Teaching English Reading for Science and Technology in Chinese High Schools: Challenges and Pedagogical Approaches

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Abstract. T Reading in scientific and technical English has become increasingly vital for students' education in the 21st century, owing to the rapid advancements in science and technology and the expansion of global collaboration and communication. This study distributed a questionnaire to teachers and students in the first three years of high school to determine students' learning needs for reading English in science and technology. The results indicate that students' needs differ by grade level and require personalized learning plans. Teachers should adopt various teaching methodologies and adapt their methods to cater to the needs of students at each grade level.

Keywords: English reading for science and technology, challenges, pedagogical approach.

1. Introduction

Reading scientific and technical English has become increasingly vital for students in the twenty-first century, as rapid advancements in science and technology, along with growing international collaboration and communication, have driven its importance. English materials focusing on these subjects have emerged as essential resources for students seeking to expand their knowledge across various disciplines, including the humanities, sciences, and technologies. As international academic exchanges flourish, so does the interest in scientific and technical English, offering practical advantages for students looking to progress in their careers and assimilate into society.

However, the effectiveness of reading comprehension in scientific and technical English is hindered by the fact that many English texts incorporate recent, influential scientific and technological breakthroughs that are not typically covered in high school curricula, leaving students with limited background knowledge. Implementing English reading instruction with a focus on science and technology poses specific challenges and obstacles for educators. Since English teachers' areas of expertise often do not encompass science and technology, their analysis of related materials tends to concentrate on grammar and semantics, resulting in superficial instruction. Teaching students to read technical content can be difficult, as it often employs specialized language and complex sentence structures that are challenging for students to comprehend.

Consequently, instructing students in reading scientific and technical material has proven to be a formidable task, with reading comprehension issues in this domain contributing to the most significant score losses. There is an urgent need to identify teaching strategies that are both highly effective and widely endorsed by students and teachers in actual practice. In this study, the researcher will employ cross-sectional designs to collect data on reading scientific and technical English across various grade levels. This approach aims to better understand the needs of students at different stages of education and ultimately enhance the teaching methods for reading in science and technology.

2. Literature Review

Upon examining the literature search findings, the researcher discovered no specific literature addressing the teaching of English in science and technology within basic education. Nevertheless, several university-level studies on English education in science and technology provided varying degrees of inspiration for this study. For instance, Song Liyuan builds upon the concept of "modal factors" introduced by biologists and applies it to English reading education. He contends that the

learning process for students in technical English reading courses encompasses the assimilation, retention, expression, and transmission of the linguistic modalities inherent in technical English. The responsibility of educators lies in assisting students in expediting their imitation and reproduction of robust and positive modalities found in technical English reading materials through pre-and post-reading activities, enabling them to comprehend, master, and adeptly employ the linguistic modalities they encounter [1]. This notion applies to university students and can also extend to basic education.

In traditional high school English reading instruction, educators frequently employ teaching strategies such as multimedia-assisted teaching and presentation-based learning. By analyzing literature specifically focused on English reading research in high school education, researchers identified several highly-cited teaching strategies in recent years, including group learning [2], mind mapping [3], scaffolding theory [4], anchoring teaching strategies [5], and differential teaching theory [6]. While these studies do not specifically target technology-based English reading, they retain a degree of adaptability.

Furthermore, certain linguistic theories can be employed to develop instructional strategies suitable for teaching English reading in science and technology. For example, renowned American language educator Krashen comprehensively outlined five hypotheses, collectively referred to as the input hypothesis theory, in his book Input Hypothesis: Theory and Implications. These hypotheses consist of the acquisition and learning hypothesis, the natural order hypothesis, the monitoring hypothesis, the input hypothesis, and the affective filter hypothesis. Though widely considered the most comprehensive and prominent theory in second language acquisition, it remains divisive. The theory's crux lies in the concept of comprehensible input, or the "i+1" model. The "i" symbolizes the learner's current language knowledge level, while the "1" denotes the gap between the learner's present language knowledge and the subsequent level. Krashen argues that the practical level of language input can neither equal the language learner's current status, i.e., "i," nor significantly exceed it. As a result, practical, comprehensible input can only be slightly greater than "i" and less than "i+1". According to the literature on scientific and technical English reading, it is recommended that a substantial volume of non-fiction English reading materials be incorporated into the teaching process.

Johns, T. & F. et al. introduced the educational concepts of "text as a vehicle for information" (TAVI) and "text as a linguistic object" (TALO) [7]. TAVI (text as a vehicle for information) possesses a logical core that shifts pedagogical emphasis from language knowledge transmission to the comprehensive conveyance of linguistic information. The importance of textual information surpasses vocabulary acquisition or grammatical analysis. Students should read the text to comprehend its overarching meaning, obtain valuable information, and expand their knowledge, rather than focusing on minute and specific linguistic aspects. TALO (text as a linguistic object) implies that the textbook's design aims to impart language knowledge, encompassing text, vocabulary, linguistic points, grammatical explanations, and exercises centered on grammar training. The amalgamation of TAVI and TALO proves more fitting for teaching English reading within the realm of science and technology.

3. Research Design

3.1. Research Questions

In response to the prevalent challenge faced by Chinese secondary school students in reading scientific and technological texts in English, this study employs descriptive research to identify the primary errors students commit in this domain following the recent college entrance examination reform. By examining both the aspects teachers emphasize and those they overlook during the instructional process, the study aims to synthesize effective pedagogical approaches for English-based scientific and technological reading in the context of the reformed college entrance examination. This, in turn, will furnish insights for enhancing students' reading proficiency and comprehension quality.

Question 1: The pivotal and arduous aspects of teaching English reading in science and technology across various grade levels;

Question 2: The pedagogical methods employed for instructing English reading in science and technology at distinct grade levels;

Question 3: The instructional strategies adopted by educators throughout the teaching process.

3.2. Research Methods and Tools

The research design implemented Cross-sectional Design (CSD) approaches to orchestrate a stratified inquiry predicated upon discrete grade levels, with the objective of amassing data pertaining to the teaching of English reading in science and technology across a diverse array of grade levels. This, in turn, facilitated a more profound comprehension of students' requirements at each grade level, while simultaneously refining the pedagogy of English reading in the realm of science and technology.

We devised two questionnaires (one for students and one for educators) by utilizing samples from existing questionnaires and adhering to the study's specifications. The student-oriented questionnaire primarily comprises basic personal information, English learning challenges, interests, and expectations regarding instructional methods. Conversely, the educator questionnaire encompasses vital info about instructors, teaching methods and strategies variations, and obstacles encountered during the teaching process.

Leveraging the online version of Questionnaire Star Data Analysis, we employed IBM SPSS 22.0 to analyze the collected data.

3.3. Research subjects

By contacting the high school subject teachers at that particular school, questionnaires were given out to students in three high school grades in a region of eastern China. They received the same quality of English instruction, and while answering questions about their school's various grades, they could be completely truthful. 37 valid student surveys were ultimately collected. Cronbach's alpha was proven reliable by the data's statistical findings. The coefficient of the student questionnaire reached 0.867, showing that this questionnaire has a high degree of reliability; the KOM value of the validity analysis questionnaire reached 0.756, suggesting a high degree of correlation between the questions on the questionnaire.

The English teachers of the three high school grades in the province of eastern China were issued a questionnaire by getting in touch with the high school topic instructors at that specific institution. They could be altogether truthful when answering the questions regarding the English learning circumstances of different grades at that school because they were in a learning environment with no apparent discrepancies. In the end, 32 trustworthy teacher questionnaires were gathered. The statistical results of data showed Cronbach's alpha's precision. The teachers' questionnaire's high level of validity was demonstrated by its coefficient of reliability, which was 0.642, and by the validity analysis questionnaire's KOM value, which was 0.563, which showed a high level of correlation between its questions.

4. Results

4.1. Results of student questionnaire data analysis

A cross-tabulation analysis of grade level with students' enjoyment of reading in scientific and technical English revealed that students' enjoyment of reading in scientific and technical English tended to decrease with increasing grade level. In contrast, a cross-tabulation analysis of grade level with judgments of the difficulty of reading in scientific and technical English revealed that the higher the student's grade level, the more difficult they thought reading in scientific and technical English was.

According to the regression data, the main factors influencing students' interest in reading science and technology in English are "whether it can be integrated into the current English reading classroom

teaching," "the current teaching method of combining group discussion in the classroom," and "more guidance on reading methods and reading thinking." The three factors that were found to have the most significant impact on students' interest in reading about science and technology were "whether it can be integrated into the current English reading classroom," "the current teaching method of combining group discussion in the classroom," and "more guidance on reading methods and reading thinking." In particular, these are mentioned:

1) A substantial correlation between "students' interest in reading science and technology in English" and "the ability to integrate into the current English reading classroom" was discovered, with the latter value reaching 0.000. According to this, a positive correlation exists between students' classroom involvement and learning motivation.

2) There was a negative correlation between the regression coefficient of -0.42 and the following variables: "Can they integrate into the current English reading classroom" and "The teaching methods they want to use to direct their reading and reading thinking." This shows a negative relationship between student engagement in the classroom and the necessity for guided teaching approaches.

The p-value of "students' expectations of classroom teaching methods" and "the teaching methods they want teachers to guide in reading methods and reading thinking" reached 0.001, which also revealed a significant correlation, according to subsequent research. This demonstrates that most pupils strongly demand guided reading strategies and reading comprehension.

According to the results of the ANOVA, the p-values for the student's grade level, interest in reading English for science and technology, ability to integrate into the current English classroom, and expectations for classroom teaching methods were all less than 0.1. The p-values were all below 0.01, indicating a significant difference. This demonstrates how students' passion for learning English and their level of integration into the English-speaking classroom increased significantly as they moved up the grade scale. They also had higher standards for teachers to use better methods of instruction.

4.2. Results of student questionnaire data analysis

According to a cross-tabulation analysis of the survey data, most teachers believed that students in various grade levels had diverse degrees of English proficiency.

According to the ANOVA, the correlation between the claims "reading in scientific and technical English is a difficult problem for students in English reading" and "there are differences in English reading ability among students in different grades" is 0.48, indicating a solid connection. This shows that it is a widespread belief among teachers that imparting technical English reading abilities is a difficult task.

Based on a regression analysis of the data, it was determined that the two main strategies used by teachers to address students' problems reading English in science and technology were "supplementing students with relevant scientific and technological expertise in teaching reading English in science and technology" and "using knowledge gained through reading as a teaching strategy in teaching reading English in science and technology."

In the analysis of ANOVA, the p-values of "whether reading science and technology is a difficult task in students' English reading" and "whether the difference in students' language ability is a difficult task in teaching reading science and technology in high school English", "whether the difficulty of reading science and technology terms is a difficult task in teaching reading science and technology in high school English" and "whether reading skills are a difficult task in teaching reading science and technology in high school English" showed strong correlations. The p-values for the questions of "if the difficulty of scientific and technical terminology is a difficult point in reading" and "Whether reading skills is a difficult point in reading" are both less than 0.01, indicating a substantial link. As a result, teachers may find it challenging to teach scientific and technical English reading due to students' difficulties with the English language, their reading comprehension, and the use of scientific and technical vocabulary in reading materials.

The results of further research revealed that "different grades of science and technology English reading require different teaching methods" and "Do you agree to supplement students with relevant science and technology professional knowledge in science and technology English reading teaching? ", "Do you agree to strengthen language learning foundation training for students in science and technology English reading teaching? ", and "Do you agree to adopt teaching strategies that enrich students' learning?" Additionally, the p-values for "agree to use reading to acquire knowledge as a teaching strategy in science and technology English reading teaching" are less than 0.01, showing a significant link. As a result, it can be concluded that most educators agree that the teaching of scientific English reading at various grade levels requires the use of multiple methodologies and instructional tactics.

5. Findings and Discussion

5.1. Key Findings

The investigator discerned the subsequent patterns in the instruction of English reading within Chinese high schools via this study:

1) Distinct grade levels witness a diverse emphasis on scientific and technical English reading themes, wherein educators employ a myriad of pedagogical techniques to tackle the formidable reading obstacles.

2) A majority of students appreciate teachers' counsel regarding reading tactics and comprehension. However, as their proficiency in the English language improves, their dependence on teachers' guidance diminishes.

3) Educators perceive students across various grade levels as possessing disparate degrees of English competency.

4) In their pedagogical approach, teachers typically prioritize reading to acquire knowledge and to equip students with relevant technical expertise.

5.2. Discussion

This investigation reveals that the majority of Chinese students concur that grasping scientific and technical English poses a formidable challenge. In light of the aforementioned study's findings, the following recommendations are proposed to effectively facilitate the necessary teaching and learning of reading science and technology English in China:

1) Teachers ought to devise bespoke English teaching curricula tailored to students across various grade levels, given that the primary pedagogical challenges within the three high school grades encompass vocabulary acquisition, sentence interpretation, and grammatical foundations. Corresponding teaching methodologies should be implemented accordingly.

2) Throughout the instructional process, students ought to receive differentiated guidance based on their individual capabilities, fostering the cultivation of dependable reading techniques and critical thinking, rather than adhering to a "one-size-fits-all" paradigm. Pedagogical methods should be customized to suit each student's aptitudes, with the development of personalized teaching plans as a priority.

3) When instructing students in reading English for science and technology, teachers may employ pedagogical strategies that align with students' scientific and technological proficiencies, fortify their linguistic learning foundations, and augment their reading experiences. For instance, teachers could supply students with topical news articles and science and technology-related stories as educational resources, effectively heightening their engagement and enthusiasm for learning.

References

[1] Song Liyuan. (2013). Teaching English as a Foreign Language with Modal Theory. Journal of Science Education, (13), pp.149-150, 234.

[2] Wang, Haixia. (2012). The use of cooperative group learning in high school English reading teaching. Shanghai Normal University.

[3] Yuan Xiaowan. (2019). Action Research on Thought Mapping in Middle School English Reading Teaching. Jiangsu University.

[4] Tian Wenyan, Zhang Xinqi & Zhou Xuanfeng. (2019). A strategy construct for teaching English reading in high school under the guidance of stenting theory. Journal of Heilongjiang College of Education, 38(9), pp.80-82.

[5] Yang, Liu. (2014). Using anchoring teaching strategies to improve high school students' reading skills. Shanghai Normal University.

[6] Xu Jie. (2012). A Study on the Application of Differential Teaching Theory in High School English Reading Teaching. Shandong Normal University.

[7] Johns, T., & Davies, F. (1983). Text as a Vehicle for Information: The Classroom Use of Written Texts in Teaching Reading in a Foreign Language. reading in a foreign language, 1(1), 1-19.