



The Influence of Family Factors and Teacher Expectations on Secondary School Students' Academic Achievement Motivation: A Multiple Linear Regression Analysis based on the Program for International Student Assessment (PISA) 2018 Database of Four Provinces in China

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Abstract. This research adopted PISA 2018 Student Questionnaires Database to process the sample figures in four participating provinces of China (Beijing, Shanghai, Jiangsu, Zhejiang), by investigating the academic achievement motivation among 10330 15-year-old students. Specifically, the study employed multiple linear regression equation model to probe into the relationship between the academic achievement motivation and two relatively broad constructs, including family factors and teacher expectations. In order to explore the precise effects of family factors and teacher expectations, these two constructs have been subdivided into two variables respectively, namely, family economic, social and cultural status (ESCS), parental support, teacher support and teacher-student relationship. The research findings showed that: (1) There were significant correlations between the academic achievement motivation and four abovementioned independent variables. Furthermore, every variable was closely related. (2) Family sociocultural economic status (ESCS) and teacher support could positively predict students' academic achievement motivation, and the effect size of the former is greater than that of the latter. (3) Parental support and teacher-student relationship negatively predicted students' academic achievement motivation. Parents' over-intervention and students' slackness might be one of the important reasons for the decline in academic achievement motivation.

Keywords: academic achievement motivation; family economic, social and cultural status (ESCS); parental support; teacher support; teacher-student relationship; PISA 2018

1 Introduction:

The inquiry of motivation at the earliest could be traced back to the viewpoints concerning human aspiration, volition and instinct, which were produced by several renowned philosophers, Aristotle, Descartes, Locke. Motivation was an activity that

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reflected desire [5]. Under the physiological categories, it was found that motivation was one of the cerebral advanced functions and it was the manifestation of a specific central activity leading to psychological responses [4]. Influenced by these theories, some early psychologists believed that will, analogous to motivation, was consisted of intention and volition. Thereinto, intention referred to the individual's expectation, demand and purpose, whereas, volition was the ability to convert inner desires into active behaviors [32] [66]. With the continuous in-depth research and the large-scale wave of behaviorism in the 1930s, the investigation of motivation theory shifted towards Hull's Drive Theory in which motivation was divided into basic elements, such as needs, internal drive, goals and incentives. Yet, through the 1960s and into the 1970s, some modern motivational psychology researchers spotted that the concepts of Drive Theory focused on explaining the immanent causes of human behavior in Physiology, while social behavior, which gradually predominated, were still short of study [30]. But as the research further moved along into the field of cognitive psychology, the factors that triggered motivation were classified into needs (internal factors) and incentives (external factors). Moreover, needs were subdivided into the scope, including individual demand, interests, beliefs, worldviews, etc., while incentives laid more emphasis on goals, pressure, responsibilities and obligations brought about by the ambient conditions. From then on, the possibilities that impacted motivation have been elucidated from the aspects of Physiology. More importantly, the unique social significance of human activities, such as exploration, comprehension, fulfilment, creation and so forth, has also attracted attention of the relevant scholars [35]. Therefore, the investigation on motivation has been extended from the original psychological domain to many other academic areas due to the aforementioned connections.

Discussing the interrelationship between social behavior and motivation from the perspectives of Education can be specific to the fact that the extrinsic motivation of learning motive in Pedagogy can promote the occurrence of students' social behavior. For example, some students urge themselves on to study hard in order to receive the parental and teachers' rewards or to avoid punishment from them. Owing to the multifarious starting points and research orientations of motivation in different fields, the definitions of motivation are too numerous to mention and cannot be lumped all together. However, the current conception of motivation widely recognized in academia was proposed by Woodworth in *Dynamic Psychology*, which was published in 1918. He summarized motivation as an inner psychological tendency or driving force that stimulated, guided and maintained individual behaviors in a goal-oriented manner. In terms of Educational Psychology, researchers were more concerned with student academic achievement motivation. Elliot and Church [22] defined academic achievement motivation as students' cognitive structures of academic success, failure and their relevant learning behaviors as well as students' psychological perception towards the intention or reason of their related academic achievement behaviors. Some research indicated that academic achievement motivation exerted positive effects on learning, like orientation, persistence, and initiative [48], and it enabled to modulate psychological potential by means of timely preparation, intense focus and incremental investment, thereby allowing full play to cognitive competence and high efficiency of learning [19]. Accordingly, since the 21st century, many countries have cultivated and trained

students' academic motivation to assist them in reaching learning objectives, and incorporated this index into the educational strategies aiming at improving the overall quality of students. Meanwhile, academic achievement motivation per se has gradually become one of the crucial issues of modern educational psychology [74].

At present, many domestic and foreign scholars generally employ the interior and exterior dichotomies to delve into the related motivational variates. The dichotomies appertain to the two facets that affect student academic achievement motivation, involving the internal and external factors of students themselves. Amongst them, gender and age are representatives of the internal ones, whereas, family, school and society are normally regarded as the outside influences. Besides, gender and age have been taken into account as control variables in many particular analyses of the external elements [16] [45]. Additionally, the plentiful international literature have also conducted profound discussions about various arguments on the basis of empirical and theoretical frameworks. In the light of familial reasons, the scale, members, the family status of each member [53] and the social class of the whole family [57], to some extent, all have a bearing on the level of students' academic achievement motivation.

As an indispensable constituent of family members, parents' educational background, occupation, salary level, and parenting styles [1] likewise have an inevitable effect on students' learning initiative. Of school factors, the role of teachers, shaping students' academic achievement motivation, cannot be neglected as well. Their behavior patterns [44], communication attitudes [3], relationship with students [45] and autonomy support [33], etc. are closely associated with students' academic achievement motivation.

At last, apart from the adjustment and adaptation of student subject itself to social changes [37], the cultural traditions and mainstream ideology of the overall society [29] can also reflect the degree of students' academic achievement motivation. Given the development pathway of individuals that is affected by special circumstances, which is mentioned in Vygotsky's Socio-cultural Theory, the values, beliefs, customs and basic skills of social groups in different cultures have multitudinous functions for the individual development and their practical actions [14]. Consequently, this study pay more attention to the contributing factors of academic achievement motivation under localization.

By retrieving massive domestic literature on academic achievement motivation, it has been found that, as far as personal reasons were concerned, gender, age [40], individual long-term academic experience of success and failure [38], and self-efficacy [21] [43] have been corroborated the pertinence with academic achievement motivation to a certain extent. With regards to family factors, some empirical results have demonstrated that there is a strong link between academic achievement motivation and parents' educational attainments, careers, incomes, upbringings and many other respects. It is also worth mentioning that the aforesaid viewpoints can positively predict achievement motivation [68] [70]. For instance, Ren and Xin [51] used family possessions, parents' educational level and types of job as indicators of family socioeconomic status, finding that the students with high socioeconomic status had significantly stronger learning motivation than those with average or lower ones. In addition, Wang and Li [62] in their study have noted that parents' emotional warmth and behavioral support

were significantly positively correlated with secondary school students' academic achievement motivation in like manner. Finally, when it comes to the elements of school, teachers play a pivotal role in participating students' learning and daily school life so that students in return retain a high perceptual sensitivity to teachers' expectations and behavior [65], thus, teachers unarguably are capable of influencing the students' motivation for academic achievement [63]. In accordance with five empirical studies, Chen [9] reached the conclusion that there was a significant association between teacher autonomy support, family social class and students' academic achievement motivation. What counts most in his findings is that when the effects of teacher autonomy support came into play, family social class could serve as a regulator. As a result, on the foundation of two scenario inspirations and simulations, the consistent conclusions were drawn: For the students of the lower-middle class, teacher autonomy support had positive impacts on their academic achievement motivation, which was in contrast to the students of high social class on account of the relatively low influence coefficient.

Hence, based on the previous studies, this research selected the participants from the dataset of PISA 2018 with a high degree of consistency of the age (by and large approximately 15 years old) and a relatively balanced gender ratio after the holistic statistical analysis so as to control variables (For more details, please refer to the data source). It also emphatically analyzed the impact of external factors on students' academic achievement motivation.

Nevertheless, through reviewing and digging into the available literature, it has shown that the majority of the investigations on secondary school students' academic achievement motivation still largely centered on the western countries, however, little literature with empirical evidences was produced regarding Chinese teenagers. The retrieval information of Chinese National Knowledge Infrastructure (CNKI) has suggested that there have been only 134 papers containing "academic achievement motivation" or "achievement motivation" in the subject, title or keywords since 1991. Besides, before 2012 the publication of the articles was in a small quantity, even emerging a cliff between the years. The tendency towards the slow growth in the number has become apparent until after 2012. By virtue of the further screening for the titles, abstracts and the full texts of the articles, it turned out only 24 studies depending on the data usage to quantitatively analyze the middle school students' academic achievement motivation and other variables were listed. But in the meantime, most of them did not mention several critical research priorities, namely the mechanism and structure of students' academic achievement motivation, the changes of achievement motivation under the complementary functions of multiple factors in different dimensions and the rigid measures with the fixed scale contents not in line with the local physical situation, etc. Given the above, it can be amply summed up the following issues that require to be highly regarded without delay in the existing work:

The related variables and constructs of the studies are usually simplistic and unitary. Many discussions on academic achievement motivation were merely anchored in searching its correlation with academic performance and the subsequent impacts [25]. Additionally, despite some multivariable studies, they only touched upon the relationship between a single variable and scholastic attainment besides achievement

motivation, such as self-management ability [41], self-efficacy [7], learning strategies [39], etc. Yet, the problem lies in the fact that less attention has been paid to the potential variables of intrinsic motivation that could affect the academic outcome. Even though there was the pertinent literature on academic achievement motivation, more often than not, the investigations comprised one construct, like family rearing style [75], learning engagement [71], teacher support behaviors [11] and so on. The narrow scope of these researches and the relevant analyses were difficult to reveal the actual influences of the mentioned elements.

The data acquisition methods of the empirical studies, for the most part, still adopted Achievement Motives Scale (AMS) compiled by Norwegian psychologists Gjesme, T. and Nygard, R. in 1970 [26]. Although the scale has high reliability and validity, some questions in the survey probably cannot present the real reflection of the academic achievement motivation among current students along with the rapid advances in technology and the relentless innovation of educational philosophy.

Numerous scholars who implemented the field research were confined to a single geographical region by reason of the accessibility of data, the quantity of the researchers and the technical difficulty of operation. On the other hand, the geographical and cultural differences might account for the distinctions of students' academic achievement motivation in different areas. Thus, the representativeness of the definitive conclusions remain elusive.

Except for the studies utilizing the large databases, many other documents made no mention of how to take samples from the subjects so that many researchers are not yet convinced in terms of several points of contention, specifically, the scientific nature of the sampling size, the uniformity of the distribution and the acceptable range of the sampling error.

2 Research Question:

China, the largest developing country in the world, it not only differs from the western nations with respect to the macro environment, for example, economic situation, the fabric of the society, income distribution and the process of urbanization, etc., but also its diversity of educational management systems, pedagogical ideas, school layout, home-school resource cooperation and other domestic educational tactics results in differences to some extent with western cultural background.

Accordingly, combined with the review of the literature and the prior discussions of the practical studies, this research accepted the sample data from PISA 2018 of four provinces in China. It was designed to probe into the effects of family factors and teacher expectations on academic achievement motivation amidst 15-year-old middle school students, which has its peculiar research value. The primary reasons include the following: First, the dimensions of family factors and teacher expectations integrate the vital contexts and objects that play an essential role in student learning behaviors and intentions, that is to say, family and school, parents and teachers. As a consequence, these variables were chosen to lay a solid foundation for a comparatively complete and reliable empirical evidence for other research in the realm of this academic topic.

Second, as an international evaluation program, multilateral agencies and institutions are jointly responsible for the elaborate design and iterative testing of PISA questionnaires, including Australian Council for Educational Research (ACER), Dutch National Institute for Educational Measurement (CITO), Westat Corporation and Educational Testing Service (ETS) in the United States and Japanese National Institute for Educational Policy Research (NIER). This multinational union is in charge of updating the appraisal content and establishing the structure of the assessment in line with the developing trend of international education. Hence, the reports have high adaptability to the Times and allow to target for the different portions of the research. Third, China, as one of the foremost participating countries in PISA, was selected four provinces or cities of the mainland for evaluation, which remedy the limitations of geographical regions to a certain extent. Last, the sample entirety of PISA relies on the age-based definition in order to ensure the representation of the sample size. Furthermore, it uses Proportional to Population Size (PPS) to improve the accuracy of analyzing the variance between schools and within schools as much as possible and to reduce the sampling error and systematic bias.

3 Data Analysis:

3.1 Data Sources

The data derives from the test results of Program for International Student Assessment (PISA) in 2018, which was launched in 2000 and was organized by the Organization for Economic Co-operation and Development (OCED) every three years. It conducted a longitudinal investigation on the core learning capabilities of 15-year-old school students worldwide, to be specific, science, mathematics and reading literacy. In order to provide valid evidence for the unceasing reform and innovation of education and pedagogy, this project was intended to dissect the considerable parameters of students' development in various nations with an educational panorama covering background, input, process, output and outcome.

Therefore, this article selected 12058 students from 361 schools as the samples in the four provinces or cities of China (Beijing, Shanghai, Jiangsu and Zhejiang) by adopting the student questionnaire. After processing the missing values, the effective samples are 10330 constituting 5001 girls and 5329 boys and the ratio of male to female is 1.07:1.

3.2 Research Variables

The dependent variable of this study is academic achievement motivation, which could be measured and analyzed by the degree of the expectations in academic achievement and the desired educational level obtained in the future. The PISA report has illustrated the measurement index by means of the average presented in the International Standard Classification of Education (ISCED Level). In view of the independent variables, the category includes two dimensions: family factors containing students' family

economic, social and cultural status (ESCS) and parental support and teacher expectations incorporating teacher support and teacher-student relationship.

3.2.1 The Dependent Variable --- Academic Achievement Motivation

On the basis of the performance goal orientation in Goal Orientation Theory proposed by Carol S. Dweck in the 1980s, it expatiated upon the students' enterprising behavior and aspiration related to academic achievement motivation. They largely depended on the individual's commitment to seek positive feedback or results about their abilities to demonstrate personal capacity. What's more, Hoffmann et al. [31] found that performance goal orientation could significantly affect learning efficiency. To sum up, this paper exploited the degree of students' expectations for educational and professional accomplishments in the future from the questionnaire as the indicator to estimate the current level of their academic achievement motivation.

3.2.2 The Independent Variables --- Family Factors

Amid familial factors, for the sake of measuring the variable, ESCS, PISA has employed the materialistic standpoints in gradient methodology and social economic status (SES) for reference. For instance, regarding the measurement of SES in North America as a benchmark, PISA has built a weighted average of three indices: the highest educational level of the parents, the occupational status and family property in ISCED scale. The first two moduli conform to North American SES evaluation standard, while family possessions are defined as an appraisable segment of household income and material wealth because of the ownership or consumption of durable goods [24]. Then, seeing the students' response rate, the aspects below in the questionnaire are attached to the study: parental educational attainments, professional qualifications, family material wealth and physical learning resources.

The second element of family factors is parental support. In accordance with Self-determination Theory (SDT), although immersive learning state is influenced by the attitudes, values and hobbies of one's own, students' behavior and motivation are directed by the surroundings as well [55] [58]. As one of the most decisive roles in the family circumstance, their expression of empathy, respect for children's thoughts, behavioral support and verbal praise for children's autonomous expression could make a profound impact on students' academic motivation and performance [28] [69]. Consequently, this study abstracted and lucubrated the questions of the survey that belonged to the issues of student perceptual emotional identification, academic support, behavioral assistance and verbal encouragement from their parents.

3.2.3 The Independent Variables --- Teacher Expectations

As regards the assessment of teacher support within the realm of teacher expectations, this research applied Tardy's Model of Social Support [59] and Child and Adolescent Social Support Scale (CASSS) [34] formulated by Malecki and Demary in 2000 as the reference standard so as to examine the student individual perception of teacher support from the perspectives of emotional support, informational support, appraisal support and instrumental support.

Extensive theory-driven research has shown the conception and measurement about teacher-student relationship of teacher expectations, for instance, Attachment Theory put forward by John Bowlby, Sociocultural Theory introduced by L.S. Vygotsky, Social Cognition Theory proposed by Albert Bandura and Ecological Systems Theory raised by U Bronfenbrenner, etc. In conclusion, aiming at the measurement of multi-scale teacher-student relationship with diverse factor structures, this study combined the latter two components of the widely accepted three-dimensional scale (Conflict, Intimacy, and Dependence) of Pianta [47] and the four-dimensional scale (Trust, Respect, Communication and Discipline) of Riddle [52] to evaluate teacher-student relationship perceived by the participants. Table 1 illustrates the specific pertinent content of the questionnaire to demonstrate each variable.

Table 1. Variable Declaration

Dependent Variable	Variable Declaration
Academic Achievement Motivation	Utilizing four-point Likert Scale and ISCED Level to analyze the degree of students' anticipation of educational and professional accomplishments in the future. The Four-point Likert Scale Questions: <i>1. Thinking about your school: Trying hard at school will help me get a good job. 2. Thinking about your school: Trying hard at school will help me get into a good <college>.</i> Six Yes-no Questions related to ISCED Level: <i>e.g. Do you expect to complete? <ISCED level 2>.</i>
Independent Variables	Variable Declaration

<p>Family Factors</p>	<p>Family Economic, Social and Cultural Status (ESCS)</p>	<p>Utilizing short answer questions and ISCED Level to analyze. Short Answer Questions: <i>1. What is the <highest level of schooling> completed by your mother? 2. What is the <highest level of schooling> completed by your father?</i></p> <p>Eight Yes-no Questions of parents' occupational qualifications related to ISCED Level: <i>e.g. Does your mother or father have this qualification? <ISCED level 6> (incl. higher qualifications at level 5A in some countries).</i></p> <p>Twenty-two questions related to family possessions of physical learning materials: <i>e.g. In your home: A desk to study at, A room of your own, A quiet place to study, A computer you can use for school work, Educational software, A link to the Internet, Classic literature (e.g. <Shakespeare>), Books of poetry, Works of art (e.g. paintings), Books to help with your school work, Technical reference books, A dictionary, Books on art, music, or design, etc.</i></p> <p><i>How many in your home: Televisions, Cars, Rooms with a bath or shower, <Cell phones> with Internet access (e.g. smartphones), Computers (desktop computer, portable laptop, or notebook), <Tablet computers> (e.g. <iPad>, <BlackBerry PlayBook>), E-book readers (e.g. <Kindle>, <Kobo>, <Bookeen>), Musical instruments (e.g. guitar, piano) and How many books are there in your home?</i></p>
	<p>Parental Support</p>	<p>Utilizing four-point Likert Scale to analyze the extent of agreement on parental support perceived by students: <i>e.g. Thinking about <this academic year>: My parents support my educational efforts and achievements, My parents support me when I am facing difficulties at school, My parents encourage me to be confident.</i></p>
<p>Teacher Expectation</p>	<p>Teacher Support</p>	<p>Utilizing four-point Likert Scale to analyze the frequency and extent of teacher support perceived by students: <i>e.g. How often during <test language lessons>: The teacher gives extra help when students need it, The teacher helps students with their learning, The teacher sets clear goals for our learning, The teacher made me feel confident in my ability to do well in the course, The teacher provides individual help when a student has difficulties [...], The teacher tells me in which areas I can still improve, The teacher tells me how I can improve my performance.</i></p>
	<p>Teacher-student Relationship</p>	<p>Utilizing four-point Likert Scale to analyze the degree of recognition of the harmonious teacher-student relationship perceived by students: <i>e.g. Thinking of past two <test language lessons>: The teacher listened to my view on how to do things, I felt that my teacher understood me, It was clear to me that the teacher liked teaching us, The enthusiasm of the teacher inspired me.</i></p>

Note: Source: The Survey of Student Questionnaire of PISA 2018 www.oecd.org/pisa/data

Table 2 presents the descriptive statistics of correlated variables and valid sampling data.

Table 2. Descriptive Statistics of Correlated Variables

	N	Minimum	Maximum	Mean	Std. Deviation
ESCS	10428	1.16	2.34	1.7589	.12364
Parental Support	11952	1.00	4.00	3.3301	.64285
Teacher Support	11924	1.00	4.00	2.3008	.35143
Teacher-student Relationship	11966	1.00	4.00	3.0246	.66200
Academic Achievement Motivation	11974	.50	2.50	.9691	.34419
Valid Data	10330				

Note: Source: The Survey of Student Questionnaire of PISA 2018 www.oecd.org/pisa/data

3.3 Data Analysis

By the linear correlation analysis between academic achievement motivation and four independent variables, ESCS, parental support, teacher support and teacher-student relationship, the cumulative correlation coefficient of this study has substantiated that academic achievement motivation had a significant positive correlation with each element (The results are shown in Table 3). It is also especially noteworthy that the four independent variables are significantly associated with each other so that it meets the requirements for the linear analysis.

Table 3. Correlation Analysis between the Dependent Variable and the Four Independent Variables

	ESCS	Parental Support	Teacher Support	Teacher-student Relationship	Academic Achievement Motivation
ESCS	1.00				
Parental Support	-.059**				
Teacher Support	-.038**	.111**			
Teacher-student Relationship	-.108**	.268**	.394**		

Academic Achievement Motivation	.051**	.178**	.041**	.159**	1.00
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Note: * means the significance less than 0.05; ** means the significance less than 0.01;
 Source: The Survey of Student Questionnaire of PISA 2018 www.oecd.org/pisa/data

Above all, taking the findings of correlation analysis among the variables and the aforementioned theoretical frameworks as the baseline, it turns out that family factors and teacher expectations have a prominent impact on secondary school students’ academic achievement motivation. To draw the further discussion about its impact, the multiple linear regression model will be established to explain it in detail next. The multivariable linear regression model can dissect the influences of each independent variable on academic achievement motivation so that the linear relationship between student academic achievement motivation and two broader scopes, namely family factors and teacher expectation, can also be interpreted accurately.

4 Results

First of all, Figure 1 and Table 4 have calculated the residuals and coefficient of determination (R2) respectively to ensure that the premises of setting up the multiple linear regression model were tenable, thereby satisfying the prerequisites of the regression analysis. Moreover, on the basis of the verified assumptions, Table 5 and Table 6 conducted the variance analysis of the multiple linear regression equation and finally established the stepwise regression of the equation according to the coefficient of the independent variables.

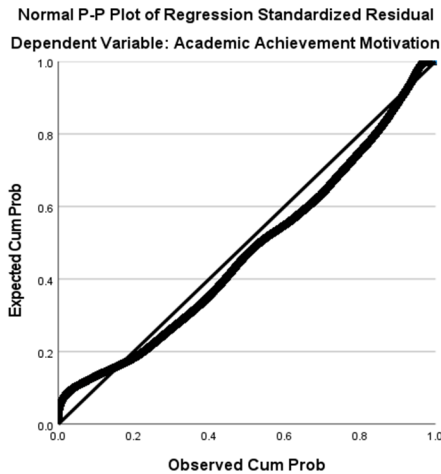


Fig. 1. Normal P-P Plot of Regression Standardized Residual

It can be seen from Figure 1 that all points are relatively close to the diagonal line. The standardized residual is 1.000, which is less than 2, thus supposed to be normal.

Table 4. Coefficient of Determination (R^2) Analysis of Regression Equation

Model	R	R Square	Adjusted R Square	Durbin-Watson
1	.219 ^a	.048	.048	1.990

Note: Source: The Survey of Student Questionnaire of PISA 2018 www.oecd.org/pisa/data

According to Table 4, the multiple correlation coefficient (R), R2 and the adjusted R2 of this model are separately 0.219, 0.048 and 0.048. Also, the sample size of this study is multitudinous. Hence, the interpreting percentage of the regression equation is comparatively high. Given the assumption that the independence of the residuals for the model was validated, when Durbin-Watson (DW) value is closer to 2, the less relevancy among the residual terms. For this investigation, DW value is 1.990, which approaches 2, indicating that the residual terms are mutually independent. As a result, the concrete analysis of the regression model can be carried out.

Table 5. Analysis of Variance (ANOVA)

Model	Sum of Squares	df	Mean Square	F	Significance
1 Regression	58.101	4	14.525	130.227	.000 ^b
Residual	1151.616	10325	.112		
Total	1209.717	10329			

- a. Dependent Variable: Academic Achievement Motivation
- b. Predictors: (constant): Teacher-student relationship, ECSC, Parental Support, Teacher Support

Note: Source: The Survey of Student Questionnaire of PISA 2018 www.oecd.org/pisa/data

The F value corresponding to the regression equation is 130.227. Additionally, the significance is 0.000, less than 0.05, so that it rejects the null hypothesis and affirms the validity of the established regression equation.

Table 6. Coefficients of Independent Variables

Model	Unstandardized B	t	Significance
(Constant)	1.237	22.173	<.001
ESCS	.081	3.043	.002
Parental Support	-.080	-15.047	<.001
Teacher Support	.022	2.185	.029
Teacher-student Relationship	-.065	-11.590	<.001

Note: Source: The Survey of Student Questionnaire of PISA 2018 www.oecd.org/pisa/data

On the basis of Table 6, the established regression equation is deduced as below: Academic Achievement Motivation = $1.237 + 0.081*ESCS - 0.08*Parental\ Support + 0.022*Teacher\ Support - 0.065*Teacher-student\ Relationship$. This model equation reveals that the higher the sociocultural status of the student's family, the more teacher support the student receives, thus the stronger academic achievement motivation. Nonetheless, the more parental support as well as the higher index of teacher-student relationship the student gains, the weaker academic achievement motivation is.

Table 7. Collinearity Statistics of Independent Variables

Model	Tolerance	VIF
ESCS	.987	1.013
Parental Support	.927	1.078
Teacher Support	.840	1.191
Teacher-student Relationship	.783	1.278

Note: Source: The Survey of Student Questionnaire of PISA 2018 www.oecd.org/pisa/data

It can be informed from Table 7 that the tolerance of the four independent variables ranges from 0.783 to 0.987, which is close to 1. So is the value of variance inflation factor (VIF), showing that the weak collinearity in the midst of the variables. Therefore, there is no discernible interaction effect among the variables so that the regression equation is well-founded.

5 Discussion

On the foundation of PISA database and varied involved parameters, the findings of data analysis were presented as follows.

5.1 The Influence of Family Factors on Secondary School Students' Academic Achievement Motivation

The results of data analysis displayed that all four variables were significantly correlated with students' academic achievement motivation. In addition, family ESCS exerted a positive effect on it, which coincided with Goal Orientation Theory [20] and the existing empirical research findings [61]. On the other hand, the coefficients of the multiple regression equation implied that parental support had a negative impact on students' academic achievement motivation. What counts more importantly is that this conclusion stands in stark contrast to some previous studies [13]. In response to this result, under the scope of family factors, family ESCS and parental support respectively serve as the direct and indirect paths to act on academic achievement motivation whereby the copious literature on the interrelation between family background and academic achievement motivation has been reviewed [23]. The direct bearings encompass that parents take advantage of family physical resources and social contacts to select schools for their children and provide better conditions for learning and appropriate

material incentives, thereby boosting the internalization of students' learning motivation sequentially [10]. As a consequence, in the families with a high sociocultural class, the parents are, more often than not, well-educated with a well-paid and decent job. Meanwhile, they attach much importance to education of their children and invest time and effort in their academic performance. Conversely, the parents in the disadvantaged groups, restricted by the lower literacy level and career-related reasons, pay less attention and energy to the school work of their children, resulting in the limitation of their children's academic achievement motivation as well [12].

Similarly, the indirect influence of parental support also mirrors their investment and involvement in children's learning [27]. However, their participation cannot always be an auxiliary booster for students' academic achievement motivation [60]. The ample proofs have demonstrated that the differences in the methods and extent of parental support could lead to various effects on students' academic achievement motivation. First, if the parents proffer the guidance and advice for the study of their children with the autonomous support and proper engagement, it will be conducive for the students to attain the opportunities of self-exploration, enhance their self-efficacy, arouse a stronger intrinsic learning motivation and sustain the momentum of learning initiatively [49]. A study on the parental rearing patterns indicated that the parents of adolescents with a higher level of academic achievement motivation laid more emphasis on the independence in the process of their growth, enduing them with the freedom to explore and allowing them to be in the relaxed and stable frame of mind over a long term [64]. In some cases, despite the supportive behaviors, the development of students' academic performance would be hindered on account of the parents' mandatory interventions and excessive penetration into students' school life [17]. Under such circumstances, the immoderate expectations and involvement increase nothing but pressure and give rise to some psychological problems of the students, such as flinch, depression [72] and the sense of inferiority [2]. In other words, parental expectations and participation render children feel controlled and restricted. Over time, the students' own will and inclination are compulsorily superseded with a strong dependence, leading to the lack of enthusiasm and positivity for learning but only to passively fulfill the parents' desires [67]. Taking the obtained results of the aforementioned studies into account, this research also, in some degree, responds to and illuminates the similarities and contradictions with the prior findings by means of dissecting the linear relationship between parental support and students' academic achievement motivation.

5.2 The Influence of Teacher Expectations on Secondary School Students' Academic Achievement Motivation

Regarded as a substantial part of perceptual social supportive system among students, teachers' autonomous support can not only alleviate students' physical and mental discomfort, but also can facilitate the internalization of students' motivation, gratify their self-actualization needs, and accelerate the academic development [42] [58]. Analogous to the family sociocultural status in the construct of family factors, teacher support likewise plays an active role in students' academic achievement motivation. It is inseparably linked with the statements in Self-Determination Theory (SDT) concerning the

degree of to which the students themselves are motivated [56]. Belonging to SDT, Basic Psychological Need Theory denotes that the extent of individuals' internalization for the requirements, values and rules of the outside context relies heavily upon the satisfaction of psychological needs acquired by the individual in activities. Furthermore, a higher degree of self-determination can bring a sense of greater gratification. The real-life embodiment of academic achievement motivation manifests that the more teacher support is provided, the more the student autonomous motivation can be stimulated, accompanying with more positive learning behaviors [15] and academic accomplishments [46]. In addition, Organismic Integration Theory (OIT) of SDT believes that if the surroundings can support and meet the fundamental psychological demands of individuals, especially in terms of the autonomous support from the external environment that enables to foster the formation of individuals' autonomous motivation, the milieu could further affect the cognitive ability and behaviors of individuals [18]. Based on the above theoretical viewpoints proved by empirical analyses, this study was also aware of the coefficients in the established equation that the effect size of teacher support was smaller than that of family ESCS. So it was in line with the opinions of Ecological Systems Theory put forward by Bronfenbrenner [6] that the environmental system interrelated with individuals as well as their development. On students' part, family is the microsystem with the primary influence on themselves, followed by the school. After being tested by the models in some domestic and foreign studies, another point worth noting is that the impact of teacher support on the students with a highly-ranked family in the society is insignificant. Accordingly, when the students perceive the autonomous support from the teachers, their familial ESCS is deemed as one of the critical influence sources to determine whether the students can generate a stronger motivation for academic achievement and have a more burning ambition for academic commitment [10] [36].

From the perspective of teacher-student relationship under the dimension of teacher expectation, the findings reveal that it negatively predicts academic achievement motivation of the secondary school students. Although the conclusion counters to many existing research results [8] [54], which rooted for the statements that a good teacher-student relationship was beneficial for improving students' academic motivation, some scholars have also dug into the possibilities from the angle of developmental psychology that the relationship might have a negative association with academic achievement motivation of students. First of all, the psychological and physical development of middle school students is still in its infancy. The ninth grade students at the age of 15 reach the turning point of the cognitive development so that it allows their critical thinking capabilities to be cultivated. However, some problems of mental afflictions inevitably ensue, bringing both the high degree of inner dependence on teachers and parents and criticism and reverse psychology. There is an urgent need for them to own the decision-making power and the right to speak independently. At this moment, teachers should be equipped with a certain deterrent and reasonable controls so as to correctly guide students towards the further academic development and strengthen their self-confidence. Yet, the other side of the coin is that an overly intimate teacher-student relationship can also create an unduly relaxed and sluggish learning atmosphere and lead to the decline, to some extent, in the level of teacher expectations perceived by students and

in the motivation to gain the approval from the teachers. Ultimately, it could display a downward trend in students' academic achievement motivation [73]. Second, some surveys exposed that when an excessively tight emotional bonding between the teachers and the students came into being, there would be some potential pitfalls for students' learning initiative and motivation to attain better academic performance due to "exclusiveness", namely, failure to build a rapport with other teachers. The students may experience the separation from their teachers on account of personnel transfer, graduation, retirement, etc. [50].

6 Conclusion and Outlook

Familial sociocultural status and parental support in family education expectations are essential variables among family factors that have bearing on students' academic achievement motivation. What's more, in pedagogical practice, teachers play a major role of a guide in teaching activities and students' school life. Thus, their autonomous supportive behaviors and the level of intimacy in the interaction between them and the students occupy a non-negligible position for students' academic achievement motivation. Nevertheless, the preceding research, in general, concentrates on the effect of a single construct on students' academic achievement motivation. By contrast, this paper utilized the dataset with high volumes of four participating Chinese provinces (Beijing, Shanghai, Jiangsu, Zhejiang) in PISA 2018, selected four distinct variables under the dual dimensions, analyzed the correlation between them and the dependent variable, measured the effect size of each variable, and systematically investigated the influence mechanism of family factors and teacher expectations targeting at academic achievement motivation of middle school students. As a consequence, the conformity of the conclusions to the theoretical framework is higher than that of previous studies. The scopes of the contents about the variables explicated in the articles are more comprehensive and pluralistic. And the discussion also introduced several broader research perspectives. In the second place, compared with the majority of domestic empirical data on this topic, as an extensive international education evaluation project, the database of PISA is provided with a more adequate and scientific framework of assessment and measurement than the data collected from the questionnaires compiled by the research fellows. By way of a range of testing and surveying, the researchers can drill down and identify the specifics of secondary school students' academic achievement motivation and the attitudes towards different learning circumstances along multiple dimensions. Hence, the diversity of PISA's assessment format is helpful to gather more information in the future. Moreover, the selection of student samples in PISA abides by the normalized principles. For example, each examined skill and ability requires to be divided into exact indexes. Even though some factors are difficult to quantify, such as motivation and interest, the study adopted a relatively stable observable variable, namely time, to process the data quantitatively to a certain extent. Only by this way can the investigation guarantee the reliability and validity of the questionnaires and the scientific attributes of the psychometric methods.

However, ineluctably, the limitations of this study should be clearly addressed as well. First, the empirical analysis of this article rested on the bedrock of the student questionnaire in PISA 2018, which is designed to be suitable on a massive scale and with a broader practicability, instead of simply serving as the specialized toolkit for the purpose of this research issue. Thus, the partial results of the demonstration may still be incomplete. The scholars can continue to conduct a more in-depth statistical measurement and develop more appropriate research instruments and customized scales on the basis of the relevant rationale. In addition, the collected figures involved the information of parental supportive behaviors and teacher expectations in this study perceived by students individually. Briefly, the two variables, parental support and teacher expectations, were assessed merely by the students' perception so that there might have a certain degree of subjectivity and bias. Future research can shed light on the attitudes from teachers and parents by making a comparison with students'. Therefore, it enables to further examine whether there is a difference between the level of the support and expectations perceived by students and the extent that the parents and teachers believe to provide. Also, if a larger-scaled and deeper investigation on parental support is implemented in the future, including the emotions of parents and the orientations of supportive attitudes, a more thorough discussion will be carried on. Last but not least, excluding the impacts of family factors and teacher expectations on the academic achievement motivation illuminated in this paper, individual-and-school-related facets can likewise account for the differences in the level of achievement motivation of each student in part, such as the operation of schools, schooling conditions, the geographical location, the personality characteristics, personal lifestyles, etc. These elements, to some extent, can jointly restrict as well as be responsible for the development of students' academic achievement motivation. In summary, in terms of the further exploration in the subject of this field, it is of vital importance in academia to clarify which factors of the academic achievement motivation are dominant and secondary.

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