School Emphasis on Academic Success and TIMSS Science/Math Achievements

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Article Info	Abstract
	The study provided a structural equation modeling (SEM) of school leaderships' views of school emphasis on academic success relative to students' performances in Trends in Mathematics and Science Study (TIMSS) 2015 in Science and Math in the United Arab Emirates (UAE). The school emphasis was reflected by teachers, parents, and students' priority and ambition for academic success. The school questionnaire items related to school leaders' perception of teachers, parents, and students were used for the analysis (13 items). Both exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) were employed to construct the SEM. The SEM provided acceptable fit statistics with several significant paths. Results pointed to the significance of attitudes and behavior of teachers, parents, and students. There were significant paths from teachers to students, from parents to both students and TIMSS scores, and from students to TIMSS scores. The direct impact of the parent construct on the TIMSS scores was elaborated carefully. Implications of the study were discussed along with future research directions.

Introduction

The importance of academic success has been emphasized since it directly decides the positive outcomes of the students after graduating, and that students with good degrees or high levels of education are more probably to be employed and paid a higher salary than others with no academic success (Fleetwood and Shelley, 2000; Rentner and Kober, 2001). Research stresses that academic optimism made a significant contribution to student achievement (Hoy, Tarter, & Hoy, 2006). Academic optimism often reflects parents, teachers, and students' priority and ambition for academic success (Gustafsson and Nilsen, 2016; Scherer and Nielsen, 2016). School's emphasis on academic success and its influence on student achievements has also been extensively dealt with in the literature (Goddard, 2002). For example, Scherer and Nilsen (2016) examined the role of instructional quality as a potential mediator between school climate and student motivation by focusing on three aspects of school climate (emphasis on academic success, safety, and order in schools) and three aspects of achievement motivation (self-concept, intrinsic value, and extrinsic value). They noted a significant positive relation between instructional quality and achievement motivation at the classroom level in mathematics. The existence of a substantial positive effect of pedagogical content knowledge on students' learning gains was reported by Baumert et al. (2010) using multilevel structural equation models. Goe (2007) also provided extraordinary research synthesis to study the link between teacher quality and student outcomes. Using a framework of inputs, processes, and outcomes, the synthesis is considered a "one-stop shop" for researchers and policymakers interested in the science behind claims about the link between teacher quality and student academic achievement.

Some analysts, however, criticized that previous educational studies investigated the determinants of school academic achievement independently (Kocakaya and Kocakaya, 2014; Papanastasiou, 2002). Despite many models dealing individually or collectively with the effect of many factors related to attitudes and reactions of parents, teachers, and students, and academic outcomes, there still exists a gap of integrating those constructs to better understand the academic achievement of students. Only a few limited empirical research has attempted to link several factors when ascertaining the Science and Mathematics achievements of students (Kung and Lee, 2016; Pullmann and Allik, 2008). This study aims to use the UAE's data for 4th Graders to advance research on the effects of structural conceptualization of parental involvement, student features, teachers' features from one end, and Science and Mathematics achievement as an end result. For the UAE, this integration would provide broader information on how the affective and cognitive variables are related, in their influence on student academic outcome. The specific research questions of this research are the following:

- Which of the three constructs of principals' perceptions of teachers, parents, and students has the strongest relation with Science and Math performance?
- Could we identify an overall structural model and identify the nature of relations among predictors of teachers, parents, students, and academic achievements?
- What would principals perceive as the direct and indirect structural relationships between the constructs of teachers, parents, and students when student achievement is the dependent variable?

The UAE Education Systems

School education in the UAE is divided into public and private systems. The public schools in the UAE are constitutionally a matter for the country's two systems: the Ministry of Education (MoE) and the Abu Dhabi Education Council (ADEC). These two entities maintain a highly centralized educational system in which most policy-related decisions including staffing policies, school resources and management, and curriculum development are made at the national or district level. In each of the two systems, often there is a great deal of educational uniformity in terms of curriculum, textbooks, and general policies regarding teacher recruiting and training. Both MoE and ADEC also oversee the specific regulations for private schools in the country. There is also the Knowledge and Human Development Authority (KHDA) in Dubai, which is the agency concerned about private schools in Dubai. In general, the private school system is characterized by more decentralized systems in which many important decisions are left to local schools in light of some general policies issued by the government bodies. This decentralized structure of private schools has led to greater variation in schools' operation, student learning, and academic outcome. The three entities together have some influence on national directions through their policies, laws, regulations, financial support, and initiatives. Ultimately, the three entities are responsible in one way or another for the outcomes of student achievement in the country.

Literature Review

Parental involvement is a significant factor that shapes the attitudes and educational aspirations of young children (Castro et al., 2015; Chao, 2000; Fan, 2001; Fan and Chen, 2001; Hong and Ho, 2005; Papanastasiou, 2002). In many cultures, parental involvement is a cultural conception of responsibility that is seen to influence students' academic achievement significantly (Ho, Chen, Tran, & Ko, 2010; Hong and Ho, 2005). Dimensionalities in parental involvement possibly differ across cultures and cultural conceptions relating to children's academic achievement have been highly influential in shaping their type and methods of involvement (Kung and Lee, 2016). Thus, research stresses that a more precise and differentiated construct of parental involvement is needed to address this issue from a cultural perspective (Hong and Ho, 2005). In most cultures, and in academically-oriented societies, parental involvement focuses mainly on school-related attitudes such as academic beliefs, expectations, direct involvement and parental instruction, and indirect home structure for supporting learning and provision of resources that effect and improve children's school performance (Chao, 2000; Wong-Lo and Bai, 2013).

Research has consistently demonstrated the importance of parental involvement in its influence on the academic achievement of children (Jeynes, 2003, 2007). In fact, parental involvement constructs or dimensions have emerged as stronger predictors of school achievement than many other factors (Deslandes, Royer, Turcotte, & Bertrand, 1997). Many studies have noted multiple aspects associated with parent involvement and participation (Chen and Gregory, 2010; Somers et al., 2011; Strayhorn, 2010). In general, parental involvement variables usually include parental aspirations and expectations for their children's education, communication with children about school-related matters, parental supervision, and parental participation in school activities (Jeynes, 2007). One of the most important specific aspects of parental involvement influencing school outcomes is parents' expectations and aspirations (Fan and Chen, 2001). It is believed that parents convey their expectations to their children and provide educational goals for them (Hong and Ho, 2005; Jeynes, 2007). Parents talk with their children about the value of education, discuss future educational and occupational expectations, and help children draw links between schoolwork and its real world applications (Hill and Tyson, 2009; Taylor, Clayton, & Rowley, 2004). Specifically, many researchers note that parents can convey the value of Science or Mathematics to their children, and this can be associated with achievement in the subject (Hong et al. 2010; Sun, Bradley, & Akers, 2012). Parents encouraging children to participate in particular extracurricular activities related to Math and Science can have indirect effect on their academic future and outcome (George and Kaplan, 1998).

Substantial research exists that stresses the role of teachers and teaching practices in enhancing student achievements. Gustafsson and Nilsen (2016) investigated the causal effects of aspects of teacher quality and school climate on mathematics achievement. Their empirical study focuses on mathematics achievement across all countries participating in TIMSS 2007 and TIMSS 2011 by using a difference-in-differences analytical approach. Hill, Rowan, & Ball (2005) found teacher's higher levels of subject matter knowledge to be the key ingredient that influences students toward better performance and understanding of school process. Some noted that when teachers have higher levels of subject matter knowledge and understanding, are focused on instruction, and teach a high quality curriculum, they could provide students greater opportunity to learn more (Darling-Hammond, 1997; Hanushek and Rivkin, 2010). Chu et al. (2015) stressed that teacher quality is an important factor in improving student achievement. Hanushek (2011) noted that a student improves three times more in his or her academic achievement when taught by a high quality teacher (relative to a low quality teacher). Some studies have sought to identify the specific teacher credentials that signal teacher quality that has an effect on raising student achievement (Harris and Sass, 2011; Kukla-Acevedo, 2009).

Research has also identified some teacher features and characteristics to be remarkably influential on enhancing student achievement (Zakharov, Tsheko, & Carnoy, 2016). TIMSS (2011a and 2011b) results showed a positive school environment can increase student learning indirectly by facilitating greater teacher job satisfaction and self-efficacy (Caprara, Barbaranelli, Borgogni, & Steca, 2003). Research also shows that teacher collaboration with each other can have positive effect on student learning (Goddard, Goddard, & Tschannen-Moran, 2007; Wheelan and Kesselring, 2005). Teachers have an essential role in nurturing the development of student motivation in a subject by creating an environment that allows students to work autonomously while providing support, guidance, and positive feedback (Ryan and Deci, 2000). Teachers can provide positive feedback, listen and respond to students' questions, and be empathetic to their needs (Reeve, 2002).

There is a strong association between individuals' attitudes toward education and their academic performance and commitment. Some studies focused on the relationship between individual student attitude and characteristics of their academic achievement (Erdogan, Bayram, & Deniz, 2008; Konting, 1990; Lee and Malik, 2015). Research shows that students who have negative attitudes toward education are found to exhibit challenging behavior (Ming, Ling, & Jaafar, 2011). Living in poor and slum areas is found to contribute to the low academic achievement of students (Farooq, Chaundhry, & Berhanu, 2011). It should be noted that the TIMSS questionnaires have been used extensively in analyzing student Math/Science achievements. TIMSS 2015 general framework assumes that understanding how to improve student achievement and learning in Math and Science is crucial for educational policy makers, as well as principals, teachers, and parents (TIMSS, 2015). Karimzadeh, Tahmasebi, Salehi, & Shojaee (2015) used confirmatory path analysis of relationships between gender differences and teachers' role with math achievement through mediator variables in Iranian 8th Grade Students. Akilli (2015) used students' questionnaires and science success in TIMSS 2011 to demonstrate the science success regression levels of chosen emotional features of 8th grade students using Structural Equation Model.

Methods

Data and Instrument

The TIMSS 2015 project collected extensive information from school leaders on how they perceived their own school teachers, school children, and their parents. They provided valuable information with regard to teachers' degree of success in implementing the school's curriculum, teachers' collaboration and working together to improve student achievement, their understanding of the school's curricular goals, their ability to inspire students, and their expectations for student achievement. With regard to parents, TIMSS 2015 included important variables on how school leaders perceived parents and their degree of involvement with their child's schooling and education. The school questionnaire covered important issues such as parental support for student achievement, parental commitment to ensure that students are ready to learn, parental expectations for student achievement, parental pressure for the school to maintain high academic standards, and parental involvement in school activities. The school questionnaire also asked school leaders to provide their judgment on their students' attitudes. The three items were related to students' desire to do well in school, students' ability to reach school's academic goals, and students' respect for classmates who excel in school. TIMSS 2015 data for 4th Grade in UAE schools are used for this study (Math overall and Science overall scores). In addition, certain items on the school questionnaire were used (questions ACBG15A to ACBG15M - the new labels of 15A to 15M were used for simplicity). The weighted score per each domain in TIMSS was generated for each student (grouping

variable was the student ID) using the IDB Analyzer. The weighted scores and additional school demographics data were then merged with the student questionnaire using the SPSS merging function based on the Student ID.

The three items related to student are "their desire to do well in school," "their ability to reach school's academic goals," and "their respect for classmates who excel in school." The first item is related directly to student motivation. The other two items are related to their ability to reach certain goals and attitude toward their classmates. The teacher related items are their "understanding of the school's curricular goals," "degree of success in implementing the school's curriculum," "expectations for student achievement," "working together to improve student achievement," and "ability to inspire students." The first two items reflect generic skills and hence tap into teacher quality. The four parent related items deal with "involvement in school activities," "commitment to ensure that students are ready to learn," "expectations for student achievement," and "support for student achievement." It should be emphasized that all these items together reflect school emphasis on academic success. Schools leaders were asked to tell how they would characterize each of the statements within their school. A five-point scale was used (1: Very high, 2: High, 3: Medium, 4: Low, and 5: Very low). It is important for the intended analysis to use standardized variables. The variables in the school questionnaire are measured at different scales from TIMSS scores of Math and Science. Using these variables without standardization in effect gives the variables different range of weight in the analysis. Transforming the data to comparable scales can prevent this problem (Schumacker and Lomax, 2016).

The study used raw observations in the datasets to proceed with its intended statistical analysis instead of weighted observations based on the assigned sampling weights. It should be pointed out that the TIMSS system collects data with a rigorous two-stage stratified cluster sample design, where samples of schools and classrooms are randomly drawn from a stratified sample of schools in the participating countries (Foy and Joncas, 2004). As a result, the raw data are considered to be representative samples of students at each grade for each participating country. It should also be pointed out that sampling weights are generated in the TIMSS because the participating countries have different sizes of student population. In addition, as Joncas (2004) pointed out, the differential selection probabilities of students need to be adjusted to produce accurate survey estimates and unbiased cross-country comparisons. However, the current study aimed to examine the data within a single country (the UAE) and did not intend to compare results across different countries. Hence, as pointed out in similar studies, the use of sample weights was less appropriate for the purpose of this study, since using raw observations would be more authentic to reflect actual variations among the variables in a single country (Chen. Lin, Wang, Lin, & Kao, 2012).

Sample

A total of 558 schools across the UAE (Grade 4) participated in TIMSS 2015. Out of the total, 186 schools (33.3%) were public schools and 372 schools (66.7%) were private schools. The public schools taught government curriculum, while private schools used one of 11 different curriculums. Public-MoE curriculum constituted 33.3% of the sample, while Private-MoE accounted for 15.8% of the sample. Other private school curriculum included United Kingdom (18.3%), Indian (14%), United States (10%), and Pakistani (2%). Other curriculums included Australian, Canadian, International Baccalaureate (IB), the Philippine, and SABIS. The schools in the sample were representing the seven Emirates - Abu Dhabi (163 schools), Dubai (168), Sharjah (85), Ajman (43), Umm Al Quwain (11), Fujairah (34), and Ras Al Khaima (54). Enrollment in the schools was recorded to average 1183 students (minimum of 24, maximum of 9984, and standard deviation of 1126, 777). However, the average 4th Graders enrollment was 832 (minimum of 2, maximum of 834, and standard deviation of 93.851). The sample schools were identified as urban-densely populated (28.5%), suburban-on fringe or outskirts of urban area (24.4%), medium size city or large town (32.1%), small town or village (10.2%), and remote rural (4.7%).

Analysis

The current study aims to better understand the causal relationships that may exist among features associated with parents, teachers and students and their collective influence of scores of the UAE's 4th Grade students in Science and Math in TIMSS 2015. Only items of the school questionnaire dealing with "school emphasis on academic success" were used (ACBG15A to ACBG15M of the school questionnaire). Descriptive statistics of the 13 items were presented.

Before conducting SEM, it is commonly necessary to validating the scales used in the school questionnaire as a way to identify a set of latent constructs or factors. It is usually appropriate to do EFA to explore the existence of factors (latent dimensions) that contains items that are inter correlated and represent the same dimension. Hence, EFA was utilized to investigate variable relationships and identify few interpretable underlying factors. EFA would further our understanding if the multiple observed variables have similar patterns of responses. The idea is to allow each resulting factor to capture a certain amount of the overall variance in the observed variables. In this regard, it is important to identify the relationship of each variable to the underlying factor as expressed by the so-called factor loading.

It was necessary to test whether the sample variance-covariance matrix is supported by the theoretical concept. Therefore, it was ideal to test CFA measurement models to determine if the variables share common variances in defining the latent variables as assumed. As this study attempted to establish key variables that relate to the construct, a general structural equation model was run by testing all possibilities of linkages between the constructs representing teachers, parents, students, and TIMSS scores. It is necessary to mention that all assumptions for CFA and EFA were tested.

Finally, the SEM could help us to understand the relations that might exist and the identification of direct and indirect effects of the constructs on student achievement. CFA was mainly used to confirm or reject the measurement models suggested. Both the measurement models and the structural equation model were analyzed using LISREL 9.2, by examining fit statistics such as Chi-square ($\chi2$) statistics and associated p-values (and degrees of freedom), root mean square error of approximation (RMSEA), the goodness of fit index (GFI), the normed-fit index (NFI), the non-normed-fit index (NNFI), the adjusted goodness-of-fit index (AGFI), the comparative fit index (CFI), and the Root Mean Square Residual (RMR). Values for ($\chi2/df$) is considered satisfactory when < 3. Values of CFI, GFI, AGFI, NFI, and NNFI of > 0.90 are recommended. An RMSEA in the range of 0.05 to 0.10 is considered an indication of fair fit, while values smaller that 0.05 is considered good fit (Steiger, 2007).

Results

Descriptive Statistics

Table 1 provides the mean and standard deviation for each of the items. The questions were scored where one denoted very high, so higher scores reflected more negative perception. Hence, the table also shows reversed mean scores for better interpretation and understanding. As a result, higher scores reflect more positive perception. With regard to school feedback about teachers in the school, relatively medium range means were recorded (from 3.06 to 3.27). The highest mean was related to teachers understanding of the school's curricular goals, while the lowest mean was associated with teacher's expectations for student achievement. With regard to parents, all five items scored below 3 (or below medium). The highest score was related to parental expectations for student achievement (2.96), where the lowest score was related to parental commitment to ensure that students are ready to learn (2.53). For students, the highest score was related to students' respect for classmates who excel in school (3.21), and the lowest score related to students' ability to reach school's academic goals (2.82).

Table 1. School feedback on teachers, parents, and students

How would you characterize each of the following within your school? (Very high, high, medium, low, very low)	Mean	Mean Reversed	SD
15a Teachers' understanding of the school's curricular goals	1.73	3.27	.660
15b Teachers' degree of success in implementing the school's curriculum	1.84	3.16	.688
15c Teachers' expectations for student achievement	1.94	3.06	.706
15d Teachers working together to improve student achievement	1.76	3.24	.729
15e Teachers' ability to inspire students	1.83	3.17	.721
15f Parental involvement in school activities	2.45	2.55	.990
15g Parental commitment to ensure that students are ready to learn	2.47	2.53	.889
15h Parental expectations for student achievement	2.04	2.96	.817
15i Parental support for student achievement	2.44	2.56	.840
15j Parental pressure for the school to maintain high academic standards	2.14	2.86	.866
15k Students' desire to do well in school	2.03	2.97	.740
15l Students' ability to reach school's academic goals	2.18	2.82	.698
15m Students' respect for classmates who excel in school	1.79	3.21	.696

Factor Analysis

A first run of EFA with Varimax rotation (with principal component) yielded two factors with 63.566% variance explained. Another EFA was run by asking for specific three factors to be produced. The Varimax rotation results of that analysis are provided in Table 2. The solution is ideally divided into three dimensions with components loading on the three factors of teachers, parents, and schools. The total variance explained is 70.493%, which is considered good. Cronbach Reliability Alpha considers each of the factors as good if for teachers it is 0.885, for parents it is 0.871, and for students it is 0.831. Factor loadings usually reveal extent to which each of the variables contributes to the meaning of each of the factors. The numbers indicate high loadings for all of the variables in the EFA. For further analysis, the resulting three constructs or factors for teachers, parents, and students were used.

With regard to the three student related items, it should be noted that the item "Students' desire to do well in school" would reflect student engagement. The other two item - students' ability to reach school's academic goals and students' respect for classmates who excel in school - do not reflect student motivation or engagement or attitudes towards mathematics or science. Hence, we need to be careful; we may not refer to this as a cohesive and single latent construct. The most likely reason why the three items were able to form a reliable latent variable (from the EFA analysis) is because they all reflect the principal's perception of student's priority and ambition for academic success. The same goes for the other two constructs (teachers and parents).

Table 2. FA results with three factors requested

Items	F1 Teachers	F2 Parents	F3 Students
15b	0.82		
15a	0.80		
15e	0.78		
15d	0.76		
15c	0.66		
15g		0.79	
15i		0.79	
15h		0.73	
15j		0.73	
15f		0.67	
15m			0.80
15k			0.74
15l			0.71

Measurement Models

First, a CFA of the two constructs of teacher and parents was performed. The covariance matrix is shown in Table 3. For the student construct, there were only three variables. For the teacher construct, the resulting fit statistics were adequate. The recorded Chi-square ($\chi2$) is 7.274 with a P of 0.1221, with 4 degrees of freedom (df), and $\chi2/df = 1.811$. The RMSEA is 0.07, NFI is 0.985, NNFI is 0.983, CFI is 0.993, RMR is 0.0261, GFI is 0.982, and AGFI is 0.966. The resulting standardized estimates ranged between 0.73 and 0.92. For the parent construct, the resulting fit statistics were adequate also. The recorded Chi-square ($\chi2$) is 2.174 with a P of 0.7038, with 4 degrees of freedom (df), and $\chi2/df = 0.5435$. The RMSEA is 0.002, NFI is 0.994, NNFI is 0.990, CFI is 0.999, RMR is 0.0148, GFI is 0.995, and AGFI is 0.980.

The resulting standardized estimates ranged between 0.63 and 0.80. Next, a CFA is sum for the complete measurement model that is shown in Figure 1. All standardized estimates are also shown. The resulting fit stats for the model with all three constructs were good [maximum likelihood ratio of Chi-square is 156.81 with 57 degrees of freedom ($\chi2/df$ is 2.751), NFI of 0.958, CFI of 0.970, RMSEA of 0.0636, RMR of 0.0359, GFI of 0.953, and AGFI of 0.924]. With those fit statistics, we may conclude that the measurement models show that the corresponding latent variables can be represented by the observed ones (Bentler, 1990). As a result, we could develop a structural model where the dependent variable is TIMSS Math and Science scores to better understand how latent variables interact with each other.

Structural Equation Model

A general structural equation model was run by testing all possibilities. Figure 2 provides the final model where all constructs of teachers, parents, students, and TIMSS scores are shown. Table 4 shows the final standardized loadings, t-statistics, and path standardized coefficients. Table 5 shows the path coefficients and the corresponding t-values. The final model provided some acceptable fit indices. The maximum likelihood ratio of Chi-square is 148.102, with 79 degrees of freedom (χ^2/df is 1.87), NFI of 0.962, CFI of 0.973, RMSEA of 0.0619, RMR of 0.0404, GFI of 0.944, and AGFI of 0.915. All standardized estimates with their t-values are shown in the table. The most significant path coefficient is the one from parents to students with a value of 0.53 with t-value of 9.79. The connection strength (path coefficient) represents the response of the dependent variable to a unit change in an explanatory variable when other variables in the model are held constant (Bollen, 1989). The variables related to parents in the school questionnaire were all significant with relatively high loadings. They reflect parent's degree of involvement in school activities (0.69), their commitment to do their utmost to ensure that the child is ready to learn (0.88), with high expectations for their achievement (0.73). In addition, the parent construct reflects the parent's support for student achievement (0.83), while exerting pressure on the school to maintain high academic standards (0.67). Given the nature of the variables on the parent's construct, it is important to point out that parents have both direct and indirect effect on TIMSS scores. The direct effect of 0.33 is significant with a t-value of 4.41. The indirect effect of 0.1166 is through the mediation of students. As a result, parents exert a total effect of 0.0.4466 on TIMSS scores [the indirect effect is calculated as the multiplication of the direct effect of parents and students (0.53) and the direct effect of students and TIMSS scores (0.22), which is 0.1166].

Table 3. The covariance matrix

	ZMath	ZScie	G15A	G15B	G15C	G15D	G15E	G15F	G15G	G15H	G15I	G15J	G15K	G15L	G15M
ZMath	.998														
ZScie	.980	1.002													
15a	-.264	-.259	.990												
15b	-.267	-.265	.735	.999												
15c	-.356	-.362	.574	.629	1.000										
15d	-.267	-.278	.541	.593	.612	1.010									
15e	-.190	-.191	.580	.611	.532	.709	1.004								
15f	-.239	-.253	.425	.382	.457	.521	.477	1.002							
15g	-.405	-.426	.394	.419	.511	.491	.434	.625	1.003						
15h	-.433	-.453	.347	.330	.492	.374	.285	.450	.642	1.007					
15i	-.338	-.352	.364	.405	.439	.397	.408	.581	.746	.607	1.007				
15j	-.383	-.399	.288	.317	.395	.368	.283	.438	.562	.585	.572	.995			
15k	-.348	-.367	.397	.396	.481	.429	.467	.412	.529	.506	.526	.520	.982		
15l	-.372	-.381	.425	.497	.528	.460	.489	.443	.562	.489	.555	.434	.661	.999	
15m	-.280	-.310	.377	.376	.450	.404	.403	.375	.455	.427	.424	.366	.593	.608	.997

Table 4. The standardized estimates (loadings) and t-statistics

Dimensions and variables (items)	Standardized estimates	t-values
Teachers		
15a	0.70	17.60
15b	0.75	19.29
15c	0.85	21.53
15d	0.78	19.06
15e	0.80	19.74
Parents		
15f	0.69	17.98
15g	0.88	25.51
15h	0.73	19.23
15i	0.83	23.44
15j	0.67	17.06
Students		
15k	0.81	19.01
15l	0.84	20.84
15m	0.72	17.72
TIMSS scores		
Math scores overall	0.97	57.77
Science scores overall	0.95	54.52

Table 5. SEM paths and corresponding t-values

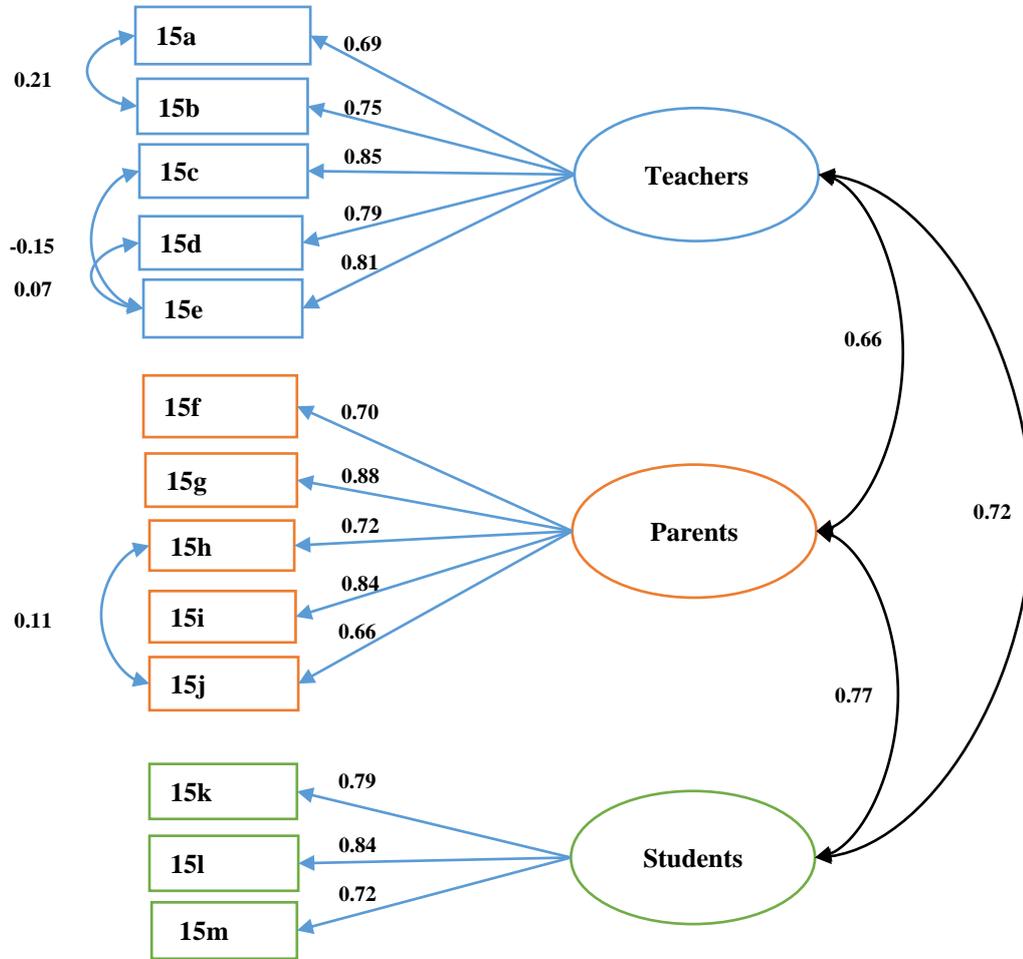| Path (To/From)	Estimate	t-value
Teacher → Student	0.37	7.20
Teacher → Score	(0.04)	(0.57)
Parent → Student	0.53	9.79
Parent → Score	0.33	4.41
Student → Score	0.22	2.59

Figure 1. The measurement model (independent constructs and variables)

There is no significant path from teachers to TIMSS scores since the recorded path coefficient is 0.04 with a t-value of 0.57 only. As a result, teachers seem to do their utmost to influence the student's knowhow and knowledge of both Math and Science. This can be said, because results also show that teachers have a significant effect on students with a direct effect of 0.37 with a t-value of 7.20. All five variables in the teacher's construct demonstrated high and significant loadings ranging from 0.70 to 0.88. The highest loading was pertinent to teacher's ability to inspire students. The other variable that got a relatively high loading (0.83) is relevant to teacher's expectation for student achievement.

The students construct shows a direct effect (relatively medium) to TIMSS scores with a path coefficient of 0.22 and a t-value of 2.59. The student construct is composed of variables that are reflective of student's desire to do well in school (0.81) and their ability to reach school's academic goals (0.84). The third variable reflects their association with high achievers in school (0.72).
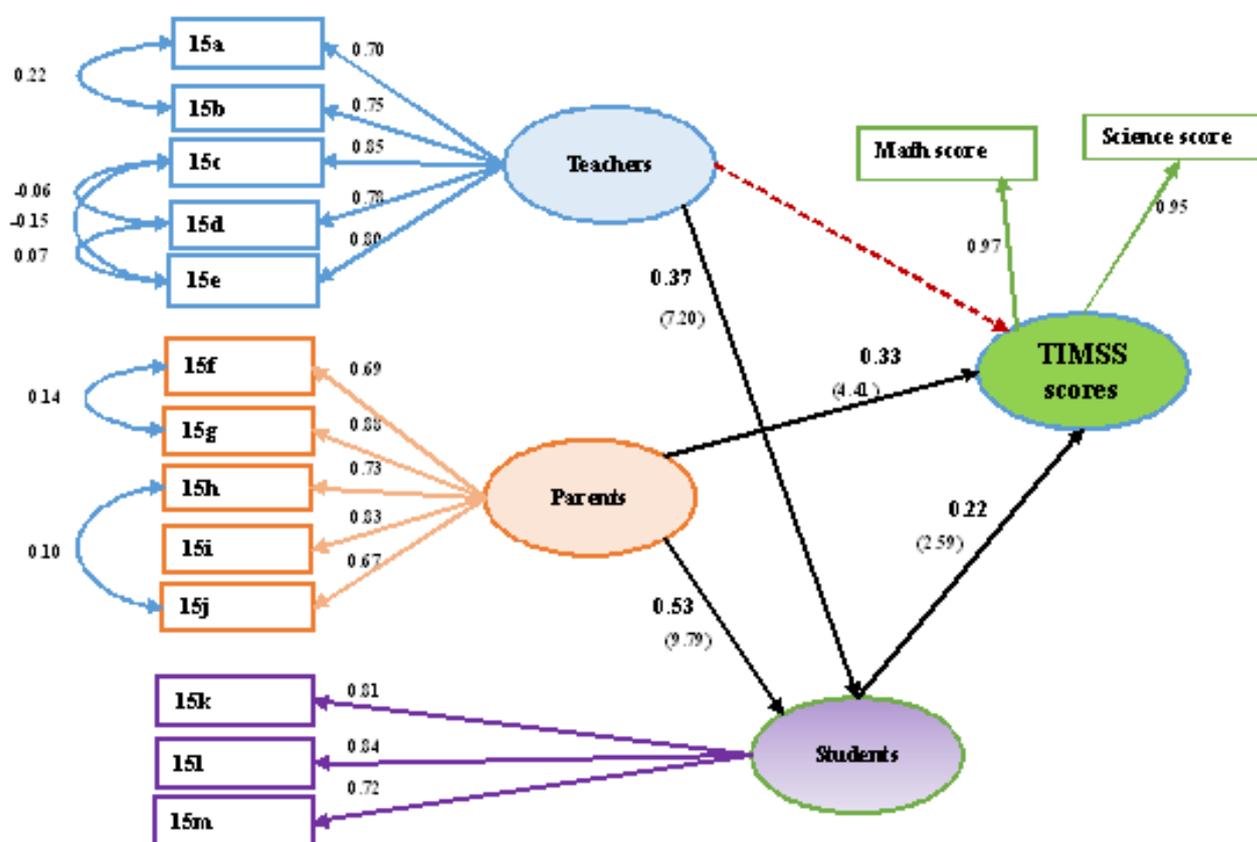
Figure 2. The structural equation model

Discussion

This study explored how Science and Mathematics outcomes are stimulated by predictors related to features associated with the constructs of teachers, parents, and students. For this analysis we decided to use only the school questionnaire data of TIMSS from the UAE. Consistent with the results of studies conducted in other cultures, the results of this study indicated that several exogenous factors related to the three constructs. For example, teacher's understanding and implementation of school curriculum, their expectation and ability to inspire students, and their collaboration with other teachers play a significant role in improving students' academic achievement (Chu et al., 2015; Kocakaya and Kocakaya, 2014; Zakharov et al., 2016). The parental involvement dimension played a primary role, directly and indirectly, in students' achievement (Adamski, Fraser, & Peiro, 2013; Park, Byun, & Kim, 2011; Wilder, 2014). The students' attitudes toward reaching the school's academic goals, and their desire and motivation to do well in school provide significant evidence that the phenomenon of Science and Math achievement is multidimensional in nature (Lee and Mallik, 2015; Ming et al., 2011).

A strong direct association is demonstrated between the type of parental involvement and academic achievement. This phenomenon is effectively true specially when parents have high academic expectations for their children, develop and maintain communication with them about school activities and schoolwork. These findings are consistent with the previous related studies (DePlanty, Coulter-Kern, & Duchane, 2007; Gonzalez and Wolters, 2006; Rubin, 2005; West and Thoemmes, 2010), which suggest the significance of aspects of parental involvement such as accompanying and supervising children's main school goals, their presence at the school, and their direct or indirect involvement in the school-related activities.

Numerous empirical studies show that parental characteristics and parental involvement are correlated with student academic achievement and student attendance and behavior (Bourdieu, 1991; Desforges and Abouchaar, 2003; Griffith, 1996; Hornby and Lafaele, 2011). This present research is consistent with this, but it further

highlights that principals' perceptions of parental factors may be related to student achievement through different ways. Parental factors, especially three of the five items (G, H, I,) that comprised the 'parents' construct adopted by this research, contribute to the development of student's learning ability, potential, and efforts or cultural capital in a broader sense. Students inherited, habituated, and nurtured in such cultural capital rich home environment are more likely to excel in academic achievement (Hartas, 2011; Lareau and Horvat, 1999). In this sense, parental factors have a 'direct' effect on student achievement, as shown by this research. Parental factors, including involvement in school activities (F, J), also contribute to the development of student's dispositions at school (Bourdieu, 1977, 1991), through which students capitalize school learning resources. This may explain the 'indirect' path of parental effects on student achievement.

Figure 2 shows the behavior of the actual data as seen by school leaders. We can assume that students with higher latent ability would have steeper slopes for the function relating the parent involvement scale with student's academic achievement. When we look at the simple means of the five variables of the parent construct, we note the lowest averages (all five variables below the 3.0 limit). This fact might call for more investigation to better understand where parental involvement is high, and where it is low. Understanding the differences among parents and correlating them with student's achievement might lead policy makers to focus and concentrate on specific cases to achieve results more effectively.

Teachers show significant direct influence on students. This result is in line with other similar studies (Cornelius-White, 2007; George and Kaplan, 1998; Harris and Sass, 2011). In addition to their role of providing class instruction to students, they have the momentous role of inspiring them and have high expectations for their achievement. One significant implication of the results is that policymakers at the government or school level in the UAE appear to be able (at least to a degree) to identify most observable components of teacher quality. Many relevant and immediate concerns might be analyzed deeper. For example, teacher recruiting processes, most desired characteristics and features of teachers, type of professional developments offered, and degree and type of teacher are not communicated. In other words, policy makers and school administrators must make recruiting, hiring, assignment, and compensation decisions based on carefully planned criteria and may adopt refined approaches.

Conclusions, Implications, and Future Research Directions

To the best of our knowledge, our study is the first to explore linkage between related constructs of parents, teachers, students, and the student achievement construct in the UAE. A strong relationship was found between parental expectations and student educational achievement. In general, results are congruent with many other studies that attempted to analyze the relationship between parental involvement and the academic achievement of their children (Wilder, 2014). Wilder (2014) believes that "parental expectations reflect parents' beliefs and attitudes toward school, teachers, subjects, and education in general. As children are likely to harbor similar attitudes and beliefs as their parents, having high parental expectations appears vital for academic achievement of children" (p. 392).

TIMSS has provided a good database and source of information for describing the variation found across the country in many of the variables (some not discussed in this study) that have been shown to be related to student achievement. This study shows that the quality of the database stands given the statistical fits that were observed in this study of the measurement models. It should be stressed that TIMSS 2015 questionnaires provide valuable information with regard to many important school, student, and teacher characteristics. In future studies, performing both Analysis of Variance (ANOVA) and Multivariate Analysis of Variance (MANOVA) of TIMSS scores relative to each of these features and characteristics could shed light on important differences between the different categories of each sample. Such analysis could provide additional insight for policy makers to better understand the nature of differences between schools and students. The resulting information could be used in developing significant initiatives and policies with regard to school education.

Future research should also try to investigate the effect of home background and socioeconomic status, as well as other variables such as number of books at home, parent's education. These items are provided by TIMSS but in the student questionnaire. The current use of SEM provided good fit. However, we also need to stress that there are different levels that are involved with regard to students or schools in the UAE. Future research should concentrate more on the different school levels, and hence it needs to take into account the hierarchical levels of TIMSS (students nested within classes, nested within schools). Future research should incorporate either two-level model (students and schools) to control for students' individual achievement, and then report findings from

level 2 (schools). The main advantage is that such complex relationships among variables can be studied on different levels as well as across different levels.

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