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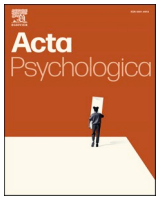

Beyond the classroom: Examining the varied impact of family dynamics on students' academic success

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ABSTRACT

The family unit is foundational to a child's cognitive and social development. Variations in family dynamics significantly influence disparities in educational outcomes. This study aimed to explore the effects of family socio-economic variables on students' learning behavior at home and learning engagement at school. It examined the effects of family income, the father and mother's education level or cultural capital, and their communication with teachers on students learning engagement at school through the mediation role of students' learning behavior at home. The sample in an online survey was 2476 parents and teachers across China, and data was analyzed using SPSS, PROCESS macro for SPSS, and JASP. The findings highlight the importance of parent-teacher communication, which exhibited a significant total effect on student engagement. This influence surpasses other factors, such as family income and the education level of mothers and fathers, on students' learning engagement at school. Thus, the study emphasizes effective communication between parents and teachers in fostering students' learning engagement.

1. Introduction

Family background and the child's educational inequality in school are strongly correlated, as Coleman's seminal work (1966) highlighted. Recent studies, like those by Xue et al. (2020), support this idea, demonstrating that familial factors may significantly impact student achievement more than schools or communities (Fang, 2020; Mosteller, 2014). Hence, empirical evidence from various global studies confirms this perspective (Condo et al., 2022). The economic and education system reforms in China, mainly referring to those of the late 1970s and 1980s (respectively), significantly reshaped the educational landscape. The reforms included, among other issues, the decentralization of educational funding (allowing local governments and private entities to play a more significant role in education). While this increased access to education, it also widened the socio-economic gap, as wealthier families could afford better-quality schools and supplementary resources than their counterparts. Consequently, socio-economic status became a stronger predictor of academic success as disparities in access to quality education and parental involvement became more pronounced.

After the reform, the socio-economic status in China has grown in importance as a predictor of academic success (Lu et al., 2019). Notable are the two paths that involve direct rivalry for educational opportunities and different parenting styles depending on one's socio-economic status (Li & Qiu, 2018). Parents with higher levels of education tend to be more involved in their children's education, which helps to create a disciplined and supportive learning environment (Diaconu-Gherasim & Măirean, 2016). Socio-economic determinants, on the other hand, have a particularly significant impact on the academic performance of urban students (Jarvis et al., 2022), with elite-class children demonstrating superior language competence (Zhu, 2020). Other studies conducted in Gansu province (Alghazo et al., 2021) and Nanjing (Fang & Feng, 2008) provide additional evidence of the favorable relationship between parental socio-economic level and student learning outcomes.

According to data from the Organization for Economic Cooperation and Development (OECD), students from less advantaged families perform worse academically than their more advantaged peers (OECD, 2016). Furthermore, socio-economic status shapes educators' perspectives, frequently resulting in reduced standards for students from lower socio-economic backgrounds (Glock & Kleen, 2020), fostering prejudices that harm student learning and evaluation (Westphal et al., 2016). Although some studies (Pit-ten Cate & Glock, 2019) show no difference in the stereotypes held by teachers, other research suggests that in-

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service teachers may hold more significant implicit prejudices than pre-service teachers, especially regarding ethnic minorities (Glock & Karbach, 2015).

Moreover, parents set their children up for growth by orienting them and supporting their formal and informal learning processes. Yet, how the desire is translated into reality varies from one to the other based on the family's standing within unequal societies (Scanlon et al., 2019). In comparison to middle-class parents, according to Curtis et al. (2021), working-class parents feel less secure helping their children with schoolwork, and their low capacity to pay for private tuition and extracurricular activities gives middle-class families an educational edge and increases the performance gap between their children and those from other socio-economic classes. Parents with college degrees possess the bravery and skill to offer support by actively participating in decision-making, touring universities, and offering feedback on college application materials for their children. Therefore, parents' knowledge and social networking contribute toward academic achievement and employment opportunities among adolescents from middle-class families (Curtis et al., 2021). The value, higher expectations, and support of working-class parents to their children are challenged by unfamiliarity with college concerns like affordability, requirements, and financial aid opportunities (Scanlon et al., 2019).

Furthermore, their future direction strongly motivates the students' learning behavior. They can use their ability to look into the future and comprehend how their present actions will affect their ability to achieve their goals in the future (Seginer & Mahajna, 2018). The educational attainment of parents and the degree of the family-school relationship are two factors that affect adolescents' future orientation (Tuominen et al., 2020). Hence, family members who are a child's primary caregivers are the most vital indicators of a child's future success, even though creating expectations about the future takes on a unique significance during adolescence (Blazevic, 2016; Zhao et al., 2019), it starts at a very young age.

Indeed, parents have a vital role in the family, which is the institution where a child's occupational development process begins (Blazevic, 2016; Justyna, 2017). Children's learning and future job choices are influenced by family structures, relationships between members, responsibilities each family member assumes, and the values and attitudes underpinning their behavior (Zhang, & feng, Zilundu, P. L. M., Zhou, L., & Guo, G. qing., 2020). Since children are expected to pick up and grow up with their families' behaviors, the impact of families on their future orientation and academic accomplishment might help explain how the family's socio-economic status can be passed down from one generation to the next (Chiang et al., 2020). According to Rodríguez, 2021, a study carried out in Trinidad among adolescents revealed a strong correlation between the absence of a father and the child's inclination toward instant gratification. This behavior often results from not having a clear understanding of one's destiny. Meng et al. (2020) found that children's need for instant gratification is also linked to a lack of trust, as fatherless families are characterized by distrust.

The absence of a father can profoundly influence a child's learning engagement and career decisions in several interconnected ways. First and foremost, studies have indicated that paternal absence often disrupts the development of trust and self-regulation, critical attributes for academic persistence and long-term planning (Amato & Gilbreth, 1999; Lamb, 2010). Children without a present father are at risk of lacking consistent reinforcement of discipline and support, which can contribute to behaviors such as a preference for instant gratification and diminished goal orientation, undermining their learning engagement and career aspirations (McLanahan et al., 2013). In addition, fathers frequently play a pivotal role in shaping their children's sense of purpose and future orientation. Their absence is reported to lead to an unclear sense of destiny, leaving children less equipped to connect their educational efforts with meaningful career outcomes (Cabrera et al., 2000; Ermisch & Francesconi, 2001). Furthermore, the lack of paternal involvement can reduce children's economic and social capital, further limiting their access to quality educational resources and career opportunities (Bourdieu, 1986; Coleman, 1988).

Cultural capital and social capital theories can be used to explain how a family can affect students' engagement in learning (Karalis Noel & Finocchio, 2022). According to cultural capital theory, parents with high capital levels are aware of school policies and, hence, devote more time and attention to fostering their children's academic success through additional cultural resources (Kingston, 2001; Mishra, 2020). Prieur and Savage (2011) claimed that the outstanding educational success rate among children from educated homes may be explained by this theory, which Bourdieu and his colleagues put forth. The phrase "cultural capital," which was first used by renowned French sociologist Pierre Bourdieu in his paper "Cultural Reproduction and Social Reproduction," refers to assets in the sociological domain that include conduct, intelligence, education, and skills (Chiang et al., 2020). Higher expectations for their children's education are placed on parents with substantial cultural capital, which significantly impacts the student's academic engagement (Bourdieu & Passeron, 1990; Eryilmaz & Sandoval-Hernández, 2021).

Differences in socio-economic status (SES) significantly contribute to disparities in educational opportunity and inequality because of the unequal distribution of resources and access to cultural and social capital. Bourdieu's theory of cultural capital explains that families with higher SES are more likely to possess (and transmit) valuable cultural capital (i.e., knowledge, behaviors, and attitudes) that align with the educational system's expectations, thus giving their children an advantage in academic success (Bourdieu, 1986). Parents with higher SES often provide enriched learning environments, better access to educational materials, and the ability to participate in extracurricular activities, cumulatively enhancing their children's educational outcomes (Coleman, 1988). In contrast, families with lower SES may face financial and social constraints (lack of access to quality schools or a limited understanding of navigating educational institutions) that limit their capacity to support their children's education. In addition, social capital (the networks and relationships that facilitate successful action) is often more robust among families or communities in higher SES, enabling better support systems and resources for students (Putnam, 2000). These inequities continue to perpetuate cycles of educational disadvantage, as children from low SES backgrounds may struggle to acquire the cultural and social capital needed to compete on an equal footing with their counterparts.

According to Lyu et al. (2019), the social capital hypothesis describes how parents participate in their children's education. The theory's fundamental ideas include social relationships (interactions) and their constituent parts, such as social networks, generalized trust, civic participation, and reciprocity rules (Bhandari & Yasunobu, 2009; Boland, 2020). According to Barrera-Verdugo's (2021) theory, parents with higher socio-economic status will always fully participate in their children's education by managing their children's absences from school and other risky behavior and communicating with teachers to improve their academic engagement. This theory explains the mechanism of family influences on children's learning engagement. Indeed, research has also shown that parental involvement in their children's education (e.g. talking to them about school-related concerns, being involved in school events, and checking their homework) can help them learn better at school (Li & Qiu, 2018; Mishra, 2020).

Parent-teacher communication is imperative for children because it is crucial in fostering their learning engagement, academic achievement, and motivation. Effective communication allows parents and teachers to align their efforts in supporting children's education, creating a consistent and supportive environment at home and school (Epstein, 2001). Studies have indicated that frequent and meaningful parent-teacher communication positively impacts students' engagement in their learning activities. The relationship stems from the ability to communicate early to address academic challenges and provide tailored support (Kraft & Dougherty, 2013). When parents are actively informed and

involved in their children's academic progress, students often show increased intrinsic motivation and active participation in learning tasks (Hill & Tyson, 2009). These interactions encourage a sense of accountability in students, further promoting academic success.

Moreover, parent-teacher communication is a foundation for building trust and collaboration, which is essential for academic achievement. For instance, parents who are regularly updated about their child's academic and social progress are better equipped to provide necessary resources and emotional support, contributing to higher grades and better attendance (Fan & Chen, 2001). Communication also enhances students' motivation by reinforcing the value of education and establishing higher expectations (Grolnick & Slowiaczek, 1994). The shared accountability between parents and teachers fosters a supportive learning environment that motivates students to strive for better outcomes. Consistent and constructive communication improves academic performance and nurtures a positive attitude toward learning.

2. Problem statement

While there are existing studies that highlight the relationships (both causal and correlation) between family dynamics (socio-economic status, parental education, and communication with teachers) and their influences on students' academic success (Coleman, 1966; Xue et al., 2020), most have been conducted in Western contexts (developed nations). Limited research has explored how these dynamics operate within rapidly changing socio-economic contexts, including China, where educational reforms and rising economic inequalities have reshaped family structures and behaviors (Li & Qiu, 2018; Lu et al., 2019). Furthermore, these studies have primarily treated family influences as direct predictors, overlooking the mediating role of children's learning behavior at home, particularly in linking family characteristics to school learning engagement (Curtis et al., 2021; Scanlon et al., 2019). This study addresses these gaps by examining the interplay between family dynamics and students' learning engagement in the distinct socio-cultural setting of China, focusing on the mediating role of children's home learning behavior. The study tests their relevance in the Chinese context and offers novel insights into how family resources and practices impact academic outcomes in an era of growing inequality.

2.1. Objective of the study

This study investigated how family characteristics affect children's engagement in and behavior related to learning at school. Through the mediating role of children's learning behavior at home, the study primarily looked at the effects of family socio-economic status, the educational attainment of the mother and father, and their communication with teachers on students' learning engagement at school. The goal is supported by prior research (both theoretical and empirical data), which indicates that the socio-economic status of their families can influence students' learning processes and outcomes. Thus, the study extends the body of knowledge by examining the social and cultural capital theories in the context of China.

2.2. Hypotheses of the study

1) Family income has a significant association with students' learning engagement at school.
2) Parents' education is significantly associated with students' learning engagement at school.
3) Communication with teachers is significantly associated with students' learning engagement at school.
4) Students learning behavior at home mediates the relationship between family dynamics (education, economy and communication) and learning engagement at school.

2.3. Model of the study

The model of this study is formulated based on the literature reviewed and our hypotheses, which predict that family factors have a more significant influence on students' learning engagement at school. In Fig. 1 below, parents' education level, communication with the school, and family income influence adolescents' learning behavior at home through paths a11, a12,13, and a14, which further influences that child's learning engagement at school through path b11. The independent variables (family factors) directly affect an outcome variable (students' learning engagement) through paths c11, c12, c13, and c14. However, we further predicted that fathers' than mothers' education level has a lesser impact on the adolescent's learning behavior at home.

The split of the SES variable into two domains (parents' education and income) was made to reflect distinct yet related aspects of socio-economic status that could influence student outcomes. The division was based on theoretical frameworks and prior research, which suggest that these dimensions can have separate impacts on educational engagement. Statistically, we conducted a factor analysis (to assess the independence of these domains), and the results supported their distinctness. The 10 items were allocated to these domains based on their content relevance, and we ensured that each item best represented the underlying construct. We also tested for multicollinearity between these variables, which indicated that they are relatively independent but may exhibit some overlap, as expected in real-world scenarios.

3. Method

3.1. Procedure

One thousand five hundred fifty-nine parents (1559) completed the online survey between July 2021 and December 2021. The participants responded to an online questionnaire distributed by research assistants through different social media platforms. The authors guaranteed the confidentiality of their responses throughout the reporting process and the anonymity of all the information provided by the participants. The questionnaires were completed within 15 to 20 min. The study followed the Declaration of Helsinki and received approval from the College of Teacher Education Ethics Committee at *** university.

3.2. Participants

A total of 1475 parents ($M_{age} = 41$, $SD_{age} = 5.09$) of primary school children with varying educational backgrounds participated in this study, and their responses were analyzed (Male = 47 %). The ages of the children whose parents filled out the questionnaire ranged from 6 years to 11. Parents' education level ranged from professional certificate to Ph. D. The online questionnaire had a high response rate; 1559 responses were received, of which 94.61 % (n = 1475) were analyzed. The remaining (5.39 %) were incorrect responses and outliers and were excluded from the analysis. The percentage indicates that a small proportion of the data collected contained errors or inconsistencies (i.e., incomplete responses). In the context of the analysis, these responses were flagged during the data-cleaning process to ensure the reliability and accuracy of the results. The incorrect responses were identified through data validation checks, which included cross-referencing responses for logical consistency and completeness. Then, some of these responses were corrected when possible (e.g., if a missing value could be reasonably imputed based on other data). In contrast, others were excluded entirely from the final dataset to prevent skewing the results. This process was done to ensure that the remaining dataset was accurate and representative, allowing for a more robust and credible analysis.

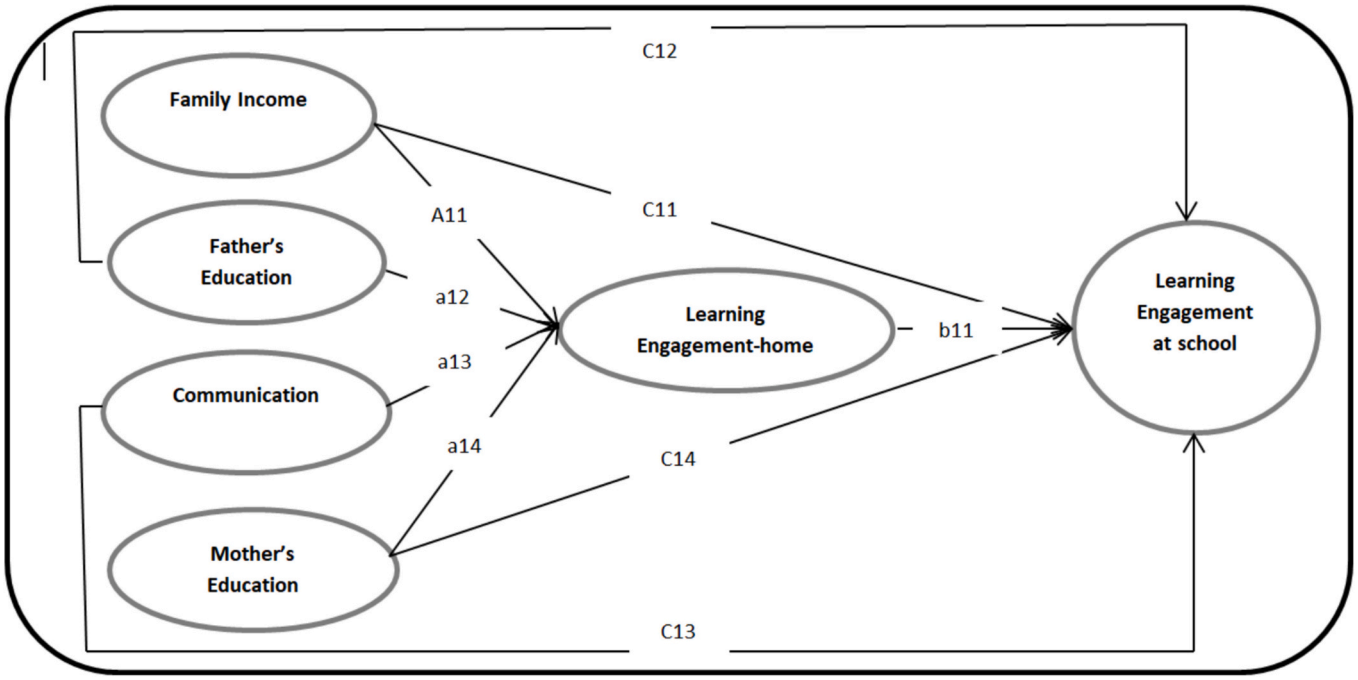

Fig. 1. A model through pathways.

3.3. Measurement tools

3.3.1. Family's socio-economic status

Socio-economic status (SES) is a multidimensional construct. Still, for this study, we focused specifically on two key dimensions: family income and parents' education. These dimensions were central to understanding their impact on students' learning engagement. In our analysis, we separated the educational levels of fathers and mothers to capture potential gender differences in parental influence on students' academic outcomes. In addition, while parent-teacher communication is closely related to the two dimensions of SES, it was treated as a distinct variable in our study, as communication reflects both active involvement and socio-cultural factors that may not directly overlap with educational attainment.

3.4. Teacher-parent communication

The study utilized the Teacher-Parent Communication Competence Scale (TPCCS), developed to assess teachers' communication skills with parents (Ozcinar, 2020). The scale consists of 26 items, grouped into dimensions such as attitudinal, cognitive, and behavioral competencies related to communication. Each item was rated using a 5-point Likert scale, with values ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). Parents' high scores on this scale indicated high communication competence with teachers at school. The scale demonstrated strong internal consistency, with a Cronbach's alpha coefficient of 0.93, indicating its reliability in measuring the communication competence of teachers in their interactions with parents.

3.5. Learning behavior at home

One of the six dimensions of the home-school communication construct, with a total of 22 items, is the 2-item component on learning at home. A 5-point Likert scale, ranging from 1 to 5, was used to measure the items, where the parents who scored high indicated that their children had high learning behavior at school. To assess the internal consistency of the measure for learning behavior at home, we calculated McDonald's omega (ω), given the two-item structure of the scale. The value was 0.87, indicating an acceptable level of internal consistency for this measure (Malkewitz et al., 2023). This alternative to Cronbach's alpha (α) is considered more appropriate for scales with fewer items and provides a more accurate reflection of the reliability of the construct.

3.6. Learning engagement at school

The study utilized the learning engagement scale from the 2010 translation and revision of Li Xiying's Utrecht Work Engagement Scale for Students (UWES-S). The original Wilmar Schaufeli's UWES-S has 17 items in three dimensions: behavioral, cognitive, and emotional engagement. Every question was given a Likert value on a 7-point scale, ranging from 1 (Never) to 7 (Always), where a high score means high learning engagement at school. The scale had a Cronbach's alpha coefficient of 0.95.

3.7. Statistical analysis strategy

All statistical analyses were conducted using SPSS 26 and JASP 0.16 software. The correlations among the main variables were obtained using Pearson's correlation. We tested the multiple mediated effects of family socio-economic status, learning behavior at home, and learning engagement at school with model 6 of the PROCESS procedure for SPSS.

4. Results

4.1. Preliminary analysis

4.1.1. Confirmatory factor analysis

To test the hypotheses, the study conducted the discriminant validity of measurement model for family socio-economic status, learning behavior at home and learning engagement using a series of confirmatory factor analyses (CFAs), the goodness of fit index (GFI), root mean square error of approximation (RMSEA), standardized root mean residual (SRMR), Tucker-Lewis's index (TLI) and expected cross-validation index (ECVI) (Shao & Lassleben, 2021). The results are indicated in Tables 1, 2, and 3. Generally, while an RMSEA of <0.08 suggests a good model-data fit, a value <0.05 indicates a closer model fit (Cho et al.,

Table 1
Confirmatory factor analysis results.

Variables	Recorded CFA's results					
	CFA	GFI	SRMR	TLI	RMSEA	ECVI
Family income	0.92	0.96	0.03	0.92	0.04	0.94
Parents' education	0.96	0.90	0.04	0.95	0.03	0.97
Learning engagement at home	0.95	0.96	0.03	0.98	0.05	0.91
Learning engagement at school	0.98	0.97	0.03	0.97	0.04	0.97
Communication	0.88	0.91	0.02	0.94	0.06	0.96

Note: CFA = confirmatory factor analyses; GFI = goodness of fit index; SRMR = standardized root mean square approximation error; RMSEA = root mean square error of approximation; ECVI = expected cross-validation index.

2020). TLI and CFI values>0.90 for CFA indicate an acceptable fit (McNeish & Wolf, 2023). The ECVI value <6.703, GFI close to 1, and SRMR closer to 0 indicate a good model fit (Chan et al., 2006; Hu & Bentler, 1999). In this case, our results show the model's fitness in all aspects.

We used Confirmatory Factor Analysis (CFA) to validate the scales, ensuring that the observed variables represented the intended constructs. The approach (CFA) was chosen for its robustness in confirming factor structures and evaluating validity and reliability, thus aligning with best practices in social science research (Hair et al., 2019; Kline, 2015).

4.2. Correlation and descriptive analysis

Before mediation analysis, a correlation analysis was conducted to determine the degree of association between the variables. This analysis, detailed in Table 2, utilized correlation coefficients to measure the extent of change in one variable (e.g., students' learning engagement at home) concerning another (e.g., home-school communication) (Curtis et al., 2021; Jarvis et al., 2022; Meng et al., 2020; Seginer & Mahajna, 2018).

The results of the analysis show that there is a significant, although moderate, correlation between students' learning engagement and parental communication with educators, with a correlation coefficient of ($r = 0.223$) and a significance level of ($p < 0.01$). The mothers' and fathers' educational levels also show a significant relationship with the students' learning activities at home, with correlation coefficients of ($r = 0.120$) for both, indicating a more significant influence on learning engagement. Furthermore, results show that students' learning at home and parental communication have a strong correlation ($r = 0.775$), suggesting a more significant relationship. On the other hand, there is a significant but lesser association between family income ($r = 0.098$) and home learning activities and learning engagement at school ($r = 0.094$). Additionally, with coefficients of ($r = 0.076$) and ($r = 0.068$), respectively, the educational attainment of mothers and fathers is small but favorably connected with communication.

Students' home learning behavior has a mean of (M = 3.281), above the average score, and a standard deviation of (SD = 1.040). Table 2 shows that students' learning engagement score is high (M = 4.983) and above the median, with a standard deviation of (SD = 1.079). On average, students show high engagement in learning activities within

Table 2
The results for correlations among variables.

#	Variable	1	2	3	4	5	6	7
1	Parents' age	1	–	–	–	–	–	–
2	Father's education	0.056*	1		–	–	–	–
3	Mother's education	−0.021*	0.660*	1	–	–	–	–
4	Family income	−0.075	0.331	0.354	1	–	–	–
5	Communication	0.050*	0.076	0.068	0.080	1	–	–
6	Learning at home	−0.008*	0.120	0.120	0.098	0.775	1	–
7	Learning engagement	−0.077	0.092	0.098	0.094	0.246	0.223	1
	Mean	***41.071***	***3.755***	***3.594***	***1.880***	***3.483***	***3.281***	***4.983***
	Standard Deviation	***5.090***	***1.038***	***1.031***	***0.812***	***0.792***	***1.040***	***1.079***

Note: The correlations are based on Pearson's r. *$p < 0.05$, $p < 0.01$.

Table 3
The direct and indirect effect of family's socio-economic status on learning engagement.

							95 % Confidence Interval	
Direct effects				*Estimate*	*SE*	*p*	*Lower*	*Upper*
Family income	→	Learning engagement		0.057	0.022	0.011	0.013	0.101
Father's education	→	Learning engagement		0.020	0.022	0.000	−0.023	0.063
Communication	→	Learning engagement		0.225	0.032	0.001	0.163	0.063
Mother's education	→	Learning engagement		0.041	0.022	0.000	−0.002	0.084
Indirect effects								
Family income	→	LH	→ LE	0.001	0.001	0.028	−0.001	0.004
Father's education	→	LH	→ LE	0.002	0.001	0.009	0.024	0.005
Communication	→	LH	→ LE	0.067	0.023	0.000	0.021	0.113
Father's education	→	LH	→ LE	0.003	0.002	0.003	0.064	0.006
Total effects								
Family income	→	Learning engagement		0.058	0.022	0.009	0.014	0.102
Father's education	→	Learning engagement		0.022	0.022	0.002	−0.021	0.065
Communication	→	Learning engagement		0.293	0.022	0.001	0.250	0.335
Mother's education	→	Learning engagement		0.044	0.022	0.000	0.001	0.087

Note. SE means standard error. LH means learning at home. LE means learning engagement. Delta method standard errors. Normal theory confidence intervals. ML estimator.

formal school settings and at home. The high mean for learning engagement in both settings implies that students find both classroom-based and home-based activities more motivating or rewarding because of different factors (i.e., parents' support and attractive classroom environment).

4.3. Hypotheses testing results

According to regression analysis, students' learning engagement was most significantly impacted by direct communication ($\beta = 0.225$, SE = 0.022) and overall ($\beta = 0.293$, SE = 0.022). The significant mediation effect ($\beta = 0.067$, SE = 0.023) was observed in the relationship between learning engagement at school (LE) and learning at home (LH). Compared to other independent variables, the father's educational degree had the least direct ($\beta = 0.020$, SE = 0.022) and total effect ($\beta = 0.022$, SE = 0.022) on students' learning engagement. The relationship between family income and students' engagement in their studies was least mediated by learning at home. Table 5 presents a summary of these findings together with a 95 % confidence interval.

5. Discussion

The findings significantly contribute to the broader understanding of how socio-economic status (SES) shapes students' learning engagement, specifically by highlighting the role of family communication, income, and parents' educational background. According to Bourdieu's cultural capital theory (Reed & Johnson, 2023), families with higher SES often possess the resources, skills, and networks that can positively and significantly influence students' educational outcomes. In this context, the observed significance of parent-teacher communication reflects the capacity of families to bridge home and school environments, a process often mediated by cultural capital. Effective communication may compensate for lower SES, enabling parents to advocate for their children's needs and reinforce learning engagement despite financial constraints.

Additionally, these findings align with the family investment model (Duleep, 1998), which posits that families with more significant economic and educational resources have a high probability (are better positioned) to invest in their children's learning through enriched home environments and stronger school connections they have. However, the weaker associations observed between family income, parents' education, and learning engagement suggest that the direct impact of SES may be less pronounced than traditionally theorized. The finding supports the argument that non-material aspects of SES (i.e., parental involvement and aspirations) can play a more critical role in shaping students' learning behavior (both at home and school). These insights underscore the need for targeted policies and programs that empower families across all socio-economic strata to actively engage with schools and support their children's education.

Our hypotheses were based on the prediction that family factors (social and cultural capital) play a critical role in students' home learning behavior and engagement at school. Specifically, the study measured the effects of parents' age, education level, family income, and communication (as independent variables) on students' learning engagement at school (dependent or outcome variable) through the mediation role of learning at home (mediator). The findings have supported the hypothesis that all the family variables positively affected students' learning engagement at school. However, parents-teacher communication significantly affected students' learning engagement compared to other independent variables. In contrast, fathers' education had the least effect on the same variable. The results have been consistent with previous studies (Meng et al., 2020; Prieur & Savage, 2011), suggesting that economically disadvantaged parents can close their children's academic achievement gap by strengthening home-school communication.

The observed correlation between parents' age and students' learning engagement warrants careful interpretation. Parents' age appears significant, as it may substitute for unmeasured factors (i.e., child age, school level, socio-economic status, or parental education) which could influence this relationship. It is also imperative to consider that younger and older parents may support learning differently based on their life experiences and available resources, making it essential to account for these contextual variables. The exclusion of such factors limits the study's ability to isolate the independent effect of parental age on learning engagement.

Indeed, cultural capital, like behavior, education, and skills among parents in a family, influences students learning at home. As predicted by cultural capital theory, the findings have supported the theory and our second hypothesis that learning at home (due to parents' supervision) plays a vital mediation role in the relationship between all the family variables of our interest and students' learning engagement at school. The mediator (learning at home) has strengthened the effect of each independent variable on students' learning engagement for communication without the mediation effect. Comparatively, the father's education level had the lowest effect on students' learning engagement at school, but the mediators increased the effect further. Each independent variable had a lower effect on students' learning engagement at school without a mediator and a relatively high effect after including a mediator, as Table 2 indicates.

We further predicted that fathers' education level has a lesser effect on students' learning engagement at school. The prediction was based on the previous literature, which suggested that fathers have less time to spend with their children. They may have less impact on their children's academic achievement than mothers. The findings supported our hypothesis and the suggestions of the previous literature, which lacked empirical evidence to support the claim. Generally, it can be argued that family income has a more significant effect on students' learning engagement at school compared to both parents' education levels. Although the results in this study collide with numerous past studies (Chiang et al., 2020; Jung et al., 2020), some literature still suggests that high family income assures students' learning materials and good school with good teachers (Eryilmaz & Sandoval-Hernández, 2021). The availability of learning materials influences the student's motivation to learn at home and school, further predicted by family income (Dubois, 2011).

6. Conclusion

Family is one of the most critical factors in students' performance at school. However, families must communicate with the school teachers to improve student learning. This study has revealed the more significant effect of family-school communication on students' learning engagement. Despite other factors like family income, father and mother's age, and education level, communication has been the prominent factor for proper learning at school. The correlation between learning at home and learning engagement at school is positive, and the effect of learning at home on learning engagement (through a path diagram) at school is also high. Although family income is a factor, parents in economically disadvantaged families can still focus on establishing effective communication with teachers to boost their children's learning engagement.

While fostering such communication can indeed mitigate some barriers associated with limited resources, the approach assumes that parents in low-income families have the time, knowledge, and access to establish consistent engagement with teachers (factors often constrained by their socio-economic realities). In addition, systemic challenges (i.e., such as schools' limited capacity to facilitate inclusive communication or cultural mismatches between parents and educators) may further hinder these efforts. Therefore, while the recommendation holds potential, its implementation requires targeted interventions, including training programs for parents, institutional support, and policies addressing the structural inequalities perpetuating these barriers. These steps together

ensure that meaningful parent-teacher communication becomes a practical and sustainable avenue for improving students' learning engagement in economically disadvantaged settings.

7. Limitations of current study and suggestions for further studies

A limitation of this study is the potential lack of full geographic and socio-economic representation due to the reliance on an online survey. This approach may have inadvertently excluded participants from remote or low-income areas with limited access to electronic devices or internet connectivity. It could bias the findings toward more urban and affluent populations. Future studies can address this limitation by employing stratified sampling techniques to ensure proportional representation from diverse regions and socio-economic groups. For instance, researchers could collaborate with local education authorities to distribute physical questionnaires or conduct in-person interviews in areas with limited internet access.

This study focused on family factors that can determine students' learning engagement at school by examining the family's economic income, parents' age, education level, and communication with teachers. However, family factors like parents' plans for their children, parents' professions, and the number of siblings can also influence students' learning engagement at school. There are school-related and student-related factors for students' learning engagement. This study has no empirical evidence on whether family, school, or school-related factors play a more significant role in students' learning engagement. In the future, a study that compares the effects of these categories of factors on students' learning engagement at school will be beneficial in understanding where to focus more.

A comparative analysis that evaluates the relative impact of family, school, and student-related factors on students' learning engagement would be valuable to be conducted in future studies. Specifically, future studies must assess how each factor (i.e., family income, parents' education, and teacher-parent communication) compares in terms of its direct influence on engagement behaviors such as participation, motivation, and academic performance. Additionally, examining how school-related factors (i.e., teaching methods, class size, school resources) and student characteristics (i.e., self-regulation, peer relationships) interact with family factors would better understand which aspects contribute most significantly to fostering effective student learning engagement. A comparative analysis in the future will provide evidence-based insights that will guide educational interventions, aiming to optimize student engagement across multiple contexts.

The data was collected during the COVID-19 pandemic, in which most school systems, family-school communication, students' learning at home, and learning engagement at school were affected. At some points, variables like learning at home might have been influenced by several factors, like the introduction of distance learning. During the lockdown, most parents were at home most of the time, which might have affected the students' learning habits. However, we can still focus on these results as a reference to several further studies, especially after the pandemic. The effects of all family variables, except communication, are small, suggesting that other factors, either within or outside the family, play a more significant role in students' learning at home and learning engagement at school.

CRediT authorship contribution statement

Karifala Marah: Investigation, Formal analysis, Data curation, Conceptualization. **Antony Fute:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software. **Daniel Kangwa:** Software, Resources, Project administration, Methodology.

Author contribution

All the authors fully participated in accomplishing this article, and they thank all the participants in this study.

Ethics statement

Ethics approval was granted by the Ethics Committee of Zhejiang University's College of Teacher Education (Protocol code: 20230072) approved in 2023.10.09.

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Declaration of competing interest

Authors confirm that there are no conflicts of interest.

Data availability

The data that support the findings of this study are available from the corresponding author, [A.F], upon reasonable request.

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