

Constructing a Data-driven In-depth Interaction Model for English Language Teaching and Learning in Large Classes Targeting Whole Person Development

Haige Shi

School of Fundamental Education, Beijing Polytechnic, China

Shihaige@sina.com

Abstract. The inherent limitations of large-class English instruction frequently lead to a decrement in instructional efficacy, particularly when contrasted with smaller class environments. This study introduces a novel pedagogical framework, termed the Data-Driven In-Depth Interaction Model for English Language Teaching and Learning (ELTL), tailored for large-class settings and aimed at promoting comprehensive personal development in the era of big data. The model, grounded in data collection, analysis, and mining, was implemented in a classroom teaching practice, yielding significantly superior outcomes for the experimental group in comparison to the control group. The advent of the big data era necessitates a pedagogical paradigm shift from one-dimensional to three-dimensional instruction, a redefinition of the teacher's role from a traditional lecturer to an integrative facilitator, and a marked enhancement in teacher data literacy, evolving from passive data acquisition to proactive data-driven decision-making.

Keywords: big data; ELTL in large classes; data-driven in-depth interaction model

1. Introduction

The unveiling of Made in China 2025 signifies China's comprehensive embrace of a manufacturing powerhouse development strategy, propelling the nation towards the forefront of global manufacturing prowess. The advancement of vocational education is imperative for China's industrialization and modernization. The National Implementation Programme for Vocational Education Reform, colloquially referred to as the "20 Articles on Vocational Education," has charted a new course for the evolution and reform of vocational education. The 2019 Government Work Report further accentuates this by advocating for an expansion of higher vocational college and university enrollment by one million individuals. As vocational education burgeons, the expansion of higher vocational enrollment has forged a novel trajectory for China's higher vocational education in the new era. Consequently, large-class teaching has emerged as an inevitable byproduct of this swift educational expansion.

Large-class teaching is not a novel concept and it has been a topic of scholarly discourse since the late 20th century when higher education expanded. In the annals of Chinese educational development, there have been two notable peaks in enrollment growth. The first peak, from 1999 to 2006, was characterized by the "Massification of Higher Education" paradigm. The second, spanning from 2019 to 2024, is marked by the "one million higher education enrollment expansion" initiative. Constrained by factors such as teacher availability, infrastructure, and enrollment plans, the surge in university enrollment has led to generally larger class sizes, making large-class teaching a norm. Scholars worldwide hold varying views on the definition of large-class teaching; British scholars suggest a threshold of over 50 students (Hayes, D., 1997)[1], while Chinese scholars typically define it as classes with 60 or more students (Lei Peihua, 2006) [2].

Current research on large-class teaching predominantly addresses three facets: the challenges and factors impeding its effectiveness; strategies to mitigate these issues by refining traditional teaching methodologies; and solutions tailored to the digital environment, such as addressing low student engagement, insufficient commitment to learning, and the inefficiency of teaching and learning due to class size. The primary challenges teachers face in large classes include maintaining classroom order, catering to diverse student learning levels, and personalizing instruction due to limited

teacher-student and student-student interactions. These challenges manifest as low teacher-student interaction, poor relevance, and suboptimal teaching efficiency. Large class sizes make classroom management arduous, teaching content adaptation challenging, and feedback and practice opportunities scarce (Wu Huijuan, Yang Qinyan, Xiao Yangtian, 2024) [3].

Scholars have proposed numerous strategies and teaching models to address large-class teaching issues, which can be distilled into three main theories. The first, the "large class break-up theory," advocates for a "large class lecture + small class seminar" model (Ma Jie et al., 2022; Liu Debin, 2020) [4,5] and a "large class lecture + small group seminar + learning assessment" model (Han Ying, 2020) [6]. The second, the "large class integration theory," emphasizes the establishment of a network platform and the implementation of a hybrid teaching model. Li Cuilian (2022) [7] outlines a three-stage optimization path for blended teaching: online resource integration, teaching link, and course evaluation. Wang Hui (2023) [8] suggests a large-class English writing teaching approach based on the iWrite writing platform, which enhances teaching efficiency through a combination of machine, teacher, and peer assessments. The third theory, the "teaching assistant system theory," proposed by Liu Ying (2014) [9], focuses on creating an efficient large-class teaching model suitable for China's context, discussing the establishment of a student-centered teaching model and a robust teaching assistant system. These theories, rooted in the educational technology and teaching capabilities of their respective times, address large-class challenges through group cooperation, network-based blended teaching, and institutional solutions.

The advent of 21st-century information technology has revolutionized society, giving rise to a new educational ecology. Scholars have explored English teaching models for large classes within network environments, proposing constructivist-based network teaching models, independent learning models, and collaborative learning models (Xiong Hui, 2006; Sun Jiao Xia, 2006; Pang Hai Cai, 2007; Guo Zhihong, 2007) [10,11,12,13]. These models emphasize student agency in the teaching and learning process, with teachers transitioning from leaders to organizers and instructors, focusing on learner-centered approaches that leverage scenarios, collaboration, and cognitive tools tailored to individual learners.

In summary, the interconnection of the aforementioned aspects has led scholars to propose various teaching modes and strategies to address large-class teaching challenges, leveraging the network environment to resolve issues of the time. However, these approaches have not fully integrated the specific analysis of the big data era and the theory of holistic development to propose effective solutions. As we transition from the network era to the big data era, the introduction of big data technology has not only transformed traditional teaching methods but also brought revolutionary changes to English education. With the advent of big data technology, can current large-class English teaching experience a new impetus and undergo transformative changes? Should the large-class English teaching model, aimed at holistic development in the new era, align with the construction of a new model? What are the outcomes and effects of such an alignment? These questions form the research hypotheses and inquiries of this paper.

2. Constructing a Deep Interactive Model for Teaching English in Large Classes: Targeting Whole Person Development

The advent of 21st-century information technology has revolutionized societal dynamics, and the educational landscape in the era of big data is no exception, presenting a novel educational ecology. Big data, characterized by its vast scale, diversity, and velocity, transcends the capabilities of traditional database tools in acquisition, storage, management, and analysis. Its application in education, particularly in English teaching, offers unprecedented opportunities. Through the analysis of student learning data and educational resources, big data enables personalized teaching approaches, enhancing educational quality and student outcomes.

2.1 Opportunities for English Teaching in Large Classes in the Era of Big Data

English education faces a myriad of new challenges and opportunities. Firstly, big data technology heralds a paradigm shift in English teaching methodologies. The integration of big data analytics into English instruction provides educators with powerful tools for data-driven decision-making. Teachers can harness big data to collect and analyze student learning data, thereby gaining insights into their students' learning profiles and needs. Learning management systems can aggregate student behavior and performance data, which can then be subjected to data mining and analysis to identify learning patterns and deficiencies. This enables targeted, personalized teaching strategies.

Secondly, big data technology facilitates more efficient and personalized teaching methods in English education. Educational institutions can leverage big data analytics to discern students' learning preferences and needs, curating a diverse array of learning resources and pathways. By analyzing students' engagement with various learning materials and methods, educators can tailor course content and resources to better meet individual learning styles, thereby enhancing the educational experience.

Despite the myriad benefits, the application of big data in English education presents challenges, such as managing and analyzing vast datasets, safeguarding student privacy, and ensuring data security. Experts advocate for a cautious approach, emphasizing the importance of data security, privacy protection, and professional development for educators to effectively utilize big data technologies.

2.2 Educational Philosophy and Implementation Framework for Whole-Person Development

Confronted with the challenges of the big data era, English educators must navigate a nuanced path, avoiding the pitfalls of both technological stagnation and over-reliance on new technologies. The crux lies in the seamless integration of big data with English education, adhering to a human-centric value orientation that harmonizes instrumental and value rationalities. Carl Rogers, a proponent of humanistic pedagogy, championed the concept of whole-person education, which aims to foster comprehensive cognitive and emotional development and self-realization. This approach emphasizes student-centered learning, holistic development, the balance of emotion and cognition, and the pursuit of authentic learning experiences that require deep teacher-student and student-student interactions.

2.3 Addressing the Dilemma of Large Class Teaching: A Data-Driven Deep Interaction Model for English Language Teaching and Learning

To address the interaction challenges in large class English teaching, strategies to enhance classroom engagement and teaching quality are paramount. Zhang Gang (2013) [14] advocates for cooperative learning, while Cui Yu (2018) [15] and Qin Jin (2017) [16] explore interactive teaching methods to improve student performance in large class settings. Guo Guanyu et al. (2016) [17] propose a group teaching model for ideological and political theory courses, focusing on pre-class grouping, in-class utilization, and post-class reinforcement.

To overcome the interaction barriers in large class English teaching, it is imperative to reconceptualize the teaching logic driven by big data, adhering to learner-centric principles and whole-person education. A data-driven deep interaction model for English teaching in large classes is proposed, as depicted in Fig. 1. This model involves teacher-student interactions at three stages: pre-class, in-class, and post-class, with multiple interactions in each phase constituting deep engagement. These interactions are data-driven, guiding the linear teacher-student interaction process. The data flows are dynamic rather than static, multi-perspective rather than single, multidimensional rather than single ones, with teachers and students exchanging information for assessment, decision-making, and personalized instruction. In the pre-class data flow, teachers collect data through student questionnaires (using online platforms) to prepare for classroom teaching, while students provide feedback. During the in-class data flow, teachers analyze student

data to tailor teaching materials. In the post-class data flow, teachers mine homework data to identify and address student challenges, providing personalized support and targeted feedback.

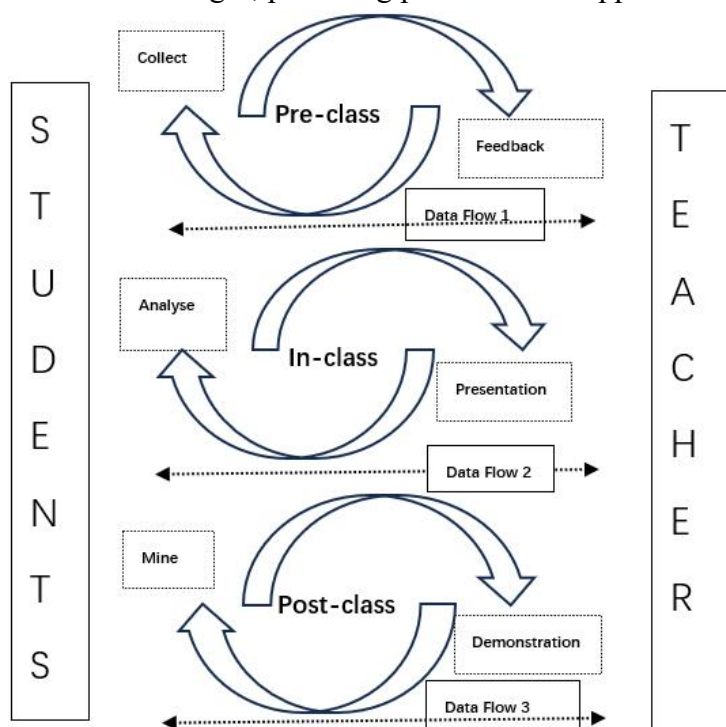


Fig. 1 Data-Driven In-depth Interactive Model for Teaching English in Large Classes

This model emphasizes the dynamic and complementary nature of teacher and student data, facilitating a continuous, reciprocal exchange that enhances the effectiveness and precision of teaching and learning in large class settings. The entire teaching process is divided into three dynamic data flows, each of which is based on the outcomes of prior data, allowing teachers to promptly adjust and implement personalized, tailor-made teaching strategies. The pre-class data flow (Data Flow 1) enables educators to gather preliminary insights by distributing questionnaires to students via online teaching platforms such as Questionnaire Star applet and Super Star Learning Pass. This process allows teachers to amass data on students' prior knowledge, learning preferences, and topic-related expectations, which are then synthesized to inform classroom preparation. Concurrently, students contribute feedback data that assists teachers in understanding their perspectives and needs. In Data Flow 2, educators engage in a critical analysis of the collected student feedback. This analysis is pivotal for discerning students' interests, topic preferences, and knowledge accumulation. By correlating this data with the curriculum, teachers can curate and design instructional materials that are both engaging and tailored to the students' learning profiles. The post-class data flow (Data Flow 3) involves a meticulous examination of students' homework submissions post-lecture. This step is crucial for identifying areas where students exhibit varying levels of understanding, particularly in mastering complex concepts, grammar rules, key points, long and difficult sentences, etc.. Educators are encouraged to showcase exemplary work, offer personalized guidance to students struggling with specific topics, and provide targeted feedback through various methods, such as one-on-one tutoring or specific instructional videos. The strategic placement of data within this feedback loop ensures that the educational content remains accessible and accurately addresses the diverse learning needs of the students, thereby enhancing the overall effectiveness of the teaching process. It is a deep data-driven teaching strategy that is distinctly different from the conventional shallow one-on-one question-and-answer sessions in the classroom, with an emphasis on relevance, personalisation, and even customisation, which also requires teachers to take on more responsibility and to invest more in terms of time and effort.

3. Teaching Practice and Result Analysis

Employing the data-driven in-depth interactive model for large-class English teaching, the author conducted a semester-long teaching experiment at a higher vocational college in Beijing. The study utilized the College English course as a test case, selecting 89 students from the 22nd New Energy Automobile major in the College of Automotive Engineering as the control group and 92 students from the 22nd Computer Science major in the College of Electronic Information as the experimental group. Both groups were matched in terms of initial English proficiency. The textbook used was "New Era Vocational English General English 1," authored by Lu Xin and Gao Xiaojiao and published by Foreign Language Teaching and Research Publishing House. The control group received instruction through conventional teaching methods, whereas the experimental group engaged with the data-driven deep interactive model outlined in Figure 1 for each unit of study (totaling 8 units). The experimental group demonstrated a markedly higher rate of class participation compared to the control group. The end-of-semester student evaluations revealed a strong preference for the deep interactive teaching mode, with 86% of students expressing a preference, 4% indicating dislike, and 10% rating it as average. The experimental group's average final grade was 17.9 points higher than that of the control group, with an average score of 71.8 points for the control group and 89.7 points for the experimental group.

The teaching process, informed by the data-driven in-depth interactive model for large-class English teaching, is illustrated in Fig. 2. The illustration shows some typical interactive elements that are commonly used in the English classroom, and it should be noted that it is only an example and not exhaustive. For example, replacing a reading test with an oral test or a vocabulary dictation. Each instructional action by the teacher is meticulously designed based on prior data collection, mining, analysis, and application, resulting in a profound teaching approach that transcends the traditional question-and-answer format. This model fosters a more dynamic and personalized learning environment, where student engagement and academic achievement are significantly enhanced. Throughout this data-driven process, students' self-directed learning capabilities are enhanced, their capacity for individual expression is highlighted, critical thinking skills are fortified, and breakthroughs are achieved in addressing the challenging and complex aspects of English language learning. The emotional engagement with the learning process is further accentuated, all of which inevitably contribute to the holistic development of the students and an elevation in their learning achievements.

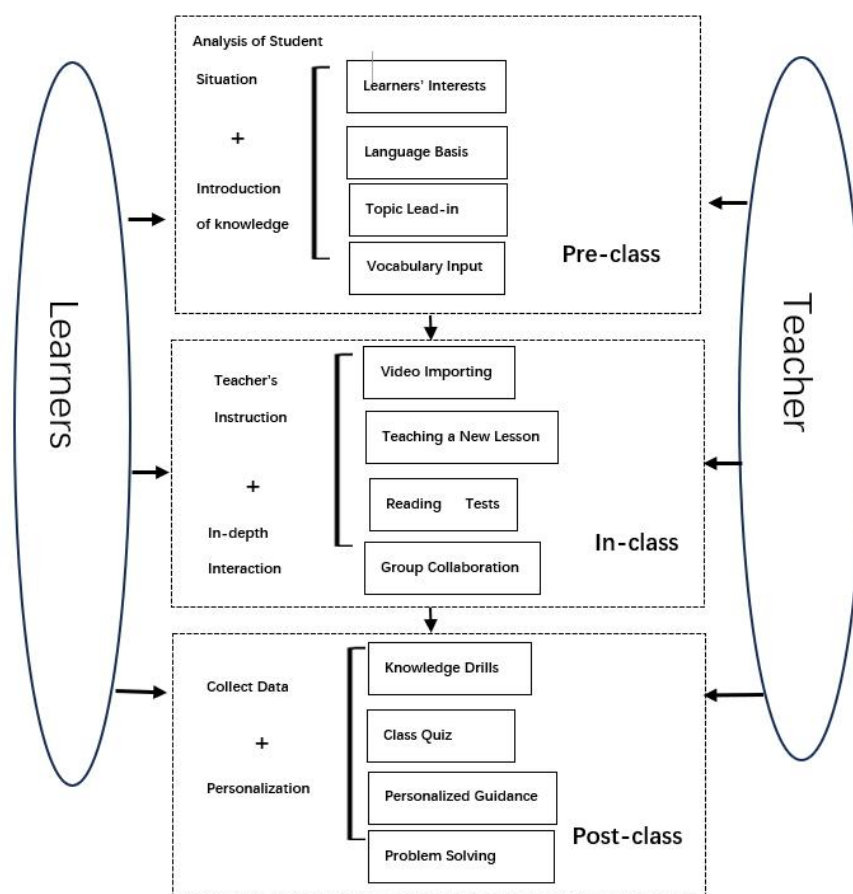


Fig. 2 Data-driven in-depth interactive model of ELTL in large classes

4. Summary

The advent of the big data era has introduced novel challenges to English education, necessitating that educators adeptly harness the opportunities it presents. English teachers must not only excel in collecting and interpreting a diverse array of teaching data but also in leveraging this data to enhance instruction, thereby cultivating a robust data literacy. It is through a high level of data literacy that educators can more efficiently serve literacy needs and nurture advanced English talent. Sheng Yangyan and Zhou Tao[18], the translators of the book "The Age of Big Data," posits that while China is not significantly lagging in vertical applications of big data, the data literacy of some primary and secondary school teachers remains concerning. This situation is ill-suited to the evolving professional growth requirements of educators in the era of big data.

4.1 Transformation of Teaching Methods: From One-Dimensional to Three-Dimensional

Reflecting on the evolution of teaching practices, educators have witnessed four transformative shifts. The first transition was from imparting knowledge to nurturing individuals, the second from teaching knowledge to facilitating learning, the third from surface-level to in-depth learning, and the fourth from traditional to internet-based teaching (i.e., online classes). As Professor Wang Zhengqing[19] suggests, we are currently in the midst of the fourth leap, where the core objective is to actualize data-driven intelligent education. Each leap has revolutionized traditional educational structures and methods, advancing educational efficiency and quality. The State Council's Outline of Action for Promoting the Development of Big Data [20] explicitly calls for leveraging big data to transform educational methods, promote equity, and enhance educational quality. The big data era

demands a shift from one-dimensional teaching of materials to a three-dimensional approach that fosters the holistic development of individuals and the realization of whole-person education.

4.2 Transformation of Teachers' Roles: From Instruction to Integration

In the big data era, the roles of teachers are undergoing profound changes. Teachers are now seen as knowledge integrators rather than mere possessors, responsible for curating and synthesizing information from diverse sources to ensure a comprehensive understanding of the subject. They are transitioning from knowledge transmitters to learning guides, focusing on facilitating the learning process, encouraging critical thinking, and fostering independent learning skills. Teachers are evolving from curriculum implementers to developers, playing a pivotal role in designing and adapting materials to cater to students' diverse needs and interests. They are also moving from classroom dominators to organizers, creating inclusive environments that promote active student participation and collaboration, fostering a sense of ownership and responsibility among learners.

Furthermore, teachers are transforming from homework assigners to resource aggregators, curating a wealth of learning materials and tools to support individual student needs. This shift enables students to engage with a broad spectrum of resources and deepen their understanding of the subject. Lastly, teachers are evolving from correct and incorrect adjudicators to opinion exchangers, encouraging students to express their thoughts and engage in meaningful discussions, fostering critical thinking, empathy, and the development of well-rounded individuals.

In conclusion, the role of teachers in the big data era has evolved in multiple dimensions. They have transitioned from knowledge possessors to integrators, from transmitters to guides, from implementers to developers, from dominators to organizers, from assigners to aggregators, and from adjudicators to exchangers. These transformations reflect the imperative for educators to adapt to the changing educational landscape and promote a more student-centered approach to learning.

4.3 Teachers' Data Literacy: From Acquisition to Application

The conceptual framework of data literacy was initially developed by Israeli scholar Eshet Alkalai in 2004, as outlined in the article "Information Literacy, Statistical Literacy, and Data Literacy". The information age provides vast opportunities for organizations to improve their efficiencies by relying on big data-AI empowered analytics[21]. In the domestic academic sphere, Yu Huiju and Yang Junfeng regard data literacy as a crucial component of core literacy, emphasizing that it is "not merely the application of technology but a more comprehensive skill" [22]. According to Li Qing and Ren Yishu [23], teachers' mastery of data literacy represents a sophisticated aspect of their professional capabilities. It not only enables them to adapt to societal changes but also empowers them with a valuable tool to grasp students' learning levels and cognitive abilities more comprehensively. From a teaching practice perspective, Athanases' team argues that teacher data literacy involves the purposeful collection, analysis, reflection, and processing of students' assignments and grades to improve teaching practices and student outcomes [24].

In conclusion educators are not merely custodians of data; they are also proficient in harnessing its potential to enhance the pedagogical and instructional endeavors, which encapsulates the quintessence of the big data epoch. This proficiency in data utilization is pivotal for the advancement of educational practices, as it enables a nuanced understanding of student learning trajectories and the formulation of targeted instructional strategies. The adeptness in data application is thus a hallmark of the contemporary educator, signifying a paradigm shift from passive data management to active data-driven decision-making in the realm of academia.

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