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## \*CORRESPONDENCE

Sudarto M. Abukasim  
✉ sudartoabukasim21@gmail.com

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# Unveiling the hidden mechanisms behind cognitive achievement: a structural equation modeling approach to teacher learning, academic persistence, and school climate

Sudarto M. Abukasim\*, Hari Sutrisno and Eli Rohaeti

Department of Chemistry Education, Faculty of Mathematics and Natural Science, Yogyakarta State University, Yogyakarta, Indonesia

Cognitive achievement in education results from the complex interaction between personal, institutional, and contextual factors. This study investigates how teacher learning characteristics such as instructional competence, personal efficacy, and pedagogical strategies along with school climate and students' academic persistence, influence cognitive outcomes. The purpose of this study is to analyze the influence of teachers' learning characters on cognitive achievement by considering the mediating role of school climate and students' academic perseverance. This study uses a quantitative approach with a covariance-based structural equation modeling method (CB-SEM). The research sample consisted of 1,057 high school students in North Maluku Province, Indonesia. Data were collected using a Likert scale questionnaire and analyzed using SPSS 24, JASP 0.19, and SmartPLS 4. The results showed that professional competence, personal efficacy, and instructional models employed by teachers significantly affected cognitive achievement. In addition, the school climate and academic perseverance are mediators that strengthen the relationship between teachers' learning character and students' cognitive achievement. These findings confirm that a practical learning approach supported by a conducive school environment and students' academic perseverance can contribute to the quality of education as it improves learning outcomes. This research provides insight into educators and education policymakers to develop effective learning strategies.

## KEYWORDS

teacher learning character, cognitive performance, school climate, academic persistence, CB-SEM model

## Introduction

In this modern era, education development is the key to forming modern human beings who can master various sectors of life. Education encourages the development of universal human values individually and collectively, improves public life, and encourages active participation in a democratic society (Sarkar, 2023; Spiel et al., 2018). Implementing good education will produce graduates who are ready to compete and qualified (Sunarya et al., 2024). To form graduates who compete in the world of work, various innovations are needed in holistic learning and to create a competitive character for students (Abuelmaatti and Vinokur, 2024; Kocsis and Pusztai, 2025). There are various variables in determining the

quality of education, one of which is the achievement of cognitive achievement (Purković and Kovačević, 2020). Achievement of Cognitive Achievement in Education is influenced by the complex interaction between contextual factors, personal and institutional. In other words, the complexity of school management, teachers' learning character, and students' personal (Choi and Lee, 2022; Ma et al., 2017). The output of the quality of education that is aspired to will encourage economic growth, reduce inequality, and improve the quality of life of the community, the country, and the nation (Zickafoose et al., 2024).

Although there are many innovations in the character of teacher learning, the formation of a school climate has improved the quality of education by adopting various variables in producing quality learning outcomes. Still, in reality, it is a challenge (Ni and Wang, 2022). Encouraging teachers to be involved in the competence of reflecting and identifying the learning process as a weakness so that it has an impact on the quality of teaching (Andriyani, 2019). Promoting a culture of collaboration between teachers through peer support and education and learning experiences together is also weak because there is competition among each teacher, so there is a weakening of innovation to improve the continuation of learning (Del Gobbo and Galeotti, 2022; Santaolalla et al., 2020). Not all educators and students have adequate skills in following the learning process, so they need optimal encouragement from teachers and school managers in the learning process (Sebastian et al., 2016). Optimal encouragement from teachers and school education staff can encourage active participation, build a strong social climate in the school, and encourage students to improve their learning competencies (Liu et al., 2023).

The learning character of teachers with various dimensions is a factor that can increase achievement (Al Jaber et al., 2024). Teacher learning character is defined as a multidimensional construct that includes eight main dimensions: professional competence, personal competence, learning planning, learning evaluation and improvement, personal efficacy, social efficacy, learning model, and learning media. This dimension reflects the teacher's instructional quality and professional confidence in shaping an effective learning process. Characteristics such as competence and efficacy in teachers can motivate students, and students may have difficulty following the learning stages given by the teacher (Danışman et al., 2020). Characteristics such as teacher efficacy and teacher innovation will also form a good relationship between teachers and students (Binks-Cantrell and Joshi, 2015). Teachers innovate and display exemplary performance in learning by making improvements in learning design, and the use of learning media will form good classroom management (Audisio et al., 2024; Chen and Wang, 2024). In addition to the learning character of the teacher, which is a direct factor, there is also an indirect influence on the achievement of conclusive achievements, including the school climate and internal beliefs of students, such as academic persistence (Archambault et al., 2020).

This research is necessary because it seeks alternatives to various factors of teachers' learning character with the mediation of the school climate and internal factors such as academic persistence (Amsalu and Belay, 2024; Hammar Chiriach et al., 2023). Support for improving teacher competence, performance, efficacy, and innovation can trigger the growth of student motivation and increase academic persistence in learning (Gaganao and Odon, 2024).

Another factor that can affect cognitive achievement is the school climate, where physical and academic conditions become other factors influencing indirectly (Maxwell et al., 2017).

This research offers an integrative approach by examining students' cognitive achievement through the dimensions of teachers' learning character influenced by the mediating role of the school climate and academic persistence. The character of teacher learning, which consists of competence, performance, efficacy, and innovation, is an important factor in the process of knowledge transfer, character building, and motivation that teachers do directly or indirectly to students. In addition to these direct influences, this study also emphasizes the importance of the role of contextual and psychological mediators. The school climate, as a representation of the school's institutional and physical conditions, plays a role in shaping a learning environment that supports academic achievement. Meanwhile, academic persistence that reflects students' commitment to learning and resilience in the face of academic challenges acts as an internal mediator that connects the influence of teachers' character to student learning success. This study responds to gaps in the previous literature that generally examined teacher factors separately and has not examined in depth the mediation mechanisms that link teacher behavior to student achievement. By combining Bandura's sociocognitive theoretical approach and Bronfenbrenner's educational ecology, this study presents a comprehensive theoretical framework in explaining the dynamic interactions between teacher characteristics, school contexts, and students' internal dispositions in influencing cognitive achievement variations.

The research problems in this study focus on how teachers' learning characteristics affect students' cognitive performance, as well as how the mediating role of school climate and academic persistence in these relationships. In this context, this study aims to reveal more deeply the direct and indirect relationship between teachers' learning characteristics and students' academic achievement through school environment mediators and student learning diligence. Based on this formulation, this study asks three main questions, namely: (1) How does the teacher's learning characteristics directly affect students' cognitive achievement? (2) Does the school climate mediate the influence of teachers' learning characteristics on students' cognitive achievement? and (3) Does academic persistence act as a mediator in the relationship between teachers' learning characteristics and students' cognitive achievement? The relationship between these variables is visualized in the conceptual model presented in Figures 1, 2.

## Research method

### Research design

The design of this study uses a quantitative approach with the analytical method of covariant base structural equation modeling (CB-SEM) to test the dimension of teachers' learning character on cognitive achievement mediated by school climate variables and academic persistence. This approach was chosen because of the objective and systematic measurement of the variables studied.

### Population and sample/material

The research sample was collected from 6 districts/cities in North Maluku Province, Indonesia, and the total research sample was 1,057 high school students. The distribution of the research sample is as

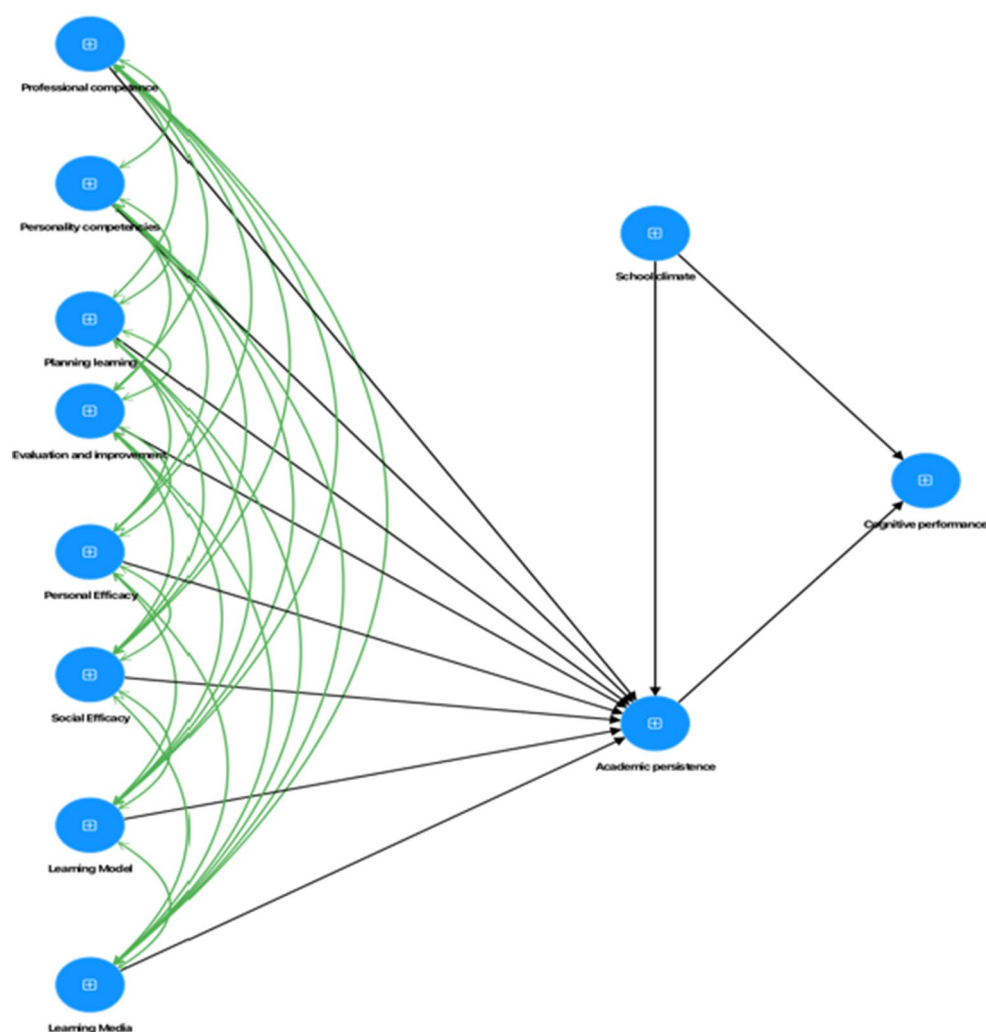


FIGURE 1

Model of the influence of the learning character dimension of teachers in the school climate on cognitive achievement.

follows: as many as 534 students from Ternate city, 132 students from South Halmahera district, 126 students from Morotai Island district, 116 students from Halmahera Uta district, 96 students from Tidore Islands city and 53 students from West Halmahera district. The distribution of samples based on data distribution is seen in the following map image. Stratified random sampling was applied to ensure proportional representation of students across six districts (Figure 3).

## Instrument/procedure

The arrangement of the instrument was carried out in three stages. The first instrument was prepared based on theoretical studies through the approach of adaptation, modification, and extraction of scientific sources for the preparation of the framework of variables and dimensions as well as the arrangement of statement items and questions for cognitive achievement variables (Bichi et al., 2019; Stransky et al., 2023). Second stage is validated by experts, at this point through five experts to validate the content of the instrument, which is then analyzed using the Aiken approach (Correro-Bermejo et al.,

2024; Martinez-Rincon et al., 2022; Pedraz-Petrozzi et al., 2021). The third stage is an empirical test, which is carried out to test whether the instrument is suitable for use (Kumlien et al., 2017; Larasati et al., 2020; Parmaningsih and Saputro, 2021). By involving 157 high school students who were different from the sample to be studied, after conducting a validity and reliability test using SPSS 24 and the results of the instrument used for the research stage. The questionnaire used to collect the research data uses Google Forms, and the questionnaire book is distributed. The scale used in assessing the questionnaire items is a Likert scale with an interval from 1 (disagree) to 4 (strongly agree).

The instrument underwent a linguistic adaptation process, including translation and back-translation to ensure cultural appropriateness. A pilot study was also conducted on a separate sample of 157 students to assess clarity and reliability prior to full deployment (Table 1).

## Analysis data

The data obtained will be analyzed statistically to identify the relationship between the character dimension of school management



FIGURE 2

Model of the influence of the dimension of teacher learning character in the mediation, academic persistence on cognitive achievement.

and cognitive achievement influenced by the mediation of school climate and academic persistence (Tables 2, 3). The data were analyzed univariate and bivariate using SPSS 24, then reliabilities analysis and Confirmatory factor analysis (CFA) were carried out using the JASP 0.19 application, and at the model evaluation analysis stage, SMARTPLS 4 was used (Figure 4).

## Results

Although the Cronbach's alpha value for the professional competence dimension was 0.673, which is slightly below the conventional threshold of 0.70, it remains acceptable for exploratory research (Shmueli et al., 2019). Moreover, all factor loadings within this dimension exceeded 0.6, and composite reliability values met the

standard, supporting the internal consistency of the construct (Table 4).

Regarding the AVE values, while a few dimensions such as professional competence and learning model fell just below the 0.50 threshold, this was offset by strong convergent validity through item loadings and satisfactory HTMT values (Tables 5–7). According to Afthanorhan et al. (2021), AVE values slightly below 0.5 can still be acceptable when supported by other reliability metrics (Figure 5).

## Discussion

This study analyzes the model of teacher learning character (personal competence, professional competence, learning design, evaluation of learning improvement, personal efficacy, social efficacy,

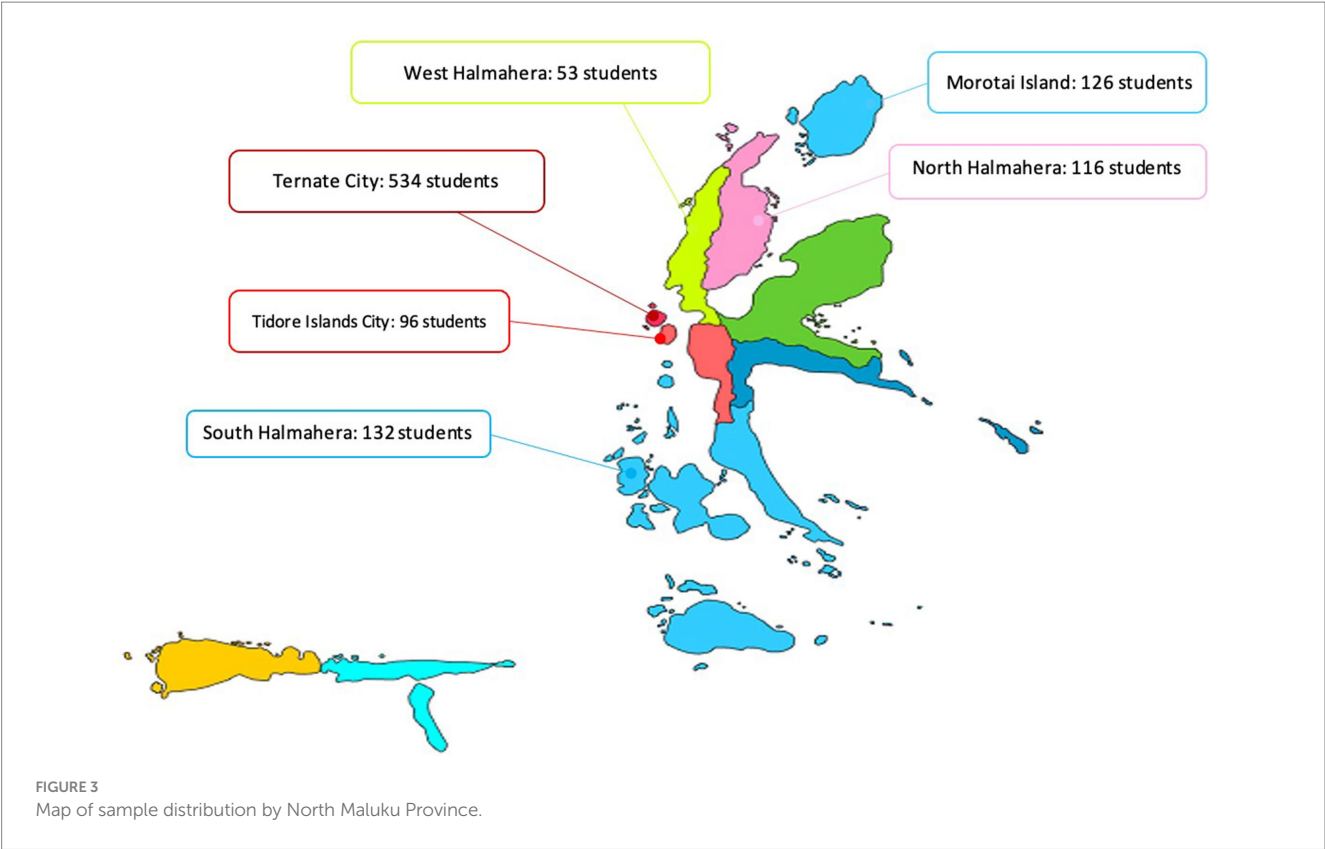


TABLE 1 List of measurement items on the research instrument.

Variable	Dimension	Number of items
Teacher's learning character	Professional competence	5
	Personal competence	5
	Learning planning	5
	Evaluation and improvement	5
	Personal efficacy	5
	Social efficacy	5
	Learning model	5
	Learning media	5
Mediation	School climate	10
	Academic persistence	10

learning model, learning media) on cognitive achievement influenced by school climate mediation and academic persistence. Teacher learning characteristics such as efficacy, competence, learning design, and learning evaluation positively affect cognitive achievement (Archambault et al., 2012; Bhai and Horoi, 2019; Flint et al., 2024; You et al., 2021). The relationship between social efficacy and personal efficacy from teachers also impacts improving student learning outcomes (Fan and Williams, 2018). In addition to direct relationships, the mediating influence of a positive school climate can also enhance the relationship between teachers and students, which supports a collaborative environment that will impact student achievement (Dickhäuser et al., 2021). The mediating role of students' academic persistence, such as commitment and challenges, is a factor that

TABLE 2 Model measurement estimation criteria.

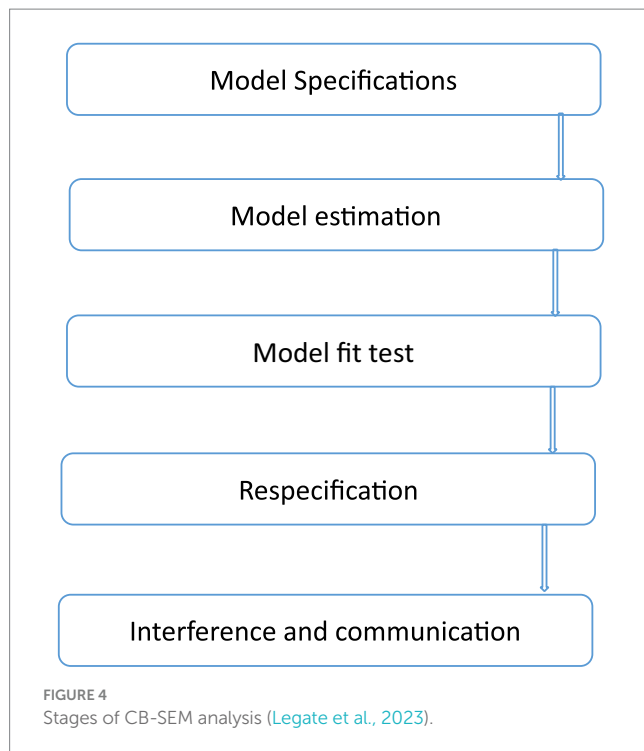
Aspects	Description	References
Cronbach alpha reliability	<ul style="list-style-type: none"><li>• Less reliable: 0–0.2</li><li>• Somewhat dense: &gt;0.2–0.4</li><li>• Moderately dense: &gt;0.4–0.6</li><li>• Reliable: &gt;0.6–0.8</li><li>• Very dense: &gt;0.8</li></ul>	Hair et al. (2019)
Explanatory factor analysis (EFA)	Prerequisite: <ul style="list-style-type: none"><li>• Bartlett's Sphericity Test: &lt;0.05</li><li>• KMO: &gt;0.5</li><li>• Item loading factor: 0.3</li></ul>	Hair et al. (2019)

TABLE 3 Model measurement evaluation criteria.

Goodness-of-fit indicator	Criteria
ChiSqr/df	<2 (Good), <5 (Acceptable)
RMSEA	<0.06 (good), <0.08 (Acceptable)
GFI	>0.90 (good)
AGFI	>0.90 (good)
PGFI	>0.5 (Good)
SRMR	<0.08 (Good)
NFI	>0.95 (good)
TLI	>0.9 (good)
CFI	>0.90 (good)

Groskurth et al. (2024), Legate et al. (2023), and Surjanovic and Loughin (2024).





supports the teacher's learning character in improving student learning achievement (Kikas and Mägi, 2017). This study answers the variable gap that various dimensions of teacher learning character can directly affect teacher achievement and by mediating school climate and academic persistence.

Evaluation of the measurement of the teacher's learning character model on cognitive achievement influenced by the mediation of school climate and academic persistence by confirming the compatibility of the model where the Goodness of fit (GoF) value indicates that this research model has a match with empirical data (Pho, 2024). The majority of indicators show that the model has met the criteria recommended for analysis in SEM. The main indicators of model compatibility are  $\text{ChiSqr/df} = 3.817$ ,  $\text{RMSEA} = 0.053$ ,  $\text{GFI} = 0.991$ ,  $\text{PGFI} = 0.705$ ,  $\text{SRMR} = 0.040$ ,  $\text{NFI} = 0.901$ ,  $\text{TLI} = 0.910$ ,  $\text{CFI} = 0.924$  indicating a fit value or meeting the required GoF value standard (Maia and Lima, 2021). Meanwhile, one indoctrination does not meet the value standard, namely  $\text{AGFI} = 0.862$ . Although the AGFI value is slightly below the ideal threshold  $\geq 0.90$ , the overall model is still considered acceptable based on a combination of other strong indicators such as RMSEA, CFI, TLI, and SRMR. The slightly low AGFI value can be due to the complexity of the model that includes many constructs and mediation pathways, which can statistically affect the adjustment score. Some previous studies have also shown that AGFIs tend to be sensitive to sample size and the number of indicators in the model (Hair et al., 2019). Taking into account all the other GoF parameters that are in the good category, the validity of the model can still be maintained empirically and theoretically. Overall, this model meets the prerequisite GoF standards (Cho et al., 2020). This is in line with research conducted by Dević (2019). In its findings, it was stated that SEM's analysis confirmed that teachers' learning proficiency and learning characteristics significantly improved cognitive achievement and supported model conformity. The model hypothesized in various

studies with data shows that the relationship between teacher behavior, school climate, and student learning outcomes is strong (Dević, 2019; Fan and Williams, 2018).

The study results show that the variables in this model have a significant direct influence on cognitive achievement and weak or insignificant relationships. Overall, the study's results confirm that academic persistence, professional competence, social efficacy, and learning models significantly improve cognitive achievement. Teacher efficacy academically is a significant predictor of perseverance that can motivate students to improve their ability to seek good learning achievement (Lent et al., 2016). Collectively, it is confirmed that the variability of the dimension of teacher learning character has a negative impact on cognitive achievement, as found in Table 8 of the findings of direct influence. These factors are variable, reinforcing cognitive achievement (Andres, 2020).

The study's findings on school climate mediation show a high significance level. These findings confirm that a good school climate can shape the variables of teachers' learning characteristics toward the achievement of teachers. The learning model teachers apply can impact cognitive achievement due to the influence of school climate (Sari and Kismiantini, 2023). According to Maxwell et al. (2017), the school climate plays a significant role in the achievement of students' academic outcomes. A positive student discipline and behavior climate can improve students' cognitive achievement (Teng, 2020). In addition, the physical condition and social conditions of the school are the effect of instructional leadership on student achievement (Dutta and Sahney, 2022) (Table 9). This study also found that personal competence and personal efficacy with the mediation of school climate significantly affect cognitive achievement. School climate mediates the relationship between teacher competence and efficacy on students' cognitive performance (Fan and Williams, 2018; Velásquez and Castellanos, 2024; Zysberg and Schwabsky, 2021). Positive perception of the school climate increases self-efficacy, leading to an increase in contemplative achievement (Fan and Williams, 2018; Zysberg and Schwabsky, 2021). The school climate strongly influences the positive relationship between teacher competence, teacher efficacy, and contingency achievement, as shown in Table 10 of the findings of school climate mediation. These findings show that creating a school climate, both physical and social conditions, is important because it can encourage the improvement of teachers' learning character, which can ultimately improve students' cognitive achievement.

This study fills the gap by revealing that school climate is important in mediating the relationship between teacher learning character and student achievement. Confirm that the variety of social efficacy, personality competence, and learning media significantly impact students' cognitive achievement through the school climate. In addition, it highlights that not all aspects of Education contribute significantly to cognitive achievement, especially in the school climate mediation pathway. This gives a new perspective that the challenges of poor learning planning can have a negative impact on the academic environment and cognitive achievement (Table 11).

The study's results showed that the confirmation of the factor of academic persistence as a mediator had a significant effect on learning media and cognitive achievement. This unexpected negative mediation effect may be attributed to cognitive overload caused by overuse or misapplication of learning media. Similar findings have been reported in prior studies, such as Law and Stock (2019),

TABLE 4 Model measurement estimates.

Variable	Dimension	Item	Outer loadings	Cronbach's alpha	AVE
Teacher's learning character	Professional Competence	KG1	0.802	0.673	0.418
		KG2	0.757		
		KG5	0.749		
	Personal Competence	KG3	0.874	0.758	0.420
		KG4	0.733		
		KG7	0.499		
		KG8	0.778		
	Learning planning	KiG1	0.832	0.770	0.486
		KiG2	0.736		
		KiG5	0.869		
	Evaluation and Improvement	KiG10	0.717	0.878	0.563
		KiG9	0.786		
	Personal efficacy	EG1	0.737	0.657	0.551
		EG10	0.756		
		EG2	0.713		
		EG6	0.860		
	Social efficacy	EG3	0.933	0.756	0.510
		EG4	0.740		
		EG7	0.728		
	Learning Model	IG1	0.767	0.755	0.459
		IG10	0.715		
		IG2	0.801		
		IG6	0.812		
	Learning Media	IG3	0.799	0.687	0.507
		IG4	0.867		
		IG7	0.714		
		IG8	0.744		
Mediation	School Climate	IS1	0.713	0.685	0.583
		IS10	0.766		
		IS5	0.809		
		IS9	0.769		
	Academic Persistence	KA10	0.734	0.688	0.507
		KA3	0.778		
		KA6	0.736		
		KA7	0.873		

indicating that excessive media multitasking may negatively impact students' focus and persistence. This can happen because there is a reciprocal relationship between student learning perseverance and teacher learning innovation, especially in making learning media (Wu et al., 2024). This strengthens the negative relationship trend, showing other influencing factors besides the learning media variable. Other findings show that personal efficacy mediated by academic persistence significantly affects cognitive achievement. Increased confidence in learning to students is influenced by student commitment and challenges as part of academic persistence to improve student academic achievement (Boudrenghien and Frenay, 2011; You, 2018).

The mediation of significant academic persistence on cognitive achievement influences the learning model, but the relationship path is negative. This shows that specific learning models can improve students' academic persistence, which ultimately leads to students' Cognitive achievements. A complex and multifaceted relationship provides an adverse effect pathway between academic persistence and cognitive achievement (Law and Stock, 2019; Parry and Le Roux, 2018). However, persistence is generally beneficial and effective in improving cognitive achievement, but it depends on various factors, including the learning model, self-progress, stress management, and a conducive learning environment.

TABLE 5 HTMT values between research variables.

	Academic persistence	Cognitive performance	Evaluation and improvement	Learning media	Learning model	Personal efficacy	Personality competencies	Planning learning	Professional competence	School climate	Social efficacy
Cognitive performance	0.042										
Evaluation and improvement	0.484	0.010									
Learning media	0.627	0.067	0.862								
Learning model	0.060	0.053	0.666	0.421							
Personal efficacy	0.628	0.032	0.865	0.986	0.458						
Personality competencies	0.587	0.043	0.964	0.832	0.595	0.858					
Planning learning	0.549	0.016	0.998	0.852	0.604	0.845	0.980				
Professional competence	0.198	0.072	0.596	0.621	0.679	0.633	0.600	0.586			
School climate	0.482	0.031	0.949	0.821	0.681	0.851	0.940	0.897	0.580		
Social efficacy	0.129	0.025	0.668	0.455	0.937	0.500	0.599	0.597	0.706	0.669	

Source: SEM Output using SmartPLS 4; statistical method: CB-SEM.



TABLE 6 Evaluation of the validity using the Fornell–Larcker criterion.

	Academic persistence	Cognitive performance	Evaluation and improvement	Learning media	Learning model	Personal efficacy	Personality competencies	Planning learning	Professional competence	School climate	Social efficacy
Academic persistence	0.766										
Cognitive performance	−0.043	1.000									
Evaluation and improvement	0.480	−0.018	0.723								
Learning Media	0.622	−0.051	0.863	0.766							
Learning Model	0.013	0.047	0.644	0.398	0.719						
Personal Efficacy	0.636	−0.048	0.856	0.979	0.442	0.711					
Personality competencies	0.620	−0.037	1.011	0.864	0.603	0.900	0.679				
Planning learning	0.543	−0.026	1.017	0.824	0.593	0.847	1.028	0.642			
Professional competence	0.200	−0.056	0.594	0.627	0.655	0.643	0.644	0.588	0.676		
School climate	0.504	−0.018	0.972	0.827	0.665	0.861	1.012	0.926	0.594	0.742	
Social Efficacy	0.109	0.029	0.657	0.449	0.906	0.493	0.610	0.589	0.692	0.669	0.768

Source: SEM Output using SmartPLS 4; statistical method: CB-SEM.

TABLE 7 CB-SEM measurement model fit index.

GoF	Estimated model	Interpretasi
ChiSqr/df	3.817	Model fit
RMSEA	0.053	Model fit
GFI	0.991	Model fit
AGFI	0.862	Tidak fit
PGFI	0.705	Model fit
SRMR	0.040	Model fit
NFI	0.901	Model fit
TLI	0.910	Model fit
CFI	0.924	Model fit

This study makes a new contribution that academic literature highlights the role of academic persistence as a mediator in the relationship between learning factors carried out by teachers or the character of teacher learning and students' cognitive achievement. These findings show that learning media does not always positively impact cognitive achievement, especially if its use is ineffective and decreases students' academic persistence. Teachers' efficacy has a significant role or influence on academic persistence and student achievement. Meanwhile, a model of non-exhaustion can reduce students' academic persistence and does not impact improving students' cognitive achievement. These findings confirm that the school environment, such as school climate and academic persistence, play a significant role in determining the accomplishment of Shiva's cognitive achievement if done well and

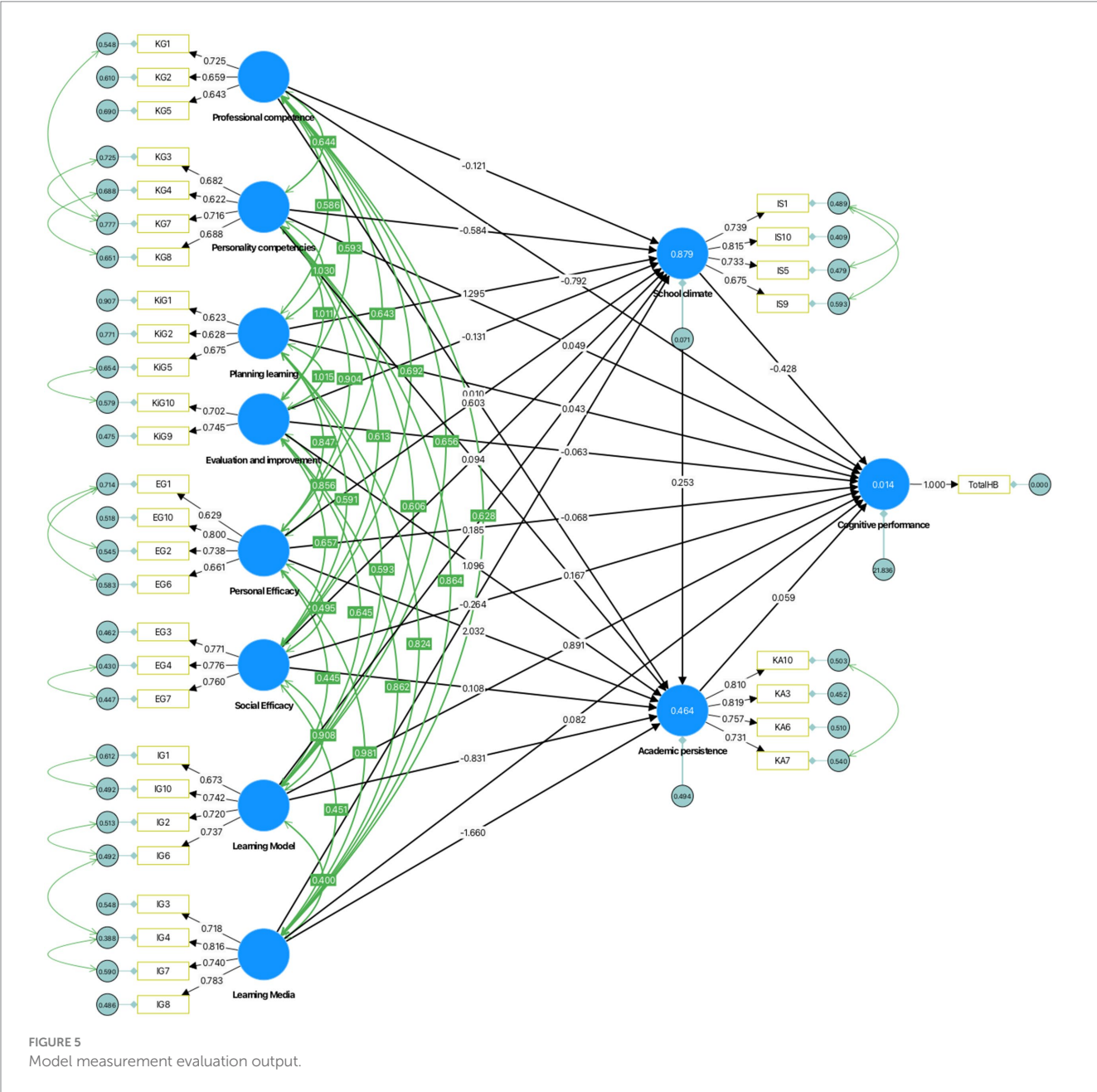


TABLE 8 A direct influence of teacher learning character dimmest on cognitive achievement.

Indirect effect	Original sample (O)	T statistics ( O/STDEV )	p values
Academic persistence → Cognitive performance	0.012	2.17	0.030
Evaluation and improvement → Academic persistence	0.857	0.842	0.399
Evaluation and improvement → Cognitive performance	−0.100	0.100	0.317
Evaluation and improvement → School Climate	−0.128	0.237	0.812
Learning Media → Academic persistence	−1.517	1.948	0.041
Learning Media → Cognitive performance	0.015	1.778	0.075
Learning Media → School Climate	−0.302	0.549	0.583
Learning Model → Academic persistence	−0.663	1.974	0.048
Learning Model → Cognitive performance	1.450	14.830	0.000
Learning Model → School Climate	0.184	0.889	0.374
Personal Efficacy → Academic persistence	2.029	2.388	0.017
Personal Efficacy → Cognitive performance	−0.014	1.420	0.155
Personal Efficacy → School Climate	0.753	1.344	0.179
Personality competencies → Academic persistence	−0.636	0.555	0.579
Personality competencies → Cognitive performance	0.098	0.730	0.465
Personality competencies → School Climate	−0.690	1.120	0.263
Planning learning → Cognitive performance	0.077	0.657	0.511
Planning learning → School Climate	1.280	2.008	0.045
Professional competence → Academic persistence	0.008	0.032	0.974
Professional competence → Cognitive performance	−1.315	16.212	0.000
Professional competence → School Climate	−0.123	1.019	0.308
School climate → Academic persistence	0.202	0.293	0.770
School climate → Cognitive performance	−0.700	6.160	0.000
Social Efficacy → Academic persistence	0.092	0.272	0.786
Social Efficacy → Cognitive performance	0.290	3.050	0.002
Social Efficacy → School Climate	0.101	0.501	0.616

Source: SEM Output using SmartPLS 4; statistical method: CB-SEM.

positively. This study emphasizes that the importance of internal factors of teachers and students, as well as the formation of a climate, greatly determines students' academic success. Increasing the competence of education providers, including teachers and school stakeholders, is a strategic factor that can affect student achievement.

## Conclusion

This study confirms that the learning characteristics of teachers, school climate, and academic persistence are essential in improving cognitive prestige. These findings have significant implications for educators and policymakers and the importance of education in developing effective learning strategies. In particular, this study confirms that professional competence, problem-solving, learning design, and learning models applied by teachers directly and indirectly influence cognitive achievement. Therefore, it is important for teachers to continue to develop capacity through continuous professional training, especially in learning methods, classroom management, and student-centered

learning approaches. Schools must also create a school climate that focuses on learning culture because it can encourage innovation and collaboration between teachers to increase the effectiveness of the learning process.

The role of school climate mediation as a mediator in improving student achievement. A conducive academic environment can strengthen the impact of the learning model applied by teachers. Schools need to ensure that the policies and learning practices implemented can create an atmosphere that supports academic engagement and students' success. Strategic steps need to be taken to promote school leadership, improve supporting facilities, and manage positive social relations in the school environment.

The findings of this study also reveal that academic persistence is a key factor in bridging teachers' personal efficacy and cognitive achievement. The higher the students' academic persistence, the more excellent the opportunity for students to achieve optimal learning skills. Therefore, schools and education institutions must integrate learning strategies to increase students' intrinsic motivation, such as challenge-based learning, self-reflection, and constructive feedback. In addition, the use of learning media must be in accordance with the

TABLE 9 Effects of school climate mediation and academic persistence.

Indirect effect	Original sample (O)	T statistics ( O/STDEV )	p-values
Social Efficacy → School climate → Academic persistence	0.020	0.125	0.900
Social Efficacy → School climate → Cognitive performance	−0.077	2.220	0.027
Evaluation and improvement → School climate → Academic persistence → Cognitive performance	−0.000	0.101	0.912
Professional competence → School climate → Academic persistence → Cognitive performance	−0.000	0.347	0.733
Social Efficacy → School climate → Academic persistence → Cognitive performance	0.000	0.259	0.802
Personality competencies → School climate → Academic persistence → Cognitive performance	−0.020	0.540	0.579
Learning Model → School climate → Academic persistence → Cognitive performance	0.000	0.390	0.696
Evaluation and improvement → Academic persistence → Cognitive performance	0.109	1,702	0.089
Learning Media → Academic persistence → Cognitive performance	−0.181	2.989	0.002
Learning Model → Academic Persistence → Cognitive Performance	−0.088	2.055	0.040
Personal Efficacy → Academic persistence → Cognitive performance	0.240	2.829	0.004
Personality competencies → Academic persistence → Cognitive performance	−0.086	1.140	0.254
Learning Media → School climate → Academic persistence → Cognitive performance	−0.011	0.309	0.764
Professional competence → Academic persistence → Cognitive performance	0.000	0.063	0.952
School climate → Academic persistence → Cognitive performance	0.022	0.591	0.553
Social Efficacy → Academic persistence → Cognitive performance	0.019	0.481	0.631
Planning learning → School climate → Academic persistence → Cognitive performance	0.032	0.820	0.412
Personal Efficacy → School climate → Academic persistence → Cognitive performance	0.020	0.571	0.558
Evaluation and improvement → School climate → Academic persistence	−0.026	0.061	0.951
Evaluation and improvement → School climate → Cognitive performance	0.095	1.082	0.280
Learning Media → School climate → Academic persistence	−0.061	0.150	0.880
Learning Media → School climate → Cognitive performance	0.210	2.51	0.012
Learning Model → School climate → Academic persistence	0.037	0.203	0.839
Learning Model → School climate → Cognitive performance	−0.131	4.060	0.000
Personal Efficacy → School climate → Academic persistence	0.152	0.282	0.778
Personal Efficacy → School climate → Cognitive performance	−0.531	4.978	0.000
Personality competencies → School climate → Academic persistence	−0.139	0.285	0.775
Personality competencies → School climate → Cognitive performance	0.480	5.289	0.000
Planning learning → School climate → Academic persistence	0.258	0.391	0.696
Planning learning → School climate → Cognitive performance	−0.889	6.829	0.000
Professional competence → School climate → Academic persistence	−0.025	0.177	0.860
Professional competence → School climate → Cognitive performance	0.09	3.771	0.000

Source: SEM Output using SmartPLS 4; statistical method: CB-SEM.

TABLE 10 Findings of School Climate Mediation.

Indirect effect	Path coefficient	p values
Social Efficacy → School climate → Academic persistence	0.020	0.625
Learning Model → School climate → Cognitive performance	−0.131	0.000
Personal Efficacy → School climate → Cognitive performance	−0.531	0.000
Personality competencies → School climate → Cognitive performance	0.333	0.000
Planning learning → School climate → Cognitive performance	−0.889	0.000
Professional competence → School climate → Cognitive performance	0.090	0.000
Learning Media → School climate → Cognitive performance	0.146	0.012
Social Efficacy → School climate → Cognitive performance	−0.077	0.027
Evaluation and improvement → School climate → Cognitive performance	0.095	0.194

TABLE 11 Mediation findings academic persistence.

Indirect effect	Path coefficient	p values
Learning Media → Academic persistence → Cognitive performance	−0.181	0.002
Personal Efficacy → Academic persistence → Cognitive performance	0.167	0.004
Learning Model → Academic persistence → Cognitive performance	−0.088	0.040
Evaluation and improvement → Academic persistence → Cognitive performance	0.076	0.089
Personality competencies → Academic persistence → Cognitive performance	−0.086	0.176
School climate → Academic persistence → Cognitive performance	0.022	0.384
Social Efficacy → Academic persistence → Cognitive performance	0.019	0.438
Professional competence → Academic persistence → Cognitive performance	0.000	0.661

needs of students because, in learning science, content must be adjusted to the learning media.

Overall, this study provides in-depth insights into the interaction between teachers, the school environment, and students in shaping academic success. The implications of these findings underscore the importance of a multidimensional approach in education that does not only focus on strengthening motivation and resilience. By applying the results of this research to education policies and practices, it is hoped that a learning system that is more adaptive, inclusive, and oriented toward developing student potential can be maximized.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. Written informed consent from the participants was not required to participate in this study in accordance with the national legislation and the institutional requirements.

Author contributions

SA: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. HS: Supervision, Conceptualization, Validation, Writing – review & editing. ER: Supervision, Conceptualization, Validation, Writing – review & editing.

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