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The Relationships between Teacher and Student Qualities in TIMSS 2019: A Path Analysis Model

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Abstract

In this study, the model that examined the relationship between teacher and student qualities was tested based on the teacher and student questionnaire in the TIMSS 2019 Turkey sample. The variables of experience, participation in professional development, professional development needs, school academic emphasis, instructional quality in the teacher questionnaire, as well as the instructional clarity, instructional climate, sense of school belonging and mathematics achievement variables in the student questionnaire were investigated. Data of 171 teachers and 3841 students were used. In the study, the path coefficients of the relations between the variables and the goodness of fit values for the model created were interpreted. All of the path coefficients between the variables had a significant and moderate effect. When the standardized path coefficients in the model were examined, the highest value (β = 0.48) was obtained on the way that instructional clarity predicted sense of school belonging and the lowest value (β = 0.14) was obtained on the way that the participation in professional development predicted the instructional climate. When the fit indices were examined, it was concluded that the model-data fit of the established model was perfect. In addition, it was determined that 33% of the variance in the mathematics achievement and 27% of the variance in the sense of school belonging were explained by direct effects in the model.

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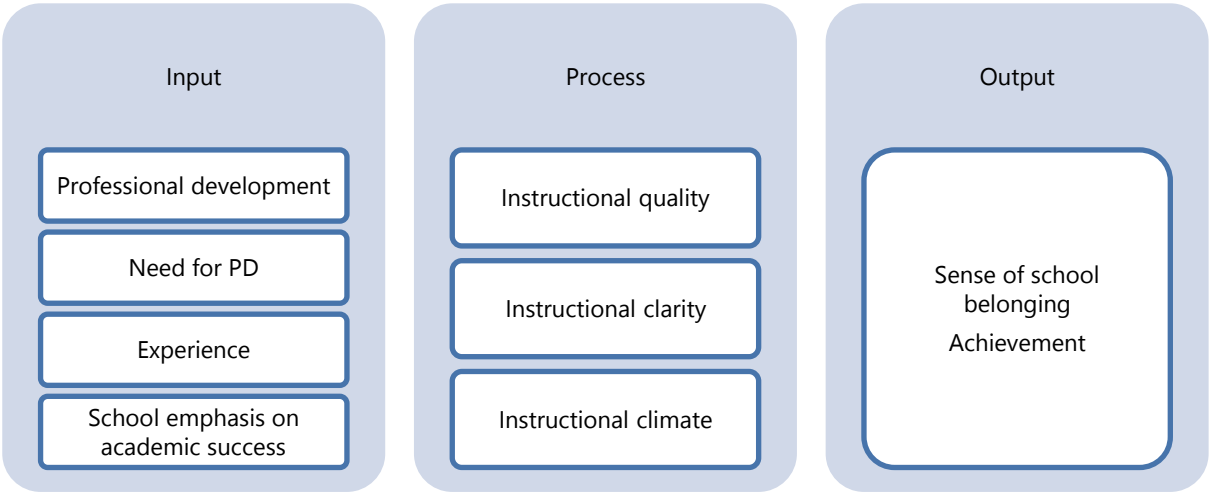
INTRODUCTION

Education is a complex system composed of interrelated components with varying degrees of influence on student learning. All components serve for improving the commonwealth by upbringing youth with better qualities. The education system is designed to achieve national and global goals and prepare individuals for the future. Within this perspective, one crucial student outcome that has become an essential purpose of the education system is student achievement. Each component of the education system and instructional design is planned to maximize achievement which is deemed to be a predictor of success throughout life. Academic achievement is deemed to have a direct influence on the positive outcomes of the students after they graduate (Badri, 2019). Although academic achievement is the most frequently emphasized student outcome, student learning and development comprehends a focus on physical, emotional, mental and social aspects as well (Baria & Gomez, 2022). To this end, it is necessary to support individuals for identity formation which is substantially influenced by the culture and climate of the school. Students benefit from a school atmosphere or environment in which they experience a sense of belonging (Kiang, Malin, & Sandoz, 2020). School belonging is defined as "the extent to which they feel accepted, respected, included and supported by others in the school social environment" (Goodenow & Grady, 1993, pp. 60-61). School belonging is generally associated with various outcomes of education and development, which encompass not only individuals' academic achievement but also their psychosocial health and wellbeing, by helping them transition into adulthood (Allen et al., 2021).

Enhancing student outcomes as an ultimate goal of schooling has become a focal research area in the field of educational sciences. Factors that influence achievement, in particular, have been questioned and searched by researchers all over the world for a long while (Akyüz & Berberoğlu, 2010). Among other determinants, the most significant institutional factor that matters for student achievement is teachers (Clotfelter, Ladd, & Vigdor, 2006; Darling-Hammond & Youngs, 2002; Squire-Kelly, 2012). Teachers have critical contributions and implications on student achievement (Kola & Sunday, 2015). In a general sense, the quality of the education system is built upon the quality of its teachers who are depicted as the most crucial resource in today's schools (OECD, 2018). In this perspective, a growing body of research has investigated the relationship between achievement of students and teacher characteristics, particularly which teacher characteristics influence teacher effectiveness to what extent (Kunter, et al., 2013; Wayne & Youngs, 2003). According to the classification of Darling-Hammond (2000), teachers' general academic ability and intelligence, knowledge about subject matter, teaching and learning; experience of teaching and the qualifications determined by teacher certification are among the teacher qualifications associated with student achievement. Similarly, Goe (2007) aimed to understand the relations between key components of teacher quality and student learning outcomes and put forth a theoretical framework for teacher effectiveness that has been used in various studies (Glassow, Rolfe, & Hansen, 2021; Nilsen, Gustafsson, & Blömeke, 2016). This framework is constructed on inputs, processes and student outcomes. The input refers to teacher qualifications and characteristics influencing both the process which refers to practices of teachers and student outcomes. The variables examined within the framework of this current study are presented below in Figure 1 based on Goe's (2007) theoretical framework.

Figure 1. *Conceptual Framework*



In this study, teachers' participation in professional development, need for professional development, teachers' experience and school emphasis on academic success were used within the aspect of input. Instructional quality, clarity and climate were examined within the process whereas the outcome examined in the study is students' sense of school belonging (affective outcome) and student achievement in mathematics (cognitive outcome).

CONCEPTUAL FRAMEWORK

EXPERIENCE

One of the teacher characteristics that is frequently associated with student achievement is the variable of years of teaching experience (Sauceda, 2003) and the relationship between teacher experience and student learning has been repeatedly analyzed in empirical studies (Bhai & Horoi, 2019; Buddin, & Zamarro, 2009; Clotfelter et al., 2006; Harris & Sass, 2011). Teachers' years of experience help them form their skills and competencies (OECD, 2018). As teachers become more experienced in the profession, they keep improving in their effectiveness, which indicates that teaching experience positively influences student achievement outcomes (Kini & Podolsky, 2016). Experience also influences teachers' knowledge gains, teaching practices, self-efficacy and class climate (Fischer et al., 2018; OECD, 2009).

PROFESSIONAL DEVELOPMENT

Another main teacher characteristic that substantially influences instructional practices and student learning is teachers' opportunity to engage in professional learning and development (Timperley, Wilson, Barrar, & Fung, 2007). Teachers' professional development contributes to bringing about innovations in their practices, attitudes and beliefs and students' learning outcomes (Guskey, 2002). As effective professional development positively influences the knowledge, skills, beliefs and attitudes of teachers, this influence results in a change in terms of instruction and pedagogy which maximizes student learning (Desimone, 2009). Due to its impact on teachers' knowledge and practices and student learning, the professional development of teachers has long been of interest to researchers (Kang, Cha, & Ha, 2013). TIMSS data includes both teachers' participation in professional development and their professional development needs (Mullis & Martin, 2017).

INSTRUCTIONAL QUALITY

Instructional quality is defined as a construct that is associated with teachers' instructional practices well known to have a positive influence on the cognitive and affective outcomes of students (Nilsen et al., 2016). Literature shows that there is a significant relationship between instructional quality and student outcomes including achievement and motivation in addition to other schooling

outcomes (Atlay, Tieben, Fauth, & Hillmert, 2019; Bellens, Van Damme, Van Den Noortgate, Wendt, & Nilsen, 2019; Blömeke, Olsen, & Suhl, 2016; Kunter et al., 2013). There are also studies indicating that the quality of instruction is more significant than teachers' certification, experience, education, class size and classroom climate (Tengberg, van Bommel, Nilsberth, Walkert, & Nissen, 2022). Instructional quality is, on the other hand, influenced by school and teacher-related characteristics (Holzberger & Schiepe-Tiska, 2021).

INSTRUCTIONAL CLIMATE

Instructional climate is an essential component with the potential to determine student outcomes and lead to school effectiveness (Barksdale, Peters, & Corrales, 2021; Fraser, 1986; MacAulay, 1990). As perceived by students, the instructional climate has several characteristics which influence student growth, development, motivation and achievement (Duffin, Keith, Rudloff, & Cribbs, 2020; LaRocque, 2008). In addition to its influence on student outcomes, the climate is substantially associated with teachers' instructional beliefs including expectations, goals and self-efficacy beliefs (Rubie-Davies, 2015).

INSTRUCTIONAL CLARITY

An important determinant of student outcomes is the clarity of instruction. As a fundamental component of teaching effectiveness, instructional clarity refers to the ability to teach clearly so that students can understand course material (Chesebro, 2003).

The degree to which students perceive their teachers' instructional clarity may influence their affective outcomes and academic achievement (Chen & Lu, 2022; Chou, 2021). As effective teachers clearly explain course content, students have the opportunity to comprehend the content by grasping the connections between topics. In this sense, students learn by making connections between topics and previous knowledge (Arends, 2021).

SCHOOL EMPHASIS ON ACADEMIC SUCCESS

As a component of school climate (Nilsen et al., 2016), school achievement emphasis reflects prioritizing achievement (Nilsen & Gustafsson, 2014). The emphasis or expectancy of academic success in a school influences its success. School emphasis on academic success includes the success in the curriculum implementation, parental involvement and students' motivation to be successful (Hooper, Mullis, & Martin, 2013; Martin, von Davier, & Mullis, 2013).

Overall, the potential relationships between these variables might offer insight for understanding factors that influence students' achievement and wellbeing throughout their life. Thereby, in this study, the relationships between teachers and students' qualities are investigated based on the sample of TIMSS 2019 Turkey. Within this framework, students' academic achievement in mathematics and sense of school belonging were investigated as the cognitive and affective student outcomes respectively. The variables and data examined in this research reflects the distinctive aspect of this study. First of all, school belonging is widely known to be a predictor of academic and psychosocial success (Allen, Kern, Vella-Brodrick, Hattie, & Waters, 2018; Slaten, Ferguson, Allen, Brodrick, & Waters, 2016). Although the literature also indicated school belonging is related to the climate and relations between teacher and student, research on classroom and school-related factors is relatively limited (Allen et al., 2021). There has been less focus on enlightening the factors that contribute to school belonging (Bouchard & Berg, 2017). Based on this aspect, the findings of this research are supposed to contribute to the literature on school belonging. Furthermore, in the current study, achievement and sense of school belonging were analyzed based on factors and practices in school (school emphasis on academic success) and classroom context (teacher professional development, need for professional development, teacher experience, instructional clarity, climate, clarity). Additionally, rather than limiting data to a specific participant group, this research sought to investigate the relationships between student outcomes and teacher qualities by using both student

and teacher data in TIMSS 2019. In this sense, the findings of this study are supposed to give new insights into the development of student outcomes in schooling.

RESEARCH PROBLEM

In this study, the variables of experience, participation in professional development, professional development needs, school emphasis on academic success, instructional quality in the teacher questionnaire, as well as the instructional clarity, instructional climate, sense of school belonging and mathematics achievement variables in the student questionnaire were examined based on TIMSS 2019 Turkey data. In the research, a path analysis was performed and the hypotheses about the relationships were tested. The hypotheses examined in the model are presented in Table 1.

Table 1. *Hypotheses of the Research*

Hypotheses	*Paths*
Experience affects professional development needs.	Year → PdFuture
Experience affects instructional quality.	Year → InsQual
Experience affects mathematics achievement.	Year → MathAch
School emphasis on academic success affects professional development needs.	Emphasis → PdFuture
School emphasis on academic success affects instructional quality.	Emphasis → InsQual
School emphasis on academic success affects mathematics achievement.	Emphasis → MathAch
Participation in professional development affects professional development needs.	PdPast → PdFuture
Participation in professional development affects instructional climate.	PdPast → InsClim
Professional development needs affects students' sense of school belonging.	PdFuture → Belong
Instructional quality affects instructional climate.	InsQual → InsClim
Instructional quality affects instructional clarity.	InsQual → InsClar
Instructional climate affects instructional clarity.	InsClim → InsClar
Instructional climate affects mathematics achievement	InsClim → MathAch
Instructional clarity affects mathematics achievement.	InsClar → MathAch

METHOD

RESEARCH MODEL

This study is a correlational research that tests hypotheses established regarding the relationships between the variables of experience, participation in professional development, professional development needs, school emphasis on academic success, instructional quality, instructional clarity, instructional climate, sense of school belonging and mathematics achievement in the sample of TIMSS 2019 Turkey. In correlational studies, hypotheses regarding the relationships between two or more variables are tested (Fraenkel, Wallen, & Hyun, 2011).

STUDY GROUPS

Two study groups were included within the scope of the research. These groups consisted of 181 mathematics teachers and 4077 8^{th} grade students from 181 schools that participated in TIMSS 2019 from Turkey. TIMSS 2019 data obtained from the teacher questionnaire and the student questionnaire were merged by taking into account the School ID and Teacher ID variables.

The mean scores of instructional climate, instructional clarity, sense of school belonging and mathematics achievement was used to merge the data for each school. After the data were merged, each row with missing data was excluded in the analysis by using the listwise method. Therefore, the final data file contains data of 3841 students from 171 schools and teachers. The distribution regarding the gender, age and graduate degrees of the teachers and the gender of the students are presented in Table 2.

Table 2. *Distributions of Teachers and Students*

Teachers		
Gender	Female	90 (52,6%)
	Male	81 (47,4%)
Age	Under 25	10 (5,8%)
	25-29	50 (29,2%)
	30-39	78 (45,6%)
	40-49	30 (17,5%)
	50-59	3 (1,8%)
Degree (ISCED)	Bachelor's or equivalent	159 (93,0%)
	Master's or equivalent	12 (7,0%)
Students		
Gender	Female	1907 (49,6%)
	Male	1909 (49,7%)
	Missing Value	25 (0,7%)

DATA COLLECTION TOOLS

The data used in the research were obtained from TIMSS 2019 teacher and student questionnaires. The data of Turkey has been downloaded from the international database of IEA (https://timss2019.org/international-database/). Within the scope of the research, the variables investigated by drawing on the teacher and student questionnaires were determined by examining the TIMSS 2019 Technical Report (Martin et al., 2020) and the literature. The variables discussed in the study and the items related to these variables were presented in Table 3.

Table 3. *The Variables and Item(S)/Scale Related to Variables*

Variables	*Item Code(s)*	*Item(s) or Scale*	*Response(s)*
		Teacher Questionaries'	
Experience *(Year)*	BTBG01	By the end of this school year, how many years will you have been teaching altogether?	Open ended
Professional Development to Teach Mathematics-Past *(PdPast)*	BTBM22AA	Mathematics content	1-Yes 2-No
	BTBM22AB	Mathematics pedagogy/ instruction	
	BTBM22AC	Mathematics curriculum	
	BTBM22AD	Integrating technology into mathematics instruction	
	BTBM22AE	Improving students' critical thinking or problem solving skills	
	BTBM22AF	Mathematics assessment	
	BTBM22AG	Addressing individual students' needs	
School Emphasis on Academic Success-Teacher *(Emphasis)*	BTBGEAS	School Emphasis on Academic Success-Teacher-Scale	
Professional Development to Teach Mathematics-Future *(PdFuture)*	BTBM22BA	Mathematics content	1-Yes 2-No
	BTBM22BB	Mathematics pedagogy/ instruction	
	BTBM22BC	Mathematics curriculum	
	BTBM22BD	Integrating technology into mathematics instruction	
	BTBM22BE	Improving students' critical thinking or problem solving skills	
	BTBM22BF	Mathematics assessment	
	BTBM22BG	Addressing individual students' needs	
Instructional Quality *(InsQual)*	BTBG12A	Relate the lesson to students' daily lives	1- Every or almost every lesson 2- About half the lessons 3- Some lessons 4- Never
	BTBG12B	Ask students to explain their answers	
	BTBG12C	Ask students to complete challenging exercises that require them to go beyond the instruction	
	BTBG12D	Encourage classroom discussions among students	
	BTBG12E	Link new content to students' prior knowledge	
	BTBG12F	Ask students to decide their own problem solving procedures	
	BTBG12G	Encourage students to express their ideas in class	
		Student Questionaries'	
Instructional Clarity in Mathematics Lessons *(InsClar)*	BSBGICM	Instructional Clarity in Mathematics Lessons-Scale	
Instructional Climate in Mathematics Lessons *(InsClim)*	BSBM18A	Students don't listen to what the teacher says	1- Every or almost every lesson 2- About half the lessons 3- Some lessons 4- Never
	BSBM18B	There is disruptive noise	
	BSBM18C	It is too disorderly for students to work well	
	BSBM18D	My teacher has to wait a long time for students to quiet down	
	BSBM18E	Students interrupt the teacher	
	BSBM18F	My teacher has to keep telling us to follow the classroom rules	
Student Sense of School Belonging *(Belong)*	BSBGSSB	Students Sense of School Belonging-Scale	
Mathematics Achievement *(MathAch)*	BSMMAT01-05	Arithmetic Mean of BSMMAT01, BSMMAT02, BSMMAT03, BSMMAT04 and BSMMAT05	

YEAR

In the TIMSS 2019 teacher questionnaire, for the variable of "year", the data on the number of years one has been working as a teacher at the end of the relevant year were collected through an open-ended question and teachers were asked to express the year as an integer.

PROFESSIONAL DEVELOPMENT TO TEACH MATHEMATICS

In the TIMSS 2019 data, there are 7 items, used to determine teachers' participation in professional development (PdPast) in the last two years and the need to participate in professional development in the future (PdFuture), were coded as "Yes" as 1 and "No" as 2. In this data, after the responses coded as 2 were converted to 0, the values were summed up and used as the number of professional development activities in which the teachers participated and needed to participate in future.

SCHOOL EMPHASIS ON ACADEMIC SUCCESS

There are 12 items in this section where teachers define the academic emphasis of the school. These items are related to the stakeholders of the school as follows: "Teachers' understanding of the school's curricular goals", "Parental commitment to ensure that students are ready to learn", "Students' desire to do well in school" and "Collaboration between school leadership (including master teachers) and teachers to plan instruction". These items were rated as "1-Very high", "2-High", "3-Medium", "4-Low" and "5-Very low" on a 5-point Likert scale. The scale (SCL) score of the School Emphasis on Academic Success-Teacher, which was created by reverse coding, was used. As the score in the related variable increases, the emphasis on school increases.

INSTRUCTIONAL QUALITY

There are 7 items in the teacher questionnaire to determine teachers' perceptions of instructional quality in the classroom. These items were rated as "1- Every or almost every lesson", "2-About half the lessons", "3-Some lessons" and "4-Never" on a 4-point Likert scale indicating frequency. Within the scope of the research, these items were reverse coded and exploratory factor analysis was performed. As a result of the factor analysis, the item "BTBG12C - Ask students to complete challenging exercises that require them to go beyond the instruction" was found to be the only item in the 2nd factor in Turkey data. Accordingly, this item was excluded and a component score was calculated for the remaining 6 items by using regression coefficients through principal component analysis. The factor loads of the remaining 6 items ranged between 0.556 and 0.744, while the explained variance was 45.90%. The Cronbach's alpha coefficient for the scale was found to be 0.73.

INSTRUCTIONAL CLARITY IN MATHEMATICS LESSONS

There are 6 items in this section, which measures students' perceptions of instructional clarity. Sample items are as follows: "I know what my teacher expects me to do", "My teacher has clear answers to my questions", "My teacher links new lessons to what I already know". The level of participation in these items was rated as "1-Agree a lot", "2-Agree a little", "3-Disagree a little" and "4-Disagree a lot" on a 4-point Likert scale. The scale (SCL) score of Instructional Clarity in Mathematics Lessons, which was created by reverse coding in the TIMSS 2019 data, was used. As the score in the related variable increases, the clarity of instruction increases.

INSTRUCTIONAL CLIMATE IN MATHEMATICS LESSONS

There are 6 items which measure students' perceptions of instructional climate. These items were rated as "1-Every or almost lesson every lesson", "2-About half the lessons", "3-Some lessons", "4-Never" on a 4-point Likert scale indicating frequency. As a result of the exploratory factor analysis, it was determined that the explained variance was 61.08% and the factor loads varied between 0.744 and 0.832. Accordingly, a component score was obtained for 6 items, by using regression coefficients

through principal component analysis. The Cronbach's alpha coefficient for the scale was found to be 0.87.

STUDENT SENSE OF SCHOOL BELONGING

There are 5 items in this section, which measure students' sense of school belonging. Some of those items in the scale are as follows: "I am proud to go to this school" and "I feel like I belong at this school". The level of participation in these items was rated as "1-Agree a lot", "2-Agree a little", "3-Disagree a little" and "4-Disagree a lot" on a 4-point Likert scale. The scale (SCL) score of Student Sense of School Belonging, which was created by reverse coding in the data, was used. As the score in the related variable increases, the sense of school belonging increases.

MATHEMATICS ACHIEVEMENT

In the TIMSS 2019 data, there are 5 variables representing the variable of mathematics achievement. These variables are called "plausible values" and codes of BSMMAT01, BSMMAT02, BSMMAT03, BSMMAT04 and BSMMAT05 are used for each of them. Within the scope of the research, for the mathematics achievement variable, the mathematics achievement score was obtained for each student by first calculating the arithmetic mean of all plausible values. Then, for each school, the mean score of mathematics achievement of the students in each school was calculated and included in the analysis.

DATA ANALYSIS

Path analysis was performed in order to determine the relationships (path coefficients) between the variables examined within the scope of the research. Accordingly, all of the variables in the study were considered as observed variables. In the phase of the data analysis, after the variables related to the student and the teacher were merged based on the mean, the multivariate normality of the data was examined firstly. The RMK value was found to be 1.018, indicating that the data were multivariate normally distributed. Additionally, in order to examine whether there was a multicollinearity problem, the correlation coefficients between all variables were examined and the highest correlation was determined to be 0.453. The correlation coefficients were not high, showing that there was no multicollinearity problem. Since it was determined that the data were normally distributed and there was no multicollinearity problem, the model was tested on the covariance matrix by using the maximum likelihood (ML) estimation method.

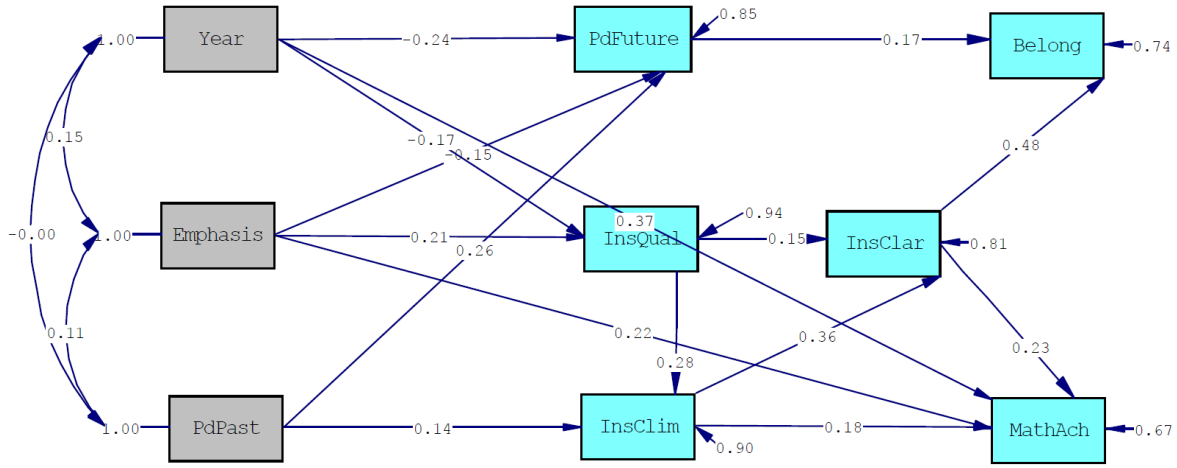
LISREL 8.8 package program was used to examine the model-data fit and to determine the path coefficients. As a result of the path analysis, the path coefficients, the significance of the path coefficients, the explained variance ratio and the regression equations were reported and interpreted. In the interpretation of the path coefficients, criteria for effect levels ($|large\ effect|$≥ 0.50; $|moderate\ effect|$ ≈ 0.30; $|small\ effect|$ ≤ 0.10) were used (Kline, 2005). In addition, in the context of fit indices, RMSEA, SRMR, Satorra-Bentler X^2/df, CFI, NFI, NNFI, GFI and AGFI were also reported and interpreted by comparing them with criterion values. While the criteria for perfect fit were RMSEA, SRMR ≤ 0.050, X^2/df ≤ 2.00 and CFI, NFI, NNFI, GFI, AGFI ≤ 0.95; criteria for good fit were considered as RMSEA, SRMR ≤ 0.080, X^2/df ≤ 3.00 and CFI, NFI, NNFI, GFI, AGFI ≤ 0.90 (Brown, 2006; Jöreskog & Sörbom, 2001; Sümer, 2000; Tabachnick & Fidell, 2013).

FINDINGS

As a result of the research, the path diagram including the standardized path coefficients of the model related to the hypotheses established between experience (Year), participation in professional development (PdPast), professional development needs (PdFuture), teachers' reports of school academic emphasis (Emphasis), instructional quality (InsQual) variables in the teacher questionnaire and the instructional clarity (InsClar), instructional climate (InsClim), sense of school belonging (Belong)

and mathematics achievement (MathAch) variables in the student questionnaire in the TIMSS 2019 Turkey sample is given in Figure 2.

Figure 2. *Path Diagram for the Model*



By examining Figure 2, it was found that all of the standardized path coefficients were greater than 0.10 (Kline, 2005). Additionally, it was observed that the highest standardized path coefficient, β = 0.48, was on the path from instructional clarity (InsClar) to sense of school belonging (Belong), while the lowest standardized path coefficient, β = 0.14, was on the path that predicted instructional climate (InsClim) from participation in professional development (PdPast). Standardized path coefficients, significance values and the effect levels are presented in Table 4.

Table 4. *Path Coefficient, t value and Effect Level for Paths of Model*

Paths	Path Coefficient	t value	Effect level
Year → PdFuture	-0,24	-3,43*	Moderate Effect
Year → InsQual	-0,17	-2,27*	Moderate Effect
Year → MathAch	0,37	5,99*	Moderate Effect
Emphasis → PdFuture	-0,15	-2,16*	Moderate Effect
Emphasis → InsQual	0,21	2,85*	Moderate Effect
Emphasis → MathAch	0,22	3,49*	Moderate Effect
PdPast → PdFuture	0,26	3,69*	Moderate Effect
PdPast → InsClim	0,14	1,98*	Moderate Effect
PdFuture → Belong	0,17	2,64*	Moderate Effect
InsClar → Belong	0,48	7,47*	Moderate Effect
InsQual → InsClim	0,28	3,90*	Moderate Effect
InsQual → InsClar	0,15	2,13*	Moderate Effect
InsClim → InsClar	0,36	5,14*	Moderate Effect
InsClim → MathAch	0,18	2,63*	Moderate Effect
InsClar → MathAch	0,23	3,44*	Moderate Effect

Based on Table 4, it can be asserted that the standardized path coefficients in the model indicated moderate levels of effect (Kline, 2005). As mentioned before, while the instructional clarity is the strongest predictor of the sense of school belonging with the highest effect, years of experiences is the strongest predictor of mathematics achievement with the second highest effect. Moreover, when the t values for all paths were examined, it was determined that all of the path coefficients were significant. Hence, it could be interpreted that the hypotheses about the predictive relationships between the variables were significant and that the related variables predicted each other at a significant level.

After ensuring that all path coefficients were significant, it was also necessary to examine the model-data fit of the established model. The fit indices calculated for the model-data fit and the fit levels based on the comparison of these fit indices with the criteria are given in Table 5.

Table 5. *Fit Indices for Model*

Fit Indices	*Value*	*Criterion Value*	*Goodness of Fit*
RMSEA	0,031	≤0,050	Perfect fit
SRMR	0,045	≤0,050	Perfect fit
X^2/df	1,17	≤2,00	Perfect fit
CFI	0,98	≥0,95	Perfect fit
NFI	0,92	≥0,90	Good fit
NNFI	0,96	≥0,95	Perfect fit
GFI	0,97	≥0,95	Perfect fit
AGFI	0,94	≥0,90	Good fit

The fit indices of the model in Table 5 shows that the NFI and AGFI values indicated a good fit when compared with the criterion values. It was determined that the fit indices RMSEA, SRMR, X^2/df, CFI, NNFI and GFI values indicated perfect fit. Accordingly, it was concluded that the model-data fit was perfect. In addition to the model-data fit, the regression equations in the model and the explained variance rates were also examined and given in Table 6.

Table 6. *Structural Equations for Direct and Indirect Effect and* R^2

Dependent Variable	*Structural Equations*	R^2
	Direct Effect	
PdFuture	PdFuture = - 0.24*Year - 0.15*Emphasis + 0.26*PdPast	0,15
InsQual	InsQual = - 0.17*Year + 0.21*Emphasis	0,061
InsClim	InsClim = 0.28*InsQual + 0.14*PdPast	0,099
InsClar	InsClar = 0.15*InsQual + 0.36*InsClim	0,19
Belong	Belong = 0.17*PdFuture + 0.48*InsClar	0,26
MathAch	MathAch = 0,23*InsClar + 0,18*InsClim + 0,37*Year + 0,22*Emphasis	0,33
	Indirect Effect	
MathAch	MathAch=-0,018*Year+0,023*Emphasis+0,037*PdPast	0,21
Belong	Belong=-0,061*Year-0,001*Emphasis+0,068*PdPast	0,0085

It was determined that the variables of instructional clarity (InsClar), instructional climate (InsClim), experience (Year) and school emphasis on academic success (Emphasis) directly predicted mathematics achievement (MathAch). Those independent variables explained 33% of the variance in mathematics achievement (MathAch). It was the highest variance value that explained mathematics achievement in the model. The model established within the scope of the research explained approximately 1/3 of the variance in the mathematics achievement of 8th grade students in the sample of Turkey participating in the TIMSS 2019. Professional development needs (PdFuture) and instructional clarity (InsClar) directly predicted the variable of school belonging (Belong) and explained 26% of the variance in the variable of school belonging (Belong). This value is the second highest variance value that explained one of the dependent variables in the established model.

Analysis of the indirect effects on the dependent variables revealed that the variables of experience (Year), school academic emphasis (Emphasis) and participation in professional development (PdPast) indirectly explained 21% and 0.85% of the variance in mathematics achievement and sense of school belonging respectively. Thereby, it might be stated that the variance explained by all variables (directly or indirectly) that predicted mathematics achievement based on the total effect on mathematics achievement in the model was 54%. The variables that indirectly predicted mathematics achievement explained 21% of the total variance, which indicated that these variables had significant effects. On the other hand, these predictor variables explained approximately 1% of the variance in the sense of school belonging, which showed that the effect was quite low.

CONCLUSION, DISCUSSION AND SUGGESTION

In this research, the path analysis conducted on the variables regarding teacher and student qualities in the sample of TIMSS 2019 Turkey was examined. The variables of experience, professional development needs, participation in professional development, teacher's reports of school emphasis on academic achievement, instructional quality in the teacher questionnaire, as well as the variables of instructional clarity, instructional climate, sense of school belonging and mathematics achievement in the student questionnaire were investigated. It was determined that all the coefficients in the path diagram were significant.

First of all, the direct and indirect relationships affecting students' sense of school belonging were discussed based on literature. Analysis of the path coefficients indicated that the strongest predictor of students' sense of school belonging was instructional clarity with the highest effect level in the model. This result is in line with the results of Freeman, Anderman and Jensen (2007) who found that the instructional process which was designed and implemented well enhanced students' sense of class belonging. This result is remarkable in the sense that school belonging, which is substantially correlated with school context, is significantly influenced by a class related variable. This result suggests that students' perceptions of teacher practices and efforts to make the instructional process clear and useful for students enhances students' sense of school belonging. It can be asserted that when students are aware of their teachers' expectations and believe that the teacher aim to help learners, this contributes to students' sense of school belonging. Likewise, it is necessary for teachers to support their students by explaining the topic clearly, linking new and previous knowledge and revising the unclear topics for development of students' sense of school belonging. On the other hand, it is worthy of note that that finding is in contrast with the results of Akiva, Smith, Sugar and Brummet (2011) who focused on the staff instructional practices, youth engagement, and belonging in out-of-school time programs and revealed that instructional quality was not significantly related to belonging. In this sense, it can be concluded that the relationship between instructional process and belonging needs further research.

Overall instructional quality appears to be significantly related to youth reports of engagement but not belonging. Welcoming atmosphere predicts belonging, but choice does not. Both content and age appear to have significant impacts on relationships between staff instructional practices and proximal youth outcomes.

In the model obtained in the research, it was revealed that the variable of instructional quality was a significant predictor of instructional clarity. Within the framework of TIMSS, this finding indicates that teachers' practices to relate the course content with students' daily life or previous knowledge, using classroom discussions and problem solving activities influences students' perceptions of instructional clarity. Instructional quality, on the other hand, was found to be positively correlated with teachers' report on school achievement emphasis. Teachers competence of implementing the curriculum effectively by understanding the curricular goals, parental expectations and support for achievement and involvement in school activities and student wish and ability for achievement are the essential indicator of school achievement emphasis. Thereby, it can be concluded that successful practices in terms of these indicators enhances teachers' practices in the class and the quality of instruction. On the other hand, a variable that was found to have a negative influence on instructional quality is the variable of teachers' years of experience. As experience increased, instructional quality decreased. Within the framework of TIMSS, this finding show that experienced teachers do not spend time on classroom discussions and problem solving activities. Additionally, as teachers' years of experiences increases, their practices in terms of relating the content with daily life or students' background knowledge also decreases. It can be asserted that this finding concurs with the findings of previous studies. With a focus on classroom management, Ünal and Ünal (2011) indicated as teachers' years of experience increased, their tendency to be in control for interaction with students also

increased. Similarly, Rice (2010) noted that less-experienced teachers might be more effective than experienced teachers because experienced teachers did not follow advances in curriculum and pedagogy or they were affected by teacher burnout. On the other hand, there are also contradictory findings in the literature. Işıkoğlu, Baştürk and Karaca (2009) indicated that experienced teachers held more student-centered orientations than teachers who had less experience. Burroughs et al. (2019), comparing 38 countries at grade 8 based on TIMSS data, revealed that in many countries, experience was not a significant predictor of the instructional quality. Furthermore, Blömeke et al. (2016) found that the influence of experience on the instructional quality differed by county. While experienced teachers indicated higher levels of instructional quality, there were also results indicating negative correlation for some countries such as Hong Kong, Sweden, Portugal, Netherlands. Therefore, it is necessary to note that the relationship between teachers' experience years and the quality of instruction requires additional research.

The second variable that influenced students' sense of school belonging was teachers' professional development needs. As teachers need for professional development increased, students' sense of school belonging enhanced as well. Furthermore, it was observed that as teachers gained experience, their professional development needs decreased. Ekşi and Çapa-Aydın (2013), similarly, found a negative correlation showing that teachers' professional development needs decreased as their experience increased. The reason behind those results needs further investigation as they might stem from teachers' other traits such as motivation and enthusiasm, self-efficacy beliefs or burnout levels. In the study of Owens, Sadler, Murakami and Tsai (2018), who also determined a negative correlation between the years of teaching experience and interest in professional development, experienced teachers believed that professional development activities would not contribute much to the instructional process and student learning. On the other hand, Gökmenoğlu, Clark and Kiraz (2016) found that teachers' experience was not associated with teachers' reported training needs and training program preferences. Similarly, Akçay Kızılkaya (2012) found that there was no significant relationship between teachers' years of experience and their attitudes to professional development.

The direct and indirect relationships affecting students' mathematics achievement were also discussed based on literature. Results indicated that instructional clarity significantly influenced academic achievement. Research in the literature also confirms that clarity is a significant predictor of achievement. Bolkan (2016), for instance, found that clarity significantly affected student learning. Loes and Pascarella (2015) also asserted that clear and organized instruction significantly influenced student's use of deep approaches to learning, including reflective and integrative learning. Similarly, Yağan (2021), examining the relationships between teachers' skills in terms of classroom management and instructional clarity and students' mathematics achievement revealed that as teachers' instructional clarity skills increased, mathematics achievement also increased. Therefore, it can be asserted that teachers' in-class practices and students' awareness of those practices and efforts contributes to students' sense of school belonging.

Another variable that was found to have a significant influence on students' mathematics achievement was teachers' years of experience with the second highest explained variance obtained from the path analysis. That is, as teachers' years of experience increase, student achievement increases as well. In the literature, there are several studies with concurring findings. For instance, Burroughs et al. (2019) revealed that in 14 out of 38 countries, the more experienced teachers positively affected student mathematics achievement at grade eight. Clotfelter et al. (2006) also determined that experience of teachers had positive influence on academic achievement. Consistently, Kini and Podolsky (2016) found that experience positively affected student achievement and the influence of experience, with the highest influence in the initial years of teachers, continued to be a significant predictor throughout teachers' career. Blömeke et al. (2016) indicated that the reason behind the relationship between teacher's years of experience and student achievement may

be related to experienced teachers' capacity of preparing better instructional process and class context that enhance academic achievement.

Another teacher related variable that was positively correlated with academic achievement was teachers' report of school emphasis on academic success. That is, teachers, students and parents' expectations and practices towards the shared goal of improving achievement contributes to academic achievement. This finding is consistent with those in the literature. Badri (2019), who analyzed the relationship between school leaderships' perceptions of school emphasis on academic success and performances of students in TIMSS 2015 in Science and Math in the United Arab Emirates, found that teachers' understanding and implementation of the curricula, their capacity to inspire students, collaboration among teachers significantly increased student achievement. Research on parental involvement also validates this result since parental involvement, particularly parents' expectations for student achievement, was found to be strongly correlated with achievement (Castro et al., 2015; Fan & Chen, 2001). Similarly, knowledge about the curriculum including the materials, curricular goals and structures, are deemed to be important for designing instruction and enhancing learning (Penuel, Phillips, & Harris, 2014).

One other variable that significantly influenced achievement was instructional climate. It was determined that students' perceptions of the instructional climate were positively correlated with their mathematics achievement. Students who perceived positive classroom climate had higher levels of achievement. Thereby, it can be concluded that teachers may contribute to academic achievement of students by creating a positive instructional climate. A similar finding belongs to Koyuncu (2022) who found that students with lower levels of achievement experienced disorderly behaviors more frequently compared to their classmates with higher levels of achievement. Ersan and Rodriguez (2020) also found a positive relationship between school environment and mathematics achievement. Berkowitz (2017), who reviewed 78 studies on the influence of school and classroom climate on academic achievement, found a positive correlation between climate and academic achievement in a majority studies. In parallel, Van de Grift (2007) also asserted when the learning climate was safe and stimulating and the class management was efficient, student outcomes positively and significantly improved including both students' attitudes and behaviors.

Considering the model created within this current research, it was determined that participation in professional development was a significant predictor of the variable of instructional climate. In other words, it was revealed that participation in professional development was effective in creating a positive classroom atmosphere. TALIS also suggested that teachers' participation in professional development was associated with their mastery of methods to use in the classroom (OECD, 2009). Therefore, it can be concluded that by increasing the intensity of professional development opportunities, it is possible to equip teachers with required competences for positive instructional climate.

Overall, some suggestions are offered based on the research results. First of all, professional development opportunities may be prepared for teachers in order to increase the clarity and quality of instruction. Since teachers' understanding and implementation of curriculum influences instructional practices, professional development activities that focus on curriculum implementation may beneficial. In organizing those opportunities, teachers' opinions and needs should also be considered. Furthermore, as teachers' efforts to enhance clarity of the instructional process contributes to the instructional climate, it is necessary to facilitate student learning by making the content easier to understand, building on students' previous knowledge and inspiring students for active participation. Moreover, the potential influences of all teacher and class related components that influence instructional clarity should also be regarded for enhancing school belonging. In the light of the results of the study, some suggestions are also presented for future research. This study was limited to 8th grade student and teacher data from the Turkish sample of TIMSS 2019. Similar variables can be examined through comparative studies that focus on different education levels or different

countries. Additionally, the independent variables of this study included experience, professional development needs, participation in professional development, teacher's reports of school emphasis on academic achievement, instructional quality, instructional clarity and instructional climate. Thereby, path analyses created for different variables associated with students' sense of school belonging and their achievement in mathematics may also be examined.

AUTHOR CONTRIBUTION

All authors contributed equally to the manuscript development and preparation.

REFERENCES

Akçay Kızılkaya, H. (2012). *A research on the examination of teachers' professional development in terms of their attitudes about professional development and job satisfaction,* [Unpublished master's dissertation]. Kırıkkale University.

Akiva, T., Smith, C., Sugar, S., & Brummet, Q. (2011). Staff instructional practices, youth engagement, and belonging in out-of-school time programs. Paper presented at the American Educational Research Association Annual Meeting, New Orleans, Louisiana.

Akyüz, G., & Berberoğlu, G. (2010). Teacher and classroom characteristics and their relations to mathematics achievement of the students in the TIMSS. *New Horizons in Education, 58*(1), 77–95. Retrieved from https://eric.ed.gov/?id=EJ893714

Allen, KA., Slaten, C.D., Arslan, G., Roffey, S., Craig, H., & Vella-Brodrick, D.A. (2021). School belonging: The importance of student and teacher relationships. In: Kern, M.L., Wehmeyer, M.L. (Eds) *The palgrave handbook of positive education*. Palgrave Macmillan, Cham. https://doi.org/10.1007/978-3-030-64537-3_21

Allen, K. A., Kern, M. L., Vella- Brodrick, D., Hattie, J., & Waters, L. (2018). What schools need to know about fostering school belonging: A meta-analysis. *Educational Psychology Review,* 30, 1–34. https://doi.org/10.1007/s10648-016-9389-8

Arends, F. (2021). Help them understand: the importance of instructional clarity in teaching and learning. *HSRC Review. 19*(2), 33-34. Retrieved from http://hdl.handle.net/20.500.11910/16078

Atlay, C., Tieben, N., Fauth, B., & Hillmert, S. (2019). The role of socioeconomic background and prior achievement for students' perception of teacher support. *British Journal of Sociology of Education, 40*(7), 970-991. https://doi.org/10.1080/01425692.2019.1642737

Badri, M. (2019). School emphasis on academic success and TIMSS science/math achievements. *International Journal of Research in Education and Science (IJRES), 5*(1), 176-189. Retrieved from https://files.eric.ed.gov/fulltext/EJ1197994.pdf

Baria, K., & Gomez, D. (2022). Influence of social support to student learning and development. *International Journal of Research Studies in Education*, *11*(2), 69-97. https://doi.org/10.5861/ijrse.2022.112

Barksdale, C., Peters, M. L., & Corrales, A. (2021). Middle school students' perceptions of classroom climate and its relationship to achievement. *Educational Studies, 47*(1), 84-107, https://doi.org/10.1080/03055698.2019.1664411

Bellens, K., Van Damme, J., Van Den Noortgate, W., Wendt, H., & Nilsen, T. (2019). Instructional quality: catalyst or pitfall in educational systems' aim for high achievement and equity? An answer based on multilevel SEM analyses of TIMSS 2015 data in Flanders (Belgium), Germany, and Norway. *Large-Scale Assessments in Education, 7*(1), 1–28. https://doi.org/10.1186/s40536-019-0069-2

Berkowitz, R. (2017). A research synthesis of the associations between socioeconomic background, inequality, school climate, and academic achievement. *Review of Educational Research*, *87*(2), 425-469. https://doi.org/10.3102%2F0034654316669821

Bhai, M., & Horoi, I. (2019). Teacher characteristics and academic achievement. *Applied Economics,* 51, 4781-4799. https://doi.org/10.1080/00036846.2019.1597963

Blömeke, S., Olsen, R. V., & Suhl, U. (2016). Relation of student achievement to the quality of their teachers and instructional quality. In T. Nilsen, & J.-E. Gustafsson (Eds.) *Teacher quality, instructional quality and student outcomes* (pp. 21–50). Springer.

Bolkan, S. (2016). The importance of instructor clarity and its effect on student learning: Facilitating elaboration by reducing cognitive load. *Communication Reports, 29*(3), 152-162. https://doi.org/10.1080/08934215.2015.1067708

Bouchard, K. L., & Berg, D. H. (2017). Students' school belonging: Juxtaposing the perspectives of teachers and students in the late elementary school years (grades 4–8). *The School Community Journal, 27*(1), 107–136. Retrieved from https://files.eric.ed.gov/fulltext/EJ1146469.pdf

Brown, T.A. (2006). *Confirmatory factor analysis for applied research*. Guilford Press.

Buddin, R. & Zamarro, G. (2009). Teacher qualifications and student achievement in urban elementary schools. *Journal of Urban Economics*, 66, 103-115. https://doi.org/10.1016/j.jue.2009.05.001

Burroughs, N., Gardner, J., Lee, Y., Guo, S., Touitou, I., Jansen, K. et al. (Eds.). (2019). Teaching for excellence and equity. IEA research for education 6. Springer Open.

Castro, M., Expósito-Casas, E., López-Martín, E., Lizasoain, L., Navarro-Asencio, E., & Gaviria, J. L. (2015). Parental involvement on student academic achievement: A meta-analysis. *Educational Research Review*, 14, 33–46. https://doi.org/10.1016/J.EDUREV.2015.01.002

Chen, X., & Lu, L. (2022). How classroom management and instructional clarity relate to students' academic emotions in Hong Kong and England: A multi-group analysis based on the control-value theory. *Learning and Individual Differences,* 98, 1-11. http://dx.doi.org/10.1080/03075079.2011.616955

Chesebro, J. L. (2003). Effects of teacher clarity and nonverbal immediacy on student learning, receiver apprehension, and affect. *Communication Education,* 52, 135–147. https://doi.org/10.1080/03634520302471

Chou, M.H. (2021). The mediating role of achievement emotions in the relationship between instructional clarity, English proficiency, and reading strategies. *Educational Psychology, 41*(5), 582-601. https://doi.org/10.1080/01443410.2021.1882660

Clotfelter, C. T., Ladd, H. F., & Vigdor, J. L. (2006). Teacher-student matching and the assessment of teacher effectiveness. NBER Working Paper No. 11936, January.

Darling-Hammond, L. (2000). Teacher quality and student achievement: *A review of state policy evidence. Educational Policy Analysis Archives, 8*(1). https://doi.org/10.14507/epaa.v8n1.2000

Darling-Hammond, L., & Youngs, P. (2002). Defining "Highly qualified teachers": What does "scientifically-based research" actually tell us? *Educational Researcher,* 31, 13-25. https://doi.org/10.3102/0013189X031009013

Desimone, L. M. (2009). Improving impact studies of teachers' professional development: Toward better conceptualizations and measures. *Educational Researcher,* 38, 181-200. https://doi.org/10.3102%2F0013189X08331140

Duffin, L. C., Keith, H. B., Rudloff, M. I., & Cribbs, J. D. (2020) The effects of instructional approach and social support on college algebra students' motivation and achievement: classroom climate matters. *International Journal of Research in Undergraduate Mathematics Education*, 6, 90-112. https://doi.org/10.1007/s40753-019-00101-9

Ekşi, G., & Çapa-Aydın, Y. (2013). English instructors' professional development need areas and predictors of professional development needs. *Procedia-Social and Behavioral Sciences,* 70, 675-685. http://dx.doi.org/10.1016/j.sbspro.2013.01.108

Ersan, O., & Rodriguez, M. C. (2020). Socioeconomic status and beyond: A multilevel analysis of TIMSS mathematics achievement given student and school context in Turkey. *Largescale Assessments in Education, 8*(1), 1-32. Retrieved from https://eric.ed.gov/?id=EJ1277199

Fan, X., & Chen, M. (2001). Parental involvement and students' academic achievement: A meta-analysis. *Educational Psychology Review,* 13, 1–22. https://doi.org/10.1023/A:1009048817385

Fischer, C., Fishman, B., Dede, C., Eisenkraft, A., Frumin, K., Foster, B., Lawrence, F., Levy, A. J., & McCoy, A. (2018). Investigating relationships between school context, teacher professional development, teaching practices, and student achievement in response to a nationwide science reform. *Teaching and Teacher Education, 72*, 107–121. https://doi.org/10.1016/j.tate.2018.02.011

Fraenkel, J. R., Wallen, N. E., & Hyun, H. H. (2011). *How to design and evaluate research in education*. Mc Graw Hill.

Fraser, B. J. (1986). *Classroom environment*. Croom Helm.

Freeman, T. M., Anderman, L. H., & Jensen, J. M. (2007). Sense of belonging in college freshmen at the classroom and campus levels. *The Journal of Experimental Education, 75*(3), 203-220. https://doi.org/10.3200/JEXE.75.3.203-220

Glassow, L.N., Rolfe, V. & Hansen, K.Y. (2021). Assessing the comparability of teacher-related constructs in TIMSS 2015 across 46 education systems: An alignment optimization approach. *Educational Assessment, Evauation and Accountability,* 33, 105–137. https://doi.org/10.1007/s11092-020-09348-2

Goe, L. (2007). *The link between teacher quality and student outcomes: A research synthesis*. National Comprehensive Center for Teacher Quality.

Goodenow, C., & Grady, K. E. (1993). The relationship of school belonging and friends' values to academic motivation among urban adolescent students. *The Journal of Experimental Education, 62*(1), 60-71. https://doi.org/10.1080/00220973.1993.9943831

Gökmenoğlu, T., Clark, C., & Kiraz, E. (2016). Professional development needs of Turkish teachers in an era of national reforms. *Australian Journal of Teacher Education, 41*(1), 113-125. http://dx.doi.org/10.14221/ajte.2016v41n1.7

Guskey, T. R. (2002). Professional development and teacher change. *Teachers and Teaching: Theory and Practice,* 8, 381- 391. https://doi.org/10.1080/135406002100000512

Harris, D.N., & Sass, T.R. (2011). Teacher training, teacher quality and student achievement. *Journal of Public Economics,* 95, 798-812. https://doi.org/10.1016/j.jpubeco.2010.11.009

Holzberger, D., & Schiepe-Tiska, A. (2021). Is the school context associated with instructional quality? The effects of social composition, leadership, teacher collaboration, and school climate. *School Effectiveness and School Improvement, 32*(3), 465–485. https://doi.org/10.1080/09243453.2021.1913190

Hooper, M., Mullis, I. V. S., Martin, M. O. (2013). TIMSS 2015 context questionnaire framework. In Mullis, I. V. S., Martin, M. O. (Eds.), *TIMSS 2015 assessment frameworks* (pp. 61–82). Retrieved from Boston College, TIMSS & PIRLS International Study Center website: http://timssandpirls.bc.edu/timss2015/frameworks.html

Işıkoğlu, N., Baştürk, R., & Karaca, F. (2009). Assessing in-service teachers' instructional beliefs about student-centered education: A Turkish perspective. *Teaching and Teacher Education,* 25, 350-356. https://doi.org/10.1016/j.tate.2008.08.004

Jöreskog, K. G., & Sörbom, D. (2001). *LISREL 8: User's reference* (2nd ed.). Scientific Software International.

Kang, H., Cha, J., & Ha, B. (2013). What should we consider in teachers' professional development impact studies? Based on the conceptual framework of Desimone. *Creative Education,* 4, 11-18. http://dx.doi.org/10.4236/ce.2013.44A003

Kiang, L., Malin, H., & Sandoz, A. (2020). Discovering identity and purpose in the classroom: Theoretical, empirical, and Applied Perspectives. In Burrow, A. L., Hill, P. L. (Eds.), *The ecology of purposeful living across the lifespan* (pp. 93–113). Springer International Publishing.

Kini, T., & Podolsky, A. (2016). *Does teaching experience increase teacher effectiveness? A review of the research*. Learning Policy Institute.

Kline, R. B. (2005). *Principles and practice of structural equation modeling* (2nd ed). New York, NY: Guilford.

Kola, A. J., & Sunday, O. S. (2015). A review of teachers' qualifications and its implication on students' academic achievement in Nigerian schools. *International Journal of Educational Research and Information Science, 2*(2), 10-15. Retrieved from https://www.semanticscholar.org/paper/A-Review-of-Teachers'-Qualifications-and-Its-on-in-Aina-Sunday/d3b05e304d4e09145673965547422cc01a00580a

Koyuncu, İ. (2022). TIMSS international benchmarks of eighth graders in mathematics: A correspondence analysis study. *International Electronic Journal of Elementary Education, 14*(2), 179-194. http://dx.doi.org/10.26822/iejee.2022.237

Kunter, M., Klusmann, U., Baumert, J., Richter, D., Voss, T., & Hachfeld, A. (2013). Professional competence of teachers: Effects on instructional quality and student development. *Journal of Educational Psychology, 105*(3), 805–820. https://psycnet.apa.org/doi/10.1037/a0032583

Larocque, M. (2008). Assessing Perceptions of the Environment in Elementary Classrooms: The Link with Achievement. *Educational Psychology in Practices,* 24, 289-305. https://doi.org/10.1080/02667360802488732

Loes, C. N., & Pascarella, E. T. (2015). The Benefits of Good Teaching Extend Beyond Course Achievement. Journal of the Scholarship of Teaching and Learning, *15*(2), 1–13. http://dx.doi.org/10.14434/josotl.v15i2.13167

MacAulay, D. J. (1990). Classroom environment: A literature review. *Educational Psychology, 10*(3), 239-253. https://doi.org/10.1080/0144341900100305

Martin, M. O., von Davier, M., & Mullis, I. V. (2020). Methods and Procedures: TIMSS 2019 Technical Report. *International Association for the Evaluation of Educational Achievement*. Retrieved from https://timssandpirls.bc.edu/timss2019/methods/pdf/TIMSS-2019-MP-Technical-Report.pdf

Mullis, I. V. S., & Martin, M. O. (Eds.). (2017). TIMSS 2019 Assessment Frameworks. Retrieved from Boston College, TIMSS & PIRLS International Study Center website: http://timssandpirls.bc.edu/timss2019/frameworks/

Nilsen, T. & Gustafsson, J. E. (2014). School emphasis on academic success: exploring changes in science performance in Norway between 2007 and 2011 employing two-level SEM. *Educational Research and Evaluation, 20*(4), 308-327. https://doi.org/10.1080/13803611.2014.941371

Nilsen, T., Gustafsson, J. E., & Blömeke, S. (2016). Conceptual framework and methodology of the report. In T. Nilsen & J. E. Gustafsson (Eds.), *Teacher quality, instructional quality and student outcomes, relationships across countries, cohorts and time* (pp. 1-21). IEA Publishing.

OECD (2009). *Creating effective teaching and learning environments first results from TALIS*. Paris Organization for Economic Co-Operation and Development.

OECD (2018). Effective Teacher Policies: Insights from PISA, PISA, OECD Publishing, Paris. https://doi.org/10.1787/9789264301603-en

Owens, D. C., Sadler, T. D., Murakami, C. D., & Tsai, C-L. (2018). Teachers' views on and preferences for meeting their professional development needs in STEM. *School Science and Mathematics*. *2018*(118), 370– 384. https://doi.org/10.1111/ssm.12306

Penuel, W. R., Phillips, R. S., & Harris, C. J. (2014). Analysing teachers' curriculum implementation from integrity and actor-oriented perspectives. *Journal of Curriculum Studies, 46*(6), 751-777. https://doi.org/10.1080/00220272.2014.921841

Rice, J. K. (2010). The Impact of Teacher Experience Examining the Evidence and Policy Implications. National Centre for Analysis of Longitudinal Data in Educational Research, Urban Institute.

Rubie-Davies, C. (2015). Teachers' instructional beliefs and the classroom climate. In H. Fives & M. G. Gill (Eds.), *International handbook of research on teachers' beliefs* (pp.266 - 283). Routledge.

Sauceda, Ak.K. (2003). *The effect of teacher degree level, teacher certification, and years of teacher experience on student achievement in middle school mathematics,* [Unpublished doctoral dissertation]. Baker University.

Slaten, C., Ferguson, J., Allen, K., Brodrick, D., & Waters, L. (2016). School Belonging: A Review of the History, Current Trends, and Future Directions. *The Educational and Developmental Psychologist, 33*(1), 1-15. https://doi.org/10.1017/edp.2016.6

Sümer, N. (2000). Yapısal eşitlik modelleri: Temel kavramlar ve örnek uygulamalar. *Türk Psikoloji Yazıları*, 3, 49-73. Retrieved from http://www.nebisumer.com/wp-content/uploads/2015/03/SumerN.2000.YEM_TPY.pdf

Squire-Kelly, V. D. (2012). *The relationship between teacher empowerment and student achievement*, [Unpublished doctoral dissertation]. Georgia Southern University.

Tabachnick, B. G., & Fidell, L. S. (2013). *Using multivariate statistics* (6th ed.). Pearson.

Tengberg, M. van Bommel, J., Nilsberth, M., Walkert, M., & Nissen, A. (2022). The quality of instruction in Swedish lower secondary language arts and mathematics. *Scandinavian Journal of Educational Research, 6*6(5), 760-777. https://doi.org/10.1080/00313831.2021.1910564

Timperley, H., Wilson, A., Barrar, H., & Fung, I. (2007). *Teacher Professional Learning and Development: Best Evidence Synthesis Iteration [BES].* Wellington, New Zealand: Ministry of Education. Retrieved from http://www.educationcounts.govt.nz/themes/BES

Ünal, Z., & Ünal, A. (2011). The impact of years of teaching experience on the classroom management approaches of elementary school teachers. *International Journal of Instruction*, *5*(2), 41-60. Retrieved from https://eric.ed.gov/?id=ED533783

Van de Grift, W. (2007). Quality of teaching in four European countries: A review of the literature and application of an assessment instrument. *Educational Research*, 49, 127-152. https://doi.org/10.1080/00131880701369651

Wayne, A. J. & Youngs, P. (2003). Teacher characteristics and student achievement gains: A review. *Review of Educational Research, 73*(1), 89–122. https://doi.org/10.3102/00346543073001089

Yağan, S. A. (2021). The relationships between instructional clarity, classroom management and mathematics achievement: Mediator role of attitudes towards mathematics. In W. B. James, C. Çobanoğlu, & M. Cavuşoğlu (Eds.), *Advances in global education and research* (pp. 1-11). USF M3 Publishing. https://www.doi.org/10.5038/9781955833042