aids its practice. Also, P-PTPK has causal effect on engagement and achievement in mathematics. The simple explanation of this is that knowledge of PTP may propel parents into having regular communication with teachers over children's mathematics learning, and according to Little, Geo, and Bell (2009), it may increase student engagement through homework completion rates, on task behaviour, as well as classroom participation. All these impact positively on mathematics achievement.

T-PTPA and P-PTPA have causal linkages with student mathematics engagement and mathematics achievement. This finding corroborates the fact that when children are aware that parents and teachers give attention to their learning, they become interested and motivated to learn. This promotes engagement and enhances achievement in mathematics (Paswan et al, 2002). P-PTPP & T-PTPP are significant on engagement and mathematics achievement. The findings of this study corroborate the results of Robert (2015) that various involvement practices of parents in children education promote intrinsic motivation and increase academic engagement with positive impact on achievement. It is also in tandem with the fact that PTP is a protective factor and a home school strategy that enhances school success (Christenson, 2003).

b) Student Academic Engagement on Mathematics Achievement?

The present study also reveals that engagement can predict mathematics achievement. This is in tandem with the findings of Orozco et al (2009) and Fredricks et al (2004) that engagement is a robust predictor of academic performance; it checks low achievement that may result in high dropout rates in schools. In the same vein, the finding corroborates Deneen (2010)'s discovery that academic engagement not only improves school attendance and classroom behaviour but promotes learners' ability to enhance classroom learning.

Conclusion

Mathematics is an essential tool in almost every field of human endeavour yet many students find it difficult. Effort must therefore be made to evolve support systems that will enhance mathematics achievement. The findings of this study affirm that partnership between parents and mathematics teachers influence student's academic engagement and achievement in mathematics. The PTP knowledge, attitude and practice of both parents and mathematics teacher promoted learning outcomes in mathematics. In other words, a home and classroom environment conducive to mathematics learning may help to mitigate the problem of low achievement in this important subject. As students become engaged with mathematics, interest in the subject will be aroused and sustained. This will invariably change their perception of mathematics.

Recommendations

Qualified mathematics teachers should be engaged to teach mathematics in schools to ensure a good foundation for students.

School authorities should educate and encourage parents on the importance of going into PTP with mathematics teachers to promote mathematics learning in children.

Limitations

Due to the constraints of finance and time, only four local government areas were sampled from each of the three senatorial districts in Oyo State.

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