Effective Strategies for Teaching Academic Writing and Literary Reading: Perceptions and Challenges of STEM Students in Chinese Higher Education

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ABSTRACT

Drawing on the experiences and practices of teaching "Literature and Writing" courses at ShanghaiTech University, this paper explores effective strategies for integrating academic writing and literary reading in college literature classes to develop students' cognitive abilities through a writing-to-learn (WTL) approach. The study examines the preferences and challenges STEM students face in learning academic writing and literary reading, highlighting common obstacles these learners encounter. Data were collected through a survey instrument and analyzed using descriptive statistics. The results reveal STEM students' reading and writing habits and perspectives on one-on-one writing conferences. This paper proposes possible solutions for teachers to help students cultivate writing and critical thinking skills through a blend of WTL and interdisciplinary teaching approaches.

Keywords: Academic writing; higher education, writing to learn; interdisciplinary teaching, STEM education

INTRODUCTION

Teaching literature and writing courses in institutes of technology presents unique challenges due to students' differing educational focuses and expectations in universities that emphasize Science, Technology, Engineering, and Mathematics (STEM). In mainland China, this situation is exacerbated by the Chinese education system, which provides distinct academic training for science and humanities tracks as early as high school. Additionally, students must declare their major upon university admission, and technically oriented students typically prioritize

scientific and technical subjects over humanities throughout their secondary and higher education. Before the writing reform in the early 21st century, college writing courses in the Chinese language were usually not offered to STEM students; even for humanities students, these courses often emphasized the theory of writing and knowledge of genres rather than writing practice and the development of critical thinking skills (Han, 2005).

Since the beginning of the 21st century, writing instruction and composition studies in China have undergone a transformation due to the introduction of Western educational theories and pedagogies (Song & Yang, 2024). In recent years, the writing-to-learn (WTL) approach has shown promising results in some college English courses (e.g., Wang, Niu & Zheng 2000; Zheng, 2004; Zhu & Zeng, 2007); meanwhile, Chinese writing courses at technology-focused institutions have begun incorporating the WTL strategy into general education (GE) curricula. For example, Tsinghua University, a top-ranking university focusing on science and technology, established the Writing and Communication Center in 2018, drawing on the model of the Princeton Writing Program. Through small class sizes and one-on-one feedback sessions, Tsinghua offers diverse topic-based writing courses to enhance STEM students' writing and communication skills (Li, 2021; Su 2021).

Although Chinese higher education professionals recognize the importance of writing and other communication competencies, the teaching methodologies of WTL and writing across the curriculum (WAC) have not been widely implemented in higher education due to the nature of the Chinese educational model and the emphasis on science and technology instruction in Chinese political culture (Wu, 2012). Few researchers have studied the effectiveness of writing instruction from students' perspectives in technical universities. The research context of this study, ShanghaiTech University (hereinafter referred to as ShanghaiTech) is a small research university in Shanghai with undergraduate students predominantly in science and engineering disciplines. "Literature and Writing" is one of the required GE modules for undergraduates at ShanghaiTech. Since fall 2021, we have reformed this module by transforming some of the original 2-credit, lecture-based literature courses into 3-credit, writing-intensive courses. This reform aims to further implement the WTL concept within the framework of humanities education and help STEM students develop reading, writing, and critical thinking skills.

This paper explores students' perceptions of literature courses and the WTL approach to teaching "Literature and Writing" courses at ShanghaiTech.

LITERATURE REVIEW

Writing to Learn Approach and Students' Learning and Writing Development

Writing has been recognized as an effective learning strategy since the 1970s. The WTL methodology is based on the premise that writing can be a powerful tool for learning and thinking. This approach emphasizes writing as a process and uses

writing assignments to facilitate students' learning of course content and improve their critical thinking skills. The theoretical underpinnings of WTL are rooted in constructivist theories of learning, which posit that learners actively construct knowledge through experiences and interactions with the world around them. Vygotsky's (1978) social constructivist theory highlighted the importance of language and social interaction in the learning process, suggesting that writing can serve as a medium for dialogue and reflection. Emig (1977) further emphasized that writing serves as a unique learning mode, involving active cognitive engagement and aligning with powerful learning strategies. More recent developments in cognitive science support these ideas, reinforcing the notion that writing facilitates deeper learning through active engagement and reflection. Hayes and Flower's (1980) cognitive analysis of the writing process confirmed the connections among writing, learning, and thinking. Bangert-Drowns et al. (2004) suggested that writing enhances learning by scaffolding metacognitive processes, aiding in developing self-regulated learning strategies.

Many studies exploring the practical applications of WTL have demonstrated its effectiveness in enhancing student learning and writing development across various educational contexts. For instance, Langer and Applebee (1987) found that integrating writing activities into the curriculum led to significant improvements in students' analytical and interpretive skills. In higher education, Bean (2021) emphasized integrating writing and critical thinking into courses to promote self-reflection and foster more personally meaningful learning. Beaufort (2007) proposed a conceptual model of the knowledge domains in college writing practice that not only helps students develop subject matter and critical thinking expertise but also facilitates positive transfer of learning. Recent scholars have also explored how WTL strategies can be applied in STEM fields to improve conceptual understanding, critical thinking, and interdisciplinary collaboration (Kim & Kim 2024; Mathison & DeGrauw, 2024).

Interdisciplinary Teaching and Critical Thinking

Interdisciplinary teaching integrates multiple academic disciplines into a cohesive learning experience, based on the premise that critical thinking requires analyzing problems from multiple perspectives, synthesizing information, and drawing connections—capabilities enhanced by an interdisciplinary approach. This teaching method is also grounded in constructivist learning theory, which emphasizes the active construction of knowledge by integrating new information with prior experiences and understandings (Jacobs, 1989). Such integration aligns with the development of critical thinking, as students must engage with course material, make connections, and apply concepts to novel situations.

Recent research has increasingly highlighted the role of interdisciplinary teaching in fostering "integrative thinking"—the ability to consider multiple, sometimes conflicting, perspectives and synthesize them into a coherent understanding (Boix Mansilla, 2005; Repko, 2008). This skill is crucial for critical

thinking and problem-solving. Haynes and Burayidi (2000) found that students in an interdisciplinary urban studies program exhibited higher levels of critical thinking, particularly in analyzing complex issues, evaluating evidence, and drawing well-reasoned conclusions. Similarly, Boix Mansilla and Duraising (2007) reported that students in an interdisciplinary humanities program, exhibited stronger integrative thinking, perspective-taking, and the ability to evaluate the credibility of information sources.

In light of the findings of previous studies and the survey below, this study suggests that blending interdisciplinary teaching with WTL can be a promising approach to enhancing students' critical thinking skills through writing. By exposing students to multiple disciplinary perspectives and encouraging them to make connections and synthesize information, interdisciplinary writing assignments can cultivate the cognitive abilities essential for critical thinking. Further research is needed to continue exploring this teaching approach's function and identify best practices for implementing interdisciplinary curricula.

Implement Interdisciplinary Teaching and Learning

In today's world, developing the intellectual capability to evaluate controversial issues through multiple perspectives and methodologies critically is an essential skill for long-term success (Wang, S., 2019). Empowering students to become independent and critical thinkers is considered one of the most important objectives of higher education (Pithers & Soden, 2000). Developing critical thinking requires the acquisition of intellectual and academic tools, and research suggests that an interdisciplinary approach to education fosters the development of critical thinking skills (Newell, 1992; Howlett, Ferreira & Blomfield, 2016).

Meaningful interdisciplinary teaching and learning play an increasingly crucial role in achieving the modern educational goal of promoting critical thinking. This approach fosters the development of diverse perspectives and values by encouraging students to transcend the boundaries of a single discipline. It also enhances communication and collaboration, enabling students from varied backgrounds to engage effectively. Importantly, the benefits extend beyond academia, as interdisciplinary analysis skills evolve into practical soft skills applicable in real-world contexts (Wang, S., 2019).

Based on the theories discussed earlier, this study suggests that adopting interdisciplinary pedagogical strategies in higher education is crucial for improving STEM students' critical thinking and expanding their intellectual and practical capabilities. It is premised on the idea that writing can facilitate interdisciplinary learning for STEM students in the following ways: (1) Helping students clarify their thinking, organize ideas, and synthesize findings from diverse disciplines. (2) Facilitating communication of interdisciplinary understanding to various audiences and purposes through appropriate genres, formats, and styles. (3) Encouraging reflection on their learning process, evaluation of strengths and weaknesses, and identification of areas for improvement. (4) Enabling the creation

of new knowledge, insights, and solutions by integrating and transforming information from multiple disciplines.

RESEARCH METHOD

This case study specifically focuses on the data collected by the questionnaire, including the written reflection of the class online. At the end of 2021, we conducted an anonymous questionnaire survey among ShanghaiTech undergraduates who had taken courses in the "Literature and Writing" module during the fall semester.[1] The survey aimed to gather students' opinions on reading, writing, and course instruction. A total of 168 students participated in the survey, having enrolled in eight different themed courses taught by four instructors. Among them, 112 students were enrolled in the 3-credit courses, and 56 students were enrolled in the 2-credit courses.

Participants

Since ShanghaiTech students typically complete most of their GE courses within the first two years of their studies, the majority of the survey respondents were first- and second-year undergraduates with science and engineering backgrounds, including fields such as computer science, electronic engineering, life science, physics, chemistry, industrial design, and mathematics. The demographic breakdown of the respondents is as follows: 112 first-year students (67% of the total), and 56 second- and third-year students (33%). Male students comprised 108 of the respondents (64%), while female students comprised 60 (36%).

Table 1
Majors of the students who participated in the survey

Major (s)	Students
Computer Science & Electrical Engineering	53
Life Science	50
Physics	18
Industrial Design	18
Materials Science & Chemistry	9
Biomedical Engineering	8
Mathematics	8
Management Science	4
Total	168

Data Collection

An online questionnaire was sent to 168 students, all of whom completed it. The questionnaire consisted of 24 questions divided into four sections: student information, reading, teaching, and writing. The primary objectives of the survey were to understand three key areas: (1) the reading preferences of STEM undergraduates and their interest in literature courses, (2) students' writing preferences and self-assessments, and (3) students' perspectives of one-on-one writing conferences and the relationship.

Research Questions

The present study aims to determine how STEM students perceive the practice of the WTL approach in teaching academic writing and literary reading in higher education. Data was collected using a research-designed survey and analyzed using descriptive statistics to answer the following questions:

(1) What are the preferences and challenges of college students in STEM majors regarding learning academic writing and reading literary texts in Chinese?

(2) How can teachers develop students' writing and thinking skills by blending WTL with an interdisciplinary approach?

Procedures and Instruments

We believe that academic writing is a process of interpreting and synthesizing information, and organizing and expressing thoughts. Students will develop an interest in writing to learn through reading, thinking, writing, revision, and one-on-one conferences. In addition, we recognize that enhancing writing and communication skills requires skill training and the development of students' reading and thinking habits, as both are crucial for fostering student literacy. However, according to a recent survey, Chinese college students lack sufficient reading time, and the prevalence of entertainment-driven and fragmented reading habits hinders the improvement of their writing abilities (Zeng & Nie 2018).

In the fall of 2021, we introduced six new 3-credit courses within the "Literature and Writing" module, while retaining the four original 2-credit courses. These new courses include "Argumentative Writing," "Novel Reading and Criticism," "Classical Chinese Literature in Modern Times," "Pre-Tang Poetry and Prose," "Taiwanese Literature and Writing," and "Selected Readings in Modern Chinese Literature" (see Table 2 for a comparison between the 3-credit and 2-credit courses). All these 3-credit literature courses are taught in small classes of no more than 20 students to ensure effective teacher-student interaction. Our course design combines an average of 2 hours of classroom teaching with 1 hour of writing practice each week. The first 2 hours focus on reading and discussion of literary works, while the third hour involves more flexible formats such as one-on-one

writing conferences and writing workshops, conducted at different times and locations.

The 3-credit "Literature and Writing" courses have the following three characteristics. First, these courses have a balanced focus on literary reading and writing training. Instructors select literary texts from specific periods, genres, or themes, guiding students to read, analyze, and discuss these works in class, cultivating their reading and thinking habits and developing their humanistic literacy. Students are required to write argumentative essays on selected topics or assignments. Through small group discussions, one-on-one writing conferences, and various writing activities and training, students are inspired to critically think about these works and cultural phenomena, develop personal insights, and learn to write logically by academic standards.

Table 2
Comparison between 3-Credit Courses and 2-Credit Courses

Criteria	3-Credit Courses	2-Credit Courses
Class Size	No more than 20 students	30-50 students
Teaching Method	Combination of classroom teaching, one-on-one writing conferences, and extracurricular activities	Classroom teaching only
Syllabus	Same requirements and guidelines for writing format, objectives, word count, one-on-one writing conferences, and extracurricular activities	No standardized requirements for writing
Writing Volume	Over 4000 words, including two revision processes	No standardized requirements
Reading Volume	Increased volume of literary readings	Not specified
One-on-One Writing conferences	Students must participate at least twice per semester, each session lasting 30-45 minutes	Not specified
Assessment Method	Writing accounts for more than 55% of the total course grade	No standardized requirements
Extracurricular Activities	Participating students can earn extra credit	Not specified

Secondly, these courses require each student to schedule at least two one-on-one sessions with the instructor per semester, each lasting 30 to 45 minutes.

During these sessions, instructors provide comments and feedback on students' drafts and discuss specific revision strategies with them. The process of participating in these two writing conferences and revising their essays is also included in the course assessment. At the end of the semester, students are expected to reflect on their instructors' feedback and submit revised academic papers.

Lastly, extracurricular activities are coordinated with in-class learning. Instructors organize writing workshops outside of class and encourage student participation by offering extra credit. These activities aim to encourage undergraduates from different disciplines and years to share their reading and writing experiences and engage in additional writing practice.

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RESULTS

STEM Students' Reading Preferences

Table 3
Weekly Reading Volume Completed by Students

Pages per Week	Percentage of Students
10-20 pages	39.9%
20-30 pages	29.2%
30-40 pages	15.5%
40-50 pages	6.5%
More than 50 pages	8.9%

Table 4
Average Weekly Time Spent Reading Course Materials

Time Spent per Week	Percentage of Students
Less than 1 hour	38.1%
1-2 hours	48.2%
2-4 hours	10.7%
4-6 hours	3.0%

The tables indicate that most of the surveyed students have limited time to devote to literary reading, probably due to both subjective and objective factors. The limited interest in literary works among some STEM students, coupled with the demanding nature of general science courses and major courses, results in tight study schedules for first- and second-year students at ShanghaiTech. For literature professors, reading literary works and research materials is fundamental for students to comprehend texts and develop reading skills and critical thinking.

However, most freshmen and sophomores at ShanghaiTech can read no more than 30 pages per week, with a reading time not exceeding 2 hours.

Therefore, it is necessary to consider the realistic reading capacity of STEM students when assigning reading tasks. Teachers should also support underclassmen, who may not be accustomed to extensive reading, by teaching them effective reading techniques, providing guided reading, and allowing sufficient time to cultivate reading habits. From a time management perspective, assigning fewer but high-quality readings that students can complete thoroughly is more effective, rather than overwhelming them with a large volume that may lead to superficial engagement or incomplete work.

Additionally, through our survey, we also gained insights into students' preferred reading assignments. The survey revealed that students' favorite course materials are literary works (91%), followed by films and television series (58%). With many literary classics adapted into films, incorporating audiovisual resources in literature classrooms can shift away from traditional lecture-based teaching methods. This approach enhances students' engagement with stories and characters, stimulating their interest in closely reading the original texts. It also allows for comparisons between literature and film, prompting students to discuss and contemplate the differences in literary production and film adaptations, as well as the cultural and contextual changes.

Students' Writing Preferences and Self-Assessment

Table 5
Preferred Total Writing Volume per Semester

Writing Volume	Percentage
Less than 3,000 words	25.0%
3,000-5,000 words	60.7%
5,000-7,000 words	6.9%
More than 7,000 words	8.3%

(In a Chinese document, the word count per page typically ranges from 500 to 600 words, using 12-point SimSun font with double spacing.)

Table 6
Types of Writing Students Are Most Interested in

Type of Writing	Percentage
Creative Writing	95.8%
Practical Writing	88.1%

Academic Writing	83.3%

The survey reveals that more than half of the students are comfortable with writing assignments totaling 3,000 to 5,000 words per semester. However, a quarter of the students are reluctant to write assignments exceeding 3,000 words, and many STEM students may find writing tasks exceeding 5,000 words for a single course to be overly burdensome.

Notably, although our courses focus on argumentative essays and academic writing, the surveyed students show a higher interest in creative writing compared to academic and practical writing. This interest is likely influenced by the prevalence of new media, with students frequently reading genre-specific works such as online novels, comics, and romances, as well as their interest in science fiction and technological innovation.

Additionally, we briefly examined the relationship between students' reading and writing preferences, discovering a positive correlation. Students who read more (with 30 pages each week as the benchmark) are also more inclined to engage in additional writing practice, and vice versa (see Table 7).

Table 7
The Relationship Between Students' Reading and Writing Interests

Reading Volume (per week)	Writing Less Than 3000 Words	Writing More Than 3000 Words
More than 30 pages	15.4%	84.6%
Less than 30 pages	29.3%	70.7%

Table 8
Student Self-Evaluation of Writing Skills

Writing Skill Level	Percentage
Very Strong	3.6%
Good	29.2%
Average	54.8%
Poor	12.5%

Table 9
Areas Students Hope to Improve Through Courses

Writing Skill Area	Percentage
How to Develop Logical Thinking	79.2%
How to Use Accurate, Clear, and Fluent Language	78.6%
How to Understand and Analyze Texts Effectively	64.9%
How to Organize the Structure of an Article	61.3%

How to Gather Information and Use It Properly	52.4%
How to Use Formal Written Language	45.2%

Among the surveyed students, more than half consider their writing ability average, while about one-third believe their writing skills exceed average. Regarding academic writing, students are most eager to improve their logical thinking and language skills. When analyzing students by grade level, we found that first-year students show a stronger desire to enhance their writing proficiency across all six indicators, particularly in "Gather Information and Use It Properly" (up by 20%), "Develop Logical Thinking" (up by 17%), and "Organize the Structure of an Article" (up by 14%) compared to second-and third-year students. However, there was no significant difference in self-assessment of writing ability between first-year and other students. From this survey, it can be inferred that, after one or two years of GE in humanities and social sciences, students have gained some understanding of the methods and techniques for academic writing but do not feel a significant improvement in their writing skills.

Furthermore, the self-assessment of students' writing abilities is related to their interest in reading and writing. Table 10 reveals that students who perceive their writing abilities as poor tend to engage less in writing and reading. In contrast, students who rate their writing abilities as average or above average tend to increase their writing practice and show slightly higher interest in reading.

Table 10
Relationship between Students' Self-assessment of Writing Ability and Interest in Writing and Reading

Self-assessment of Writing Ability	Writing 3000 Words or More	Reading 30 Pages or More Weekly
Strong/Good	80.0%	29.1%
Average	73.9%	32.6%
Poor	66.6%	28.6%

Student Attitudes Toward One-on-One Writing Conferences

Among the 168 students surveyed, 153 participated in one-on-one writing conferences, with 111 students required to participate due to their enrollment in the 3-credit courses. Among the 56 students enrolled in the 2-credit courses, where participation in one-on-one conferences was voluntary, 42 students (75%) chose to schedule writing sessions.

We surveyed the 153 students participating in one-on-one writing conferences to understand their attitudes toward these sessions. The survey results indicate that 98% of students consider these individual writing conferences beneficial for improving their writing skills. These findings align with the improvement of the students' grades, as revealed in Table 12.

The areas where students reported the most significant improvements after the one-on-one conferences include: clarifying viewpoints and forming logical arguments (76%), structuring essays (74%), refining word choice, sentence structure, and overall language (66%), researching and citing materials correctly (45%), understanding academic style and writing conventions (43%), and reading and analyzing texts effectively (37%). These findings align with the expectations students expressed in Table 9 regarding writing courses.

After participating in one-on-one writing conferences, 30% of students spend 1 to 2 hours revising their compositions, 33% spend 2 to 3 hours, 22% spend 3 to 5 hours, and 11% spend over 5 hours. Regarding the desired frequency of these conferences, 65% of students find twice per semester optimal, while 30% prefer increasing it to three times or more. Overall, students show enthusiastic support for one-on-one writing conferences. Nevertheless, providing such individualized sessions outside of class demands significant time and effort from professors, making them feasible only when combined with small-sized classes, ideally with fewer than 15 students.

Performance of Students

Table 11
Student Course Grades for "Selected Readings in Modern Chinese Literature" Course (Fall Semester 2021)

A+	A	A-	B+	B	B-	C+	C	C-	F
0	20	30	35	10	0	5	0	0	0

Table 12
Grade Improvement Before and After One-on-One Sessions and Revisions in "Selected
Readings in Modern Chinese Literature" Course (Fall Semester 2021)

Paper 1 original	Paper 1 revised	Paper 2 original	Paper 2 revised
80	85	75	84
69	85	83	93
72	75	69	70
74	85	82	88
75	80	81	85
82	88	77	89
75	80	81	88

80	90	76	88
83	85	75	82
81	85	78	84
83	92	81	92
70	80	86	88
82	90	84	90
80	90	81	87
79	85	82	85
76	80	80	87
82	92	79	85
68	80	79	80
83	90	87	93
82	90	82	87

Table 13
Grading Criteria for Writing Assignments in "Selected Readings in Modern Chinese Literature" Course

CATEGORIES	Score
Reading Comprehension of Literary Texts Demonstrates an in-depth and nuanced understanding of the assigned literary works, including themes, stylistic elements, narrative techniques, and their socio-cultural contexts.	0–20
Analytical Thinking and Literary Analysis Provides insightful and critical analysis of the text, uncovering complex layers of meaning and significance through well-supported interpretations that reflect advanced literary engagement.	0–20
Argumentation and Articulation of Ideas Constructs clear, coherent, and compelling arguments, articulating sophisticated viewpoints with strong textual evidence and logical reasoning.	0–20
Structure and Formatting Exhibits a tightly organized and complete structure, with well-arranged paragraphs and a logical internal flow; organizes content with clarity and	0–20

precision, adhering to academic conventions and formatting standards.	
Language Proficiency and Expression Uses precise, fluent, and grammatically correct language to communicate ideas in an appropriate academic tone and style.	0–20
Total	0–100

The results of students' overall grades and scores indicate that all students achieved notable improvement through the WTL approach, with one-on-one writing conferences providing significant benefits for most of them.

DISCUSSION AND CONCLUSIONS

Enhancing Writing, Reading, and Critical Thinking with the WTL Approach

Based on the survey of STEM students' perceptions of reading and writing, it is found that WTL is an effective strategy that utilizes the process of writing to deepen understanding, foster active engagement, and develop a range of valuable skills. When implemented thoughtfully and integrated with reading, WTL can be a powerful tool for enhancing student learning in the following ways:

Active Learning: WTL encourages students to actively engage with reading materials rather than passively absorb information. By critically evaluating, analyzing, and synthesizing information, students are required to process the content more deeply. Writing to explain ideas and supporting arguments requires them to articulate their thoughts clearly and effectively, thus fostering active learning. The following excerpts are representative of student feedback from course evaluations:

Student A: I regard the reading component of the course as an opportunity to investigate my areas of interest, serving as a stimulus for my learning and introspection. Meanwhile, the writing component allows me to articulate my thoughts, capturing the fleeting, fragmented reflections that collectively shape my sense of self.

Student B: I acquired the ability to analyze texts from various perspectives and learned how to structure my essays to achieve greater logical clarity. Additionally, I gained valuable insights into organizing the flow of ideas, making my writing more coherent and well-structured.

Personalization: Writing enables students to personalize their engagement with the material by making connections to their own experiences, interests, and perspectives. In terms of teaching, one-on-one writing conferences provide an opportunity for students to interact directly with instructors, discuss their ideas and arguments in depth, and receive immediate, tailored feedback on their writing

strengths and weaknesses. Moreover, they learn specific revision techniques to clarify their ideas and improve their drafts. This personalized approach can boost motivation and investment in the learning process. The following excerpts are representative of student feedback from course evaluations:

> Student C: It has been several years since I took the college entrance exam, and I have forgotten many writing techniques, so I am not as proficient in writing. However, the instructor patiently provided detailed feedback on each of our essays. Through one-on-one conferences, I identified problems in my writing and revised my essays with new ideas (generated during the conferences), improving my writing based on the suggestions.

> Student D: The course was highly motivational and encouraged me to make literature a fundamental part of my future pursuits. The individualized sessions were particularly beneficial, as they guided students in identifying weaknesses in their papers and offered practical suggestions for improvement, significantly enhancing my learning experience and aiding in the completion of assignments.

Disciplinary Conventions: Writing assignments tailored to specific disciplines, such as literature reviews and response papers, can help students learn the conventions and genres pertinent to particular fields of study. The following excerpts are representative of student feedback from course evaluations:

> Student E: In this course, I gained fundamental writing strategies for academic papers. Offering such a literature course in our STEM-focused university is not easy.... I was especially impressed by the instructor's attention to the Chinese writing conventions. The instructor identified and corrected habitual expressions in my essays that I had used without much thought, revealing issues I had previously overlooked.

> Student F: Each class was thoroughly prepared, offering me a foundational understanding of the methodologies and importance of literary criticism. The two writing assignments were highly flexible, which greatly stimulated my interest in writing.

Transferable Skills: The process of writing, regardless of the specific task, enhances broader academic and professional skills, such as critical thinking, communication, and problem-solving. The following excerpts are representative of student feedback from course evaluations:

> Student A: In the process of revising my paper, I repeatedly scrutinized my viewpoints and refined my language. While learning to use rigorous logic to support my arguments and precise language to convey my ideas, I

experienced the sparks ignited by the collision of thoughts. This collision occurred not only through my interactions and exchanges with the external world but also on my own journey of intellectual growth.

Student G: I never expected that at ShanghaiTech University, it would be a humanities course, rather than a science course, that would first inspire me to cultivate independent thinking and shape my values and worldview. I once thought that literature, like mathematics, had only one correct answer. However, under the professor's guidance, I realized that literature can be interpreted from multiple perspectives, and I began to see that science and life are just as complex. The insights I gained from literature ignited my curiosity to explore both science and life.

Challenges in Developing Writing Ability and Logical Reasoning Skills through Literary Reading and Writing

Analysis of the questionnaire survey results reveals that although students exhibit a keen interest in reading literary texts and writing academic papers, multiple factors such as knowledge background, cognitive abilities, previous reading and writing habits, and time constraints pose significant challenges during the actual processes of reading and writing (as shown in tables 3, 4 and 5). Tables 8 and 10 indicate that STEM students at ShanghaiTech demonstrate relatively low self-efficacy in writing, which correlates with the reading and writing habits they developed in high school. As student comments suggest, Chinese students are accustomed to reading for fixed answers and writing for tests throughout their secondary education, often resulting in a lack of college readiness skills, particularly in critical thinking and problem-solving skills. In their early college years, STEM students in China typically concentrate on mathematics and foundational science courses, leaving them little time to cultivate their reading and writing skills; by their junior and senior years, they are not required to take humanities courses, with most students shifting their focus to major-specific courses and graduate school preparation.

The survey also indicates that STEM students face many challenges in writing that are primarily cognitive rather than linguistic. Consequently, enhancing logical reasoning skills through literary reading and writing is not only an urgent demand for students themselves (as shown in Table 9, where students most desire to enhance their ability to "develop logical thinking") but also a focal point and a challenging task in teaching.

Furthermore, professors face challenges when integrating WTL into literature courses, as this approach requires careful planning, scaffolding assignments, balancing the time allocated for reading, discussing, and writing, and increasing the instructors' workload to provide tailored feedback in one-on-one conferences.

Drawing on the findings from the questionnaire and practical issues observed in teaching, we will explore how specific teaching arrangements and writing practice can effectively tackle these challenges while deliberately focusing on enhancing students' writing abilities through critical thinking and logical reasoning.

IMPLICATION

A WTL Curriculum with an Interdisciplinary Approach for STEM students in Higher education

Recognizing the challenges STEM students face in developing logical reasoning and critical thinking skills, we propose an interdisciplinary teaching approach combined with WTL strategies to address these issues. As discussed earlier, interdisciplinary teaching is an essential pathway to enhancing knowledge and cultural refinement in higher education. On a practical level, students need logical writing skills and effective communication abilities for publishing academic papers and preparing work reports.

Following the survey of 2021, we have expanded the "Literature and Writing" module by incorporating more themes beyond literature. As of the spring semester of 2024, we have included a variety of courses offered by professors from other disciplines, such as history, philosophy, logic, theater, and anthropology. Consequently, the module has been renamed to "Humanities Writing." We anticipate that the integration of WTL and interdisciplinary teaching approach will benefit student learning and writing in the following areas:

Deep Understanding:

Students can use reading reports to reflect on their learning, synthesize information from different materials, and articulate their understanding in their own words. Teachers can, for example, incorporate short reading-related assignments into writing sessions to encourage continuous reflection and processing of information.

Critical Thinking:

To enhance critical thinking skills, teachers can assign various writing tasks—such as summaries, essays, research papers, case studies, and creative writing—to engage students and challenge them in diverse ways. These assignments encourage students to analyze, evaluate, and critique information, fostering the development of critical thinking.

Interdisciplinary Application

To promote interdisciplinary integration with WTL, teaching activities should focus on bridging disciplinary boundaries and helping students identify connections between various fields of study. For instance, teachers might compare and contrast perspectives from two disciplines on specific reading material or

analyze the text through an interdisciplinary lens.

According to the findings, surveyed students show a stronger interest in creative writing than academic and practical writing, likely shaped by their frequent engagement with new media. To address this, combining creative and academic writing within one course is recommended. Furthermore, creative writing and reading could be integrated into genre-specific works relevant to technology-focused contexts, including online novels, comics, and romances.

Collaborative Learning :

Teachers should encourage students to collaborate on writing assignments to foster communication and teamwork skills. Additionally, teachers can create opportunities for students to provide feedback on each other's writing, which can enhance their writing skills and deepen their understanding of the reading material. This approach also helps students develop the ability to communicate their ideas clearly and effectively in written form. This study is based on the assumption that writing isn't solely about producing a final product; it's about actively engaging with the reading material, processing information, and making connections. By blending interdisciplinary teaching with WTL strategies, this approach empowers students to engage more deeply with complex issues, develop critical thinking and communication skills, and prepare for the multifaceted challenges they may encounter in their academic and professional pursuits. Here is the teaching model of the WTL curriculum with an interdisciplinary approach:
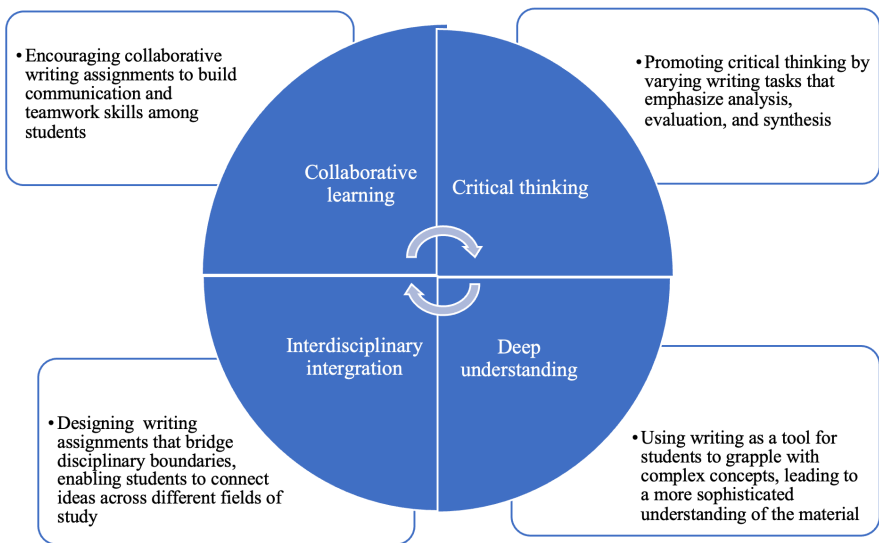
This study employs a case study of "Literature and Writing" courses to examine STEM students' perceptions of the WTL approach and the challenges they face in learning humanities subjects. We found that STEM students at ShanghaiTech acknowledge the importance of critical thinking and writing skills and highly value one-on-one writing conferences with instructors. However, they have limited time and interest in enhancing their reading and academic writing skills and tend to have a low self-evaluation of their writing abilities. It is important to emphasize that the issues and strategies discussed are primarily relevant to technology-focused universities in China. We hope the findings of this study provide insights for future adjustments and improvements to humanities courses in such institutions.

We suggest that teachers explore more diverse course themes to enhance students' reading and writing interests. In promoting writing projects, we have pursued interdisciplinary collaborations with teachers from other disciplines, extending reading and writing into broader domains, and exploring a cross-curricular writing framework. Because the successful implementation of WTL requires thoughtful planning and an awareness of challenges, integrating an interdisciplinary teaching model can effectively complement WTL by fostering greater student engagement with course content and enhancing critical thinking and analytical skills.

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Acknowledgements