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THE FACTORS INFLUENCING MIDDLE SCHOOL STUDENTS' MATHEMATICS GRADES BASED ON KERNEL REGRESSION

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Abstract: Students' math grades are often not very ideal. Due to the complexity and difficulty of mathematics, students' interest in learning is not high. Therefore, studying the factors that affect students' math grades has become an important research topic at present. This article uses the latest kernel regression models, including KLS and KRLS, to study a high school mathematics curriculum. The research results indicate that the weekly study time has a significant impact on children's academic performance; The more female, the higher the score; The educational level of parents was found to have a significant impact on children's grades through KRLS regression analysis.
Keywords: Kernel regression model; Mathematics grades; Influencing factors; Teaching quality

1 INTRODUCTION

As an important subject in high school, high school mathematics not only reflects students' academic level, but also has a profound impact on their future academic and career development. However, the abstraction and logicality of high school mathematics pose learning challenges for many students, leading to significant differences in their math grades. Therefore, exploring the factors that affect high school mathematics grades and seeking effective improvement strategies is of great significance.

In the literature on the mathematical performance of middle school students, Liu Chuangye, Dai Jinjun, Xu Zhangtao, and Peng Shuangjie focused on a series of specific cases and implemented the "one line connection" idea in university mathematics classroom teaching, connecting analysis, geometry, and algebra [1]. This approach effectively developed the professional knowledge and abilities of teacher trainees. To elevate this specific approach to a mechanism, it is necessary to vigorously develop university mathematics education research, expand the research field of mathematics education, and promote the disciplinary development of mathematics education. Li Qiuhua pointed out that the history of mathematics is a discipline that studies the origin, development, and evolution of mathematical knowledge. It covers various mathematical cultures and ideas from ancient to modern times, and its educational value cannot be ignored [2]. Zheng Xiaomei, Yao Yiling, and Lu Jijian conducted a comparative analysis of the mathematics talent education curriculum and its practices between China and the United States, exploring the problems existing in the mathematics curriculum of China's talent education and proposing the following suggestions: improving the legal policies for talent education; Overall design curriculum system; The course content returns to the mainstream of mathematics; Course development objectives should be de utilitarian; Actively carry out theoretical and practical research on the curriculum [3]. Qian Yiwen focuses on the theoretical and practical aspects of teaching reform in primary and secondary school mathematics curriculum, the theory and practice of mathematics teacher education, research on the evaluation and problem-solving of the new college entrance examination from the perspective of core competencies, research on mathematics education and teaching under the STEAM concept, and research on mathematics learning, thinking, and abilities in academic research reports [4]. Qin Desheng and Liu Pengfei have developed rich mathematical education ideas and conducted a series of innovative research based on the integration of arts and sciences [5]. Wang Limei and Song Naiqing selected 1727 CSSCI indexed papers on mathematics education research from CNKI in the past 20 years as samples, starting from the exploration of hot topics in the field of mathematics education research in China [6]. The study found that the overall development trend of mathematics education research in China has been steadily increasing despite fluctuations, with a decreasing trend in the number of publications in the past 5 years. Wang Ying and Wang Yujun proposed to establish a precise assistance mechanism for basic education mathematics teaching research at the national level to address the problem of uneven distribution [7]. In response to the problems identified through content analysis, support should be increased for research on key and difficult points in mathematics education and teaching, and a collaborative platform should be established between higher education institutions, research and management departments, and primary and secondary schools to continuously improve the quality of frontline mathematics education and teaching research. Song Yuanfeng, Ding Baoxia, Yu Xiaorui, and Li Xiuying studied the simplification of plane quadratic curve equations, the solution of cylindrical, conical, and rotating surface equations, the collinear and coplanar position relationships of vectors, and the learning methods of subspace sums for educational mathematics concepts. The methods provided are simple and easy to understand. Facilitating students' learning of relevant knowledge and enhancing their interest in learning [8]. Kong Fanzhe, Shi Ningzhong, and Zhao Xinyi creatively focus on the cultivation of students' correct values, key abilities, and essential character traits by inheriting the "Four Basics" of the "Mathematics Curriculum Standards for Compulsory Education", including basic knowledge, basic skills, basic ideas, basic activities, and experience, as well as the ability to identify, propose, analyze, and solve problems [9]. Zhu

Hua and Cao Yani focus on the development path of primary school mathematics textbooks over the past 70 years, gradually shifting from "knowledge-based" to "quality-oriented". It is not only a profound interpretation of mathematics and mathematics education by editors, but also an expansion process of mathematics education from "small" to "big" mathematics, that is, an educational process that gradually expands from learning mathematical knowledge to mathematical thinking, emotions, attitudes, spirits, etc. [10]. Sun Xinghua pointed out that mathematics education in primary and secondary schools was a key area of education reform in Ontario from 2003 to 2019. By analyzing the background of Ontario's education reform, several policy documents on mathematics education reform were introduced, including "Early Mathematics Strategies, Towards Mathematics Success, Mathematics Curriculum Standards, Focus on Mathematics Education, Revitalize Mathematics Strategies, and Focus on Mathematics Fundamentals" [11]. Li Zhuo, Yu Bo, and Zhang Yong conducted a statistical analysis of 255 doctoral dissertations in mathematics education using content analysis method. The study found that before 2002, sporadic doctoral dissertations in mathematics education were produced each year. Although the number of doctoral dissertations in mathematics education decreased in some years after 2002, it showed an overall upward trend; Suggestions are proposed from the aspects of the disciplinary status of mathematics education, the construction of doctoral programs, the research themes and methods of mathematics education [12].

2 RESEARCH METHODS AND INDICATOR SELECTION

2.1 KRLS and KLS Regression Analysis

The KRLS algorithm extends the processing capability of KLS algorithm for nonlinear data. It maps nonlinear data to a high-dimensional feature space through Mercer kernel function and converts it into a linear problem. Then, the RLS algorithm is used for linear fitting in the feature space. The mapping process of this Mercer kernel function is often referred to as the "kernel technique", which does not require explicit knowledge of the mapping form of the input sample in the feature space, but only calculates the inner product of the mapping through the Mercer kernel function. This technique uses relatively simple kernel function calculations to replace the complex calculations of mapping in high-dimensional feature spaces

Assuming the input sample is$\mathrm{u(i)}$, the input sample $\varphi\big(\mathrm{u(i)}\big)$is mapped to and simplified as in the feature space$\varphi(\mathrm{i})$. This article uses the Gaussian kernel in the common Mercer kernel function, and its expression is

$$\mathrm{k\big(u(i)\big),\ u(j)\rangle} = \exp\left(-\frac{\|u(i)-u(j)\|^2}{2\sigma^2}\right) \tag{1}$$

Among them, $\sigma$is the width parameter of the kernel function. The meaning of the so-called "kernel technique" is the feature vector in any feature space

The inner product calculation can be replaced by kernel function calculation, that is

$$\mathrm{k\Big(u(i),\ u(j)\Big)} = \langle\varphi(\mathrm{i}),\ \varphi(\mathrm{j})\rangle \tag{2}$$

Among them, u $(i)$and u $(j)$are input samples, $\varphi(\mathrm{i})$and and $\varphi(\mathrm{j})$are their corresponding feature vectors in the feature space.

Input samples$\{u(j)\}$，$j = 1$, *2* Mapping *j* to the feature space yields$\{\varphi(j)\}, j = 1$, *2, j,* Ze Te

The cost function of RLS in the eigenspace is

$$\min_{\omega(i)} \sum_{j=1}^{i} |d(j) - \varphi(j)^T \omega(I)|^2 \tag{3}$$

Given the feature matrix, the $\emptyset(\mathrm{i}) = [\varphi(1), \ldots, \varphi(\mathrm{i})]$, coefficient vector $\omega(\mathrm{i})$ can be linearly represented by the mapping of input samples in the feature i ×space as$\omega(\mathrm{i})=\emptyset(\mathrm{i})\alpha(\mathrm{i})$, where the coefficient vector in the feature space $\alpha(\mathrm{i})$is 1. Define $\mathrm{K(i)} = \emptyset(\mathrm{i})^{\mathrm{T}}\emptyset(\mathrm{i})$the i ×kernel matrix of 1, which has the advantage of being able to be calculated from input samples using "kernel techniques". Obtain the new cost function of KRLS algorithm from equation (3)

$$\min_{\alpha(\mathrm{i})} \sum_{j=1}^{i} |d(j) - \varphi(j)^T \emptyset(j)\alpha(i)|^2 = \min_{\alpha(\mathrm{i})} \|\mathrm{d} - \emptyset(\mathrm{i})^{\mathrm{T}}\emptyset(\mathrm{i})\alpha(\mathrm{i})\|^2 \tag{4}$$

Corresponding to the RLS algorithm, the purpose of the KRLS algorithm is to find the coefficient vector that satisfies the minimum $\alpha(\mathrm{i})$value of the cost function (4)$\alpha(\mathrm{i})$, and does not need to be $\alpha(\mathrm{i}-1)$recalculated with each new sample, but is calculated recursively. To avoid performing matrix inversion operations during each update, a kernel inverse matrix is defined $\mathrm{Q(i)} = \mathrm{K(i)}^{-1}$ to $\mathrm{Q(i)}$ simplify the $\mathrm{K(i)}$ complex process of recursive updating followed by matrix inversion. The cost function of equation (4) can be used to infer the iterative update expression of the KRLS algorithm. The following summarizes the basic update process of the KRLS algorithm:

(1) Map the new input sample to the feature space and calculate the inner product between the new sample and the original sample in the feature space mapping$\mathrm{h(i)}$;

(2) Calculate the prior estimation error based on the prior estimation value and the true value$\mathrm{e(i)}$;

(3) And (4), calculate the adaptive control quantity based on the kernel inverse matrix and the new input sample$\mathrm{r(i)}$;

(5) Adjust the coefficient vector of the kernel adaptive filter based on the adaptive control variable and prior error$\alpha(\mathrm{i})$;

(6) Iteratively update the kernel inverse matrix based on the adaptive control variable.

initialization$\mathrm{Q(1)} = 1/\mathrm{k}\Big(\mathrm{u(1)},\ \mathrm{u(1)}\Big)$，$\alpha(1) = \mathrm{Q(1)d(1)}$

For loop i=2, 3

$$(1)h(i) = \left[k\left(u(i), u(1)\right), \ldots, k\left(u(i), u(i-1)\right)\right]^T$$
$$(2)e(i) = d(i) - h(i)^T \alpha(i-1)$$
$$(3)z(i) = Q(i-1)h(i)$$
$$(4)r(i) = k\left(u(i), u(i)\right) - z(i)^T h(i)$$
$$(5)\alpha(i) = \begin{bmatrix} \alpha(i-1) - z(i)r(i)^{-1}e(i) \\ r(i)^{-1}e(i) \end{bmatrix}$$
$$(6)Q(i) = r(i)^{-1}\begin{bmatrix} Q(i-1)r(i) + z(i)z(i)^T - z(i) \\ -z(i)^T \qquad\qquad 1 \end{bmatrix}$$

As can be seen from the above, the $Q(i)$dimension of the kernel inverse matrix is equal to the number of input samples i. Therefore, the time and space complexity of a single update for the KRLS algorithm are both$O(i^2)$, meaning that its complexity will continuously increase with the training sample size.

2.2 Indicator System and Indicator Data

Table 1 Relevant Indicators of Mathematics Curriculum for Students in a Certain Middle School

variable	assignment
Sex - Student's gender	F=female, M=male
Age - student's age	15-22 years old
Medu - Mother's Education	0=none, 1=primary education (4th grade), 2=5-9th grade, 3=secondary education, 4=higher education
Fedu - Father's Education	0=none, 1=primary education (4th grade), 2=5-9th grade, 3=secondary education, 4=higher education
Traveltime - the time from home to school	1=<15 minutes, 2=15-30 minutes, 3=30 minutes -1 hour, 4=>1 hour
Study Time - Weekly Study Time	1=<2 hours, 2=2-5 hours, 3=5-10 hours, 4=>10 hours
Activities - Extracurricular Activities	Yes or No
Higher - Want to receive higher education	Yes or No
Famrel - Quality of Family Relationships	1=very poor, 2=poor, 3=average, 4=good, 5=very good
Freetime - free time after school	1=very few, 2=a bit few, 3=not much, not much, 4=a bit many, 5=very many
Absences - Number of absences	From 0-93
Internet - Internet access at home	(Binary: Yes or No)

Table 1 provides a brief description of the variables used in this article and their assignment methods, including continuous variables and categorical variables. Except for the student's age and absenteeism, which are continuous variables, all others are categorical variables.

3 EMPIRICAL RESEARCH

3.1 Mid Term Results of Nuclear Regression Analysis

If we use KRLS analysis to analyze gender (sex), student age (age), and mother's education (Medu) in Table 2, we found that coefficients of 0.026, 0.036, and 0.156 have a positive impact. Sex means that the more female the student, the higher the score; Age means that a student's age can affect the level of their score; Medu said that a mother's education can affect a student's personal qualities and learning attitude. A good family atmosphere can motivate students, and excessive scolding can lead to a decrease in students' interest in learning. However, according to KLS analysis, we found that coefficients of -1.080, -0.241, and -0.432 have a negative impact, meaning that the more female the math score, the lower the score; The younger the student, the lower their score, because students who are too young have less mature thinking abilities, which can affect their grades; The more excessive the mother's education interferes with students, the worse their self-care and learning abilities will be. The analysis results of the two methods are opposite and worthy of further exploration.

Table 2 Shows the Quantile Coefficient Test for Final Grades

Model	KRLS			KLS		
variable	coefficient	T value	remarkable	coefficient	Z value	remarkable
sex	0.026	0.083	0.934-	-1.080	-0.93	0.351-
age	0.036	0.459	0.647-	-0.241	-0.42	0.676-
medu	0.156	1.746	0.082*	-0.432	-0.56	0.579-
fedu	0.188	2.085	0.038*	0.854	1.05	0.293-
traveltime	-0.016	-0.108	0.914-	-0.107	-0.12	0.906-
studytime	0.301	2.671	0.008***	0.254	0.27	0.790-
activities	-0.273	-0.845	0.399-	0.163	0.69	0.889-
higher	-0.465	-1.491	0.137-	-2.093	-1.26	0.207-
internet	0.246	0.724	0.470-	0.226	0.20	0.845-
famrel	0.064	0.574	0.574-	0.310	0.27	0.786-

freetime	-0.005	-0.052	0.958-	-0.325	-0.43	0.671-
absences	-0.005	-0.441	0.659-	0.076	0.69	0.492-
Pseudo R^2						

Note: An * indicates that the p-value is less than 0.1; Two *'s indicate that the p-value is less than 0.05;
Three *'s indicate that the p-value is less than 0.01

If we analyze the father's education (Fedu) using KRLS, we find that a coefficient of 0.188 indicates a positive impact, which means that the father's education style has a significant impact on the child's grades. Specifically, a father's educational approach can affect a child's academic performance and mental health in various ways. Through KLS analysis, we found that a coefficient of 0.854 also indicates a positive impact, which means that the father's educational style directly affects the child's learning motivation and interest. If a father is too strict or uses negative evaluations when educating a child, the child may feel inferior and discouraged, thereby losing interest and motivation to learn. On the contrary, if fathers can adopt positive educational methods, encourage and support their children, they will be more willing to take the initiative to learn, thereby improving their academic performance.

If we analyze the travel time from home to school using KRLS and KLS, we find that coefficients of -0.016 and -0.107 respectively have a negative impact. This means that the travel time from home to school can affect a child's grades. If a child needs to spend a long time traveling from home to school, they may consume a lot of energy on the road, leading to decreased attention in class and affecting learning effectiveness. Children who wake up early and return late may not be able to ensure sufficient sleep time, and long-term sleep deprivation can affect their mental state and learning efficiency.

If we analyze the weekly study time using KRLS and KLS, we find that coefficients of 0.301 and 0.254 respectively have a positive effect. This means that the weekly study time has a significant impact on children's grades. Appropriate time limited learning can improve learning efficiency because children are more likely to concentrate without time pressure. Long term study will leave children with no time for proper rest and entertainment, which can lead to boredom and lack of motivation while studying. Appropriate rest and entertainment can help children relax both physically and mentally, enhance their interest in learning, and boost their self motivation.

If we analyze extracurricular activities using KRLS, we find that a coefficient of -0.273 has a negative impact. The main reasons why extracurricular activities affect children's grades include time allocation, psychological pressure, motivation, and learning efficiency. Time allocation is an important factor affecting children's grades. Extracurricular activities and studies both require students' time, and if time allocation is not reasonable, students may feel pressure between extracurricular activities and academic work, leading to a decrease in learning efficiency. However, through KLS analysis, we found that a coefficient of 0.163 indicates a positive impact. This means that students need to balance their extracurricular activities and study time to ensure that both receive sufficient attention. Proper time allocation can enable students to fully participate in extracurricular activities to develop their own qualities, while also maintaining learning efficiency, thereby improving their academic performance.

If we use KRLS and KLS analysis to study higher education, we find that coefficients of -0.465 and -2.093 respectively have a negative impact. This means that families with better economic conditions also have higher expectations for their children's education. This may be because these families can provide better educational resources and environment. Research shows that the higher parents' expectations for their children's education, the better their academic performance is usually. However, parents with high educational backgrounds may have excessively high expectations for their children, which can bring tremendous psychological pressure to them. This high-pressure environment may inhibit children's potential, causing them to lose interest and motivation in learning, thereby affecting academic performance. High expectations from the family may make children feel anxious and fearful, which in turn can affect their enthusiasm for learning and academic performance.

Using KRLS and KLS analysis, we find that the coefficients of Internet access at home and Famrel quality at home are 0.246 and 0.226, 0.064 and 0.310 respectively, which are positive effects. That is to say, home access to the Internet can positively affect children's performance, mainly by providing rich learning resources and promoting autonomous learning ability. First of all, the Internet provides children with rich learning resources. Children can learn through online education platforms, video courses, e-books, and other resources that are not only rich in content but also updated in a timely manner, meeting the learning needs of different subjects and grades. For example, children can watch video courses through online education platforms and read and learn through e-books, which can greatly enrich their knowledge reserves and enhance learning outcomes. The reason why the quality of family relationships has a positive impact on children's grades is that research has shown that in families that feel support and care from their families, the proportion of children with excellent grades is significantly higher than in other families. The democratic and negotiated parent-child interaction mode helps children's learning enthusiasm and self-management ability, thereby improving academic performance.

If KRLS and KLS are used to analyze the free time after school, we found that coefficients of -0.005 and -0.325 respectively have a negative impact on children's grades. This means that the two hours after school have a negative impact on children's grades because they have autonomy. If children do not plan properly, they can easily waste time on entertainment activities such as watching TV and playing mobile phones, resulting in reduced learning time and low learning efficiency.

If we analyze absenteeism using KRLS, we find that the coefficient of -0.005 has a negative impact, which means that absenteeism negatively affects children's grades. The main reason for this is that the child's learning progress is

hindered. If the child is frequently absent, they will miss key information such as the teacher's lecture focus, resulting in hindered learning progress and difficulty keeping up with the pace of the course.

Table 3 shows the quantile coefficient test for final grades

Model		KRLS			KLS	
variable	coefficient	T value	remarkable	coefficient	Z value	remarkable
sex	-0.958	-1.889	0.606-	-1.727	-1.12	0.265-
age	-0.268	-2.271	0.024**	-1.126	0.317	0.317-
medu	0.270	2.004	0.046**	0.660	0.52	0.602-
fedu	0.126	0.929	0.353-	0.426	0.35	0.725-
traveltime	-0.214	-0.954	0.341-	-0.567	-0.44	0.658-
studytime	0.299	1.783	0.076*	0.781	0.53	0.596-
activities	0.271	0.513	0.609-	2.195	1.55	0.122-
higher	-0.714	-1.529	0.127-	-4.954	-1.82	0.068*
internet	0.242	0.439	0.661-	0.259	0.14	0.891-
famrel	0.258	1.536	0.125-	-0.113	-0.07	0.947-
freetime	-0.031	-0.207	0.836-	0.145	0.14	0.891-
absences	0.034	1.870	0.062*	0.178	0.95	0.344-
Pseudo R^2						

Note: An * indicates that the p-value is less than 0.1; Two *'s indicate that the p-value is less than 0.05;
Three *'s indicate that the p-value is less than 0.01

3.2 Final Score of Nuclear Regression Analysis

If we analyze gender (sex) and student age (age) in Table 3 using KRLS and KLS, we find that coefficients of -0.958, -1.727, and -0.268, -1.126 respectively have a negative impact. The negative impact of sex means that the higher the female score, the lower the score. This is because in some social and cultural environments, there is a traditional role positioning of women, believing that women have weaker abilities in certain subject areas. This concept can affect women's self-awareness and learning motivation, leading to some women subconsciously having lower academic expectations, which to some extent affects their final grades. The negative impact of age refers to the fact that students of different age groups have different levels of cognitive development. The younger the students, the harder it is for them to keep up with their academic performance. This is because the thinking and reasoning abilities of low-level students are not yet fully mature, making it difficult for them to understand and master complex subject knowledge. Additionally, younger students have weaker self-control and lack effective learning strategies, resulting in lower learning efficiency and ultimately affecting their final grades.

If we analyze the mother's education (medu) and father's education (fedu) using KRLS and KLS, we find that coefficients of 0.270, 0.660, and 0.126, 0.426, respectively, have a positive impact. This means that both mother's education and father's education are important and have a significant impact on students. This is because well-educated parents can create a good family environment and resources for their children, cultivate a strong learning atmosphere at home, and cultivate their children's interest and habits in learning. At the same time, they also have reasonable and high expectations for their children's academic performance and future development. This expectation will be transformed into encouragement and support for their children, motivate them to study hard, facilitate their academic development, and thus affect students' final grades. Grades.

If we analyze the travel time from home to school using KRLS and KLS, we find that coefficients of -0.214 and -0.567 respectively have a negative impact. This is because the long travel time from home to school reduces the effective time available for students to study. If a student spends two hours commuting to and from school every day, while another student only needs half an hour, the former will spend much less time on learning than the latter. Over time, the gap in learning effectiveness may gradually become apparent, thereby affecting final grades.

If we analyze the weekly study time and extracurricular activities using KRLS and KLS, we find that coefficients of 0.299 and 0.781, and 0.271 and 2.195, respectively, have a positive impact. This means that both the weekly study time and extracurricular activities are important for students, and an increase in weekly study time helps to consolidate the knowledge they have learned. The more time students set aside to consolidate their studies every week, the better their grades will be compared to those who do not set aside a fixed amount of time to study. Their learning ability and self-control will also be stronger because memory requires continuous repetition and consolidation to be maintained in the long run. Sufficient study time every week can lead to qualitative changes over time. At the end of the term, quantitative changes can cause qualitative changes. The grades will improve. Extracurricular time allows students to arrange themselves, read professional books and literature, delve into knowledge not covered in the classroom, expand their knowledge base, and also engage in physical activities to relieve stress, maintain a good attitude, improve learning and efficiency, and help achieve better grades.

If we analyze higher education using KRLS and KLS, we find that coefficients of -0.714 and -4.954 respectively have a negative impact, due to economic cost factors and socio-cultural environmental factors. Higher education requires paying tuition fees, accommodation fees, textbook fees, etc., leading to an increase in economic costs. For some families with poor economic conditions, these costs can become a heavy burden, leading to a negative impact on their

willingness to receive higher education and a decrease in academic performance. In the social environment, there are beliefs such as the "uselessness of reading" that believe the chances of success through higher education are not greater than entering society early, which leads to a lack of enthusiasm for higher education among some people.

Using KRLS and KLS to analyze Internet access at home, we find that the coefficients of 0.242 and 0.259 are both positive, because there are massive learning resources on the Internet. Students can easily access various learning materials through the engine at home, broaden learning channels, enrich learning resources, and let students access more cutting-edge knowledge. The Internet also provides a variety of interactive learning tools, which can allow students to share learning experience and experience with each other, so as to improve their performance.

If we analyze the quality of family relationships (famrel) using KRLS, we find that the coefficient is 0.258, indicating a positive impact. This means that good family relationships can provide students with rich emotional support. Students who grow up in such a family environment will have a more positive and optimistic attitude, and their emotions will be more stable, leading to greater confidence in learning and life. However, using KLS analysis, it was found that a coefficient of -0.113 has a negative impact. This means that in some family relationships, parents have high expectations for their children's academic performance, overly focusing on grades and neglecting their physical and mental health. This can cause significant psychological pressure on children, leading to dispersed learning energy and a decline in grades. The two analysis results are opposite and deserve further exploration.

If we analyze the free time after school using KRLS, we find that the coefficient is -0.031, which has a negative impact. This may be because students have too much free time after school, and they may lack timely learning arrangements, which leads to an increase in forgetting and affects their grades. However, using KLS analysis, it was found that a coefficient of 0.145 has a positive impact. This means that if the free time after school is arranged reasonably, students can have the opportunity to participate in various interest classes and learn new skills independently. They can also use their free time to review and preview, better grasp the knowledge learned in class, and thus improve overall academic performance.

If we analyze absenteeism using KRLS and KLS, we find that the coefficients are 0.034 and 0.178, respectively, both of which have a positive impact. In fact, absenteeism has a certain influence in both positive and negative directions, because sometimes students may be absent due to physical discomfort or family matters, but excessive absenteeism can lead to students' grades not keeping up, thereby affecting their grades and causing a decline.

From the comprehensive analysis of Table 1 and Table 2, we can see that there are three significant factors in Table 1 (mid-term grades) and four significant factors in Table 2 (final grades) through data analysis. Comparing the significance of the two tables, it indicates that the overall grades of students do not show a clear level of achievement during mid-term exams, and the time from the beginning of the semester to the end of the semester is relatively short, so the significance is not high. But from the beginning to the end of the semester, the time is relatively long, the learning time is getting longer, and the knowledge reserve is constantly increasing. Learning is cumulative, and new knowledge is often built on the basis of old knowledge. Previous learning outcomes promote subsequent learning, forming a compound interest effect, which leads to a significant improvement in grades at the end of the semester.

4 RESEARCH CONCLUSION AND COUNTERMEASURES SUGGESTIONS

This article comprehensively uses kernel regression method to compare and analyze the changes in mid-term and final grades of students in a certain middle school. The analysis results lead to the following conclusions: Firstly, in the analysis data of mid-term grades, students' weekly learning is particularly important and the most significant feature in the entire data, indicating a positive impact. This suggests that the reasonable arrangement of weekly learning time can fully mobilize students' enthusiasm and thus affect their grades. In the analysis data of the final grades, the education of the father and mother is the most significant feature, which indicates that the education of the father and mother has a great impact on the entire growth and development of students. Excellent family education will cultivate children who are more proactive and goal oriented. Secondly, parental education is comprehensive. It covers multiple important areas such as lifestyle habits, moral cultivation, and learning attitudes. In terms of moral cultivation, teach children qualities such as honesty and friendliness; For learning, parents will cultivate their children's curiosity about knowledge and good study habits, which will run through their entire student life.

COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

REFERENCE

[1] Liu Chuangye, Dai Jinjun, Xu Zhangtao, et al. Educational Mathematics in Action: The Application of the "One Line Connection" Concept in University Mathematics Teaching. Journal of Mathematics Education, 2018, 27 (4): 82-87.

[2] Li Qiuhua. Reflections and Ideas on the Construction of a Case Library for the Integration of Mathematics History and Mathematics Teaching. Science and Education Literature Collection, 2024, 23(623): 52-56.

[3] Zheng Xiaomei, Yao Yiling, Lu Jijian. Comparative Study on Curriculum and Practice of Mathematics Talent Education between China and the United States. Journal of Mathematics Education, 2021, 30(4): 68-78.

[4] Qian Yiwen. Progress and Prospects of Mathematics Education Research under Problem Orientation. Journal of Mathematics Education, 2021, 30(5): 90-102.
[5] Qin Desheng, Liu Pengfei. Exploring the Chinese Path of Mathematics Education - A Brief Introduction to Professor Shi Ningzhong's Mathematics Education Thoughts. China Education Science, 2024, 7(1): 12-23.
[6] Wang Limei, Song Naiqing. Journal of Mathematics Education, Hot Topics in Chinese Mathematics Education Research in the Past 20 Years - Empirical Analysis Based on Scientific Knowledge Graph. Journal of Mathematics Education, 2022,31(5): 65-75.
[7] Wang Ying, Wang Yujun. Evidence based Research on Three National Teaching Achievement Awards for Mathematics in Basic Education. Journal of Mathematics Education, 2024, 33(5): 87-92.
[8] Song Yuanfeng, Ding Baoxia, Yu Xiaorui, et al. Reflections on Analyzing the Teaching Content of Geometry and Higher Algebra Courses Based on Educational Mathematics Concepts. Journal of Tonghua College, 2023, 44(345): 133-137.
[9] Kong Fanzhe, Shi Ningzhong, Zhao Xinyi. Analysis of the Main Changes and Characteristics of Compulsory Education Mathematics Curriculum Standards. Curriculum Textbook Teaching Method, 2022, 42(10): 42-47.
[10] Zhu Hua, Cao Yani. Mathematics Education from "Small" to "Large" - A Study on the Development of Primary School Mathematics Textbooks in New China. Journal of Science, Hunan Normal University, 2020, 5(9): 67-72.
[11] Sun Xinghua, Douglas McDougall. The Context and Review of Mathematics Education Reform in Primary and Secondary Schools in Ontario, Canada. Journal of Mathematics, 2020, 29(6): 80-86.
[12] Li Zhuo, Yu Bo, Zhang Yong. Statistics and Analysis of Doctoral Dissertations in Chinese Mathematics Education. Journal of Mathematics, 2024, 28 (2): 92-98.