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Article

# The role of home classroom climate on motivation in elementary school students based on residential space optimization

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**Abstract:** In recent years, the demand for home-based learning has grown, and the importance of optimizing residential spaces to create a positive learning atmosphere has become increasingly important. This study investigated the effects of home classroom atmosphere on elementary school students' motivation and academic immersion. A questionnaire survey was used to investigate 1,287 elementary school students in Hefei, Nanjing, and Shanghai. The results showed that home classroom atmosphere was significantly related to academic motivation ($r=0.383$, $P<0.01$) and home classroom atmosphere was significantly related to academic immersion ($r=0.565$, $P<0.01$). Regression analysis showed that home classroom climate and academic immersion explained 38.13% of the variance in academic motivation. Bootstrap analysis confirmed that academic motivation mediated the relationship between home classroom climate and academic immersion (95% confidence interval: 0.066-0.178). The study found that optimizing residential space to create a positive home classroom climate can effectively enhance elementary school students' motivation and academic immersion, providing theoretical support for home education practice.

**Keywords:** home classroom atmosphere, elementary school students, learning motivation, academic immersion, residential space optimization, mediating role

## 1. Introduction

During the Xin Guan epidemic, in response to the national call of “stopping classes and not stopping schools”, various provinces and cities actively carried out online teaching activities. The proposal of home study, as a relatively new learning mode, gradually entered the public's view, which not only ensured the normal promotion of education and teaching during the epidemic, but also brought new opportunities and challenges for the new learning mode in the post-epidemic era [1-3].

Regarding the concept of home study, some researchers define it as “a form of school education in which student groups temporarily stay at home for special reasons” [4]. Its fundamental purpose is to promote students' academic development under the premise of ensuring the safety of teachers and students, and its effectiveness depends on students' self-discipline and independent learning ability [5-6]. For elementary school teaching, the environment of home learning is very different from classroom teaching, teachers can't instruct face-to-face, and the learning effect of students can't be controlled in time, so cultivating students' motivation to learn independently has become a key link in online teaching [7-10]. At the same time, it is important to know that the family atmosphere largely influences children's home emotions, and poor family emotions will affect their learning and life adaptation at home [11-12]. Therefore, creating a suitable residential space and home learning atmosphere will be beneficial to maintain primary and secondary school students' home emotions, which in turn will enhance their learning motivation during online learning [13].

The modern educational environment is undergoing profound changes, and the popularization of digital technologies and online platforms makes learning no longer limited to traditional classrooms. Particularly in the context of global epidemics, home-based learning has become the primary mode of learning for many elementary school students, which makes the quality of the learning environment in the residential space have a direct impact on students' learning outcomes. Research has shown that a favorable physical learning environment can significantly influence students' cognitive processes, emotional responses, and academic performance. However, there is relatively limited research on how the classroom climate created within residential spaces specifically affects elementary school students' motivation and academic immersion. Learning motivation, as an intrinsic driving force for sustained learning, has a decisive impact on students' academic engagement and learning outcomes. According to self-determination theory, satisfying students' basic psychological needs such as autonomy, sense of competence, and sense of belonging can effectively promote the formation of intrinsic learning motivation. The home classroom atmosphere, as a special learning environment, may influence students' motivation and academic immersion by satisfying these psychological needs. This study collected data through questionnaires, and used correlation analysis, regression analysis and Bootstrap method to test the mediating effect, to explore the mechanism of the influence of home classroom atmosphere on elementary school students' learning motivation, and the mediating role of learning motivation in the relationship between home classroom atmosphere and academic immersion, with the aim of providing empirical evidence and theoretical guidance for optimizing residential space and enhancing the effectiveness of elementary school students' learning at home.

## 2. Study design

### *2.1. Research hypothesis*

#### 2.1.1. Impact of Home Classroom Climate on the Academic Immersion Experience

A home classroom climate is a culture and environment created within a residence that is positive, supportive and encouraging of learning. This climate can be created in a variety of ways, including the provision of rich learning resources, training opportunities, knowledge-sharing platforms, and systems of recognition and reward. When a residential space is effective in establishing such a learning climate, it positively influences the motivation of elementary school students. According to self-determination theory, people have psychological needs such as autonomy, sense of competence and sense of belonging. When the residence provides adequate learning resources and training opportunities for primary school students, they can choose more autonomously what and how to learn that suits their developmental needs. This autonomy satisfies elementary school students' desire to acquire knowledge and skills and enhances their motivation to participate in learning activities. In addition, by continuing to learn and improve their abilities, elementary school students can gain a greater sense of achievement and satisfaction, thus increasing their confidence and motivation to improve their personal abilities. A positive learning environment in the home can provide elementary school students with opportunities for development and growth, and satisfy their need for a sense of competence. The home classroom climate can also influence elementary school students' motivation through the observer effect in social cognitive theory.

H1: Home classroom climate has a positive effect on enhancing elementary school students' learning motivation in residential spaces.

#### 2.1.2. The effect of home classroom climate on motivation to learn

Residential spaces establish a positive home classroom climate that has a positive impact on the willingness of elementary school students to learn and develop. In a positive learning atmosphere, residences provide elementary school students with a wide range of learning opportunities and room for growth so that they can continue to develop their skills and knowledge and achieve their personal learning goals. According to self-determination theory, individuals seek psychological needs such as autonomy, a sense of competence, and a sense of belonging. When residential spaces create a culture that positively supports learning, elementary students can be more autonomous in choosing what and how to learn that suits their learning development needs. This autonomy fulfills elementary school students' needs for personal growth and learning development. In addition, by engaging in a variety of learning activities and continuously improving their abilities, elementary school students can gain a greater sense of accomplishment and satisfaction.

H2: The home classroom atmosphere has a positive impact on enhancing academic immersion of elementary school students in residential spaces.

### 2.1.3. Mediating effects of academic immersion experiences

Elementary school students' academic immersion experiences are based on their assessment of the learning resources, training opportunities, and culture that supports and encourages learning provided by the residence. When elementary students' academic immersion experiences the presence of these factors, they perceive the residence as having a positive learning climate and develop positive feelings and attitudes. Conversely, if elementary students experience a lack of these factors or a low value placed on learning, they may develop negative affect and attitudes. Self-determination theory emphasizes that individuals seek psychological needs such as autonomy, a sense of competence, and a sense of belonging. In a positive learning atmosphere, the residence provides a wide range of learning opportunities and space for growth, fulfilling elementary students' needs for competence and personal growth.

H3: Elementary school students' academic immersion experience will play a mediating role in the effects of residential learning climate on elementary school students' motivation and willingness to learn.

## *2.2. Research tools*

### 2.2.1. Learning Motivation Questionnaire

The questionnaire for college students' motivation was developed by Tian Lan in 2006. The scale consists of four dimensions, namely, interest in knowledge, pursuit of ability, acquisition of reputation and altruistic orientation, with 34 items, of which interest in knowledge and pursuit of ability are internal motives, and acquisition of reputation and altruistic orientation are external motives. The scale is scored on a 5-point scale, and the higher the level, the stronger the individual's motivation to learn. The Cronbach $\alpha$ reliability coefficient of the scale is 0.90, and the Cronbach $\alpha$ reliability coefficients of the factors range from 0.74-0.86, which has a good reliability.

### 2.2.2. Academic Immersion Experience Questionnaire

Learning Immersion Experience Scale, which was developed by Liu, Tuan-Fang et al. in 2017. The scale contains seven dimensions, namely, balance of challenge and skill, effortless concentration, change in sense of time, clear goals, self-contained purposive experience, loss of self-consciousness, and sense of mastery, with a total of 36 items scored on a 5-point scale, with a higher level indicating a higher learning immersion experience for the individual. The Cronbach $\alpha$ reliability coefficient of the questionnaire is 0.95, and the Cronbach $\alpha$ reliability coefficients of the factors range from 0.70 to 0.85, which is highly reliable.

### 2.2.3. Home Classroom Climate Questionnaire

The questionnaire about the classroom environment was mainly based on the "Classroom Environment Scale", and the questionnaire of this study was developed, which has a total of five dimensions, namely classroom order, student participation, teacher support, task orientation, and pleasure. There are 26 questions in total. The questionnaire "Questionnaire on Classroom Atmosphere at Home" was finalized. The questionnaire uses a 5-point Likert scale, in which 1 point is awarded for "strongly disagree", 2 points for "disagree", 3 points for "not necessarily", 4 points for "agree", and 5 points for "strongly agree".

## *2.3. Content of the study*

### 2.3.1. Objects of study

The research subjects selected for this study were primary and secondary school students in Hefei, Nanjing and Shanghai. A total of 1459 questionnaires were distributed by random sampling method, and 1287 valid questionnaires were collected, with a recovery rate of 88%. Among them, there were 453 boys and 834 girls; 578 students from urban and 709 from rural areas; 635 only children and 652 non-only children.

### 2.3.2. Measurement methods

The test was administered jointly with the College Student Motivation Questionnaire, the Adolescent General Academic Self Scale, and the Learning Immersion Experience Scale. The test was explained verbally by the main test taker before administration, and the subjects answered the questions

independently after showing their understanding; those who did not complete the questionnaire or did not want to submit it were not collected.

### 2.3.3. Statistics

SPSS 20.0 software was used for statistics. Descriptive statistics were performed for count data, Pearson correlation analysis was performed for measured data, mediating effects were assessed using hierarchical regression analysis, and regression coefficients were tested sequentially.

The method of multiple regression analysis [14] was as follows:

Describe the linear dependence between a dependent variable $Y$ and multiple independent variables $X_1$, $X_2$, $X_3 \cdots$:

$$Y = b_0 + b_1 x_1 + \cdots + b_p x_p + \varepsilon, \varepsilon \in N(0, \sigma^2) \tag{1}$$

where $b_0, b_1, b_2, \cdots, b_p$, $\sigma^2$ are all unknown parameters independent of $x_1, x_2, \cdots, x_p$. Further expressed in matrix form as follows:

$$X = \begin{bmatrix} 1 & x_{11} & \vdots & x_{1p} \\ 1 & x_{21} & \vdots & x_{2p} \\ \vdots & \vdots & \vdots & \vdots \\ 1 & x_{n1} & \cdots & x_{np} \end{bmatrix}, Y = \begin{bmatrix} y_1 \\ y_2 \\ \vdots \\ y_n \end{bmatrix}, B = \begin{bmatrix} b_0 \\ b_1 \\ \vdots \\ b_p \end{bmatrix} \tag{2}$$

It can be written:

$$X^T XB = X^T Y \tag{3}$$

Then the regression parameters are calculated according to the least squares method:

$$\hat{B} = (X^T X)^{-1} X^T Y \tag{4}$$

## 3. Results and analysis

### *3.1. Elementary School Students' Home Classroom Climate, Academic Immersion, and Motivation to Learn*

The statistical analysis of students' learning gains is shown in Table 1. The mean value of academic immersion of elementary and middle school students in the table is 5.11, and the standard deviation is 0.553, the overall level of learning status is high, and the level of each dimension tends to be consistent. In terms of specific learning gains, the average value of the scores of each factor, in descending order, is as follows: enhancement of independent learning ability, enhancement of cooperation ability, enjoyment of learning and good learning, enhancement of practical problem solving ability, enhancement of learning awareness and ability and academic immersion, which indicates that the biggest gain of primary school students' participation in residential education is to cultivate the habit of independent learning and enhancement of independent learning ability, followed by the realization of the importance of the optimization of the residential space and enhancement of the ability of cooperation and mutual assistance with others. The second is to realize the importance of residential space optimization and to enhance the ability to collaborate and communicate with others and to complement and help each other.

***Table 1.*** The study of primary school students learning

| Project | Minimum value | Maximum value | Mean value | Standard deviation |
|---|---|---|---|---|
| Learnism | 2.00 | 6.00 | 5.55 | 0.711 |
| Improve your ability to learn | 2.50 | 6.00 | 5.43 | 0.674 |
| Ability to enhance cooperation | 2.50 | 6.00 | 5.35 | 0.723 |
| Ability to solve problems | 2.00 | 6.00 | 5.22 | 0.704 |
| Improve learning awareness and ability | 2.00 | 6.00 | 5.18 | 0.722 |
| Home classroom atmosphere | 2.00 | 6.00 | 4.92 | 0.673 |
| Academic immersion | 2.30 | 6.00 | 5.11 | 0.553 |

## *3.2. Correlation and regression analysis*

### 3.2.1. Correlation analysis

Pearson correlation analyses of home classroom climate, academic immersion and motivation of elementary school students are shown in Table 2, which shows that: home classroom climate is significantly correlated with motivation ($r = 0.383$, $P < 0.01$), home classroom climate is significantly correlated with academic immersion ($r = 0.565$, $P < 0.01$), and motivation is significantly correlated with academic immersion ($r = 0.234$, $P < 0.01$). All of the home classroom climate sub-dimensions were significantly correlated with academic motivation, with correlation coefficients ranging from 0.291-0.335, and all of the home classroom climate sub-dimensions were significantly correlated with academic immersion, with correlation coefficients ranging from 0.415-0.483. The correlation coefficients between the variables in this study were all at a level below 0.6, which is a moderate correlation and suitable for regression analysis.

***Table 2.*** Pearson correlation coefficient

| | **Learning motivation** | **Academic immersion** |
|---|---|---|
| Learning motivation | | 0.234** |
| Home classroom atmosphere | 0.383** | 0.565** |
| learnism | 0.283** | 0.412** |
| Improve your ability to learn | 0.331** | 0.483** |
| Ability to enhance cooperation | 0.344** | 0.491** |
| Ability to solve problems | 0.258** | 0.437** |
| Improve learning awareness and ability | 0.291** | 0.415** |

### 3.2.2. Regression analysis

Regression analyses were conducted to analyze the classroom climate, academic immersion and motivation of elementary school students at home, and the results are shown in Table 3. The covariance tolerance in this study is between 0.915-0.988, and the VIF is between 1.012-1.093, which are all less than 10, and the covariance between the independent variables is not obvious, which is in line with the requirements of multiple linear regression model.

This study conducted a stratified regression analysis after controlling for the variables of gender, age, average daily study time, place of origin, study level, and home classroom atmosphere, with study motivation as the dependent variable, and, academic immersion as the independent variable, and the results of the study showed that home classroom atmosphere and academic immersion had a significant predictive effect on study motivation, and that study motivation=2.173+0.175×academic immersion+ 0.371×home classroom atmosphere, which explains 38.13% of the variance in academic motivation.

***Table 3.*** Regression analysis

| **Predictor variable** | **Equation 1** | | | | **Equation 2** | | | |
|---|---|---|---|---|---|---|---|---|
| | $\beta$ | **SE** | **t** | **P** | $\beta$ | **SE** | **t** | **P** |
| Gender | -0.015 | 0.065 | -0.187 | 0.855 | -0.059 | 0.051 | -1.163 | 0.251 |
| Age | 0.114 | 0.049 | 2.413 | 0.022 | 0.029 | 0.041 | 0.683 | 0.507 |
| Daily learning time | 0.031 | 0.039 | 0.761 | 0.463 | 0.033 | 0.033 | 0.991 | 0.334 |
| Biotically | 0.006 | 0.032 | 0.137 | 0.895 | 0.007 | 0.025 | 0.209 | 0.853 |
| Learning hierarchy | -1.232 | 0.964 | -1.293 | 0.203 | -0.583 | 0.767 | -0.758 | 0.455 |
| Home classroom atmosphere | 0.427 | 0.319 | 1.343 | 0.186 | 0.202 | 0.257 | 0.785 | 0.439 |
| Learning motivation | | | | | 0.175 | 0.035 | 5.442 | 0.001 |
| Academic immersion | | | | | 0.371 | 0.038 | 11.583 | 0.001 |
| $R^2$ | 0.038 | | | | 0.393 | | | |
| F | 1.842 | | | | 24.153 | | | |

## *3.3. Mediated effects test*

There is a significant positive correlation between home classroom climate, motivation, and academic immersion, while home classroom climate has a predictive effect on academic immersion, and home classroom climate has a predictive effect on motivation, which indicates that there is a mediating effect between the three, and after analyzing motivation as a mediating variable, motivation still has a predictive effect on academic immersion, and the two are significantly positively correlated.

Therefore, there is a partial mediating effect between home classroom atmosphere, learning motivation and academic immersion. Therefore, the mediating effect of home classroom climate in the relationship between motivation and academic immersion was tested by Bootstrap method (5000 repeated samples), as shown in Table 4.

From the total effect, home classroom atmosphere has a significant effect on learning motivation (p=0.000<0.001,t=6.742); from the direct effect, home classroom atmosphere has a significant effect on academic immersion (p=0.000<0.001,t=4.573), and Hypotheses 1 and 2 are valid.

***Table 4.*** Effect analysis process summary

| Effect | Term | Effect | SE | t | p | LLCI | ULCI |
|---|---|---|---|---|---|---|---|
| Direct effect | Home classroom atmosphere→ Academic immersion | 0.263** | 0.061 | 4.573 | 0.000 | 0.145 | 0.376 |
| Indirect effect | Home classroom atmosphere→ Learning motivation | 0.233** | 0.033 | 7.894 | 0.000 | 0.176 | 0.291 |
| | Learning motivation→Academic immersion | 0.496** | 0.095 | 5.585 | 0.000 | 0.319 | 0.674 |
| Total effect | Home classroom atmosphere→ Academic immersion | 0.373** | 0.059 | 6.742 | 0.000 | 0.264 | 0.481 |

Indirect effects analyses are shown in Table 5. From the results of indirect effect analysis, it can be seen that when analyzing the influence of home classroom atmosphere on academic immersion, the mediating effect test of learning motivation shows that the number 0 (i.e., CI: 0.066~0.178) is not included in the 95% confidence interval, indicating that the home classroom atmosphere has a mediating role in the process of affecting academic immersion, and the home classroom atmosphere will first affect learning motivation and then affect academic immersion through learning motivation, and hypothesis 3 is verified.

***Table 5.*** Indirect effect analysis

| Term | Effect | Boot SE | Boot LLCI | Boot ULCI | Z | p |
|---|---|---|---|---|---|---|
| Home classroom atmosphere→Learning motivation→Academic immersion | 0.117** | 0.033 | 0.066 | 0.178 | 3.97 | 0.000 |

## 4. Discussion

The results of this study indicate that home classroom climate positively predicts academic motivation. The home classroom climate can satisfy the main parts of elementary school students' basic psychological needs, i.e., the need for relationship and the need for autonomy. Good teacher-student relationships and peer relationships are conducive to meeting the needs of elementary school students' relational needs, which can make elementary school students feel that they have a close relationship with their teachers and peers, so that they receive the message of acceptance and recognition, and the opportunity to make choices and decisions on their own is conducive to meeting the needs of elementary school students' autonomy needs, which can give them the feeling of autonomy, so that they receive the message of tolerance and openness. The satisfaction of basic needs will promote the stimulation of self-determination motivation of primary school students, and when the basic psychological needs of primary school students are satisfied, their learning motivation will be further stimulated. This study also found that academic motivation positively predicts academic immersion, consistent with previous research. The higher the level of academic motivation of elementary school students, the more engaged they were in their studies. It was found that even if the task itself was very boring, it could promote individual engagement on the task when provided with cues that could motivate the individual to learn. Therefore, the home classroom climate can serve as an important motivator for elementary school students to promote motivation and to promote higher levels of engagement in learning.

## 5. Conclusion

Home classroom atmosphere has a significant positive effect on elementary school students' learning motivation and academic immersion. The mean value of academic immersion in the study was 5.11 (standard deviation 0.553), indicating that the overall learning status of students was high. The equation derived from the regression analysis (academic motivation = 2.173 + 0.175 x academic

immersion + 0.371 x home classroom climate) explained 38.13% of the variance in academic motivation. The correlation coefficients between the home classroom climate sub-dimension and academic motivation ranged from 0.291-0.335, and the correlation coefficients with academic immersion ranged from 0.415-0.483, which were both at the significant level. This suggests that optimizing the residential space to create a positive and supportive learning environment can effectively meet the basic psychological needs of elementary school students, promote learning motivation, and then enhance the academic immersion experience. In educational practice, attention should be paid to creating a favorable home classroom atmosphere to stimulate elementary school students' interest in learning and intrinsic motivation through the provision of abundant learning resources, training opportunities, and positive support.

**About the Author**

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