

English Teaching Management in Public High Schools: A Study Based on Dissipative Structure Theory under the Integration of Sustainable Development Goals in China

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Abstract

Dissipative structure theory provides essential insights for improving classroom teaching management, but empirical research on high school English is lacking. This study aims to investigate high school English teachers' perception of dissipative structure theory (including attitudes, acceptance and application level, and alignment of teaching management beliefs) and determine whether age differences exist. Descriptive statistics and ANOVA were used to analyze questionnaire data. The study findings indicate that users have low acceptance and application levels (mean=3.56), with the highest mean value found for attitudes (3.73) and the lowest mean value for implementing intention (mean=3.42). A significant difference was found between acceptance and application levels and implementing cooperative teaching and teacher-student workshops. Meanwhile, perceptions of classroom management tasks also differ significantly based on the age of high school English teachers. Three points are proposed to encourage high school English teachers to use dissipative structure theory for classroom management.

Keywords: Dissipative Structure Theory, High School English, Classroom Management

Introduction

Prigogine's dissipative structure theory is a seminal advancement in systems theory, pivoting the focus from static to dynamic structures. Renowned futurist Toffler noted that this theory bridges physics and biology, determinism and randomness, and natural and human sciences, reshaping our understanding of complex systems (Ruan, 2019). Since the 1970s, the emergence of theories like synergy, catastrophe, and chaos theory, with dissipative structure theory at the forefront, has profoundly impacted nonlinear complex systems. Scholars have explored its implications in China, finding relevance in basic education (Ye, 2019). In 2019, the

Chinese government introduced the "Decision on Deepening Education Reform and Fully Advancing Quality Education," emphasizing transformative educational concepts and methods, aligning with the principles of dissipative structure theory.

However, in the process of the new round of curriculum reform, classroom management, as the top priority of teaching management, has exhibited issues such as a relatively single management approach, deliberate reversal of the role of the subject, and passive student participation in inspections. To achieve a genuine transformation from a knowledge and subject-centred to a student-centred approach, there is an urgent demand for high school English teachers to change their educational, teaching, and teacher concepts. However, based on the author's practical experience in teaching and managing high school English classrooms, it is found that there are practical characteristics of mutual entanglement and infiltration between English classroom teaching and management. Nonetheless, it is also recognized that there are worrying situations in high school English classroom teaching management, such as significant differences in student learning outcomes, failure of teachers' educational management level to be fully utilized, and failure to cultivate students' lifelong learning habits in English." This has led to certain teachers' teaching styles being unable to play out effectively and classroom teaching order often being interfered with and influenced by external supervision systems, resulting in obvious mechanization in the pace of classroom teaching, classroom order environment, management tasks, and goal setting (Osler & Star, 1994; Yu, 2015). Applying dissipative structure theory in high school English classroom teaching management lacks research.

Therefore, against the backdrop of the new round of curriculum reform, high school English teaching pays more attention to the cultivation of core literacy skills. It focuses highly on students' language and thinking abilities (An, 1990). Consequently, it further demands that high school English teachers improve classroom teaching management to enhance students' English proficiency. Based on equilibrium mechanics research, Prigogine's dissipative structure theory provides essential insights for improving high school English classroom teaching management (Prigogine, 1987).

The research questions are as follows:

1. What is the perception of dissipative structure theory (including attitudes, acceptance and application level and alignment of teaching management beliefs) among high school English teachers in China?
2. What is the level of implementing cooperative teaching and teacher-student workshops among high school English teachers in China?
3. Does the perception of the dissipative structure theory of high school English teachers differ by age?
4. What implications can we gain from this study?

Literature Review

Dissipative Structure Theory

Several studies have attempted to apply this theory in educational science from the perspective of the concept and basic application research of dissipative structure theory (Zhu, 2022). Li (1984) pointed out that chemical phenomena have non-equilibrium characteristics, proposing a new research topic in physical chemistry, considering that dissipative structure

theory also focuses on equilibrium states and reversible processes. Chen et al (2022); Yue (2015) used dissipative structure theory as the main inspiration and employed radar chart tools to analyze the current status of disciplinary structures in universities, obtaining results showing two characteristics: polarization and equilibrium. Cai (2022); Zhang (2023) outlined the fundamental connotations of self-organizing theory and, based on analyzing the postmodern curriculum outlook and innovative thinking, concluded that modern educational reforms must take self-organizing states as the core to generate intrinsic development dynamics continuously.

In the context of English Teaching Management in Public High Schools in Shanxi Province, China, studies based on dissipative structure theory under the integration of Sustainable Development Goals (SDGs) are limited. However, researchers can explore the potential application of dissipative structure theory in enhancing the effectiveness of English language teaching and learning, considering its principles of non-equilibrium, self-organization, and adaptability. Future research in this area could investigate how dissipative structure theory can inform curriculum design, teaching strategies, and educational policies to promote sustainable development goals in English language education.

High School English Teaching Management

Despite English being classified as a "second language" in China, it has its characteristics in classroom teaching management compared to Chinese and other subjects. Meanwhile, research on high school English classroom teaching management in domestic academia is gradually increasing, mainly focusing on teaching resource allocation, teaching management methods, classroom discipline organization, teaching management philosophy, and teachers' classroom teaching management capabilities (Han, 2014; Wang, 2018; Zhu, 2017). However, relatively few literature studies focus on high school English classroom teaching management, indicating that there is still some research space. Thus, through summarizing previous research achievements, this paper recognizes that the essence of classroom teaching management should be the teacher's maintenance of teaching order and the adoption of a series of practical measures to minimize students' problematic behaviors, thereby achieving the dual improvement of students' learning enthusiasm and classroom teaching quality. The application of dissipative structure theory in English classroom teaching management-related research is influenced by the globalization of the economy and the knowledge economy, causing changes in the original closed teaching mode of high school English education in China. It is suggested to transform educational concepts, adjust talent training standards and educational management structures, thereby forming an "ordered" education and teaching system that meets the requirements of the Internet information society (Han, 2014; Wang, 2018; Zhang and Guo, 2017). In other words, this open and far-from-equilibrium system continuously exchanges information and abilities with the external environment.

Methodology

This study employed a questionnaire survey as its primary investigative tool. Adapting from Xu (2016), a questionnaire titled "Survey on the Application of Dissipative Structure Theory in English Teaching Management" was developed.

The questionnaire was a 5-point scale (38 items). It included two key sections: gathering demographic information about the participants and assessing the practical implementation of dissipative structure theory in classroom teaching management by educators.

This entailed evaluating various aspects such as the perception of dissipative structure theory (attitudes, acceptance and application level and alignment of teaching management beliefs).

The questionnaire was distributed to 320 English teachers across 16 selected public high schools in Shanxi Province. These schools were selected based on their reputable academic standards within the local educational landscape, making them suitable for addressing research inquiries. Of the 320 distributed questionnaires, 320 were successfully collected, resulting in a response rate of 100%. After excluding invalid responses, 284 questionnaires remained eligible for further analysis. This study analyses the data using percentage, mean, standard deviation, and ANOVA.

Data Analysis

The sample consists of 284 individuals, with a gender distribution of 37.3% male and 62.7% female. In terms of age, the majority fall within the 36-50 age range (60.6%), followed by 20-30 (23.2%) and 31-35 (16.2%). Regarding teaching experience, a significant portion has between 16 and 30 years of experience (43.7%), while 1-10 years and 11-15 years of experience are represented by 19.7% and 17.6%, respectively. Additionally, 19.0% of the sample have more than 30 years of teaching experience. In terms of professional titles, the majority hold either Intermediate (42.3%) or Senior (47.2%) titles, with a smaller percentage holding Junior (8.5%) or Super (2.1%) titles.

Educational backgrounds vary, with the highest proportion holding Bachelor's degrees (42.3%), followed by Master's degrees (20.4%), and lower proportions holding Vocational education (19.7%) or Secondary vocational education (17.6%).

Table 2

Summary of demographic characteristics of respondents

Variables	Characteristics	N	%
Gender	Male	106	37.3%
	Female	178	62.7%
Age	20-30	66	23.2%
	31-35	46	16.2%
	36-50	172	60.6%
Teaching experience (Year)	1-10	56	19.7%
	11-15	50	17.6%
	16-30	124	43.7%
	> 30	54	19.0%
Professional title	Junior	24	8.5%
	Intermediate	120	42.3%
	Senior	134	47.2%
	Super	6	2.1%
Educational background	Secondary vocational education	50	17.6%
	Vocational education	56	19.7%
	Bachelor's degree	120	42.3%
	Master	58	20.4%

As presented in Figure 1, participants' attitudes towards dissipative structure theory had a highest mean score of 3.73 and a moderately high level of acceptance and application

regarding dissipative structure theory, with a mean score of 3.47. Regarding the “Non-Implementation” to cooperative teaching and teacher-student workshops, with a mean score of 3.43. However, the “Implementing Intention” obtained a mean score of 3.42. Lastly, the Alignment of Teaching Management Beliefs towards dissipative structure theory had a mean score of 3.56.

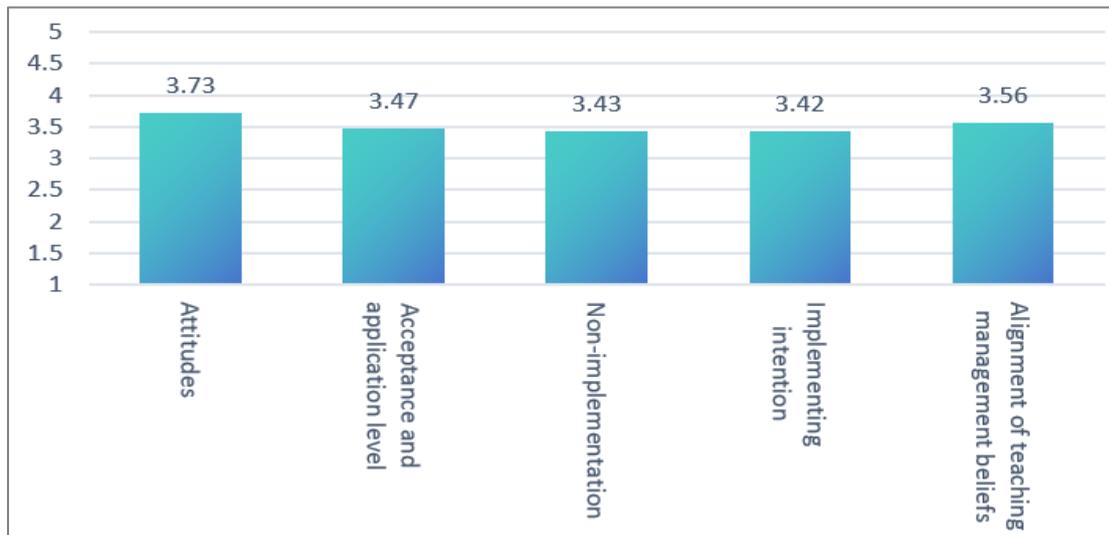


Figure 1: Mean values of perception of the dissipative structure theory

According to Table 2, the attitudes towards dissipative structure theory in classroom teaching management among teachers aged 20-30, 31-35, and 36-50 were 3.60, 3.82, and 3.76, respectively. The ANOVA indicates no significant difference in the attitudes of the surveyed teachers towards applying dissipative structure theory in classroom teaching management ($p > 0.05$). This suggests a relatively consistent attitude among the surveyed teachers. Young teachers (aged 20 to 30) have an average acceptance and application level of 3.56 towards dissipative structure theory. Middle-aged teachers (aged 31 to 35) have an average of 3.48. On the other hand, teachers aged 36 to 50 have an average of 3.36. The statistical value (F value) obtained from the variance analysis is 2.606 and a P value of 0.041, indicating a significant difference in the acceptance and application level of dissipative structure theory ($P < 0.05$). Specifically, young teachers tend to have a deeper understanding and acceptance of dissipative structure theory, while middle-aged and older teachers tend to be more conservative in their attitudes.

Table 2

Attitudes, acceptance and application of Dissipative structure theory

Dissipative structure theory	20-30		31-35		36-50		F	p
	Mean	SD	Mean	SD	Mean	SD		
Attitudes (Mean=3.73)	3.6	0.577	3.82	0.728	3.76	0.710	0.706	0.129
Acceptance and application level (Mean=3.47)	3.56	0.624	3.48	0.456	3.36	0.534	2.606	0.041

Note: 20-30=66; 31-35=46; 36-50:172

As shown in Table 3. Teachers aged 20-30 had an average score of 3.81, those aged 31-35 had an average score of 3.63, and those aged 36-50 had an average score of 3.23. Analysis of variance yielded an F-value of 19.467 with a P-value of 0.001, indicating significant differences in the alignment of teaching management beliefs with dissipative structure theory across different age groups of teachers ($P < 0.05$). Further multiple comparisons elucidate specific differences among age groups. The mean difference between teachers aged 20-30 and 31-35 was 0.18, with a P-value of 0.130. The mean difference between teachers aged 20-30 and 36-50 was 0.58 ($p = 0.000$). The mean difference between teachers aged 31-35 and 36-50 was 0.04 ($p = 0.000$). The data underscore significant differences among teachers of different age groups in their acceptance and comprehension of dissipative structure theory. Younger teachers are more inclined to embrace and apply this novel theory. In contrast, middle-aged teachers may exhibit greater conservatism due to entrenched teaching management beliefs, resulting in lower alignment with dissipative structure theory.

Table 3

Alignment of teaching management beliefs of Dissipative structure theory

Dissipative structure theory	20-30		31-35		36-50		F	p
	Mean	SD	Mean	SD	Mean	SD		
Alignment of teaching management beliefs (Mean=3.56)	3.81	0.517	3.63	0.736	3.23	0.483	19.467	0.001
	20-30vs31-35		20-30vs36-50		31-35vs36-50		p	<0.05
	D-value							
	0.18		0.58		0.04			

Note: 20-30=66; 31-35=46; 36-50:172

According to Table 4, the average score for teachers aged 20-30 who did not implement such arrangements was 3.17. In the 31-35 age group, the average score is 3.46, while for teachers aged 36-50, the average score is 3.65. The analysis of variance yielded a statistical value (F value) of 10.004, with a significance level (P value) of 0.015, indicating significant differences in the implementation of cooperative teaching and teacher-student workshops among teachers of different age groups at $P < 0.05$ level. Similarly, for the intention to implement such arrangements, teachers aged 20-30 have an average score of 3.59, those aged 31-35 have an average score of 3.42, and those aged 36-50 have an average score of 3.26. The analysis of variance yielded a statistical value (F value) of 2.606, with a significance level (P value) of 0.038, indicating significant differences in the intention to implement cooperative teaching and teacher-student workshops among teachers ($P < 0.05$).

Table 4

Implement cooperative teaching and teacher-student workshops

Implement cooperative teaching and teacher-student workshops	20-30		31-35		36-50		F	p
	Mean	SD	Mean	SD	Mean	SD		
Non-implementation (Mean=3.43)	3.17	0.816	3.46	0.907	3.65	0.864	10.004	0.015
Implementing intention (Mean=3.42)	3.59	0.624	3.42	0.456	3.26	0.876	2.606	0.038

Note: 20-30=66; 31-35=46; 36-50:172

Table 5 shows significant differences in the perceptions of classroom management tasks between teachers of different age groups. Between teachers aged 20-30 and 31-35: The mean difference is -0.47, indicating that younger teachers (aged 20-30) tend to have a lower perception of classroom management tasks related to constructing student knowledge and stimulating enthusiasm compared to teachers aged 31-35. This difference is statistically significant, with a low P value of 0.004. Between teachers aged 20-30 and 36-50: The mean difference is -1.104, suggesting a more substantial difference in perceptions between younger teachers (aged 20-30) and older teachers (aged 36-50). Younger teachers are significantly less inclined to perceive classroom management tasks related to constructing student knowledge and stimulating enthusiasm than their older counterparts, as indicated by the low P value of 0.000. Between teachers aged 31-35 and 36-50: The mean difference is -0.632, demonstrating that teachers aged 31-35 also have significantly different perceptions of classroom management tasks related to constructing student knowledge and stimulating enthusiasm compared to teachers aged 36-50, with a P value of 0.000. These findings suggest that younger teachers are less likely to prioritize tasks related to constructing student knowledge and stimulating enthusiasm in classroom management than their older counterparts. This highlights potential generational differences in teaching approaches and underscores the importance of considering age-related factors in educational practices.

Table 5

Perceptions of classroom management tasks

English classroom management	20-30vs31-35	20-30vs36-50	31-35vs36-50	p
	D-value			
Perceptions of classroom management tasks (Mean=3.47)	-0.47	-1.104	-0.632	<0.05

Note: 20-30=66; 31-35=46; 36-50:172

Conclusion

The research results show that the average attitude of high school English teachers towards dissipative structure theory is 3.73, followed by alignment of teaching management beliefs and acceptance and application level, with the average scores of the two being 3.56 and 3.47, respectively. Additionally, implementing intention has an average score of 3.42. Significant differences exist in the level of acceptance and application, as well as the implementation of cooperative teaching and teacher-student workshops. Meanwhile, there are significant differences in the views of high school English teachers on classroom management tasks among different ages. The application of dissipative structure theory meets the practical needs of reforming English teaching management in public high schools in China. However, frontline English teachers often lack theoretical guidance due to a limited understanding of dissipative structure theory and the influence of existing teaching management habits. Therefore, the following three points were proposed to promote teachers' use of dissipative structure theory for classroom management.

1. Training and support

Educational institutes need to provide relevant training and support to teachers to help them understand and apply dissipative structure theory. This can be achieved through dedicated workshops, training courses or teaching resources.

2. Create an open environment:

An open environment needs to be created in the classroom to encourage students to participate, explore and innovate. Teachers must adopt diverse teaching and assessment methods to promote students' independent learning and thinking development.

3. Practice and Reflection

Teachers should constantly practice and reflect on their teaching practices, integrate dissipative structure theory principles into classroom management, and make adjustments and improvements based on actual results.

Research Contribution

Theoretical Contribution

The application of dissipative structure theory in classroom teaching management is little discussed, so this study fills the theoretical gap in this field. By investigating high school English teachers' cognition and application level of this theory, it provides empirical support and theoretical basis for the application of dissipative structure theory in the field of education. Meanwhile, it brings new ideas and perspectives to the development of educational management theory.

Practical Contribution

The suggestions put forward in this article, such as training and support, creating an open environment, practice and reflection, directly target the practical problems of high school English teachers in the application of dissipative structure theory, and provide practical solutions to practical teaching management challenges. By adopting teaching management methods guided by dissipative structure theory, students' active participation and independent thinking can be promoted, and teaching effects and learning outcomes can be improved. This is of great significance to both teachers and students and helps to build a good educational environment and atmosphere. Through the implementation of practical suggestions, teachers can continuously improve their educational management capabilities and professional qualities, and improve their understanding and application of dissipative structure theory. This helps build a team of high-quality teachers and promotes the sustainable development of education.

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