

The Impact of Metacognition on Scores in the Cloze Tests of the New College Entrance Examination for English in Jiangsu Province: A Case Study of English Teaching in the Flow Classroom at Nanjing No.5 Senior High School

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Abstract. With the continuous reform and development of China's education system, the position of metacognition in language learning has gradually been emphasized. The New College Entrance Examination in Jiangsu Province, which is part of China's secondary education curriculum reform, imposes stricter and broader requirements on students' English proficiency. Under this new situation, it is particularly important to study in detail the use of metacognition in the English subject and to analyze the effect of metacognition on students' performance in the English Completed Gaps section of the New College Entrance Examination. In order to better understand how metacognition can help students improve their performance in the English Cloze Exam, this study will take a process in "Flow classroom" of Nanjing No.5 Middle School as a case study. The English curriculum and teaching methods of the "class" in Nanjing No. 5 Middle School are characterized by the school's high-quality teaching resources. The study also emphasizes practice and innovation to develop students' metacognitive skills. Therefore, through empirical cases, it can be better understood the role of metacognition in actual classroom teaching and practical tips to help students achieve better grades in the College Entrance Examination.

Keywords: Metacognition, cloze test, English teaching, flow classroom, constructivism.

1. Introduction

With the implementation of the New National College Entrance Examination policy in all provinces and the deepening of secondary school reforms, the paradigm of student assessment now includes the development of comprehensive qualities and competencies rather than just basic academic skills. In this context, metacognition has become central to the discussion of effective pedagogy. Metacognition, defined as the ability to control and regulate one's own cognitive processes, will play a central role in the design of English language instruction. Understanding the complex relationship between metacognition and performance is particularly important as educators attempt to navigate the rapidly changing educational environment.

This study aims to deepen the understanding of this issue by exploring the subtle effects of metacognition on test scores and identifying the underlying mechanisms of effective language learning strategies. This will have a significant impact on the way English is taught as it relates to reading comprehension rather than student practice or teacher-directed pinch tests. This study illustrates the research on metacognitive approaches and completion deficits using the new National College Entrance Examination at Jiangsu University as an example. The study's results based on questionnaires and SPSS analyses show that there is a good correlation between metacognitive strategies and better cloze test scores. This study aims to improve students' test scores and encourage educators to update more effective teaching methods and to change the way they teach.

The expected outcomes of this study go beyond a simple exploration of the metacognitive aspects of teaching English. Through a careful study of a mobile classroom in Nanjing No. 5 Middle School, this study aims to provide a practical and replicable model for integrating metacognition into English teaching methods. Expected outcomes include theoretical perspectives as well as feasible strategies

that can be replicated in other educational institutions. This study contributes to the ongoing conversation about educational effectiveness by providing concrete, contextualized methods to improve students' metacognition. In addition, this study hopes to have broader implications by providing a foundation for empirical understanding of the role of metacognition in the specific context. As metacognition is recognized as a determinant of educational success, it is expected that the results will enable educators and policymakers to utilize metacognitive strategies to improve language learning outcomes. In summary, this study attempts to bridge the gap between the theoretical and practical realms by providing a perspective that goes beyond the immediate context of the new college entrance examination in Jiangsu Province. By doing so, this study seeks to promote a paradigm that makes metacognition an integral part of English language teaching and contributes to the broader goal of developing students who are not only proficient in language skills but also support metacognitive self-regulation.

2. Literature Review

2.1. Cloze Tests in High School English

Cloze tests serve as a fundamental tool in assessing students' language proficiency, specifically focusing on their reading comprehension, vocabulary mastery, and grammatical knowledge. These tests present students with a passage where certain words are omitted, requiring them to fill in the blanks based on context and grammatical rules. This evaluation method provides a comprehensive insight into learners' language skills, encompassing their understanding of vocabulary, grammatical syntax, and pragmatic application [1]. As an integral component of high school English assessments, cloze tests offer educators a nuanced perspective on students' language competencies, contributing to a holistic evaluation of their language proficiency.

2.2. Metacognition

The actual implementation and training of strategies—which are grounded in theory and intimately tied to practice—are the primary areas of concentration for worldwide metacognition research. To further illustrate, Oxford and O'Malley & Chamot categorized metacognitive strategies into three groups: focusing on learning, planning and organizing learning, and assessment of learning [2, 3]. These groups include planning, monitoring, and evaluation strategies. Efklides analyzed the interactions between metacognitive awareness, motivation, and affect, and based on this, constructed a "metacognitive and affective model of self-regulated learning", and Robert Bjork et al. found that the degree of completion of learning can be more efficiently and effectively managed. manage one's ongoing learning activities and promote individuals to become more effective learners [4, 5]. Menderes ÜNAL defined metacognition as the relationship between an individual's thoughts and behaviors, i.e., the relationship between metacognitive learning strategies and academic success, in his study on the correlation between metacognitive learning strategies and academic success of university students [6]. One may argue that metacognition is a common cognitive process and a key component in the success or failure of education.

In recent years, the attention to metacognition in China has been growing, and the type of research has shifted from theory to practical application. Wang Youkun explored the relationship between self-efficacy, reading metacognitive strategies, and English reading performance, and argued that self-efficacy indirectly and positively affects English reading success through metacognitive strategies [7]. These metacognitive strategies have a positive impact on improving English performance. Li Shuguang proposed that namely, to integrate the metacognitive he suggests that metacognitive strategies can be better developed by integrating metacognitive content into students' various learning processes: pre-study, listening, review, homework and examination [8]. According to Cai Liying, teachers should continuously strengthen their ability to develop students' metacognitive strategies and stimulate students' metacognitive awareness from the perspective of heuristic teaching [9]. Zhou Zhaoxing conducted metacognitive strategy training in college English reading classrooms

by choosing two classes as experimental and control classes respectively [10]. Metacognitive strategy training was carried out in the experimental class, and traditional instruction was used in the control class. The experimental results show that metacognitive strategy training helps to reduce learners' anxiety and improve reading ability. By understanding metacognition through these elements, educators can gain insight into the complex mechanisms that influence how students accomplish learning tasks and respond to challenges.

2.3. Flow and Flow Classroom

The concept of "Flow", rooted in the idea of complete immersion and psychological flow, introduces a dynamic approach to learning, emphasizing heightened excitement and fulfillment in the learning process. Coined by psychologist Mihaly Csikszentmihalyi, Flow represents a state where individuals are deeply engaged, leading to increased efficiency and enjoyment in completing tasks [11].

The Flow classroom at Nanjing No.5 Senior High School serves as a practical manifestation of this concept, creating an environment that nurtures students' potential and fosters happiness among both teachers and students. The continuous exploration and development of "Flow education" at the school highlight a commitment to optimizing the learning experience. Conditions for achieving Flow, including balancing skills and challenges, setting clear goals, and providing timely feedback, contribute to creating a psychological foundation for effective learning [11].

Operational elements within the Flow classroom encompass task clarification, promoting autonomous learning, facilitating collaborative assistance, encouraging summarization and refinement, and implementing testing and feedback mechanisms. These elements collectively create an environment where students feel safe, are actively engaged, and experience enhanced efficiency in their learning endeavors.

In summary, the Flow concept and the Flow classroom provide a lens through which educators can view the learning process not only as an academic pursuit but also as a dynamic and fulfilling experience. The integration of Flow principles aligns with the overarching goal of promoting a positive and effective learning environment in high school education.

3. Methodology

Table 1. Cloze Scores

Cloze scores in September, October, November, and December (Classes 3-11)					
Class	September	October	November	December	Whether to use the meta-cognitive teaching method
3	9.571	8.833	10.180	9.030	No
4	9.780	9.205	10.300	8.280	No
5	9.841	9.326	10.460	8.630	No
6	9.027	8.278	9.110	7.610	No
7	8.605	8.333	9.180	8.380	No
8	10.071	9.571	10.760	8.490	Yes
9	10.372	9.651	11.000	8.720	Yes
10	9.676	9.200	10.240	8.090	No
11	9.333	8.579	8.530	8.110	No

The authors summarize the results of the cloze tests in four standardized mock college entrance exams for the third year of high school in Nanjing No. 5 High School. The four tests were conducted in September, October, November, and December and covered 11 classes. Of these, Class 1 and Class 2 are liberal arts classes with a strong English foundation whilst Class 3-11 are science classes with a relatively even English base. Notably, teachers in the 8th and 9th grades adopted a meta-cognitive teaching strategy. Table 1 includes the cloze scores of nine science classes (Classes 3-11) in four standardized mock college entrance exams in September, October, November, and December.

In addition, the study also chose a quantitative analysis approach by distributing questionnaires to Class 8 and Class 9 of senior three in Nanjing No. 5 Senior High School who adopted meta-cognitive teaching strategies.

IBM SPSS Statistics 27 was used to analyze data on the scores of the cloze tests in four standardized simulated college entrance exams for the third year of high school in Nanjing No. 5 High School. The T-test (independent sample T-test) and analysis of variance (one-way analysis of variance) were chosen for in-depth analysis of students' performance.

Flow classroom is a kind of classroom pattern inspired by "Flow", which aims to completely tap students' potential and encourage teachers and students to enjoy the learning progress together. The teaching strategy of Flow classroom is closely related to the principles of "self-regulation" and "collaborative learning" in meta-cognition, which is a beneficial application and extension of meta-cognition teaching strategies. Nanjing No. 5 Senior High School additionally put forward the concept of "Flow Education" on the basis of the construction of "Flow classroom", and through continuous practice and exploration, became the first school in Jiangsu Province and even the country to practice the concept of "Flow education". It is worth mentioning that Class 8 and Class 9 of senior three also adopt meta-cognitive teaching strategies to promote the development of "Flow classroom" teaching mode while practicing the concept of "Flow education". Therefore, the authors chose to analyze the score of the fourth standardized mock college entrance examination for the third year of senior high school in Nanjing No. 5 and sent questionnaires to the eighth and ninth classes in particular to gain insight into their teaching practices.

4. Results

4.1. Analysis of Variance

This study selected the cloze scores of 9 science classes (classes 3-11) out of 11 senior high schools in Nanjing No.5 Senior High School in four standardized simulated college entrance examination tests in September, October, November, and December, and applied ANOVA (single factor analysis of variance) to the scores of these 9 classes. Of these, Class 8, and Class 9 using meta-cognitive teaching strategies are listed. The results of the analysis are shown in Table 2.

Table 2. Analysis of Variance

Anova result										
Class (mean $\pm$ standard deviation)										
	Class3 (n=43)	Class4 (n=41)	Class5 (n=41)	Class6 (n=37)	Class7 (n=39)	Class8 (n=39)	Class9 (n=42)	Class10 (n=43)	Class11 (n=39)	<i>F</i> <i>p</i>
Sep	9.58 $\pm$ 3.0 6	9.41 $\pm$ 3. 91	9.32 $\pm$ 3. 57	9.14 $\pm$ 2. 86	9.87 $\pm$ 3.6 4	12.05 $\pm$ 2. 78	11.21 $\pm$ 2. 85	9.58 $\pm$ 3. 59	10.46 $\pm$ 3. 45	3.490.001*
Oct	10.12 $\pm$ 3. 29	9.56 $\pm$ 3. 69	8.83 $\pm$ 3. 38	9.68 $\pm$ 3. 41	10.38 $\pm$ 3. 36	11.49 $\pm$ 2. 88	11.62 $\pm$ 2. 55	9.65 $\pm$ 3. 74	9.49 $\pm$ 3.3 6	3.220.002*
Nov	8.63 $\pm$ 3.0 8	9.07 $\pm$ 3. 13	9.39 $\pm$ 3. 40	9.76 $\pm$ 3. 65	8.90 $\pm$ 3.3 5	11.36 $\pm$ 2. 63	10.83 $\pm$ 2. 91	9.26 $\pm$ 3. 27	9.77 $\pm$ 3.4 4	3.190.002*
Dec	10.09 $\pm$ 3. 38	9.44 $\pm$ 3. 51	9.56 $\pm$ 3. 26	9.00 $\pm$ 3. 23	9.77 $\pm$ 3.0 6	11.69 $\pm$ 2. 82	11.50 $\pm$ 3. 10	9.51 $\pm$ 3. 64	9.85 $\pm$ 3.2 7	3.230.001*
* $p < 0.05$ ** $p < 0.01$										

As can be seen from the above table, the analysis of variance (single-factor analysis of variance) was used to study the differences between grades of September, October, November, and December. The results of September, October, November, and December are all significant in different class samples ($p < 0.05$), which means that different class samples have differences in the results of different months. Specific analysis shows that the class has a 0.01 level of significance for the grades from September to December, and the monthly results are as follows: September ($F = 3.490$, $p = 0.001$),

October ($F=3.222$, $p=0.002$), November ($F=3.192$, $p=0.002$), December ($F=3.238$, $p=0.001$). From September to December, Class 8 and Class 9 demonstrated notable variations with other classes, and their scores were greater than those of other classes. In the interest of impartiality, the authors contacted each class and concluded that metacognitive teaching techniques were the only significant influencing factors throughout these months.

4.2. T-Test

Table 3. t-Test

<i>t-test analysis results</i>				
Grouping (mean $\pm$ standard deviation)				
	No metacognitive teaching method is used($n=283$)	Use the metacognitive approach($n=81$)	<i>t</i>	<i>p</i>
September	9.62 $\pm$ 3.45	11.62 $\pm$ 2.83	-5.315	0.000**
October	9.67 $\pm$ 3.46	11.56 $\pm$ 2.70	-5.183	0.000**
November	9.24 $\pm$ 3.32	11.09 $\pm$ 2.78	-5.044	0.000**
December	9.61 $\pm$ 3.33	11.59 $\pm$ 2.95	-4.840	0.000**
* $p<0.05$ ** $p<0.01$				

Through t-test (independent sample t-test) and analysis of variance (single factor analysis of variance), it can be seen that the average score of the class adopting meta-cognitive teaching strategy in cloze is generally higher than that of other classes, especially class 8 and Class 9 shows a more significant score advantage. The score difference between different classes is related to whether meta-cognitive teaching strategies are used. Those classes that did not use meta-cognitive teaching strategies generally scored lower on cloze. This further verifies the positive role of meta-cognitive teaching strategies in improving students' English learning ability.

4.3. Questionnaire Analysis

Based on the meta-cognitive strategy classification system of O'Malley and Chamot, the questionnaire covers four types of questions: planning, selective attention, self-monitoring, and self-evaluation [3]. The questionnaires were adjusted and modified based on the characteristics of the Cloze test and the actual reading performance of the high school students. The questionnaire consists of 20 questions summarizing the contents of four types of meta-cognitive strategies. The first part (questions 1-4) aims to discover whether students use the meta-cognitive strategy of "planning", that is, learners organize in advance, which consists of the concepts and main ideas of preview learning materials. The meta-cognitive strategy targeted in the second part (questions 5-10) is "selective attention", that is, learners pay attention to specific aspects of language input or situations conducive to input in advance. The type of meta-cognitive strategy targeted in the third part (questions 11-15) is "self-monitoring, which indicated whether learners check the comprehension and performance of language tasks and the thinking process. The type of meta-cognitive strategy targeted in Part Four (questions 16-20) is "self-evaluating", which discovered how learners evaluate the learning outcome, including language use, language proficiency, and strategy application.

According to the questionnaire, the frequency of use of each strategy is expressed as its average. In other words, the larger the mean, the more commonly the subject uses the strategy. Scores of 1-1.4, 1.5-2.4, 2.5-3.4, 3.5-4.4, and 4.5-5.0 indicate "never or nearly never use," "seldom use," "frequently use," "commonly use," and "regularly or nearly invariably use," respectively. After the analysis, the mean values of the meta-cognitive strategy, the four sub-strategies, and the 20 items are shown in the following figure.

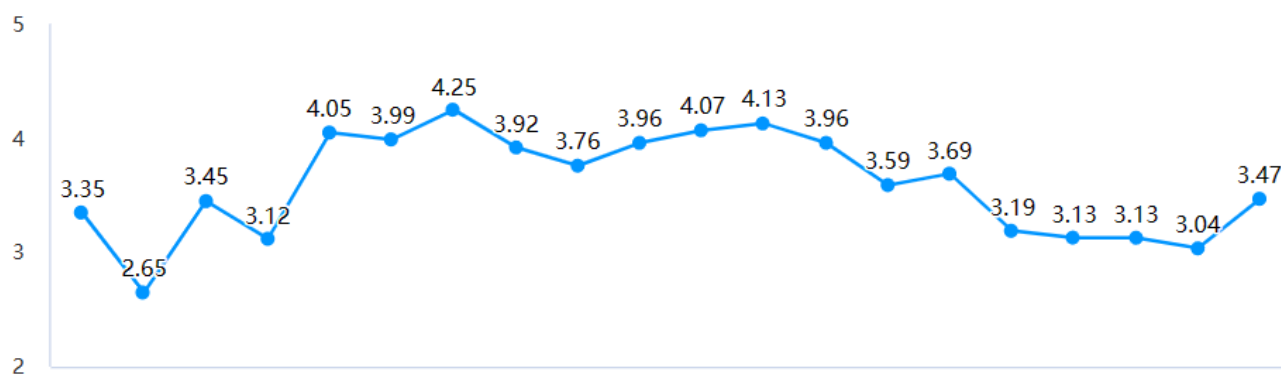


Fig. 1 Twenty questionnaire questions and the scores (Original)

In the planning section, students typically scored low with an average score of 3.324. In particular, in the second question, "Find the reading material at your level based on the English cloze goal" scored the lowest, at 2.65. This suggests that planning is a skill that needs to be nurtured over the long term, and that the teaching effect is not significant in the short term. Teachers are advised to introduce and check student feedback beforehand when teaching to develop their planning habits.

In terms of the attention questions, students performed relatively well. This may have something to do with teachers' emphasis on teaching problem solving skills. With high school students under pressure to take college entrance exams, teachers have had to shift their teaching focus to test-oriented education and focus on developing test-oriented abilities in their students. As a result, subject teachers may pay extra attention to teaching ratios or check feedback, which may account for the higher scores.

In the self-monitoring section, the overall performance is acceptable. However, the two questions of "timely checking whether the reading methods used in the English reading process are appropriate, timely adjusting the improper methods" and "adjusting my reading speed according to the reading time and amount in the English reading process" received the lowest scores. This suggests that students are paying less attention to reading skills and suggests that teachers should strengthen this instruction in their teaching.

Students also performed relatively weakly in self-evaluating. Although the question "Identify your weaknesses after reading English and consider future improvement measures" got the highest score (3.47), it was even lower than the lowest score of "check whether the reading methods used in the process of English reading and adjust the improper methods in time" (3.59). This suggests that students engage in less post-exam self-assessment and reflection. Emphasizing that learning is not simply about taking tests, the teacher imparts learning methods that can be used later. Students need to be aware that learning metacognitive strategies should not only focus on problem-solving skills, and that forming good learning habits will have an essential impact on the future.

4.4. Limitations of the Study

Currently, this study has not conducted in-depth interviews with teachers who use metacognitive strategies in teaching, nor has it explored the effects of metacognitive strategies in teaching from a teacher's perspective. Future research can be developed in a more comprehensive and in-depth direction, focusing on the practical application of metacognitive strategies in teaching and their impact on student learning outcomes. To gain a more comprehensive understanding of the challenges and achievements teachers face when using metacognitive strategies, interviews can be conducted to gain an in-depth understanding of their teaching experiences, perspectives, and reasons behind their choice of teaching strategies. This helps shed light on how teachers can effectively instruct students to use metacognitive strategies in teaching and may provide useful insights for future teaching. Future research could also focus on analyzing the effect of different metacognitive strategies in teaching and the specific measures taken by teachers to address the challenges that arise during the student's learning process. These studies help provide more specific and practical recommendations for educational practice, provide more effective instructional support for teachers, and promote better student use of metacognitive strategies to improve learning outcomes.

5. Conclusion

In summary, with Nanjing No. 5 Middle School as the study subject, this paper investigated the influence of metacognition on the English proficiency score of the current Jiangsu provincial college entrance examination by using variance analysis, t-test, and questionnaire analysis. The results of the ANOVA showed significant differences in the scores of the different class samples for September, October, November, and December. Specifically, classes 8 and 9 consistently show a significant advantage over the others, highlighting a positive correlation between the adoption of metacognitive teaching strategies and higher task scores. T-test results also highlight the influence of metacognitive teaching strategies, with significant differences observed in subgroup scores from month to month. Remarkably, the classes implementing the metacognitive strategy, especially classes 8 and 9, consistently outperformed the others, highlighting the power of metacognition in improving English learning. Through questionnaire analysis, it can also show the effectiveness of metacognitive strategies in English teaching. Teachers successfully guided students to develop English block plans, link contextual content points, and integrate options into the original text. However, students showed room for improvement in areas such as finding reading material based on test objectives, highlighting key points and assessing gains after reading English. In a broader discussion, this study highlights the significant impact of metacognitive teaching strategies on improving student mastery and overall English proficiency. It emphasizes the importance of educational practitioners prioritizing the development of student metacognitive abilities and actively incorporating these strategies into instructional practices for the integrated development of students. Teachers play a critical role in helping students better understand the learning process and improve efficiency, helping to close the learning gap between classes and promoting equity in education. In conclusion, this study advocates continued emphasis on metacognition in English education, encouraging educators to adopt relevant strategies, and identifying specific areas for improvement through a comprehensive analysis. These findings contribute to a broader understanding of effective teaching methods.

Authors Contribution

All the authors contributed equally and their names were listed in alphabetical order.

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