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**E-mail: [editorial@ij-ce.com](mailto:editorial@ij-ce.com)**  
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# Fault Analysis of High Exhaust Temperature in a Certain Diesel Engine for Power Generation

Peng Chen

College of Marine Electrical and Intelligent Engineering, Jiangsu Maritime Institute, Nanjing 200127, China

**Abstract:** The exhaust temperature of marine power generation diesel engines can reflect their thermal load and is an important parameter for monitoring in diesel engine operation and management. Excessive exhaust temperature affects the safety of diesel engines and reduces their economy. This article analyzes and searches for the phenomenon of excessive exhaust temperature in power generation diesel engines, analyzes the impact of fuel quality, intake and exhaust valves, turbochargers, and air coolers on excessive exhaust temperature in diesel engines, and proposes fault resolution measures and key points for prevention and management.

**Keywords:** Power Generation Diesel Engine; Excessive Exhaust Temperature; Fault Analysis

## 1 INTRODUCTION

The model of a certain power generation diesel engine is DAIHATSU 6DK-20, a four stroke diesel engine with a rated power of 800KW, a cylinder diameter of 180mm, and a stroke of 280mm. the exhaust temperature of each cylinder of the diesel engine is about 460 °C, and the temperature of the exhaust main pipe is about 620 °C, exceeding the exhaust temperature limit. the scavenging pressure of the turbocharger of the power generation diesel engine is low, and when the load of the power generation diesel engine approaches 350KW, the turbine will surge. Due to the rapid increase of exhaust temperature, the turbocharger volute will burn red.

## 2 FAULT ANALYSIS

### 2.1 Fuel quality analysis

Fuel quality is an important factor affecting the exhaust temperature of the entire machine. If the fuel quality cannot meet the atomization requirements, it will cause poor fuel atomization, combustion deterioration, and an increase in exhaust temperature. the power generation diesel engine of this ship shares a fuel supply unit with the main engine. As it is a new ship with strong automation function, the fuel viscosity can be stably controlled at 12Cst, and the inlet temperature is around 130 °C, fully meeting the requirements of good atomization. Conduct tests on

multiple batches of fuel oil samples, and the test results meet the requirements of ISO 8217:2010 "Marine Residue Burning

Technical specifications and standards for fuel oil. the fine filter before the fuel enters the machine has been disassembled and inspected, and there is no bypass phenomenon in the filter. the filter element is intact. Therefore, the reason for the increase in exhaust temperature due to poor fuel quality entering the combustion chamber and deterioration of combustion quality was first ruled out.

### 2.2 Turbocharger Status Analysis

Due to the poor condition of the diesel engine cylinder head, the combustion chamber and exhaust pipe deposit asphalt like fuel and residue that has not been completely burned. the harsh working environment at the cylinder head also affects the turbine, causing carbon deposition in the turbine nozzle ring (as shown in Figure 2). the scavenging pressure is low, and when the load approaches 350KW, the turbine will surge, and the charge air pressure will change with the load of the diesel engine. To know if the boost air pressure is normal, it is necessary to observe the pressure corresponding to different loads in daily operation according to the requirements of the manual. If the diesel engine manual specifies that the charge air pressure at a certain load is M value, then in actual use, if it is lower than M value at this load, the amount of air entering the cylinder will decrease within the same time, resulting in insufficient fuel combustion and an increase in exhaust temperature. the boost air pressure gauge displays the air pressure from the air cooler to the intake valve. If the boost air pressure is lower than the normal value, it is generally caused by two reasons: firstly, the working condition of the turbocharger is poor; the second reason is that the air cooler is dirty and blocked. the poor working condition of the turbocharger is mainly manifested by dirty and blocked intake valve network of the muffler, damaged or excessively worn bearings, damaged or worn impellers, and severe carbon accumulation in the nozzle ring.

### 2.3 Analysis of Air Cooler Status

The dirty blockage of the air cooler is mainly caused by the dirt on the side of the air bottle, which affects the circulation and cooling of the pressurized air. The heat transfer of the air cooler mainly cools the pressurized air from the turbocharger in the form of convection and heat conduction. If the air side of the air cooler is blocked, it will cause an increase in resistance, a decrease in air pressure in the intake manifold, a decrease in intake volume, and an increase in exhaust temperature. Poor fresh water cooling effect or bypass of air inlet and outlet of the air cooler can cause an increase in air temperature and density in the intake manifold, as well as an increase in exhaust temperature.

This type of diesel engine air cooler has a compact design and an unreasonable internal structure, which makes it difficult to remove the core. After removing the core for cleaning, the second stage core was damaged, and the lower half core of the air cooler was completely blocked. If it is not removed, it cannot be cleaned. Therefore, the loss of spare parts is very large, increasing maintenance costs.

When disassembling and cleaning the core of the air cooler, clean the inside of the air cooler shell and apply high-temperature rust resistant paint. After it dries thoroughly, install the core. When installing the core, pay attention to applying some anti adhesive on the sealing surface, not too thick, and try not to mix too much lubricating oil. This way, the core will not be too tight and pulled out too difficult the next time it is removed.

At the same time, special tools are made, which are very convenient for dismantling and cleaning the air cooler. After dismantling and cleaning the air cooler, the exhaust temperature significantly decreases by more than 20 °C.

### **3 FAULT RESOLUTION**

The turbocharger and air cooler are two important factors that affect the general increase in exhaust temperature of diesel engines, especially for high turbocharged diesel engines, which have high requirements for scavenging pressure. If the air cooler is blocked, it can cause an increase in exhaust temperature of the power generation diesel engine, and in severe cases, the power generation diesel engine can no longer be used without load. So in the process of fault analysis and resolution, the focus is on the turbocharger and air cooler.

The first consideration is the issue of adding fuel, which led to an increase in the exhaust temperature of the diesel engine. During the subsequent refueling process, new fuel was used, but the problem still did not improve. The single unit load of the diesel engine still cannot meet the load requirements of the ship's equipment, and the exhaust temperature of the diesel engine is still very high.

Subsequently, the focus will be on equipment failure. Firstly, maintenance was carried out on the No. 1 generator diesel engine, and the turbocharger of the

No. 1 generator diesel engine was thoroughly disassembled, inspected, and cleaned. The impeller shaft, bearings, and nozzle ring were replaced. The air filter screen, compressor impeller, diffuser channel, etc. of the turbocharger are too dirty, the nozzle ring, shaft air seal, working impeller, etc. are contaminated, and the working blades are deformed and damaged. These factors can all reduce the efficiency of the turbocharger, decrease the boost pressure, and cause the overall exhaust temperature of the power generation diesel engine to increase. After the above inspection, we preliminarily determined that it was a problem with the turbocharger. We contacted the manufacturer for disassembly and inspection of the turbocharger, and found that there was obvious erosion and wear on the inner side of the guide blade root of the nozzle ring. There were no other abnormalities. Replace the nozzle ring and restore the exhaust temperature to normal. Exhaust temperature after replacing the nozzle ring. From this, it can be concluded that the reason for the increase in exhaust temperature of the power generation diesel engine is the erosion and wear of the nozzle ring blades, which increases the flow area of the nozzle ring, reduces the exhaust flow rate, and greatly reduces the efficiency of the turbocharger.

turbocharger of the No. 2 power generation diesel engine is a new replacement, and the operating conditions of the two power generation diesel engines are not significantly different. It can be ruled out that the poor condition of the turbocharger causes low air pressure in the turbocharger.

, the focus of work shifted to the air cooler. Firstly, the air cooler of the No. 1 power generation diesel engine was chemically cleaned, and the air cooler core was not removed. Instead, the cover plate of the air cooler body was opened, and the air cooler chamber was filled with water and a certain proportion of air cooler cleaning agent. The air cooler core was soaked for 4-5 hours, and then rinsed several times with water until the water released after cleaning was clean water. The air cooler has been thoroughly disassembled and cleaned. Before and after disassembly, there have been significant changes in intake temperature and pressure, as well as significant changes in exhaust temperature. This indicates that high exhaust temperature is also caused by dirty blockage or air bypass of the air cooler.

Next, conduct a comprehensive lifting inspection of the cylinder heads of cylinders 1-6 of the diesel engine, clean and test the pressure, replace the intake and exhaust valves and guide sleeves, grind all intake and exhaust valves to ensure their sealing, pull out all fuel injectors for pressure testing, replace unqualified fuel nozzles, disassemble and clean all high-pressure fuel pump plungers, and replace some with new ones. Finally, replace the lubricating oil of the diesel engine crankcase.

Comparing the inspection of the new and old gas valves and valve seats, it was found that the edge thickness of the suction and exhaust valves exceeded the limit (normal suction and exhaust valve  $W=4.4+0.1$ , limit  $-0.4$ ; normal exhaust valve  $W=5+0.1$ , limit  $-0.5$ ), the width of the suction and exhaust valve seats increased, and the diameter of the contact surface increased. Therefore, a new suction and exhaust valve and valve seat were replaced.

#### **4 CONCLUSIONS**

This type of power generation diesel engine often experiences high exhaust temperature during use.

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# An Exploratory Study of the PDCA Cycle in the Management of Student Union in Colleges and Universities

*Yanling Chen, Yuding Wang, Zhi Qiao, Jie Zou*

*College of Physics and Electronic Engineering, Taishan University, Tai'an City, Shandong Province, 271000, China*

**Abstract:** The university student union acts as a bridge between the university and the students, and is an essential channel for the education and management of the university. The Student Union plays an active role in students' self-management, self-education, self-service, quality development and prosperity of campus cultural life. PDCA cycle, as an important tool in the process of enterprise quality management, is used to promote the continuous improvement of university student union management, stimulate students' enthusiasm for work and exercise their ability, to improve the quality and effectiveness of student management in an all-round way, so as to promote the orderly conduct of student union management in colleges and universities.

**Keywords:** PDCA Cycle; Higher Education; Student Union Management; Pathway

## INTRODUCTION

In the management of college students, the student union is an important bridge between the college and students, teachers and students. The comprehensive quality of students in the student union will also become an example of the quality of college students, therefore, the management of student union will become one of the key points of student management in colleges and universities. In the course of practice, colleges and universities should analyze the common problems in colleges and universities according to the actual conditions of their own colleges and universities, and start to solve the problems, so as to improve the management level of student union organizations [1].

### 1. PDCA CYCLE

The PDCA cycle is also known as the Deming Cycle because it was first proposed by American quality management expert Dr. Deming. PDCA management cycle is divided into four stages, namely Plan, Do, Check and Act, according to the "Set rules, grasp the implementation, see the results, Do processing" four steps, overall management of the quality of work, will be successful in the standard, unsuccessful left to the next cycle to solve. PDCA management cycle is a

ladder-like rise, each cycle on the level of a rise, and then improve the overall quality of work. Therefore, the application of PDCA cycle will play an active and effective role in the continuous improvement and improvement of the quality and effect of college student union management.

### 2. THE NECESSITY OF CULTIVATING TALENTS BY COLLEGE STUDENT UNION

As a link between the school and the students, the student union plays a connecting role. In the daily student management, the students of the Student Union serve the school and play a very important role in the school's student management. With the development of the times, the college student union has become an important carrier to promote the reform and innovation of the ideological and political work in colleges and universities, can constantly enhance the effectiveness of ideological and political education of college students. As the core strength of the student union, the school should pay more attention to the training of student cadres to ensure that student cadres can play a good role in all aspects.

### 3. THE PROBLEMS OF PDCA CIRCULATION IN THE PRACTICE OF STUDENT UNION MANAGEMENT IN COLLEGES AND UNIVERSITIES

(1) Student Union students lack of ability to work independently. Because of their own age and cognitive limitations, lack of independent ability in carrying out work, in the implementation process of the lack of good methods, mechanically complete the tasks assigned by the teacher, lack of independence to deal with the work, lack of innovative ability and courage.

(2) Student Union students in the work of the plan is not strong. Most of the student managers are young and have little work experience. They do not have an overall plan for the overall management, which results in imprecise and imprecise planning in their work, unexpected under-estimation or lack of alternatives in different contexts led to frequent policy changes in the implementation process, which delayed progress.



(3) Lack of communication between the student union cadres, the spirit of teamwork is not high. Because of the lack of communication and communication, when the task division is not clear, interface is not clear, responsibility is not on duty, often buck-passing, problems, blame each other, blame each other phenomenon. Team Spirit is not high, everyone is responsible for the results are not responsible for everyone.

(4) The stability of the cadre ranks is weak. The mobility of student union cadres is large and relatively unstable, so how to make a scientific mechanism of student union is particularly important. Therefore, in the management of the student union, we should be flexible management, highlight cooperation-oriented, the organization to help members shape career, members to achieve a mission for the organization, both sides help each other.

#### **4. THE IMPROVEMENT OF PDCA CIRCULATION IN THE MANAGEMENT OF COLLEGE STUDENT UNION**

In order to improve the quality of student union management and the comprehensive quality of student union managers, it is very important to perfect and use PDCA cycle. After continuous summary and reflection, held a symposium for student administrators and student cadres, for the implementation of the PDCA cycle in a variety of problems improved.

(1) Make work plan reasonably. In today's network era, we should be good at using modern scientific management methods and information means, actively explore and master the management of Student Union Trends and laws of development. First, according to the overall student work, break down the tasks, in accordance with the objectives of the development of a comprehensive and specific implementation plan, not only to be fully deployed, but also to highlight the key points; second, the classification of systematic work planning, establish the key work account, realize the student union affairs fine management [2]; third, check the work plan of each department of Student Union every semester, be good at finding problems, solving problems and summing up experiences. Each student union should form a good tradition of "Passing on and helping others", it is convenient for the next student union to draw lessons from experience and carry out its work better.

(2) Improve the execution of the work. The executive stage is very important for the management of the Student Union. If the student union is to have high executive ability, we should pay more attention to the training and management of the student cadres. First, the student union should return to the original intention of serving the students, form the structure of "Presidium+Working Department", the mechanism of volunteer assistance, the mechanism of school-

school-class three-level linkage, etc., to improve the management level of student union and student cadres [3] second, to organize data analysis and management training on a regular basis, so that student cadres have the ability and skills to adapt to their posts, can complete the work of the student union efficiently, promote the standardization level of the student union management. In the process of implementation, the student union managers have to make adjustments as they go, and come up with the most reasonable plan, which forms a small PDCA cycle, that is, find a problem, re-adjust the plan, re-implement, re-check, through constant circulation, play a positive and effective role.

(3) Carefully sum up the experience and lessons. To hold regular meetings to report on the implementation of the exchange of work, to identify and deal with problems in a timely manner, to analyse the causes of the problems, to form a summary of the work, to avoid the recurrence of similar problems, and to disseminate successful experiences, as a reference for the next cycle.

#### **5. CONCLUSION**

The management of the student union is an important part of the educational management in colleges and universities. We should attach great importance to the management of the student union and do a good job in cultivating talents. At present, there are still many problems in the management of the student union in colleges and universities. Adopting PDCA cycle can optimize the management system of the student union, standardize the management of the student union, improve the overall quality of the students and maximize the educational value, then correctly construct the talent system of the student union, promote its independent operation and promote the healthy development of the school.

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# A Study on the Relationship Between Paternal Attachment and Emotion Regulation Self-Efficacy in Chinese Medical Students

Sun Peng, Elna R. Lopez\*

Lyceum of the Philippines University-Batangas, Philippines

\*Corresponding Author E-mail: elna\_lopez1967@yahoo.com

**Abstract:** In the process of changing from student identity to social identity, in addition to the great changes in the environment, students' physiology and psychology have also changed from immaturity to maturity, and their emotions and emotions also show complex and changeable characteristics that are different from those of other age groups. In particular, with the heavy academic tasks, the differences in parent-child attachment relationship and family education, the problems of emotional regulation and self-regulation efficacy have gradually become prominent. Therefore, the influencing factors of college students' self-efficacy in emotion regulation deserve further exploration.

**Keywords:** Father-Child Attachment; Family Education; Emotional Self-Regulation Self-Efficacy.

## 1. RESERCH CONTENT

College students in today's era are facing more and more pressure, in addition to heavy academic pressure, complex interpersonal pressure, parents' high expectation pressure, and College students will easily fall into a state of depression.

The purpose of this study was to understand the overall situation and interaction between college students in terms of paternal attachment and emotion regulation self-efficacy, explore the differences in demographic variables, and find out the emotional mechanism of paternal attachment and emotion regulation self-efficacy.

### 1.1 paternal attachment

Attachment mainly refers to a special emotional connection between infants and their primary caregivers. Refers to the deep, strong, and lasting emotional connections that individuals establish with others during their growth and development (Bowlby, 1979), which arise during infancy and during the interaction between infants and their caregivers (mainly parents) an emotional connection. Attachment theory was first proposed by the British psychiatrist Bowlby, who integrated the importance of intimacy and early experience proposed by Freud with habitology, cybernetics, and information processing theory, and added his own assumptions to propose attachment theory.

Yang Anbo et al. (2008) studied the relationship between attachment and self-esteem of high school students, and the results showed that the degree of attachment between an individual and his father can affect the level of self-esteem development. Holinbeck and Wandrei (1993) showed that a good parental attachment relationship can predict the life adaptation of freshman students. the research results of Armsden and Greenberg (1987) showed that individuals with high-quality attachment relationships suffer less negative impacts when faced with stress.

### 1.2 Emotion Regulation Self-Efficacy

Self-efficacy (Self-efficacy) has had a profound impact since it came out in the 1970s. It was a form of thinking in which individuals regard themselves as objects. Beliefs, judgments or subjective self-feelings associated with completing the behavior (Bandura, 1995; Gao Shenchun, 2000). With the continuous improvement and development of the theory, Bandura divided it into general self-efficacy and specific self-efficacy. Past studies have found that not every subject in the self-report can accurately judge their own emotional regulation ability, and usually the subjects' evaluation of their own ability was more high or low (Alessandri et al., 2015), so the study selects RESE as the research variable, and conducts quantitative research on children's emotional ability from the perspective of self-perception. Depression was closely related to the ability to regulate emotions. As a sense of self-control and control, individuals want to make psychological and behavioral changes that require the participation of self-efficacy (Tang Dongling et al., 2010).

## 2. RESERCH METHODS

### 2.1 Research Design

This study used the survey method with standardized questionnaire as main gathering tools the use of professional software to conduct quantitative analysis on the results of the questionnaire survey, and draw research conclusions from the analysis results.

### 2.2 Participants

Respondents were enrolled in the year (2022-2023), and only five hundred (500) adult medical students participated. the said respondents were chosen using

the random sampling technique in which questionnaires administered to them were numbered from 1 to 4000 respectively. the respondents were chosen using the random sampling technique where from the total number, number eight was randomly picked, thus every sixth numbered questionnaires were selected as participants.

### 2.3 Measures

#### 2.3.1 Inventory of Parent and Peer Attachment Scale, (IPPA-R).

This was the test used in measuring father-son attachment. the parent-child attachment subscale in the revised Parent-Peer Attachment Scale was selected, which is suitable for college students.

#### 2.3.2 Regulatory Emotional Self-efficacy Scale, (RES).

In measuring college students emotion regulation self-efficacy, this scale was utilized by the researcher. the Chinese version of the RES scale translated by Li Xiaoyun et al. (2011) and Jin Muyang (2017) was selected.

### 3. RESULT

**Table 1** Correlation Matrix of the Variables of the Study n=501

|                     | Regulation Self-efficacy |         |                |
|---------------------|--------------------------|---------|----------------|
|                     | rxxy                     | P-value | Interpretation |
| Parent's Attachment | .949                     | .000    | HS             |

*Legend: Relationship is significant at 0.05 alpha level*  
Table 1 shows the correlation matrix of the variables studied. From the above results, it can be seen that there is a strong correlation between paternal attachment and self-emotion regulation. Represents a positive correlation between these three variables. the p-value of 0.000 as obtained means that there is a less than 0.01% chance that the observed correlations are due to random chance. This strong evidence suggests that the relationships between the variables are genuine and not simply the result of random fluctuations in the data.

Thus, parental attachment also had a strong, statistically significant positive correlation with regulating self-efficacy. This suggests that children with stronger attachment to their parents tend to have higher self-efficacy in terms of emotional regulation.

### 4. CONCLUSIONS

Respondents have average professional commitment, normative organizational commitment, average work engagement, and "considerable" self-efficacy. There were no significant differences between variables when grouped by gender, grade, family structure, father's family role, father's education level, father's nature of work, and monthly household income.

There was a significant correlation between the evaluation of parent-child attachment and the uneven

distribution of educational resources in non-single-child families, which would lead to different degrees of dependence on parents among different children.

### 5. RECOMMENDATIONS

Chinese New Era medical students may explore all possible avenues to obtain education, such as professional development seminars, conferences, or continuing education, and participate in various activities to maintain and exercise their vision and emotional regulation skills.

School administrators may implement interventions to strengthen job engagement by providing productive feedback on communication training and emotion management, and to establish working conditions that allow students to perceive themselves as having a high level of competence and a desire to recognize future development opportunities.

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# Focusing on Holistic Education to Cultivate Key Abilities

Gao Ting

Xin Feng Primary School, Chongqing, China

**Abstract:** In the context of the new era, as China's education curriculum reform enters a comprehensive and in-depth phase, education in various subjects faces the significant challenge of cultivating students' key abilities and implementing the educational concept of moral and intellectual development. The "Opinions on Deepening the Reform of the Education System and Mechanism" issued by the General Office of the Central Committee of the Communist Party of China and the General Office of the State Council explicitly states the need to "focus on cultivating key abilities that support lifelong development and meet the requirements of the times." With the advancement of globalization, the status and role of the English discipline in nurturing abilities and fostering holistic development have steadily increased. This undoubtedly triggers profound reflections among schools and teachers on how to concretely integrate the cultivation of key abilities into subject teaching.

**Keywords:** Key abilities; Holistic education; English teaching

## I. BACKGROUND OF KEY ABILITY CULTIVATION

From the perspective of international education, the cultivation of comprehensive qualities and key abilities for talents in the new era has become an increasingly urgent demand. This emphasizes the need to focus on cultivating students' personal abilities and qualities, reflecting a major focus and priority of current international education reforms. Many countries have formulated their own frameworks for core competencies based on their national conditions and educational goals. These frameworks define the basic connotations and levels of core competencies to be cultivated and revise curricula and teaching methods accordingly.

Looking at the background of domestic education reform, China is closely following the trend of the times by refining the core competencies of various subjects, promoting the reform of the examination system. Currently, China's basic education curriculum reform has entered a comprehensive and in-depth stage, and school education in the context of the new era faces the significant challenge of developing students' core competencies and implementing the fundamental task of moral and intellectual development. Taking the English

discipline as an example, China strongly advocates the integration of language learning with the concept of holistic development, cultivating core competencies such as improving students' self-awareness, self-management and planning abilities, scientific literacy, critical thinking, and logical deduction abilities, promoting comprehensive physical and mental development.

The revision of the general high school curriculum standards initiated by the Ministry of Education in 2014 conforms to the development laws and trends of education reform, showing high scientificity and timeliness, laying a solid foundation for further deepening the reform of basic education curriculum. The "Opinions on Deepening the Reform of the Education System and Mechanism" issued by the General Office of the Central Committee of the Communist Party of China and the General Office of the State Council explicitly states, "We must focus on cultivating key abilities that support lifelong development and meet the requirements of the times. In the process of cultivating students' basic knowledge and skills, we should strengthen the cultivation of students' key abilities."

## 2. INTERPRETING THE BASIC CONNOTATIONS OF KEY ABILITIES

The "Opinions" appropriately stratify the competencies needed throughout a person's life: basic competencies in common competencies, such as basic reading, writing, and arithmetic skills, and an understanding of the rules of modern civilization; core competencies in common competencies, such as cooperation, communication, innovation, critical thinking, and other abilities; and professional competencies, which are the specialized competencies individuals need to possess. Among the advanced competencies in the second layer, the "key abilities" to be discussed in this article are more advanced requirements beyond the previous concepts of "comprehensive development," "three-dimensional goals," and "quality education."

After refining, the "Opinions" propose five main abilities under "key abilities": innovation ability, thinking ability, cooperation and communication ability, information literacy, and self-management ability. These abilities precisely target key areas for student competence development, facilitating

educators in clearly defining and focusing on the key goals of education.

Firstly, innovation ability requires individuals to establish a strong awareness and spirit of innovation. In practice, individuals should cultivate innovative thinking patterns and habits, apply theories to practice, summarize patterns through continuous experimentation, face failures, actively explore, and, based on this foundation, use imagination, break free from habitual thinking, enhance innovative ability, and think about and view things from a unique perspective to make practical contributions.

Secondly, thinking ability focuses on the training of critical thinking. This includes the effective use of logical thinking to discern, analyze, infer, induce, and summarize various information and opinions, seeking new knowledge, not fearing authority, daring to question, critically reflecting on behavior, and continuously improving.

Thirdly, cooperation and communication ability refer to an individual's ability to establish a team spirit, cultivate a strong sense of social responsibility, actively participate in public affairs, clearly and expressively articulate one's own views, communicate thoughts and emotions effectively, respect others' viewpoints, seek common ground while reserving differences, and strive to achieve consensus to realize common goals.

Fourthly, information literacy involves individuals being adept at using various channels such as technology and online media to obtain information. They should judge and discern information reasonably, effectively disseminate and communicate information, widely use valid information to solve practical problems in life and learning, and improve behavioral outcomes.

Fifthly, self-management ability mainly reflects an individual's high level of autonomy and subjectivity. They can accurately grasp their strengths and weaknesses, respond to challenges from the external environment proactively, continuously monitor their behavior trends and results, establish appropriate goals, allocate time reasonably, reflect continually, and promote development.

### **3. CURRENT STATUS AND PROBLEM ANALYSIS OF SUBJECT TEACHING**

Currently, a significant problem in Chinese education is the serious imbalance in cultivating students' qualities, emphasizing the imparting of basic knowledge in subjects while neglecting the cultivation of students' key abilities. This imbalance leads to one-sided emphasis on subject knowledge in classrooms, resulting in dull and uninteresting classes, causing students to lose interest in learning.

#### **3.1 Emphasis on Knowledge Imparting, Neglect of Ability Cultivation**

Facing the pressure of exams or regional quality assessments, current subject teaching still focuses on improving students' test-taking skills, and the

phenomenon of blindly pursuing exam scores is still common. Despite China's recent strong advocacy for cultivating students' core competencies and emphasizing comprehensive development, the actual education situation is not optimistic. Phenomena such as schools occupying students' free time with supplementary classes are becoming increasingly prevalent, contradicting the current national advocacy of core competencies and key ability cultivation. Subject education should aim to improve students' overall quality, exercise various skills and abilities, enabling students to become the pillars of the nation with both cultural knowledge and sound physical and mental health.

Taking the English discipline as an example, many teachers still place the teaching focus on knowledge imparting, failing to recognize the uniqueness of English as a language-oriented discipline. For instance, there is a one-sided emphasis on the correctness and standardization of grammar, overlooking the improvement of students' practical language application abilities. Students educated in this manner often lack autonomy in learning and have lower levels of critical thinking, unable to experience the joy of language learning and the importance of language application.

#### **3.2 The Classroom: Dull and Lifeless, "Cramming" Teaching Methods Still Prevail**

One of the essential teaching objectives in the field of English, as a linguistic discipline, is undoubtedly to enhance students' language expression and communication abilities. This requires teachers to carefully design classroom activities, employ various formats to create favorable language learning environments, and provide opportunities for the improvement of students' language abilities. The aim is to encourage students to truly speak English, understand the value of English as a tool for communication, and break free from the constraints of "mute English."

However, there are still many teachers who persist in the traditional "cramming" approach, directly imparting knowledge to students. The teaching content mostly revolves around the knowledge points involved in quality assessments, with little emphasis on activities that enhance students' thinking and key abilities. This results in monotonous English classes, causing students to gradually lose interest in learning.

### **4. MEASURES AND SUGGESTIONS FOR CULTIVATING KEY ABILITIES**

The cultivation of students' key abilities is a long-term, complex, and progressively enhancing process, encompassing various aspects such as knowledge, skills, emotional attitudes, etc. After identifying the basic connotations of key abilities and the current issues in subject teaching, the pressing question is how to practically implement the cultivation of key abilities through subject teaching.

#### 4.1 Teachers as Collaborators and Facilitators of Student Learning

The uniqueness of the teaching profession lies in the diverse roles teachers play. Besides being the basic disseminators of knowledge and organizers of teaching activities, teachers should strive to become collaborators and facilitators of student learning. On the one hand, teacher authority is essential for class cohesion and student management. On the other hand, teachers should focus on building good teacher-student relationships by understanding students' unique physical and mental development characteristics. Teachers must recognize the subjective position of students in learning, playing the roles of guides, helpers, and facilitators. In such an environment, students will actively share their thoughts and challenges with teachers, and teachers will provide appropriate guidance and support based on individual situations. This changes the traditional image of teachers as absolute authorities, making students realize that teachers are part of their community, narrowing the psychological distance, and promoting equal and harmonious teacher-student relationships.

#### 4.2 Focus on Context, Use Questions to Facilitate Learning

The traditional classroom teaching model often involves a single form of teacher asking questions and students answering. Students, accustomed to sitting quietly and listening to the teacher's explanation, may not engage their minds actively and may not raise questions. This largely reflects students' lack of interest in learning and their passive acceptance of knowledge. However, the development of thinking skills typically begins with asking questions, whether actively through observation or by critically thinking about the questions posed by the teacher. It can effectively stimulate students' active thinking.

In teaching, teachers should actively create real and beneficial learning situations, formulate precise questions, guide students to think critically, and find evidence in the text to answer questions. This process encourages deep text interpretation, helps students understand the connotations of the text, and develops logical thinking skills. Importantly, teachers' questions should be closely related to students' real-life experiences, motivating students to actively participate in problem-solving driven by interest, allowing them to truly have something to say.

#### 4.3 Promote Integration of Information Technology and English Classroom Teaching

A significant difference between modern and traditional classrooms is the integration of information technology. Modern education, marked by a high degree of informatization, combines information technology with classroom teaching to effectively stimulate students' interest in learning, enrich teaching content, create authentic and vivid learning situations, enhance learning efficiency,

improve educational quality, and cultivate students' ability to independently learn in the rapidly changing information age.

To better promote the integration of internet information technology and English classroom teaching, teachers must first update their educational concepts. They should adopt an open attitude towards learning information technology teaching methods and actively incorporate them into daily teaching practices. Secondly, schools should increase investment, establish supporting hardware and software facilities, providing rich channels for teachers' teaching and students' learning to access network resources. Lastly, schools should conduct regular training for teachers, ensuring that each teacher is proficient in the use of information technology teaching methods.

#### 4.4 Adopt Developmental Teaching Evaluation Methods

Developmental teaching evaluation aims to promote not only the identification and selection of students but also the development of students' potential, personality, and creativity. The key is for teachers to view each student with a developmental perspective, respect individual differences, focus on students' development processes, and provide reasonable evaluations based on students' past performance and existing foundations. This helps establish future development goals. Teachers should use a flexible range of evaluation methods, combining quantitative and qualitative assessments, integrating formative and summative evaluations, and employing scientific assessment methods such as growth portfolios and learning diaries. Evaluation emphasis should be placed on students' collaborative inquiry and innovative practical abilities, avoiding the tendency to unilaterally emphasize subject knowledge.

### 5. CONCLUSION

The cultivation of students' key abilities aligns with the trend and requirements of cultivating talents in the new era, possessing scientific and timely characteristics. Its demand for students' collaborative abilities, communication skills, self-planning, and creative thinking reflects the urgent requirements of technological and socio-economic development. It aims to help students better face the opportunities and challenges of the new era, unleash their potential, and maximize their personal value. The ultimate enhancement of key abilities depends on the concrete implementation of subject teaching practices. For English teaching, accurate comprehension of the basic connotations of key abilities, targeted improvement of teaching processes and methods, attention to the student's subjective position, and implementation of concepts in every detail of teaching and learning are necessary to truly achieve the goals.

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# Research On the Online and Offline Blended Learning Mode of College English

*Xie Linlin*

*College of Foreign Studies, Guilin University of Technology, No. 12 Jiangan Road, Qixing District, Guilin city, Guangxi, China*

**Abstract:** In the era of rapid development of information, with the continuous improvement of science and technology, teaching modes are constantly optimized, and teaching reforms are gradually carried out. Online and offline blended learning has become one of the important methods of college English teaching. Based on the analysis of the important value of online and offline blended learning methods in college English, this article proposes optimization strategies on how to promote the better results of online and offline blended learning in college English and improve the quality of college English teaching.

**Keywords:** Blended Learning; Online and Offline; College English

## 1 INTRODUCTION

With the rapid development of computer technology, multimedia, network and communication, the 21st century has witnessed a knowledge economy era characterized mainly by informatization. With the arrival of this new era, information technology has greatly promoted the development of education. With the current reduction in English class hours, the blended mode of "online and offline" college English teaching has gradually been recognized and implemented. The online and offline blended learning mode is a mode that combines online courses with traditional teaching. The main purpose of blended learning is to optimize the selection and combination of various skills, learning elements, and learning methods.

## 2 BLENDED LEARNING

Blended Learning originally refers to the combination of various learning methods. He Kekang (2004) pointed out that after entering the 21st century, with the popularization of the Internet and the development of e-learning, blended learning has been endowed with a new meaning on the basis of its original connotation. The so-called Blending Learning is to combine the advantages of traditional learning methods with those of e-Learning (i. e., digital or networked learning). That is to say, teachers should not only play a leading role in guiding, inspiring and monitoring the teaching process, but also fully motivate students' initiative, enthusiasm and

creativity as the main body of the learning process [1]. Li Kedong (2004) defines blended learning as a blend of online learning and face-to-face learning [2]. On the surface, it is a mixture of two kinds of teaching forms. On the deeper level, it is a mixture of teaching modes based on different teaching theories, a mixture of teachers' leading activities and students' participation, a mixture of classroom teaching and online learning environment, a mixture of different teaching media, and a mixture of classroom teaching and virtual classroom or virtual communities. Through combining face-to-face education with computer-based education, blended learning optimizes and integrates various course resources, realizes individualized learning and improves students' thinking ability.

Currently, blended learning has become the mainstream mode of foreign language teaching in Universities in China. Although a large number of researches have shown that this teaching mode can help to solve the contradiction between the limited capacity of traditional classroom teaching and students' individualized learning needs, and can also promote learners' learning interest and self-learning ability, how to effectively integrate face-to-face learning and web-based learning, optimize the existing blended learning mode and improve the effectiveness of teaching and learning is still an important issue in the current foreign language teaching reform.

## 3 THE ADVANTAGES OF THE ONLINE AND OFFLINE BLENDED LEARNING MODE

In traditional offline college English teaching, classroom teaching is the only way for teachers and students to communicate. In order to complete the teaching task, teachers are the leader. Most of the time in the classroom is dominated by the teacher's lecture, with students passively listening and having little practice time. Teacher-student interaction and student-student interaction are limited [3]. Although teachers can use multimedia equipment to improve the language learning environment through Multi-sensory input, classroom equipment conditions and functions are limited. Although teachers can use courseware to improve efficiency, knowledge teaching still occupies a large amount of classroom



time. Although teachers repeatedly emphasize and require students to do preparation before class, there is a lack of effective supervision methods. Teachers can only rely on their teaching experience and students' on-site feedback to promote teaching in the classroom. Although teachers try to take care of every student in the classroom, the depth, breadth, capacity, and the pace of teaching are objectively unified throughout the classroom, making it difficult to effectively tailor teaching to individual needs and meet the personalized learning needs of students. It is inevitable that top students are not satisfied and the backward students cannot keep up. These "defects" make traditional college English teaching widely criticized and difficult to break through.

Online teaching can effectively overcome these deficiencies, break through space and time constraints, and students can learn anytime and anywhere. Teaching content can be presented in various forms such as text, sound, pictures, videos, games, interactive courseware, etc. Teachers and students can interact online in real time, and online assignments and online tests allow teachers to dynamically grasp the learning situation. Students can arrange their own learning schedule. Although online teaching has these advantages, it also has disadvantages. Compared with offline teaching, online learning lacks a sense of ritual, mission, and pride, and lacks the sense of authority given by real-life face-to-face interaction with teachers. Without a large number of classmates around, there is a lack of participation in learning, which will result in insufficient learning motivation, lack of tension during learning, weak concentration, low sensitivity, and insufficient depth of thinking, which ultimately affect learning effectiveness. It can be seen that online and offline learning mode has their own advantages and disadvantages, but they are naturally complementary. If they can be integrated effectively, and complement each other they can generate a synergistic effect [4].

#### **4 STRATEGIES OF THE ONLINE AND OFFLINE BLENDED LEARNING MODE OF COLLEGE ENGLISH**

##### **4.1 Arranging Online and Offline Teaching Content Reasonably**

Online and offline teaching is mainly divided into student tasks and teacher tasks. Through the combination of student tasks and teacher tasks, the teaching content of online and offline learning can be reasonably arranged. In online teaching, students can learn about unit topics through relevant teaching videos posted by teachers on online platforms, and complete independent online learning of related vocabulary, sentences. They can also complete the relevant assessment published by the teacher. In online learning, teachers mainly publish teaching content and conduct online evaluations. In offline learning, students reproduce scenarios based on unit

themes, fully tap into their potential for thinking and imagination, enrich learning content, and expand learning themes. At the same time, students can be divided into groups based on their online learning situation to discuss the main idea of the article, long and difficult sentences, and related vocabulary issues. They organize group questions and have them answered by teachers in offline classrooms. In offline teaching, teachers mainly help students grasp the main idea of the article, answer the questions raised by students, and expand their knowledge. In offline teaching, teachers should engage in communication and discussion on understanding the theme of the article with students, correct students' problems in pronunciation, theme understanding, summarize unit themes, and complete the evaluation of learning outcomes in online and offline courses.

##### **4.2 Using multiple teaching tools and approaches**

In order to improve the effect of online and offline learning, the updating and optimization of teaching methods has a strong influence on the improvement of students' interest in English learning. Nowadays, smart classroom has become an important part of teaching, but the real realization of smart classroom needs to realize the emancipation of students' minds, making them no longer be afraid of inaccurate pronunciation and improper word usage which may cause psychological burden on them. In online teaching, English teachers use the advanced network platform to guide students to achieve thinking collision through online interaction, to actively explore the learning content, and build a holistic and harmonious learning environment. In offline teaching, teachers can use various means to improve students' English learning effectiveness. For example, teachers can display classroom learning content to students in different forms such as movies, TED speeches, Tiktok videos etc. through the network platform, require students to complete corresponding learning tasks, and examine students' learning effects through group mutual evaluation and other means in offline classes, stimulate students' learning interest, and achieve the effect of quantitative change into qualitative change.

##### **4.3 Conducting Learning Evaluation**

Learning evaluation is an important link in the process of blended learning in College English, which runs through the whole teaching process. How to evaluate teaching and learning more accurately and objectively is an important indicator for evaluating teaching mode and teaching effect. Therefore, it is necessary to track the learner's learning process, analyze the learning results, and evaluate learners more comprehensively and accurately in an all-round way, and establish a diversified evaluation system. In the process of learning evaluation, we should consider the links and contents of learning activities comprehensively, adopt flexible and diverse evaluation methods, and set up an evaluation

mechanism that is conducive to guiding learners to achieve teaching objectives with a definite aim. Such a learning evaluation system can help to strengthen teachers' sense of responsibility, adjust teaching strategies in time, and supervise and guide learners more effectively. the evaluation criteria should take some aspects into consideration, such as teachers and students' satisfaction with learning results, the improvement of self-learning ability, the satisfaction of teaching methods, the improvement of innovative awareness and innovative ability [5].

The evaluation methods can be flexible and diverse. It can be assessment of learning made by teachers, evaluation of teaching made by students, group view or self-evaluation by students themselves. the traditional teaching evaluation is mainly based on the scores of students' classroom performance, experiment, quiz and examination. On the basis of traditional evaluation, the teaching evaluation system under the blended learning mode can also incorporate the performance of network interaction, learning progress, individual report, achievement evaluation, group discussion and interactive activity into the scoring criteria, which can not only enable students to have a better understanding of their own characteristics, thus formulating more scientific learning strategies, but also make this multidimensional evaluation more objective and accurate, which is conducive to motivating students' learning. In addition, the formative evaluation of learning process should be emphasized. the enthusiasm of online and offline learning, the improvement of learning ability and the ability of cooperation and interaction with peers should be paid attention to.

### **5 CONCLUSION**

In the information era, the advantages of blended learning are obvious. But if teachers only play electronic courseware on the online teaching platform, without designing the teaching process, homework and test, and if teachers still give priority to lectures with less discussion and interaction in offline teaching, the expected effect of blended learning can

not be achieved. To embody the advantages of blended learning, teachers should start with instructional design, teaching resources and teaching evaluation to improve the effectiveness of blended learning in College English, so as to achieve the expected effect of blended teaching.

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# Analysis of Collaborative Development Strategies for E-Books and Paper Books

Su Zhi

Taishan University, Taian, Shandong Province, 271000, China

**Abstract:** With the rapid development of digital technology, e-books, as an emerging form of reading, are gradually changing people's reading habits. However, as an important component of traditional reading methods, paper books still hold an irreplaceable position. In order to achieve the coordinated development of e-books and paper books, it is necessary to conduct in-depth research on the relationship, advantages and disadvantages, and how to complement each other between the two. This topic will focus on exploring the collaborative development strategy between e-books and paper books, in order to provide readers with a richer and higher quality reading experience.

**Keywords:** E-books; Paper books; Collaborative development; Book reading

## INTRODUCTION

The so-called books are actually the main medium for recording historical development and expressing public emotions, providing powerful auxiliary tools for people to obtain rich knowledge and experience. For paper books, they mainly rely on paper media, which are cultural carriers recorded through text, including books, newspapers, literature, etc; Electronic books, on the other hand, display content to readers through electronic readers, with the characteristic of portability, making reading more convenient for readers. However, with the progress and rise of the information age, paper books are gradually being replaced by e-books, becoming an important way of reading for people. If the two are developed in synergy, it will inevitably generate greater advantages, and the audience will also become increasingly broad, allowing the two to coexist for a long time and develop in a better direction.

### 1. THE ADVANTAGES AND DISADVANTAGES OF PAPER BOOKS

Advantages: the advantage of paper books lies in their large amount of information. A good book can bring great benefits to readers and benefit greatly after reading it. In addition, paper books have a special aroma of paper and ink, providing a sense of enjoyment during the reading process. Furthermore, the collection value of paper books is also a significant feature. Some classic and valuable books

are worth collecting, and after time, their value may be even higher. In addition, paper books are more in line with traditional reading methods, and for those who enjoy reading, they are an irreplaceable medium. Disadvantage: the information contained in paper books is fixed and the content will not change due to the reader's reading speed; Paper books cannot achieve information sharing while reading, and cannot share reading experiences with others at the same time; the preservation of paper books requires specific environments, such as light, dust, and moisture prevention, and the finished paper books cannot be reused, resulting in certain waste. With the popularization of e-books, the environmental advantages of paper books are no longer obvious [1].

### 2. THE ADVANTAGES AND DISADVANTAGES OF E-BOOKS

Advantages: Electronic books have a large capacity, can be compressed and processed, suitable for transmission and collection, which is incomparable to traditional books. Electronic books are bilingual, easy to access, can expand adults' horizons, and enhance cross-cultural awareness. Electronic books can be reused during retrieval, and paper books may be damaged over time, but electronic books are not affected by time. Electronic books have strong resource sharing, It can be quickly transmitted through the network or used by multiple people simultaneously. Disadvantages: Electronic books may experience screen flickering, reflection, and other issues during the reading process, which can affect the reading experience. Electronic books require electronic devices to read, and if readers do not have suitable reading devices, it can affect the convenience of reading. the copyright protection of electronic books also needs to be noted. If readers want to share or disseminate electronic books, they need to comply with relevant laws and regulations, otherwise they will face copyright disputes.

### 3. THE DEVELOPMENT STATUS OF E-BOOKS AND PAPER BOOKS

3.1 The content of e-books is becoming increasingly rich, and the growth space is limited

The richness of content in e-books is indeed constantly increasing, mainly due to the development of electronic technology and the efforts of the publishing industry. E-books not only contain

traditional textual content, but also multimedia elements such as images, sound, and video, making them more vivid and interesting. At the same time, the retrieval and reading methods of e-books are also more convenient, fast, and popular among readers. However, the growth potential of e-books is to some extent limited. For many readers, the reading of e-books still requires electronic devices, and the cost and portability of electronic devices are still factors to consider. In addition, issues such as battery life and screen quality of electronic devices are prone to occur, ultimately affecting the reading experience of readers.

3.2 The paper book market is shrinking and still occupies the main market share

The paper book market is indeed shrinking, mainly due to the development of digitization and the improvement of environmental awareness. Nevertheless, paper books still occupy the main market share, and for many readers, the tactile sensation and focus during reading of paper books cannot be replaced by electronic devices [3]. Some books that require repeated reading, learning, or long-term preservation, such as classic literature, historical documents, etc., still choose to purchase paper books.

#### **4. THE COLLABORATIVE DEVELOPMENT RELATIONSHIP BETWEEN E-BOOKS AND PAPER BOOKS**

##### 4.1 Long term coexistence of e-books and paper books

The collaborative development relationship between e-books and paper books is a complex and important topic, each with its own advantages and disadvantages, but there is also a certain degree of complementarity. In the foreseeable future, e-books and paper books will coexist for a long time due to the diverse reading habits and needs of readers. Some readers prefer the tactile and visual effects of paper books, while others prefer the portability and flexibility of e-books. At the same time, the publishing industry is constantly exploring and innovating, seeking new business models and solutions to meet the needs of readers. Therefore, coexistence of the two is a reasonable expectation.

##### 4.2 Complementary functions between e-books and paper books

Although e-books and paper books have differences in reading experience, they complement each other in terms of functionality. E-books can provide more reading resources, including various types of books, academic literature, reference materials, etc., and their prices are relatively low. Paper books, on the other hand, pay more attention to the enjoyment of reading experience, especially for some classic works and literary works. Readers tend to choose paper versions for better tactile and visual effects. Therefore, the two can complement each other and meet the needs of different readers.

##### 4.3 The influence of paper books is gradually weakening

With the continuous development and popularization of digital technology, the influence of paper books is gradually weakening. However, this does not mean the extinction of paper books. On the contrary, paper books still hold an irreplaceable position in certain fields, such as important academic and literary works. Meanwhile, with the development of digital technology, the publishing industry is also seeking new business models and solutions to adapt to market changes and reader needs.

Overall, the collaborative development relationship between e-books and paper books is a complex and important issue, where competition and complementarity coexist, requiring joint efforts and cooperation from the publishing industry, readers, and government. Firstly, the publishing industry needs to constantly innovate and explore, find business models and solutions suitable for the digital age, including developing more convenient and efficient digital reading platforms, providing more reading resources and services, and also paying attention to protecting copyright and intellectual property rights. In addition, the publishing industry also needs to strengthen communication and interaction with readers, understand their needs and feedback, in order to better meet their needs. Secondly, readers need to gradually adapt to the reading methods of the digital age, learn how to read and learn on electronic devices, and pay more attention to the quality and experience of reading. They not only pursue convenience and quantity of reading, but also need to pay attention to the depth and thoughtfulness of reading [4]. Finally, the government and society also need to strengthen the promotion and publicity of digital reading, and improve the public's awareness and acceptance of digital reading. At the same time, the government should strengthen the protection and management of digital copyright and intellectual property, providing a good environment and guarantee for the development of digital reading. In short, the collaborative development of e-books and paper books requires multiple efforts and cooperation. Only through continuous innovation, adaptation to market changes, emphasis on reading quality and experience, strengthening copyright protection and management, can the collaborative development of the two be achieved, providing readers with better reading experiences and services.

#### **5. STRATEGY FOR COLLABORATIVE DEVELOPMENT OF E-BOOKS AND PAPER BOOKS**

##### 5.1 Simultaneous publication of e-books and paper books

Synchronous publishing is an effective strategy because e-books and paper books have similar publication times, which can meet the needs of different readers, increase book exposure, and have the opportunity to gain more readers on multiple

platforms. When selecting content, publishers need to carefully consider which books are suitable for electronic versions and which are suitable for paper versions. For books that are suitable for electronic versions, interactive, audio or video content can be selected to attract young readers. Additionally, providing a diverse reading experience is also crucial. E-books can provide a convenient and fast reading experience, while paper books can provide a more traditional way of reading. Therefore, publishers can provide both electronic and paper versions to meet the needs of different readers. In addition, publishers can also meet the preferences of different readers by providing different reading devices, such as mobile phones, tablets, e-book readers, etc. Finally, strengthen publicity and promotion. the collaborative development of e-books and paper books requires more promotion and publicity. To this end, publishing houses can promote and advertise e-books and paper books through various channels, such as social media, advertising, online and offline activities, to attract more readers to pay attention and purchase. In short, the coordinated development of e-books and paper books requires a series of strategies to balance their advantages and overcome their respective shortcomings. Through the above strategies, the coordinated development of e-books and paper books can be promoted.

#### 5.2 Independent pricing of e-books and paper books

The pricing of e-books can be independent of paper books, based on their digitization, portability, and ease of sharing characteristics. Firstly, the price of e-books can be set based on the uniqueness and depth of their content. For example, a profound academic work or a rich textbook may be priced relatively high due to its relatively high production cost. Meanwhile, as e-books do not require physical carriers, prices can be adjusted more flexibly to meet market demand. Secondly, the price of paper books is usually related to factors such as production costs, brand value, and market positioning. the pricing of paper books usually needs to consider the costs of multiple links such as printing, binding, logistics, and sales channels. Its pricing strategy also takes into account market competition and consumer demand to ensure competitiveness in the market. Therefore, the collaborative development strategy of e-books and paper books should consider their respective characteristics and market positioning, and then adjust according to market demand. the pricing of e-books and paper books can be independent of each other to adapt to their respective characteristics and market environment. For example, certain specific e-books can be priced separately to highlight their uniqueness and quality; Meanwhile, for most paper books, pricing still needs to take into account factors such as production costs and market positioning. When implementing this strategy, it is necessary to ensure consistency in content, quality, and price

between e-books and paper books to maintain brand image and consumer trust. In addition, promotional measures such as offering coupons and bundled sales can also be used to encourage consumers to purchase both e-books and paper books simultaneously, thereby achieving synergistic development between the two [5].

#### 5.3 The advantages of integrating e-books with paper books

Firstly, fully integrate the advantages of e-books and paper books. Electronic books have the advantages of portability, portability, and easy access at any time, while paper books can provide an immersive reading experience and meet the emotional needs of readers. Therefore, combining e-books with paper books and choosing to use them according to different reading needs, such as frequent reference books, professional books, etc., can recommend using e-books; For literary works and popular science books that require deep reading and immersive experiences, it is recommended to use paper books. Secondly, strengthen the interaction and communication between e-books and paper books, establish a sharing platform between e-books and paper books, integrate high-quality e-book resources with paper books, and achieve resource sharing and exchange. Then, regular interactive activities will be held between e-books and paper books, such as the combination of paper and e-books for reading, to help readers better understand and master knowledge through the interaction. Only in this way can we better meet the reading needs of readers and promote the prosperity and development of reading culture.

#### 5.4 Emphasize copyright protection and content co construction

Copyright protection is the foundation of the development of e-books. Only by protecting copyright well can we attract more authors and publishers to participate in the production of e-books, thereby enriching the content of e-books. At the same time, paper books can also collaborate with publishing houses to jointly develop high-quality content and promote the coordinated development of paper books and e-books. Firstly, it is necessary to establish a sound copyright protection mechanism. the government and industry associations should strengthen supervision, formulate stricter copyright regulations, and combat piracy and infringement. At the same time, publishers and authors should also strengthen their self-protection awareness, sign copyright agreements, and ensure that their rights are not infringed upon. Secondly, it is necessary to strengthen content co construction. Paper books and e-books can complement each other and work together to create high-quality content. In this regard, publishers can collaborate to jointly develop high-quality content, convert the content of paper books into the form of e-books, or convert the content of e-books into the form of paper books, thereby achieving

content sharing. At the same time, publishers can also collaborate with technology companies to utilize advanced technological means to develop a more diverse range of e-book formats to meet the needs of different readers. In addition, publishers and authors can establish a long-term cooperation mechanism. Authors can authorize publishers to digitize and digitize their works, and publishers can also provide authors with certain economic rewards and social honors, achieving a win-win situation for both parties. Finally, it is necessary to strengthen publicity and promotion. Publishing houses can promote the collaborative development concept of e-books and paper books through various channels, attracting more readers to pay attention and purchase. At the same time, technology companies can also utilize technologies such as big data and artificial intelligence to provide readers with more accurate recommendation services, improve the reading rate and market share of e-books, and promote mutual development between both parties [6].

## **6 CONCLUSION**

In summary, in the current social environment, both e-books and paper books have their own suitable application scenarios and can coexist. But if we want to achieve the coordinated development of e-books and paper books in the current context, it has become a key issue for related industries to explore. We are innovating reading scenarios, identifying the advantages of the two, and then integrating them to

form a new reading experience that meets the needs of more readers.

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# Research on Energy Consumption Simulation Technology of Rural Prefabricated Building Based on Bim

Ly Junyi

Zibo Vocational College, Zibo, Shandong, China

**Abstract:** Rural buildings have lacked attention to the energy saving and environmental protection aspects of buildings for many years due to the constraints of technical conditions and economic levels, and have a greater potential for building energy saving. In this study, a building in central Shandong was investigated to explore the impact of different parts of the envelope on the energy consumption during the whole building operation period through BIM technology and to evaluate the energy efficiency of different retrofit solutions. Through the analysis, the adoption of an assembled envelope with good thermal performance can save a considerable amount of energy during its whole life cycle. the optimal retrofit option saves 2, 374 yuan per year in energy expenditures compared to the status quo option. the use of an assembled thermal insulated roof had the highest overall building energy efficiency of 9.16%, followed by precast concrete composite insulated sandwich wall panels, and hollow double-glazed broken-bridge aluminum alloy windows and doors.

**Keywords:** Building Energy Efficiency; Prefabricated Building; Energy Simulation; BIM

## 1 INTRODUCTION

Compared with residential buildings in towns and cities, rural buildings have larger size coefficients, poor thermal performance of the buildings, and the residents' awareness of energy conservation is weak, thus generally attaching insufficient importance to building energy conservation. Therefore, there is a huge potential for energy-saving renovation of rural residential buildings. As there are many factors affecting the energy consumption of buildings, mainly the building envelope, building components, occupant behavior, building orientation, building size and shape, etc. According to the International Energy Agency (IEA), the thermal performance of the building envelope is critical in determining internal energy consumption. Studies have shown that lower energy consumption can be attributed to improved insulation and more efficient building components. Xu et al. used EnergyPlus to optimize building

orientation in some typical cities in China, focusing on the performance analysis of building energy efficiency. Al-Fahmawee used mathematical methods, such as linear regression modeling, to determine the effect of different floor heights and building orientation on the level of atrium lighting. As one of the most convenient and effective measures, building envelope renovation has become a necessary part of rural residential renovation. This paper takes a typical rural lodging building in central Shandong as the research object, and explores the best solution for energy-saving renovation in combination with the local actual situation.

## 2 STATUS OF EXISTING BUILDINGS ON THE GROUND

In order to gain an in-depth understanding of the existing building forms and the surrounding environment in the rural areas of central Shandong Province, a rural lodging building in Zibo City, Shandong Province, was selected for research. the average altitude of the region is about 500 meters above sea level, with hot summers and high precipitation. Due to the construction of different rural residential building styles, building materials, spatial layout and structural form of different construction years are obvious differences. the existing buildings are mainly divided into five categories according to the age of construction: buildings of the Ming and Qing Dynasties, the building layout of the ancient courtyard form in the north, and the building materials are mainly green bricks. Into the 21st century, with the rapid development of the local economy, more and more families began to build their own villas on their own home bases, and such villas are mostly detached villas, which generally use frame structures, non-load-bearing building materials, mostly solid clay bricks, and fewer thermal insulation measures for the enclosure structure.

Due to the cost and aesthetics, rural tourism projects often choose brick-concrete houses or frame structure single-family houses. Due to the characteristics of the frame structure itself, the exterior envelope is non-load-bearing, so it is convenient to retrofit and has

better safety and durability. In this study, a frame-structured single-family house is selected for energy-saving retrofit, and the changes in energy consumption before and after the retrofit are compared.

### **3 SIMULATION ANALYSIS OF ENERGY CONSUMPTION BASED ON BIM**

#### **3.1 Profile of Projects**

The target building selected for this study is a frame structured detached three-story villa occupied by a single family. For a long time, the level of rural residential design and construction has been limited. For the traditional rural residential system, self-built houses are mostly single-story brick-concrete houses with brick masonry as the main load-bearing component. Due to the uneven technical level of rural self-built housing construction personnel, often can not be strictly in accordance with the relevant norms atlas and other construction. In addition, the main building materials, solid clay bricks with poor thermal insulation performance and mostly burned by the local individual brick factory, the quality of building materials is difficult to guarantee, coupled with the workers' construction technology is not high, wall cracking, concrete components honeycomb surface, cast-in-situ floor uneven cracks, waterproofing failure of bathroom floors, roof leakage and other quality problems occur from time to time, which seriously affects the energy consumption and comfort of the residence. As far as building energy saving is concerned, the energy saving performance of assembled parts and components is more excellent. As the country has vigorously promoted the development of assembled buildings in recent years, its superiority has become increasingly obvious. Assembled building adopts the construction method of prefabricated building components and assembled on-site, which has the advantages of energy saving and environmental protection, and short construction period.

To synthesize the above principles, control tests are set up to determine the energy-saving retrofit program for the residential enclosure in the region, and the heat transfer coefficients for the exterior walls, doors, windows, roofs and other components are in line with the requirements of the Rural Residential Buildings Energy Efficiency Design Standards.

#### **3.2 Building Thermal Environment Setting and Simulation Operation**

First of all, the project information settings and the import of meteorological data. "Personnel parameters" set per capita area of 40 square meters and the use of different rooms function of the arrangement of personnel, the number of air changes per person in accordance with the "energy-saving design standards for rural residential buildings" set up, the number of winter room calculations for the number of air changes to take  $1 \text{ h}^{-1}$ , the number of summer room calculations for the number of air

changes to take  $5 \text{ h}^{-1}$  Taking into account the local average winter air temperature of 1.7 degrees Celsius Considering the local average winter temperature of 1.7 degrees Celsius and average summer temperature of 27.8 degrees Celsius, the air-conditioning system adopts the variable air volume air-conditioning system in summer, with the COP of the chiller unit being 5.96 and the set point of refrigeration being 29.4 degrees Celsius; and in winter, it adopts the gas-fired boiler for heating, with the combustion efficiency of the boiler being percent of 84.5.

### **4 ANALYSIS OF RESULTS**

Through this case study, it has been possible to generate quantitative data that can be used to analyze the impact of the envelope on the building's energy consumption. the focus of the study for this target building is to process the BIM data using GBS in order to test the strength of the impact of different envelope structures on the overall building energy consumption. Based on the simulation results, comparing different retrofit scenarios, the minimum annual energy cost for this building is 10, 653.6 yuan and the maximum energy cost is 12, 807.4 yuan. It seems that the change is not significant enough from this data range, but the impact of maintenance structure retrofit on the whole life cycle energy cost of the building is significant. For a 30-year operating period, and assuming that energy costs are not affected by inflation, the difference between the two scenarios is 64, 600 yuan, a savings of nearly 20% of the overall building cost.

From the perspective of specific parts of the enclosure structure, according to the energy efficiency from high to low, the prefabricated of thermal insulation roof, prefabricated concrete composite thermal insulation sandwich wall panels, hollow double-glazed broken-bridge aluminum alloy windows and doors, roof infinity swimming pools, and roof assembled sunshade.

### **5 VALIDATION**

GBS uses the DOE-2.2 simulation engine, an algorithm that has been in development for over 40 years and has been validated by Laurents Berkeley National Laboratory and Los Alamos National Laboratory. To verify the accuracy of the GBS simulation results for the energy consumption of this case, the data was calibrated using Ecotect. It was verified that the data error of each scenario was within  $\pm 5\%$  and the calibration passed. Therefore, the GBS simulation results in this study can be considered relatively reasonable and accurate.

### **6 CONCLUSION**

In this study, the virtual construction of target buildings according to the different envelope structures of different remodeling schemes of buildings under BIM environment is realized, and the simulation and evaluation of the operational energy consumption of different schemes are carried out before the construction of building remodeling. This



model, to a certain extent, avoids the difficulty of correcting the situation of unsatisfactory energy saving again after the completion of the remodeling of traditional buildings.

According to the study of this case study, it was shown that the use of a thermally superior envelope when a bed and breakfast building saves 71,200 yuan over a period of 30 years in the term operation period compared to using the existing envelope. In addition, it was found that for the case building, energy efficiency retrofitting of the roof area had the most significant effect, with an energy savings of 9.16% compared to the traditional roof structure. the least significant energy savings was for the precast concrete roof shading panels, which was only 1.52%.

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