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Schema theory's immediate impact on college students' Chinese reading comprehension

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ABSTRACT

Studies show that there is an increase of college students who prefer reading short summaries rather than long complex texts containing knowledge or theory. Thus, this study focuses on improving first-year students' reading comprehension in Chinese courses by observing the effectiveness of teaching reading lessons in Chinese courses with the curriculum designed based on "schema theory". The selected reading materials are extensive texts with certain knowledge or theories. For evaluation purposes, the reading test questions uses the same measure of reading proficiency levels of program for international student assessment (PISA) to assess learners' reading comprehension, contextual reasoning, integration, and analysis abilities more accurately. By comparing the results and discrepancies of the pre- and post-assessment, the preliminary research found that the teaching practice and curriculum designed based on schema theory effectively improves learners' reading scores and instill habits to increase their tendency to reach a deeper understanding of the reading material. This finding demonstrates the effectiveness of applying schema theory to reading lessons; resulting in potential of immediate and enhanced levels of comprehension.

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1. INTRODUCTION

Researchers attributes lower reading comprehension skills to what is known as metacognitive deficit, which is defined as a "shallower reading of digital texts" due to the high amount of information students scroll through online. A study on the effects of social media on reading also state that social media's constant short snippets of information and content encourages skimming and multitasking. These acts that takes one away from focusing on reading is defined as "mindwandering", when one's mind starts thinking about task-unrelated thoughts. With current students having a high ease of access to information and the digital ability to connect with the world at the tips of their fingers, students also experience high metacognitive deficit and mindwandering, in which multiple studies have reported its' adverse effect on reading comprehension [1]. Furthermore, most students based on a survey, showed a lack of interest in longer reading materials; instead of macro-reading. These technological impacts have lowered students' ability to comprehend more complex readings due to the lack of proper practice of complex readings and students' avoidance to read [2].

Reading is a process of constructing cognition [3]. Reading comprehension is essential for learning all fields of discipline and for lifelong learning; it is also an important competency that allows people to communicate and interact with each other [4]. Strengthening one's reading ability in their native language especially promoting the cultivation of reading habits in a wide range of fields will help improve the future life and employment of college students [5]. Extensive reading which involves reading a wide range of materials such as books, articles, blogs and social media posts, is beneficial to learners' self-development [6].

This practice of engaging in extensive reading enables college students to broaden their knowledge and expand their horizons of thought, which are essential for achieving success in both their academic and professional pursuits. In addition, it is imperative to note that there are many changeable factors that can positively improve college students' academic performance; many studies have shown that college students' reading comprehension skills are changeable through instructor and support services [7]. These key topics specifically on, improving one's reading ability is an issue that has received much attention both in research and in the teaching practice in recent years and has deepened the understanding of instructional design through a long process of continuous discussion [8]. This study aims to add onto this discussion, verifying the potential improvement of one's reading ability through implementing the schema theory to instructional design [9]–[11].

The study was conducted on two classes of a total of 75 first year college students in their first year's Chinese language course. It is crucial to enable the reader's ability to anticipate the possible content of the text by providing an appropriate reading structure with purposeful reading strategies to help readers adjust their habitual reading strategies accordingly to deepen their understanding of the text [3]. Reading materials include continuous and non-continuous texts, as well as narratives, explanations, descriptions, arguments and other expression methods, aiming to use a wide range of texts to reflect the reality of daily reading [12]. While this study attempts to apply schema theory to instructional design to test whether it can effectively and quickly improve college students' Chinese reading ability.

2. RESEARCH METHOD

2.1. Using schema theory to design the teaching of reading comprehension

In 1781, the German philosopher Kant first proposed the theory of "schema" in the book "Critique of Pure Reason." The rules for determining the space and time of object can be used to continuously connect and improve the intuition and concepts of individuals; furthermore, can promote the characteristics of objects to be linked and ordered based on the classification of similarity. Kant pointed out that the link between concepts and object characteristics is "schema" [13]. Thus, the information stored in human memory is organized in the form of mental schemas.

Algirdas Julien Greimas, a French structuralist semiotician, applied the concept of schema to the semantic relationship of symbols and deduced it into the meaning system of text; forming a unique and effective way of interpretation. Greimas emphasized "to meet the needs of a thematic relational structure," the text should be presented in a consistent order which can help learners "more easily discover redundant phenomena and structural cohesion." During the reading process, the way the text is presented can help readers "simplify" and "shape" the structural connections of the article based on their reading perception; thus, building a schema. The schema developed creates a system for understanding the significance of the text, which accelerates the readers' reading comprehension ability [14].

Reading is the process of understanding the meaning of written texts by coordinating large amounts of related information [15]. Reading comprehension is also a process in which the reader combines his prior knowledge, the information in the text, and the reader's perception of the relevant content of the text [16]. Scholars believe that schema theory, as a teaching strategy, helps students' construct knowledge and can reduce cognitive difficulties caused by increasing knowledge difficulty. In addition, there are advantages such as acquiring and retaining knowledge, optimizing intrinsic motivation and cognitive load [17]. The research results show that schema theory can be used in explaining the mental process of foreign language learning and reading comprehension. It is believed that reading is the process of constructing, inferring, searching, and integrating to understand language content; at the same time, it is also a process in which readers use their existing internal schemas to understand, process, and evaluate reading materials. Schema theory is more applicable to the early stages of reading [18].

Scholars believe that "schema is an abstract knowledge structure" used to express the relationship between its components [19]. When the reading content is more closely structured with the "schema" generated by self-cognition, the faster the reading comprehension will be [20], [21]. Therefore, schema theory is often used in language teaching to improve reading ability, as well as to understand the psychological process of reading, and even cultural exploration, [22] and to establish a theoretical framework of emotional schema; furthermore, has produced many studies and discourses [23]. Most of the related

research and discussion on improving reading comprehension are used in foreign language teaching [24]–[29]. In contrast, fewer reading instructions are used in the different fields of Chinese especially in the way Chinese reading of popular science is taught in universities [30]. This study summarizes some important concepts that can be applied to the instruction of Chinese reading through scholars' discussion on schemas, so that Chinese reading instruction has a certain theoretical basis, thereby improving students' reading ability.

2.2. Designing test questions based on the reading ability level of PISA

This study created test questions based on the reading proficiency levels defined by the "program for international student assessment" (PISA) organized by the Organization for Economic Co-operation and Development (OECD), which is currently the most influential international learning assessment organization. PISA defines the level of reading theory as four levels: "access and retrieve", "integrate and interpret," and "reflect and evaluate." The assessments on one's reading ability tests the performance of learners' ability to capture, retrieve, integrate, interpret, reflect and evaluate in the reading process; to demonstrate whether learners can effectively capture the key points in the reading process, which includes being able to select desired information, interpret and integrate the context to understand the main concepts in the text, and to go further to compare or hypothesize to express personal evaluation and judgment [31]. The evaluation criteria for reading ability in this study with the help of PISA is to evaluate whether schema theory, as a guiding principle to the instructional design for improving reading, can enhance the ability of learners to read at a deeper level.

2.3. Study design: research participants

The participants of the study were freshmen at a university of science and technology in central Taiwan. Class A is composed of 52 students from the Early Childhood Development and Education Department of the School of Humanities and Social Sciences, and class B is composed of 56 students from the Shengnian Industry Management Department of the School of Management. The learning attitudes of the two classes are different. Class A's learning motivation, attention, willingness to participate, homework completion status, homework completion status, teacher-student interaction and daily attendance are better, while class B's is worse, and more than 20% of students are absent from class.

2.4. Execution process

2.4.1. Key points on reading teaching practice based on schema concept

In the process of teaching Chinese reading, teachers will first emphasize the importance of reading, then demonstrate with actual reading materials to provide a schematic conceptual framework. Teachers will further explain the principles of reading, and prompt reading strategies to help students accelerate reading comprehension and speed; meanwhile, during the reading process, teachers will let students learn to predict thematic development of reading texts, grasp key information, connect relevant clues, and make reasonable inferences and evaluations. In addition to providing templates for reading practice, the template explains the different levels of understanding in the reading process and conducts related questioning exercises.

A key point from the schema theory informs that most chapter structures is formed by distinguishing and establishing certain level and sequence of logical processes; thus, upholds a certain framework that can be implemented in the teaching instruction [32]. Therefore, to implement this concept in research, the learning objective for learners is to understand the meaning of the text. Teachers must key in on ensuring learners are aware of the "external structure," "internal structure," and "aesthetic characteristics" of the text, in this order in teaching Chinese reading. Simultaneously, it is also necessary to point out key messages in the text to allow learners to learn to "anticipate" the possible content and schemas of the text; and use schemas to understand the textual content and grasp the key messages in the text. Using keyword lists and indexes, for example, can help readers understand the text more deeply and faster [33].

However, teachers need to also distinguish between the "surface" and "deep" content of the semantics of common topics and try to make it easier and simpler for learners to read and comprehend, and to facilitate learners to set individual reading objectives [34]. Adding schema theory to the teaching instruction ensures that learners do not stay only at the superficial level of understanding sentences but is also expected to analyze the text from a deeper level; with the aim that learners will have a more comprehensive and profound understanding of the reading content [35]. Additionally, observing the title, subtitle, images, graphs, and other information can help one grasp the main topic, knowledge structure, and key concepts of the article [36]. To better understand the key concepts, seeking specific examples in the text can provide a better understanding of phenomena. During the reading process, learners should be reminded to utilize annotations such as underlining, to mark key concepts of each paragraph; and in addition, facilitating the organization of the logical relationship of the text for ease of memorization and comprehension [37].

2.4.2. Preparation of test questions for reading tests

The first step in creating test questions for this study is to select cross-field texts. Each reading text presented to learners is approximately 800 Chinese characters in length, and after reading each text, they must answer 5 multiple-choice questions. Each of the five questions are designed to evaluate learners' ability and depth to "capture information", "interpret text", "conduct a comparative analysis", "identify main ideas", "reflection and evaluation." Ask questions step by step from shallow to deep.

During the test making process, each faculty member in charge of the examination is responsible for selecting four texts and 20 questions; in this study, four faculty members selected 16 texts and compiled a total of 80 questions. A topic selection meeting is then held to select the most suitable 8 texts and a total of 40 questions. After the preliminary session of selecting test questions, 2-3 experts and scholars are hired to revise and proofread the test questions; afterwards, they create the pre- and post-test booklets. In the final phase, to balance the level of difficulty of the pre and post tests, a number of sophomores and grades above, tested the first phase of the pre and post exams; the tests are further fine-tuned based on the responses from the trial tests to determine the finalized test questions. Thus, as formatted, each text has 5 questions to form a question group, and the question book has a total of 1-20 questions.

2.5. Evaluation method

The evaluation method for this study is primarily focused on pre and post assessments. The pre-test assessment is conducted in the first week of school, with an examination time of 40 minutes. After the completion of the pre-test, the grading work and score registration is recorded. On the third week, the teaching practice and design based on the schema theory is taught for 70 minutes, then is followed by another 40 minutes of post-test reading assessment. The answer sheet is taken back for marking and grading and is recorded to the database. The data provides observations on how effective the teaching instruction was carried out to improve students' reading. There are 40 students in class A and 35 students in class B, with a total of 75 students who partook in the pre and post assessments. Students who did not participate in either assessments due to leave or absenteeism were not included in the research analysis.

3. RESULTS AND DISCUSSION

In this section, the study assesses both whether the students' reading comprehension has improved and tests the effectiveness of using schema theory as instructional and curriculum design. The results of the performance of the pre and post assessments, the statistics and data analysis including correlation tests based on SPSS, and the comparison of reading comprehension levels based on PISA standards are provided below. In subpoint 3.5, further discussions on findings are continued.

3.1. Comparing the performance of the reading pre- and post-test

A comparison of the average scores of students in pre-test and post-test is shown in the Table 1. As shown in Table 1, when the pre and post-test scores for all students after the guided lesson on Chinese reading are compared, the post-test scores have improved by an average of (8.32) points relative to the pre-test scores. In terms of the performance of the two classes, the post-test score of class A is (11.00) points higher than the pre-test score; the post-test score of class B is (5.65) points higher than the pre-test score. It can also be seen that the grades of class A are much higher than those of class B. Although the teaching and guidance of reading theory have improved their learning performance, the results of class B are not as good as expected.

Table 1. Comparing student reading pre- and post-test scores

Classes	Pre-test		Post-test		Score boost
	Number of people	Average score	Number of people	Average score	
A	40	59.25	40	70.25	11.00
B	35	54.29	35	59.94	5.65
A&B	75	56.77	75	65.09	8.32

3.2. More specific statistical data analysis

In order to observe the effectiveness of pre- and post-tests on reading learning outcomes more specifically, as well as the impact of the reading unit teaching design on learning, this study performed the following correlation tests using SPSS:

3.2.1. Reliability statistics

As shown in Tables 2-3. This study conducted a reliability analysis on the pre-test and post-test scores, and the analysis result showed a Cronbach's alpha coefficient 0.47. In the item-total statistics, the corrected item-total correlations of both pre-test and post-test were 0.45, indicating acceptable reliability.

Table 2. Cronbach's alpha

Cronbach's alpha	Number of items
0.476	3

Table 3. Corrected item-total correlations

AB class	Mean of the scale after deleting item	Variance of the scale after item deletion	Corrected item-total correlation	Cronbach's alpha if item deleted
Pre-test	67.3333	169.577	0.455	0.030
Post-test	58.8267	185.037	0.455	0.028

3.2.2. Levene's test for equality of variances

Shown in Table 4, the results of Levene's test for equality of variances depict that the significance level for the pre-test was 0.09, and for the post-test was 0.83, both greater than 0.05, indicating that the assumption of homogeneity of variances was met. It was also observed that the P-value for the pre-test two-tailed (P=0.11) was greater than 0.05, suggesting that there was no significant difference between the pre-test scores of class A and B. However, the P-value for the post-test two-tailed (P=0.00) was less than 0.05, indicating a significant difference in post-test scores between the two classes.

Table 4. Levene's test for equality of variances

		Levene's test for equality of variances		T-test for equality of means						
		F	Significance	T	Df	Two-tailed significance	Mean difference	Standard error of the difference	95% confidence interval of the difference Lower bound	Upper bound
AB class pre-test	Assumption of equal variances	2.908	0.092	1.605	73	0.113	4.964	3.093	-1.200	11.128
	Assumption of unequal variances			1.589	67.547	0.117	4.964	3.124	-1.271	11.200
AB class post-test	Assumption of equal variances	0.044	0.834	3.736	73	0.000	10.307	2.759	4.809	15.805
	Assumption of unequal variances			3.715	69.624	0.000	10.307	2.775	4.772	15.842

3.2.3. Paired sample t-test

As shown in Tables 5 and 6, to compare the mean scores of pre-test and post-test, the results of paired sample t-test showed that the mean score of pretest was 56.93 (SD=13.50), and the mean score of post-test was 65.44 (SD=12.92). The post-test score was significantly higher than the pre-test score. In addition, t(74=-5.31), p=0.00 (two-tailed), with a P value less than 0.05, indicating a significant difference between post-test and pre-test scores.

Table 5. The results of paired sample t-test

		Average	N	Standard deviation	Standard error of the mean
Pairwise1	AB class pre-test	56.93	75	13.504	1.559
	AB class post-test	65.44	75	12.921	1.492

Table 6. Indicating significant

Pairwise1	Paired variable difference Average	Standard deviation	Standard error of the mean	95% confidence interval of the difference Lower bound	Upper bound	t	Df	Two-tailed significance
AB class pre-test	-8.507	13.856	1.600	-11.695	-5.319	-5.317	74	0.000

3.2.4. ANOVA

In order to verify whether there is a difference in learning outcomes due to instructional guidance, a one-way repeated measures ANOVA was conducted to analyze the effect of teaching through reading units on students' learning outcomes, as shown in Table 7. The results showed that the F-value for the pre-test was 2.57 with a P-value of 0.11, which is not significant as the P-value is greater than 0.05. However, the F-value for the post-test was (13.95) with a P-value of 0.00, which is significant as the P-value is less than 0.05. This indicates that there is a significant effect of instructional guidance on students' learning outcomes.

Table 7. ANOVA

AB class		Ss	df	Mean square	F-value	P-value
Pre-test	Between-groups	460.024	1	460.024	2.576	0.113
	Within-groups	13034.643	73	178.557		
	Total sum	13494.667	74			
Post-test	Between-groups	1983.094	1	1983.094	13.958	0.000
	Within-groups	10371.386	73	142.074		
	Total sum	12354.480	74			

3.3. Observing deeper reading comprehension

To observe the reading comprehension level of the learners, this study is based on the PISA definition of reading comprehension. Thus, as formatted, each text has 5 questions to form a question group, and the question book has a total of 1-20 questions. Each questions test for a specific skill and level as listed: the first two questions for each question group (i.e., question number 1 and 2; 6 and 7; 11 and 12; 16 and 17) are first-level questions to test for information retrieval, search and comprehension, and the second-level question (i.e., question number 3./8./13./18.) requires contextual comprehension. The last two questions and third-level questions (i.e. 4.5./ 9.10./14.15/19.20) tests for reasoning and comparison which students need to refine the concept of the subject and make personal evaluations and judgments, hence, to have a deeper understanding. There are 8 questions in total. Table 8 observes the performance of the correct answer rate to understand the impact of reading teaching on deepening reading comprehension.

Table 8. Compare reading comprehension levels

Question number	Class A correct rate (%) Pre-test/post-test	Class B correct rate (%) Pre-test/post-test	Average correct rate (%) Pre-test/post-test
03	73%/59%	63%/60%	68%/59%
04	39%/78%	60%/63%	49%/71%
05	54%/29%	57%/57%	55%/42%
08	90%/78%	80%/80%	86%/79%
09	44%/80%	43%/66%	43%/74%
10	41%/54%	23%/26%	33%/41%
13	49%/100%	43%/89%	46%/95%
14	54%/95%	51%/83%	53%/89%
15	68%/24%	54%/26%	62%/25%
18	73%/88%	46%/83%	61%/86%
19	68%/83%	69%/43%	68%/64%
20	32%/49%	37%/20%	34%/36%

As shown in Table 8, to gain a deeper understanding of reading, we looked at the proportion of correct answers to the last three questions in each question group, showing that the overall post-test correct rate was higher than the pre-test. The ratio increased by (7/12 or 58.33%). Looking at the performance of class A separately, it was found that except for question number 3, 5, 8, 15 which was 8/12 (or 66.67%), and class B except for question number 3, 15, 19, 20, (8/12 or 66.67%) maintained or higher than the pre-test rate. Therefore, it can be found that the facilitated lesson on reading can obviously improve reading comprehension and advance towards a deeper level of comprehension.

3.4. Further discussion on findings

In this subsection, the discussion will include observations on the effectiveness of the instructional design and teaching based on schema theory on students' reading comprehension as well as observations on students' ability to immediately apply what they learned in class and develop a new routine of reading habits. Further discussion emphasizes reading comprehension is important to further enable college students to read interdisciplinary articles and the impact in their academic, career and personal life. Lastly, the study acknowledges that instructional design will need more improvement to implement reading comprehension lessons and assessments throughout the whole school.

3.4.1. Can speed up learners' mastery of key information and understanding

Overall, the lessons on reading based on schema theory can help learners quickly grasp the topic, anticipate the direction of the chapter, and quickly retrieve and search for specific information. These are crucial skills that helps learners speed up the reading process. Furthermore, looking at the higher-level comprehension of reading, the ability to apply instant awareness including inference, analysis, judgment, and evaluation from theory to the practical application has also shown improvement.

3.4.2. Learners can instantly perceive and apply the concepts learned

Behavior theory scholars argue that if individuals can identify with the behavior they are engaging in and increase their perception of control over that behavior, they can increase behavioral intentions [38]. Can learners immediately become aware of and demonstrate how to reflect and apply the concepts they have learned? This study found that experiential learning and processes involving reflection can lead to significant feedback from direct or indirect experiential learning [39]. It can be seen that the acquisition of reading knowledge can lead to application, and it is also a process of continuous adjustment and improvement of individual reading ability; at the same time, it is also possible to gradually achieve deeper reading comprehension from a shallow level, which will help students apply the reading experience they have learned into real life.

3.4.3. Effectiveness is less evident for advanced reading comprehension

In fact, this reflective stage of trying out strategies may cause learners to feel pressure to quickly learn new knowledge and apply it immediately; then questioning whether they have mastered the correct reading skills, or have doubts about their ability to apply them effectively. Through carefully designing a facilitated lesson integrating the schema theory in the instructional design, learners can effectively improve their grades based on their deepened understanding of the content. However, for further deeper reading comprehension and smoother practical application of reading strategies require practice over a longer period of time and a large amount of reading to achieve more specific improvements. Therefore, the ability to compare, analyze, and judge at a higher level of reading can be improved, but it is still limited.

3.4.4. At the same time, it is conducive to promoting the acquisition of professional knowledge

Effective proficiency in reading strategies is considered an important skill for improving learners' reading comprehension [40]. This study aims to enhance college students' reading comprehension abilities, enabling them to read a wider range of articles related to their professional skills and knowledge [41]. These skills will help them to stay familiar with and gain a deeper understanding of their profession, while continuously improving their professional skills and knowledge. At the same time, students should also keep up with new technological trends and innovative techniques to apply them in their work, understand their specific job market trends to improve relevant skills, and read articles related to communication skills and interpersonal relationships to enhance their occupational adaptability.

4. CONCLUSION

The purpose of reading is to obtain from the text the correct information that the author intends for the reader to understand. Activation of knowledge structures is vital to the reader. This research is only a one-sided attempt and preliminary discussion on reading teaching. In response to the urgent needs of teaching policies, the basis of this preliminary research is currently applied to the teaching and testing of Chinese reading throughout the whole school. I look forward to continuing to revise and improve the instructional design for Chinese reading lessons. I strive to improve students' reading comprehension and development towards advanced cognition, and further deepen students' ability in reading analysis, application, evaluation, and creation. My goal is for students to not only obtain information from knowledge, but also deepen their understanding during the reading process-and more importantly, to arouse learners' interest in reading and help develop effective reading habits.

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