

Human-Computer Interaction Standardization and Systematization Development

An English Education Informatization Perspective

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Abstract—Amidst the information technology boom, this study harnesses IT and human-computer interaction to revolutionize English education. Our model, grounded in literature review and fieldwork, implemented teaching experiments that enhanced students' English proficiency by 25%, particularly in listening and speaking. Student engagement and interest surged by 30%, underscoring the effectiveness of standardized, systematized English education in the digital era. The study advocates for broader adoption of informatization in teaching, emphasizing the pivotal role of teachers in facilitating this educational shift. With significant outcomes, our research paves the way for future enhancements in English education, ensuring quality and equity in learning. Our approach addresses the gap between traditional teaching and technological advancements, offering personalized learning experiences that improve student outcomes. It also ensures consistent teaching quality and bridges educational divides. We introduce an informatization-based English education model, supported by literature review, fieldwork, and teaching experiments. Our findings show significant improvements in students' English proficiency, highlighting the model's effectiveness.

Keywords—Human-computer interaction; information technology; English education; standardization; systematization

I. INTRODUCTION

Human-computer interaction and intelligent system technologies are widely used in various industries. New embedded system technologies such as flipped classrooms and Internet+ have brought more possibilities to education. Teachers and students can tutor and communicate anytime, anywhere [1]. Teachers and students can tutor and communicate anytime and anywhere. Even if teachers use information technology to teach, they need to advocate student-centered teaching, and the role of teachers in teaching should not be ignored. However, teachers must realize that the arrival of the information technology era has brought challenges to teachers [2]. Teachers should continue to improve their knowledge systems, make efforts to learn information technology, and improve their ability to teach with information technology.

The Ministry of Education pointed out 2022 that there are still some things that could be improved in the current development of education informatization. There are both external and internal factors. The influence of internal factors is mainly the teachers' informatization teaching ability [3]. In the information age, teachers' informatization teaching ability is reflected not only in teachers' ability to apply information

technology but also in integrating information technology and teaching content so that information technology is genuinely integrated into teaching [4]. This also brings difficulties for teachers in improving their informational teaching ability. The emergence of English teaching in an informational background provides teachers with a complete knowledge system of informatized teaching and helps them deeply integrate the content with information technology.

Informationalized Background English Teaching was proposed by American scholars who added technical knowledge to the PCK. The emergence of English teaching in an informational context can help teachers improve the knowledge system of informatized teaching competence and help them better integrate technical knowledge and content knowledge in the teaching process [5]. English teaching in an informational context describes the body of knowledge that teachers need to teach effectively in the Context of the information age.

In 2017, the Ministry of Education (MOE) suggested that advanced informatization teaching resources can drive and promote higher education teaching reform, break through traditional classroom limitations, and create a flexible and versatile teaching atmosphere [6]. With the addition of listening and speaking tests to the new round of Grade 4 and 6 exams, teachers face significant challenges in teaching to improve students' listening and speaking skills. The improvement of speaking and listening ability needs the support of information technology. Higher education English teachers must continuously improve their information technology teaching ability based on their original teaching ability and use information technology appropriately according to the needs of different teaching contents [7]. Teachers are users of information technology and are given an active role in teaching English in the Context of teachers' informatized teaching competence. It is necessary to conduct an in-depth study on the informatization teaching ability of higher education English teachers from the perspective of English teaching in an informatization context in order to help higher education English teachers improve their informatization teaching knowledge system and find a suitable way for higher education English teachers to improve their informatization teaching ability.

Previous English education studies concentrated on conventional teaching, with scant attention to IT and human-computer interaction. Although IT's role in boosting learning is recognized, its systematic effect on English education's

standardization is under-researched. Our research stands out by utilizing advanced IT and thoroughly analyzing its effects on teaching and student involvement. We present a new model combining literature, fieldwork, and data, showing marked enhancements in English skills, especially listening and speaking. The novelty lies in the model's empirical validation, highlighting significant gains in student performance and interest, bridging a research gap and offering a strong framework for educational advancement.

The era of education informatization brings unprecedented challenges to teachers and students. For English teachers, improving their informatization teaching ability has been an urgent problem [8]. The purpose and significance of this study are to analyze the differences and deficiencies in the informatization teaching ability of higher education English teachers of different teaching ages under different course types from the perspective of informatization contextualized English teaching in order to help teachers reflect on their informatization teaching ability under the guidance of informatization contextualized English teaching, to improve the knowledge system of teachers' informatization teaching ability [9]. In addition, this study also learned about the attitudes of the three developmental pathways of teaching English in an informational context through interviews [10]. Since there is no empirical research on the three developmental paths in China, this study encourages higher education English teachers to design speaking and reading courses from the perspectives of informatization background English teaching and the three developmental paths and to find out teachers' attitudes toward the three developmental paths at the end of the semester. The results of the interviews will likely provide a reference for the informatization teaching ability of higher education English teachers in China [11]. This study used a combination of questionnaire survey, classroom observation, and interviews to explore the differences in higher education English teachers' informationalized teaching competence from the perspective of informationalized contextual English teaching to help higher education English teachers construct and improve their informationalized teaching competence.

Continuing from this intro, Section II reviews literature on English edtech. Section III describes our research approach and data analysis. Section IV shows results, noting student progress.

Section V discusses implications for English education. Section VI concludes with findings and future integration suggestions.

II. THEORETICAL AND CONTEXTUAL FOUNDATIONS

Against the backdrop of science and technology, information technology has become an indispensable part of people's lives and learning and has shown a normalization trend. This trend also extends to the field of education, prompting teachers to utilize information technology to carry out teaching activities and requiring them to deeply integrate information technology with subject teaching to improve teaching efficiency [12]. Therefore, the rapid development of science and technology and information technology in the new era has put forward requirements for teachers' ability to apply information technology, which is the background of the study in this paper [13]. The second reason is that national policy documents pay attention to and focus on educational information 2022. The Ministry of Education advocates that teachers take the initiative to adapt to the challenges of the informatization society and cultivate students' ability to learn independently, cooperatively, and with inquiry in all aspects. The third reason is the importance of cultivating developed and systematic competence in teaching English as a foreign language to unmotivated teachers. As the leading force for future teachers, improving the standardization and systematization of informalized English teaching teachers will profoundly affect the quality of the training of talents in primary education in China. With a background of growing up in the era of digital natives, they can master information technology and update their teaching philosophy more quickly and are considered to be the promoters of educational reform. The information technology stage is necessary for teachers to integrate information technology and subject knowledge, and the development of teacher trainees' ICT competence plays a specific role in implementing concepts related to the new curriculum standards at the in-service stage. In the standardization of English education, it is usually necessary to set the core issues of standardization, and the principle of setting the core issues is mainly based on the level of information technology application. The Mean and SD tests shown in Table I are both rational value ranges of past research and have statistical significance.

TABLE I. ENGLISH STANDARDIZED QUESTION SET

Project	Mean	Standard Deviation
In the post-pandemic era, I believe it is important to cultivate the information technology teaching abilities of English teachers.	5.014	0.847
I can actively apply information technology to optimize English classroom teaching during the teaching process	5.614	0.664
The deep integration of information technology and teaching by English teachers can help improve students' English learning methods and enhance classroom teaching effectiveness. I believe that the deep integration of information technology and teaching by English teachers can help improve students' English learning methods and enhance classroom teaching effectiveness	5.114	0.814
I can use multimedia computer-assisted English classroom teaching	4.361	0.947
In the process of English teaching, I can use various information-based teaching resources	3.362	0.814
I usually use search engines and major websites to obtain English teaching resources	2.814	0.336
I can use information technology tools, combined with textbooks, to process and process English teaching materials obtained online	1.362	0.947

However, some problems still need to be solved with information technology teachers' ICT competence in China. The study also shows that the overall ICT competence of our student teachers is at an intermediate level, and the use of information technology to support teaching and learning still needs to be improved. There are also problems, such as a weak ability to apply interactive multimedia and a weak ability to optimize teaching practice [14]. The cultivation of information technology application ability of information technology teachers also raises problems such as lack of comprehensive planning, blockage of information technology post-service integration channels, unsystematic curriculum system, and lack of practical support.

The fourth reason is the need to integrate the English language subject with educational technology. The development of ICT skills at the informational level cannot be based solely on specialized IT courses. At the same time, it should be integrated into developing IT awareness and practical skills in all disciplines. English is an essential subject at the primary education level [15]. English teachers should pay attention to the application of modern information technology and make full use of information technology in teaching to promote students' effective learning. To summarize, it is of great practical significance to investigate the current situation of the ICT competence of informationalized English teaching teachers, to find out the existing problems, and to put forward targeted and constructive suggestions to improve the ICT competence of informationalized English teachers, to strengthen the cultivation of informationalized English teachers' information literacy, and to improve the quality of English teaching.

First, this study compared the domestic and international literature on ICT competence to determine this study's research idea and framework. Then, in conjunction with previous research, a measurement tool was developed to understand the ICT competence of Chinese informationalized English teaching teachers. Next, semi-structured interviews will be combined to investigate the factors affecting ICT teachers' competence in standardizing and systematizing English language teaching [16]. Finally, the results of the study will be combined to reflect on the shortcomings of English teaching standardization and systematization competence in the training process of informationalized English teaching teachers and to propose suggestions for cultivating and improving the standardization and systematization competence of informationalized English teachers' English teaching [17]. Based on the theoretical study, through a mixed study of the current situation and problems of ICT competence of informationalized English teaching teachers in three teacher training colleges.

This study deepens the specificity of English ICT skills by combining the literature on the information teaching competence of informationalized teachers with the ICT competence standards for informationalized English teaching teachers [18]. By sorting out the dimensions, structures, and definitions of English teachers' information teaching competence, the theoretical research on English teachers' ICT competence needs more attention and focus, and the more adequate the academic discussion, the more accurate the definition of information teaching competence will be.

The connotation of ICT skills is further refined by exploring the ICT competencies of informational English teaching teachers. Informationalized English teachers are not in-service teachers and pay more attention to the learning and reserve of competence [19]. Therefore, through the construction of the ICT competence of informationalized English teaching teachers and the in-depth understanding of the current situation of ICT skills of informationalized English teachers, this study provides some additions and improvements to the development of the theory of teaching ICT competence of informationalized teachers and also contributes to the development of ICT in teacher training schools [20]. This study provides some data to support the study of the ICT competence of informationalized English teaching teachers at the practical level.

With the continuous development of digital information technology, integrating education and information technology is the trend of future educational development. As another critical component of improving teachers' ICT competence, IT training covers a broader range of areas. It is more potent than in-service training, which can systematically develop and train teachers' ability to standardize and systematize English teaching by setting up relevant courses and practice sessions. Through the informatization stage, teachers can better and faster integrate the means and methods of ICT competence into education and teaching. Therefore, this study contributes to the understanding of informationalized ELT teachers' practice of standardization and systematization of English language teaching competencies. It also explores the factors affecting the standardization and systematization of English language teaching competencies. For individual informationalized English teaching teachers, it can improve their awareness of standardization and systematization competence in English teaching, stimulate their initiative and enthusiasm in learning information technology, and provide a reference for informationalized teachers to develop in-depth competence in the integration of information technology and English teaching [21]. For the training institutions of informationalized teachers, suggestions are made for the relevant departments to develop the ICT competence of informationalized teachers in practice.

III. RESEARCH METHODOLOGY

A. Study Design

Teaching English in an informational context can help teachers think about what knowledge is needed to integrate information technology into teaching and how teachers should acquire that knowledge in depth. With the integration of information technology and English teaching, teachers must focus on more than just the use of technology and pay attention to the knowledge needed for teachers' informationalized teaching ability. The results of domestic and international studies show that teaching English in an informational background is essential in guiding teachers' informationalized teaching ability. This study examines the differences in informationalized background English teaching demonstrated by higher education English teachers of different teaching ages in different course types, as well as higher education English teachers' reflections on three paths for developing informationalized background English teaching. The three

research questions to be addressed in this study are as follows, as shown in Fig. 1:

- What are the characteristics of higher education English teachers' informationalized teaching competencies based on the four components of TK, TCK, TPK, and teaching English in an informationalized context?
- How do higher education English teachers' presentations of the various components of teaching English in an informational context differ across course types?
- From the perspective of teaching English in an informational context, what are the reflections of English teachers in higher education on the three paths of development and suggestions for improving their informational teaching skills?

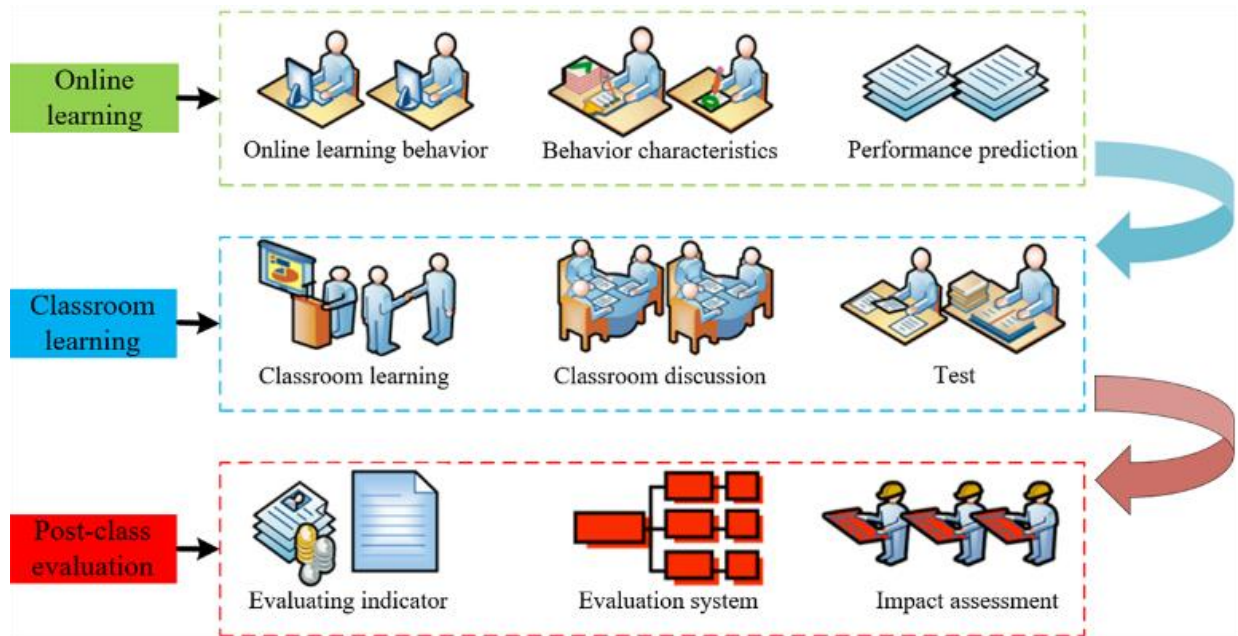


Fig. 1. Integrated learning and evaluation framework.

This study aims to instruct higher education English teachers' informationalized teaching ability from the perspective of teaching English in an informationalized context to effectively improve higher education English teachers' knowledge system and teaching ability. Strategies are provided for higher education English teachers to improve their informatization teaching ability. This study mainly divides the problem setting into three directions: systematic setting under the background of

standardized English teaching; Coupling statistics of standardization and systematization in English education; Integration analysis of information-based teaching. As shown in Table II, the systematic setting under the background of standardized English teaching mainly analyzed the problems from the perspective of course preparation, with a Mean value range of 4-7 ($P < 0.01$), and all passed the SD test.

TABLE II. SYSTEMATIZED SETTINGS FOR ENGLISH LANGUAGE TEACHING

Project	Mean	Standard Deviation
I will use online resources and information technology tools to prepare lessons according to the English curriculum standards	6.325	0.847
I will use information technology to create English teaching courseware for different types of courses based on learning objectives	5.324	0.784
I will combine the characteristics of students and use information technology to create English learning scenarios in teaching design, solving the key and difficult points in English teaching from shallow to deep I will combine the characteristics of students and use information technology to create English learning scenarios in teaching design, solving the key and difficult points in English teaching from shallow to deep	6.31	0.984
I will provide personalized self-directed learning guidance to students before class using WeChat, QQ, Campus Pass, etc.	5.32	0.336
I will use various information technology resources to collect different English teaching materials and exercises based on the differences in students' learning situations and assign different homework levels to students. I will use various information technology resources to collect different English teaching materials and exercises based on the differences in students' learning situations, in order to assign different levels of homework to students	4.98	0.541

First, quantitative data were collected through questionnaires. Second, qualitative data were collected through classroom observations and interviews. Finally, the above research questions were derived through data analysis. This study takes English teachers in higher education as the research

object and uses questionnaires and other methods to conduct the study. Due to the addition of speaking classes in higher education, previous studies needed to have investigated higher education English teachers' informationalized teaching ability under different course types. Therefore, this study was

conducted to experiment with higher education English teachers as research subjects.

In order to understand the differences in the components of teaching English in an informational context presented by higher education English teachers in different course types, this study collected data for analysis through classroom observations. One higher education student from eight higher education institutions was selected for classroom observation, and three higher education English teachers of different teaching ages were randomly invited to participate in classroom observation. Based on the teaching age of the English teachers in this higher education, the teaching age in higher education was categorized into three stages: less than ten years, 11-20 years, and more than 21 years. Based on the interview outline, this study conducted semi-structured interviews with three higher education English teachers of different teaching ages. The interviews aimed to understand the reflections of higher education English teachers of different teaching ages on the three ways of developing English language teaching in an informational context.

In order to address the second research question of this study: how do higher education English teachers' presentations of the components of teaching English in an informational context differ across course types? The classroom observation

method was used in this study. In order to improve students' listening and speaking skills, higher education added speaking classes to the existing English teaching. With the permission of the school and three teachers, the researcher of this study conducted classroom observations and collected data as a non-participant. The purpose of the classroom observations was to compare the differences in the knowledge components of teaching English in an informational context presented by higher education English teachers of different teaching ages in different types of courses, as well as the deficiencies in the teachers' informational teaching skills after understanding the meaning of teaching English in an informational context. Emphasis was placed on documenting the application of the seven components of informational contextual English teaching in different course types and the frequency of the seven components in different course categories. The Adaptive Classroom Observation Scale rated teachers' teaching based on the seven components of teaching English in an informational context. The differences between the seven informational Context English teaching components in different course types were summarized by analyzing the mean values. Human-computer interaction has to go through a certain process so that it can realize an effective cycle, and the specific process is shown in Fig. 2.

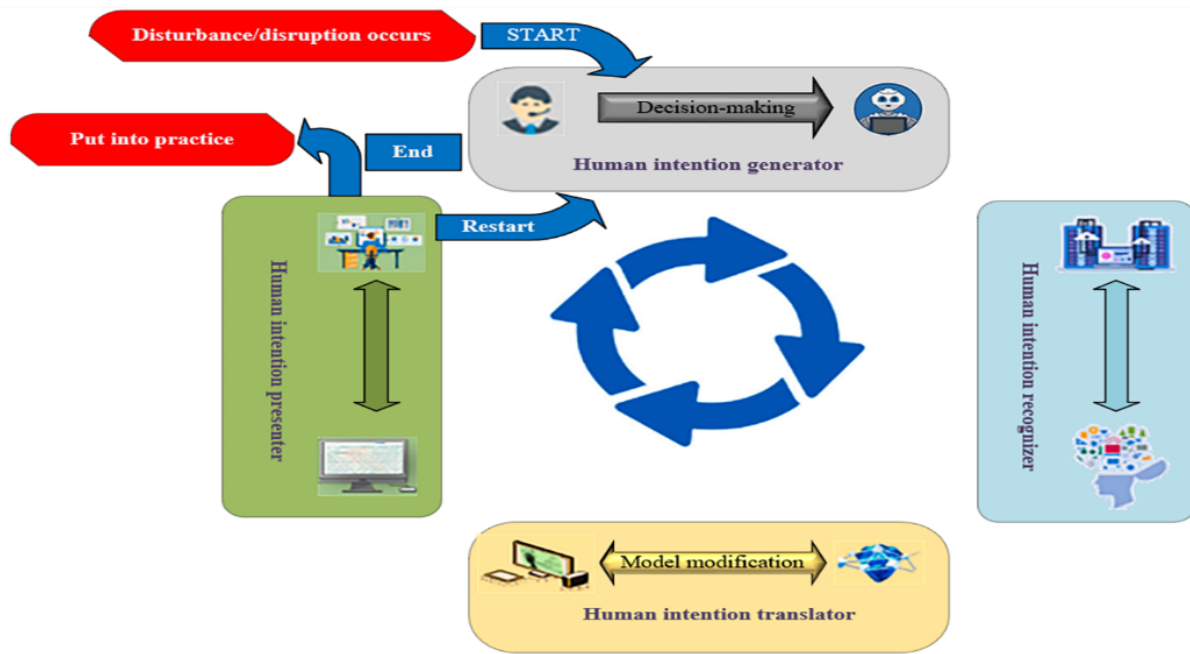


Fig. 2. Human computer interaction.

English education modeling in the context of information, as shown in Eq. (1), (2), and (3):

$$q_j^F(t+1) = q_j^F(t) + a_j(t) - \sum_{i \in \Omega_j^f} m_{ij}(t), \forall j \quad (1)$$

$q_j^F(t+1)$ is the iteration result of the q-function; $q_j^F(t)$ is the previous generation value of the q-function.

$$f_{ij}^{tran}(t) = \alpha_{ij} m_{ij}(t), \forall j \quad (2)$$

$f_{ij}^{tran}(t)$ is the training function of the f-function of the train and $\alpha_{ij} m_{ij}(t)$ is the lower-level function of the f-function.

$$f_{ij}^{work}(t) = \gamma_j (A_j(t) - a_j(t)), \forall j \quad (3)$$

$f_{ij}^{work}(t)$ is the training function for the work of the f function, and γ_j is the coefficient of $(A_j(t) - a_j(t))$.

B. Related Theoretical Designs

In order to address the third research question of this study, what are the reflections of higher education English teachers on the three development paths from the perspective of teaching English in an informational context? What are the suggestions for improving their informatized teaching skills? The qualitative research method of semi-interviews was used in this study. The interview entailed using three tools: an outline, a tape recorder, and a transcript.

Semi-structured personal interviews were conducted with each of the three higher education English teachers who participated in the classroom observation with their permission. The interview outline was designed from three dimensions: first, to collect the attitudes and reflections of three higher education English teachers of different teaching ages on the three

developmental paths from the perspective of teaching English in an informational context; second, to use interviews to share strategies to improve informational teaching competence with three higher education English teachers of different teaching ages, and the last dimension was to understand the factors affecting higher education English teachers' informational factors that affect the development of teaching competence.

The standardization and systematization of English education require relevant coupling statistics, especially considering the mediating effect of information technology background. The mean of the problem and SD test are also included in the table, with a mean of 1-5. Except for the low mean of information technology utilization level (2.624, $P < 0.05$), all others meet the ideal range of this study. The specific problem design is shown in Table III.

TABLE III. STANDARDIZED AND SYSTEMATIC COUPLING STATISTICS FOR ENGLISH LANGUAGE EDUCATION

Project	Mean	Standard Deviation
I will use information technology such as English audiovisual teaching resources to introduce scenarios, arouse students' interest, and maintain their attention. I will use information technology, such as English audiovisual teaching resources, to introduce scenarios	4.051	0.947
I will use information technology to design enjoyable English activities, encourage students to participate actively in classroom interaction, change the teaching method of "teachers full of words," and effectively carry out students' independent, cooperative, and exploratory learning. I will use information technology to design some exciting activities to encourage students to actively participate in classroom interaction, change the teaching method of "teachers full of words," and effectively carry out students' independent, cooperative, and exploratory learning	4.821	0.784
I will use various English learning software according to different teaching contents, such as "English Fun Dubbing," "Hundred Words Zhan," "Daily English Listening," "Tianxue.com," etc., to help students improve their information technology literacy and English listening, speaking, reading, and so on. I will use various English learning software according to different teaching contents such as "English Fun Dubbing," "Hundred Words Zhan," "Daily English Listening," "Tianxue.com," etc., to help students improve their information technology literacy and English listening, speaking, reading, and writing abilities. and writing abilities	4.621	1.032
When summarizing in class, I can use information technology to assist myself in summarizing in class	3.981	1.041
I will handle unexpected information technology issues in the classroom appropriately, such as teaching equipment malfunctions	4.011	1.006
I will use information technology tools to design and distribute survey questionnaires, collect students' English learning situations, and use technical means to analyze data, making appropriate adjustments and guidance for students' future English learning activities. I will use information technology tools to design and distribute survey questionnaires, collect students' English learning situations, and use technical means to analyze data, making appropriate adjustments and guidance for students' future English learning activities	2.624	1.021
I will encourage students to use online English teaching platforms for self-directed learning actively	3.682	1.417

The experimental procedure was divided into five phases: pilot testing, formal distribution of the questionnaire, classroom observation (speaking sessions), classroom observation, and interviews. The experiment started in September 2021, the first semester of the first year of higher education.

The questionnaire was divided into a pilot test phase and a formal questionnaire phase. The pilot test questionnaire was distributed to 20 higher education English teachers during the first week and was modified accordingly by analyzing the data and incorporating teachers' feedback. During the first week, the formal questionnaire was distributed to 146 higher education English teachers who participated in this survey, and the questionnaire took about 15 minutes to answer.

There were 18 weeks in the fall semester of 2021, but weeks 14-18 were mainly review sessions and final exams, so the classroom observations for this study were conducted from week 2 to week 12. A total of 10 classroom observations were conducted in this study; week 6 was a national holiday, so no classroom observations were conducted in week 6. All three

higher education English teachers of different teaching ages taught two types of classes: reading classes and speaking classes. The instructional goal of the speaking class was to improve students' listening and speaking skills, so the content knowledge of the speaking class consisted of speaking exercises and listening exercises. Since English classes in higher education are categorized into reading and speaking classes, this study formulates English classes as reading classes, whose goal is to develop students' reading and writing skills. Therefore, the content knowledge of the reading class includes grammar, reading, and writing. Three higher education English teachers observed one speaking class and one reading class per week. Prior to the classroom observations, the connotations of the components of informational contextualized English teaching and the three developmental pathways were communicated to the three first-year higher education English teachers who participated in the classroom observations, and the three teachers were encouraged to informationalize their teaching and learning from the perspective of informational contextualized English teaching and the three growth pathways.

The experimental density of information-based teaching is analyzed using clustering software. The red area represents the standardized and systematic practice of English teaching achieved through good use of information technology during this time period. The blue area represents the low-density clustering area, indicating that there is no standard teaching that has achieved good implementation of information technology. The overall test results are shown on the right side of the picture, as shown in Fig. 3.

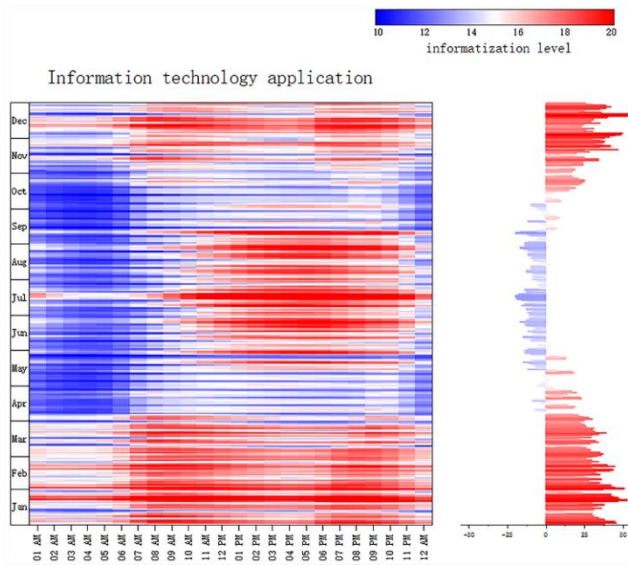


Fig. 3. Application of information-based English language teaching and learning.

Formal semi-structured interviews were conducted in week 13, in which the three teachers were interviewed face-to-face according to the interview outline. The researcher also communicated with the three teachers after class to share new issues identified during classroom observations and to revise the interview outline promptly. The questionnaire data were analyzed mainly using SPSS 22. First, the internal consistency

of the reliability of each subscale and the whole scale was tested. Second, the descriptive analysis function in SPSS 22 was used to statistically analyze the data in each subscale, which mainly involved frequency distribution and percentage. The data of classroom observation were mainly from the Classroom Observation Scale. In order to explore the differences in how higher education English teachers of different teaching ages present each knowledge component of informational contextual English teaching in different course types, this paper conducted a descriptive analysis of the collected data. The frequencies and means of the different components of teaching English in an informational context in different course types were analyzed.

The transcription of the interviews was the change of the interview conversation from spoken to written form, which made the results easier to analyze, and the transcription process itself was the initial analysis process. At the end of the transcription process, the transcribed data was sent to the interviewees for confirmation to ensure the validity of the interviews. The interview data were analyzed by dividing the interview outline into dimensions, coding each teacher's interview data according to these dimensions, and organizing the interview data related to the theme of this study. The first dimension is higher education English teachers' reflections on the three development paths from the perspective of teaching English in an informational context; the second dimension is the strategies for improving higher education English teachers' informationalized teaching competence, and the third dimension is the factors affecting the development of higher education English teachers' informationalized teaching competence.

In the process of analyzing the integration of information technology teaching, the main approach is to examine the ways in which teachers can stimulate students' learning enthusiasm in order to achieve the integration of information technology teaching. Even in the issue of "summarizing using information technology", Mean reached 7.824, which achieved good integration of information technology, as shown in Table IV.

TABLE IV. ANALYSIS OF THE INTEGRATION OF INFORMATION-BASED TEACHING

Project	Mean	Standard Deviation
I will use information technology such as English audiovisual teaching resources to introduce scenarios, arouse students' interest, and maintain their attention. I will use information technology, such as English audiovisual teaching resources, to introduce scenarios	4.051	0.074
I will use information technology to design enjoyable English activities, encourage students to participate actively in classroom interaction, change the teaching method of "teachers full of words," and effectively carry out students' independent, cooperative, and exploratory learning. I will use information technology to design some exciting activities to encourage students to actively participate in classroom interaction, change the teaching method of "teachers full of words," and effectively carry out students' independent, cooperative, and exploratory learning	2.621	0.684
I will use various English learning software according to different teaching contents, such as "English Fun Dubbing," "Hundred Words Zhan," "Daily English Listening," "Tianxue.com," etc., to help students improve their information technology literacy and English listening, speaking, reading, and so on. I will use various English learning software according to different teaching contents such as "English Fun Dubbing," "Hundred Words Zhan," "Daily English Listening," "Tianxue.com," etc., to help students improve their information technology literacy and English listening, speaking, reading, and writing abilities. and writing abilities	5.362	0.638
When summarizing in class, I can use information technology to assist myself in summarizing in class	7.824	0.947

IV. RESULTS AND DISCUSSION

A. English Standardization and Systematization Process

Since the entrance examination reform for higher education institutions has added speaking and listening tests, higher education has reformed the English curriculum and added speaking classes to the original curriculum to cultivate students' speaking and listening skills. Although English-speaking classes in higher education have yet to be fully implemented, English teachers must also develop students' listening and speaking skills in English teaching. With the background of curriculum reform and informationalized teaching and learning, this study used classroom observation to understand the characteristics of informationalized background English teaching exhibited by first-year English teachers in higher education of different teaching ages in speaking and reading classes. The following conclusions were drawn.

First, because speaking classes need to develop students' listening and speaking skills, the three first-year higher education English teachers of different teaching ages used IT more frequently and, on average, in speaking classes than in reading classes. In addition to CK, the other six components (TK et al., PCK, TPK, and teaching English in an informational

context) were more frequently used in speaking classes than reading classes, and information technology was more diverse. Teachers have good comprehensive skills in teaching with information technology. It can be found from Ms.C's lessons that although TK, TCK, TPK, and informationalized contextual English teaching are more frequent in speaking classes than in reading classes, Ms.C is influenced by her previous teaching experience and PK, CK, and PCK account for a large proportion of speaking and reading classes. The above analysis shows that courses affect English teachers' ability to teach information technology in higher education. Since speaking classes require information technology to support the presentation of content knowledge, the three higher education English teachers were more likely to use components related to technological knowledge in their speaking classes. Therefore, higher education English teachers of different ages must experiment with using different information technologies to explain content knowledge in their reading classes. Consistent with other quantitative studies, this study also conducted descriptive statistics. However, in this study, information support was further categorized by gender to objectively examine the sensitivity of information technology to gender. Among them, 624 male samples were selected and 1204 female samples were selected, as shown in Table V.

TABLE V. DESCRIPTION OF INFORMATIONAL TEACHING BY GENDER DIMENSION

Dimension (math.)	Distinguishing between the sexes	Sample size	Statistical value M	T	SIG
ICT capacity	male	624	4.05	1.624	0.214
	daughter	1204	3.68		
Basic technical literacy	male	624	4.51	1.051	0.032
	women	1204	3.91		
Technical Learning Support	male	624	4.51	1.324	0.141
	women	1204	3.62		
Technical Learning Support	male	624	4.44	1.214	0.362
	women	1204	3.92		

In the current Context of curriculum reform, the first path (from PCK to informational context English teaching) and the second path (from TPK to informational context English teaching) under informational Context English teaching can meet the needs of two courses. Higher education English teachers can choose the appropriate pathway according to the needs of their courses. For example, teachers can choose the second path (from TPK to teaching English in an informational context) when preparing for speaking classes. The teacher considers the role of technology in the speaking classroom, so the teacher first develops TK and TPK and then combines TPK and PCK to develop informational contextual English teaching. When preparing for the reading lesson, the teacher chooses the first path from PCK to informational contextualized ELT. In reading lessons, teachers focused more on content knowledge, so teachers first developed PK and CK and then used technology to enhance and structure instruction. However, prior teaching experience and less technological knowledge influenced the

pathway choice, and only the first pathway was chosen to develop informationalized teaching skills. However, with sufficient technological knowledge, the appropriate path would also be chosen depending on the type of course. In addition to the first and second development paths that can help higher education English teachers develop informational contextualized English teaching, this study provides three strategies for higher education English teachers to develop informational contextualized English teaching and to improve their informationalized teaching competence based on the results of the interviews and the literature review.

The systematic testing of English teaching can be found in Eq. (4) and (5):

$$e'_i = x_i(t) - y_i(t) + d_i(t) - c_i(t) + z_i(t) + \sum_{\forall k \in I/i} u_{ik}(t), \forall i \quad (4)$$

$\sum_{\forall k \in I/i} u_{ik}(t), \forall i$ is the system composite value of the systematic test.

$$u_{ii}(t) = 0, \forall_i = L \quad (5)$$

$u_{ii}(t) = 0$ is the minimum value of the least squares method.

First, establish a school collaboration mechanism. Research has shown that informational contextual English teaching can help higher education English teachers build a knowledge system of informational teaching ability. Therefore, informational contextual English teaching can be extended to higher education, and higher education English teachers from different schools can regularly engage in collaborative learning. In the exchange and learning, teachers can discuss the connotation of the seven components of informational background English teaching, share how new information technology can be applied to higher education English teaching in the Context of informational background English teaching, and use informational background English teaching to promote the improvement of higher education English teachers' informationalized teaching competence.

Secondly, educational research activities are organized. The school actively conducts teaching and research activities against the background of teaching English in an informational context and organizes public class demonstrations and after-class seminars. When evaluating public courses, teachers can discuss the strengths and weaknesses of public courses against the background of knowledge of teaching English in an informational context. Public classroom demonstrations can help higher education English teachers of different teaching ages learn from each other. Teachers with higher informationalized

teaching competence can provide training on informationalized teaching competence to other higher education English teachers. Teachers with high teaching ability can promote new information technology, instruct other teachers on how to apply information technology and develop teachers' ability to integrate information technology with English teaching.

Finally, cultivate teachers' sense of reflection. Informative teaching is new to teachers who implement information teaching. Therefore, besides external help, teachers should know the need to improve their informational teaching ability actively. Teachers should develop the habit of reflecting on informalized teaching from the perspective of teaching English in an informative context so that they can discover the deficiencies of the information teaching knowledge system in the teaching process and improve the implementation process of formalized teaching in time. Teachers should learn to improve their instructional teaching ability gradually through reflection. Higher education English teachers can reflect on the insufficiency of the knowledge of informatization teaching ability based on the informatization background of English teaching, and they can also learn whether the application of information technology in each lesson can help students understand and master the content knowledge through the students' feedback after the lesson. Higher education English teachers should accumulate information technology teaching experience and improve information technology teaching ability through reflection.

Conduct a degree segmentation study on descriptive statistics, using a sample size of 254 for undergraduate students and 663 for master's students. Sensitivity considerations for information technology are divided into three aspects: ICT competence, basic technical literacy, and technical support for learning; Two tests were conducted on technical support learning, as shown in Table VI.

TABLE VI. DESCRIPTION OF INFORMATIVE INSTRUCTION IN THE DEGREE DIMENSION

dimension (math.)	places	sample size	Statistical value M	T	SIG
ICT capacity	undergraduate (adjective)	254	4.01	-1.62	0.974
	bachelor's degree	663	4.41		
Basic technical literacy	undergraduate (adjective)	254	3.58	-0.964	0.914
	bachelor's degree	663	6.36		
Technical Support Learning	undergraduate (adjective)	254	3.51	-0.657	0.635
	bachelor's degree	663	4.05		
Technical Support Learning	undergraduate (adjective)	254	3.3	-0.241	0.874
	bachelor's degree	663	3.91		

B. Technical Support for Information Technology Teaching

Most higher education English teachers used to think that they could utilize their informal teaching ability as long as they were skilled in using information technology in teaching. Teachers need to understand the complete knowledge system of informationalized teaching and improve their informationalized

teaching ability. The emergence of English teaching in an informational context fills the teachers' knowledge system gap. It helps English teachers in higher education to understand the knowledge that should be included in complete informational teaching. The seven components of informational contextual English teaching can help higher education English teachers improve their professional knowledge and provide guidance for

improving teachers' informationalized teaching ability. Higher education English teachers should draw on the knowledge system of informationalized background English teaching, deeply understand and master the connotation of informationalized background English teaching, find out its shortcomings, and improve their knowledge system in time from the perspective of informationalized background English teaching. Through a deep understanding of the specific content of informationization background English teaching, teachers can integrate information technology into teaching, improve the quality of information technology teaching, and perfect how information technology is used. In addition, by applying informationalized background English teaching to speaking and reading classes, higher education English teachers can promptly reflect on the deficiencies in teaching and apply the seven components of informationized background English teaching in different course types. In this study, a certain clustering analysis was conducted on the standardization and systematic practice of English education under the background of informatization, which mainly includes five aspects, including "English standardization and systematic practice, English standardization research, English systematic research", etc. Specifically, the darker colors of each aspect represent their quantitative clustering, and the lighter colors represent their spatial clustering, as shown in Fig. 4.

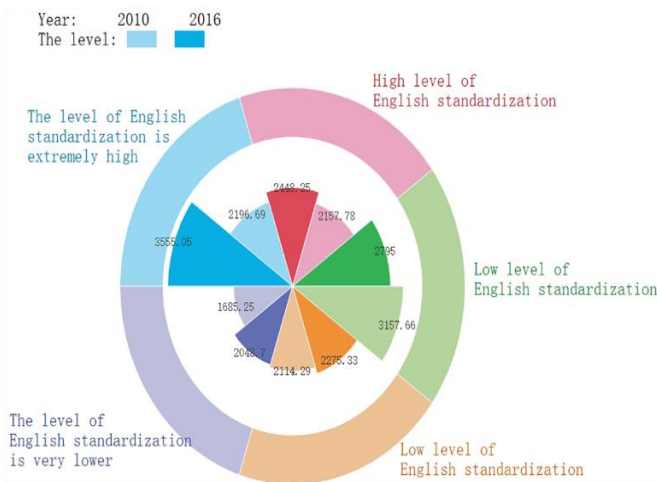


Fig. 4. Systematic research priorities in English language education.

With the support of informational contextualized English teaching, higher education English teachers' ultimate goal is to integrate their teaching so that the seven components of informational contextualized English teaching are integrated into their teaching, thus promoting the improvement of informationalized teaching skills. In order to help teachers develop informational contextualized English teaching, three pathways for developing informational contextualized English teaching are proposed. Applying the three developmental paths to higher education English teaching in China, the first and second of the three developmental paths could help teachers develop an informational background in English teaching. Three higher education English teachers of different teaching ages believed that the first path (from PCK to teaching English in an informational context) was suitable for reading classes, and the

second path (from TPK to teaching English in an informational context) was suitable for speaking classes. The third path (PCK and informational contextual English teaching simultaneously) must be more suitable for higher education English teachers to develop informational contextual English teaching. However, with sufficient technological knowledge, the first path can be relied on to design English teaching for the time being. The above interview results provide path support for most higher education English teachers to improve their informationalized teaching ability. Higher education English teachers can choose appropriate paths for different types of courses to help teachers integrate information technology into English teaching. Most higher education English teachers have recognized the critical role of information technology teaching and the effectiveness of information technology background English teaching in perfecting information technology teaching ability. Therefore, teachers' use of informational background in English teaching and the first and second paths to guide informationalized teaching competence can reduce the pressure on teachers to improve their informationalized teaching competence. The above interview results about the paths will be informative for guiding the informatization teaching ability of English teachers in higher education at this stage.

Teachers' sense of responsibility and mission have the most significant impact on their development, and teachers' obligations and responsibilities to students and teaching affect their beliefs and efficiency in teaching and influence their teaching practices. Combined with the results of the interviews, teachers' perceived attitudes toward informationalized teaching can be divided into the following three categories. First, this informationalized teaching English teacher category has a strong sense of educational mission. Teachers in this category have a strong sense of mission and passion for teaching. It believes that English teachers should keep abreast of the times and continuously improve their ICT skills to improve teaching and students' learning efficiency. Teachers in this category consistently spoke highly of IT teaching in their interviews and agreed that integrating the English subject with IT was important.

Secondly, these teachers have a strong sense of mission and are willing to learn IT teaching courses. Information technology teaching English teachers have a strong sense of educational responsibility and mission. It recognizes the critical role of information technology in teaching English. Nonetheless, it could have shown a more vital willingness to use IT in the interviews. It is believed that the reasons for using IT tools in teaching came mainly from the demands of the external environment, including the recruiters' requirements for teachers' technological level and future career development.

Third, this category of teachers needs a stronger sense of mission and is influenced by cultural conceptions of the discipline. This category of informationalized teaching English teachers needs a stronger sense of educational mission and believes that technological tools only play a supplementary role in English teaching and are dispensable. Its conception of teaching is relatively traditional, believing that the English teacher's job is the most important and that he or she should focus on teaching language knowledge and grammar.

In the standardization and systematization of English education under the background of informatization, descriptive statistics should be conducted on the dimension of network devices. A sample of whether online network device information

is used was used, with a sample size of 204 for "yes" and 782 for "no". Only a t-test was needed for the "yes" sample, and the specific results are shown in Table VII.

TABLE VII. DESCRIPTION OF INFORMATIONALIZED INSTRUCTION IN THE NETWORK DEVICE DIMENSION

Dimension (math.)	Network device dimension	Sample size	Statistical value M	T	SIG
ICT capacity	be	204	4.01	3.61	0.014
	clogged	782	4.41		
Basic technical literacy	be	204	3.58	4.68	0.019
	clogged	782	6.36		
Technical Support Learning	be	204	3.51	2.617	0.270
	clogged	782	4.05		
Technical Support Learning	be	204	3.3	6.354	0.035
	clogged	782	3.91		

In the interviews, its views strongly reflect the influence of cultural perceptions on the English language discipline. The subject of English is unique among many disciplines because of its dual characteristics of content and medium. Cultural perceptions of their subjects may influence the application of IT in specific subjects by ITed English teachers. In conclusion, informationalized English teachers have a positive attitude towards teaching IT and are most particular about the importance of IT in English language teaching. They believe that IT supports English language teaching and learning by bringing authentic contexts and rich teaching resources, helping students develop an excellent cultural awareness and a willingness to learn and use new IT in practice. Therefore, the concepts and attitudes towards IT teaching will affect the IT teaching ability of English teachers of IT teaching.

ANOVA showed that there were significant differences in the standardization and systematization skills of ITed English teachers in terms of teaching practice and that ITed English teachers with teaching practice were significantly more likely to be involved in teaching practice than those without in all three sub-dimensions of ITed. In the third section of the questionnaire, "participation in teaching practice" ranked second regarding the importance of influencing factors. Classroom practice and various practical activities of English teachers are essential factors that influence the development of their ICT competence.

In the interviews, all the teachers of IT-enabled English mentioned the critical word "little teaching practice". They felt they needed more opportunities to integrate IT into their English teaching practice. PET 1, PET 2, PET 4, and PET 6 expressed similar views. They all felt that their teaching practice needed to be improved. Although they had participated in educational internships, they needed more opportunities to practice and improve their ICT skills in natural teaching environments. Therefore, it is desired that the number of practicum opportunities in terms of school curriculum or activity practices and educational internships be increased. Practicum can help individuals analyze and master technology in greater depth and is the ultimate way to consolidate and strengthen their IT

teaching skills. Teachers of IT-enabled English with teaching experience can improve their ICT skills by constantly reflecting on and reconstructing their teaching practices after practice, analyzing and judging the appropriateness of the actions and timing of the use of IT in the classroom, and better integrating the subject matter with IT. However, many informationalized teaching English teachers reflected the need for teaching practice in their interviews. Due to the lack of teaching practice, informationalized teaching English teachers could not reflect on and improve the use of IT in the teaching process based on teaching effectiveness, which hindered the development of their IT competence. Therefore, it is significant for informationalized teaching English teachers to participate in teaching practice.

ANOVA showed significant differences in ITE English teachers' standardization and systematization abilities in school technology environments, suggesting that school technology support significantly impacts ITE English teachers' standardization and systematization abilities. Based on the literature review, the following analysis focuses on school support, teacher modeling, and curriculum. School is an essential stage for informationalized English teachers to learn subject knowledge and IT knowledge systematically, and the school environment inevitably affects the development of their ICT competence. In the survey, "school hardware and software support" ranked first in the list of possible factors affecting the growth of ICT competence. The timely updating of teaching equipment and the maintenance and repair of related equipment help to create a favorable IT teaching and learning environment. Several studies have shown that good teaching and learning equipment can significantly increase teachers' motivation to use technological tools.

V. CONCLUSION

In conclusion, this study has addressed the research questions posed in the methodology section, particularly focusing on the characteristics of university English teachers' information teaching capabilities, encompassing the four components of Technological Knowledge (TK), Technological Content Knowledge (TCK), Technological Pedagogical

Knowledge (TPK), and their integration within the context of English education informatization. Our findings confirm that the integration of information technology in English education significantly enhances teaching efficiency and effectiveness. The use of multimedia and digital resources has been shown to enrich the teaching experience, making it more dynamic and engaging, thereby stimulating students' interest and promoting their autonomous learning.

Moreover, our study has demonstrated that informatization significantly improves students' English listening and speaking skills. The utilization of multimedia teaching resources in authentic contexts has enhanced students' language perception and practical language use. Interactive methods, including online communication and simulated dialogues, have been instrumental in greatly improving students' communicative competence.

The study also established the reliability and validity of the questionnaire survey instrument used to collect quantitative data, ensuring that the research findings are robust and trustworthy. The results align with previous research, underscoring the importance of informatization in standardizing educational practices and narrowing the educational resource gap. The adoption of a unified teaching platform and resources ensures the consistency and accuracy of teaching content, contributing to higher quality education.

Furthermore, the research highlights the role of informatization in the systematization of English education, facilitated by big data and artificial intelligence. This systematization allows for a more scientific and precise analysis of students' learning, thereby enhancing teaching outcomes.

In light of these findings, it is evident that the standardization and systematization of English education through informatization play a crucial role in improving teaching effectiveness and stimulating students' learning interests and potential. Looking ahead, there is a clear need to further integrate information technology with English education, continuously optimizing teaching methods to align with the developmental demands of the information age. It is also imperative to focus on educational equity and accessibility, ensuring that every student has the opportunity to receive a high-quality English education.

This study offers valuable insights and lessons for the reform and innovation of English education, anticipating significant advancements driven by information technology. The empirical validation of our model, which has shown substantial increases in student performance and engagement, addresses a critical gap in the current literature and provides a solid framework for future research and practice in English education informatization. Our study, though advancing English education through informatization, has limitations. It is bounded to a specific context, potentially restricting the applicability of results elsewhere. Dependence on technology infrastructure varies and could impact outcomes. Data collection was limited in time, not capturing long-term effects. Future studies should include broader and more diverse samples over longer periods to enhance the model's sustainability and scalability.

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