

# Study and Practice of CLIL Teaching Model for all-English Course “Digital Fundamentals” under the Perspective of Intersubjectivity

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**Abstract.** With the acceleration of the internationalization of universities, the cultivation of interdisciplinary talent possessing both professional knowledge and international communication capabilities has become a crucial goal in higher education in China. As an important specialized basic course of electrical specialties in domestic and foreign universities, the all-English course “Digital Fundamentals” has a wide audience and plays an important role in cultivating international talents. However, teaching in all English is a great challenge for both teachers and students. Insufficient innovation in teaching methods, coupled with a lack of student engagement and initiative, inevitably leads to poor learning outcomes. In this paper, Intersubjectivity theory is introduced to motivate the students' subjectivity and improve the teaching quality in the education process of this course, and a CLIL (Content and Language Integrated Learning) teaching model is developed and effectively applied to the teaching practice. In this model, the smart information technology including network platform “MOOC” and mobile platform “Rain class” are applied to support autonomous learning and interaction, and the reasonable teaching environments including “Split classroom”, “Flipped classroom”, and “Team-based learning” are created to build consensus through verbal communication and achieve joint development through interaction between teachers and students. The opportunities for students to learn independently and communicate with teachers are much greater than the traditional teaching model. Meanwhile, a multi-element teaching evaluation mechanism is also proposed, and adopted as the source of feedback information to promote teaching and learning effectively. Practice has proved that these studies will achieve the double teaching goal of improvements in the capability of professional knowledge and the application ability of technical English. They are highly significant in positive guiding and practical reference for the teaching reform practice of similar courses.

**Keywords:** Intersubjectivity; CLIL; Digital Fundamentals; MOOC; Rain class; Split class-room; Flipped Classroom; Team-Based Learning

## 1. Introduction

Nowadays, a series of teaching reform and innovation are carried out in colleges and universities to promote the internationalization of higher education. One of them is the implementation of all-English teaching for specialized course or specialized basic courses.

CLIL (Content and Language Integrated Learning) <sup>[1]</sup> is just a learning model integrating content with language, which advocates the organic integration of professional learning and language learning. It can achieve dual improvement of both professional and foreign language abilities by using foreign languages to teach the non-English courses. As an important specialized basic course with a wide audience, Digital Fundamentals can benefit from being taught in English to facilitate international talent development. However, teaching in all English is a great challenge for both teachers and students. Insufficient innovation in teaching methods, coupled with a lack of student engagement and initiative, inevitably leads to poor learning outcomes. The concept of Intersubjectivity education emphasizes that teachers and students interact and influence each other in the educational process, which can effectively promote learning and achieve authentic, reciprocal learning. The theory of Intersubjectivity has been widely studied in the field of humanities <sup>[2-5]</sup>. However, with the deepening of educational and course reform, how to effectively apply Intersubjectivity in the teaching practice, transform teaching concepts into teaching actions, and improve the quality of education has become a challenging issue for many educators. In this paper, Intersubjectivity theory is introduced to motivate the students' subjectivity and improve the teaching quality in the education process of all-English course. Under the perspective of Intersubjectivity, a CLIL teaching model and a multi-dimensional teaching evaluation mechanism for the all-English course "Digital Fundamentals" are constructed and applied in teaching practice effectively.

## **2. New teacher-student relationship under the Intersubjectivity**

In traditional "subjectivity" educational models, teacher-centered or student-centered are both "subject-object" relationship which exists a unidirectional flow of information, and is not conducive to interaction between teachers and students <sup>[2]</sup>. To address this issue, the "teacher-led, student-centered" model was proposed <sup>[3]</sup>. It suggests that during teaching, the teacher is the subject and the student is the object; during learning, the student is the subject and the teacher is the object. However, teachers' and students' teaching and learning processes are never independent but rather inter-twined. Therefore, the "teacher-led, student-centered" model is still a subject-object relationship that goes against the fundamental law of teaching and learning.

"Intersubjectivity" originates from Western philosophy and refers to the relationship between two or more subjects, emphasizing the interaction between different subjects. Through dialogue and mutual blending between subjects, joint development and progress can be achieved <sup>[5-6]</sup>. Under the concept of Intersubjectivity, the students' passive learning becomes active learning, the teacher's monologue in the classroom is replaced by a dialogue between teachers and students, and the "subject-object" relationship is replaced by an interactive relationship between teachers and students. Teachers and students are equal dialogue partners and co-developers <sup>[7-8]</sup>. By taking students as the subject, teachers can understand the viewpoints and prior knowledge that students bring into the classroom through dialogue and interaction. In turn, teachers can better understand the students' knowledge level and apply personalized teaching methods. Only when students are the subject can their learning motivation be fully mobilized, their creativity be unleashed, and teachers' teaching enthusiasm and level be improved, ultimately achieving the common development of teachers and students.

### 3. CLIL teaching model for all-English course in Digital Fundamentals under the perspective of Intersubjectivity

#### 3.1 Connotation of CLIL teaching model

CLIL teaching model mainly includes the following four levels: Content, Communication, Cognition, and Culture, as shown in Fig.1<sup>[9]</sup>. The four Cs fully demonstrate that CLIL teaching is content and cultural oriented, with language as the medium, emphasizing communication among students and communication between teachers and students, to promote students' cognitive ability of professional content. Unlike traditional teaching model, it does not view subject and language as two independent elements, but rather places content in the field of "knowledge learning", integrating content with cognition, and using language as a cultural phenomenon to integrate communication with culture. Its core connotation is to view the subject and language as an integrated whole, integrate knowledge concepts and language learning.

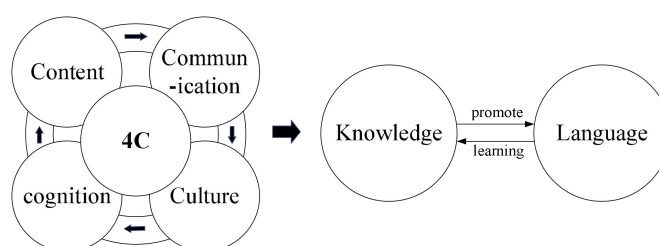


Fig. 1. CLIL teaching model and its core connotation

#### 3.2 CLIL teaching Model under the Perspective of Intersubjectivity

Different teaching objectives require different teaching methods. The teaching objectives of this course encompass two aspects: the mastery of basic professional knowledge and the ability to apply professional English skills in reading and communication. Based on the connotation of CLIL teaching model, incorporating the concept of Intersubjectivity, a teaching model has been developed for the teaching objectives of the course Digital Fundamentals, as shown in Fig.2. In this model, the opportunities for students to learn independently and communicate with teachers are much greater than the traditional teaching model. It integrates the learning of professional knowledge and language into a whole through various teaching methods: "using languages to learn professional knowledge, and learning to use languages in professional knowledge learning".

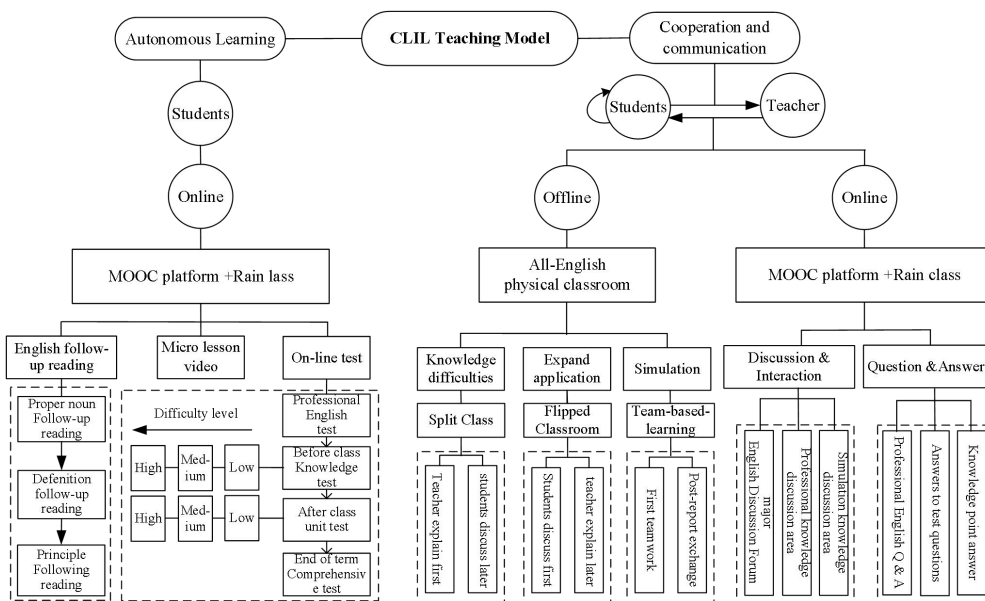


Fig. 2. CLIL Teaching Model for all-English Digital Fundamentals

### 3.2.1 Autonomous learning on MOOC and WeChat Rain class

Autonomous learning is online learning, students can learn autonomously through network platform “MOOC” and mobile platform “Rain class”.

#### 1) MOOC platform

In November 2019, the all-English course “Digital Fundamentals” was endorsed as an Open Online Course for colleges and universities in Jiangsu Province, and had been run effectively for three years on MOOC online learning platform for Chinese universities (see Fig.3). On the MOOC platform, various learning methods include “English follow-up reading training”, “Micro lessons”, and “Online tests” are supplied (see Fig.4). Students can familiarize the English expression of proper nouns, definitions and principles by “following up reading” before class. Students are allowed to choose and learn different units' micro lessons at their own pace and decide their level of participation in the course as needed. Test questions include not only professional knowledge tests but also professional English tests. Professional knowledge tests are divided into three advanced types based on students' cognitive development: pre-class knowledge point tests, post-unit tests, and comprehensive tests. At the same time, personalized testing methods are adopted to reflect students' autonomy. In the knowledge point and unit tests, questions are divided into three difficulty levels: low, medium, and high, and students can choose the difficulty level of the quiz according to their understanding. This helps teachers understand students' different learning levels, and test questions can also be practiced repeatedly.

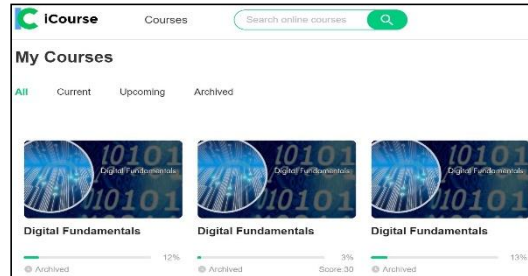


Fig. 3. "Digital Fundamentals" on MOOC platform

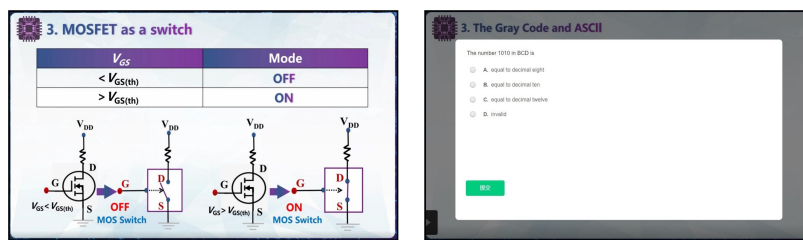


Fig. 4. Micro lessons and online test on MOOC platform

## 2) Rain class

Rain class is a smart mobile platform which integrates complex information technology methods into PowerPoint and WeChat, establishing a communication bridge between extracurricular preview and classroom teaching. In order to facilitate students to view the learning task and the courseware at any time, Rain class is used in our teaching practice to push the announcement, courseware, exercises to the students' mobile phone before class. We also use Rain class to take the online exam during the pandemic. The operation interfaces of Rain class are shown in Fig.5.

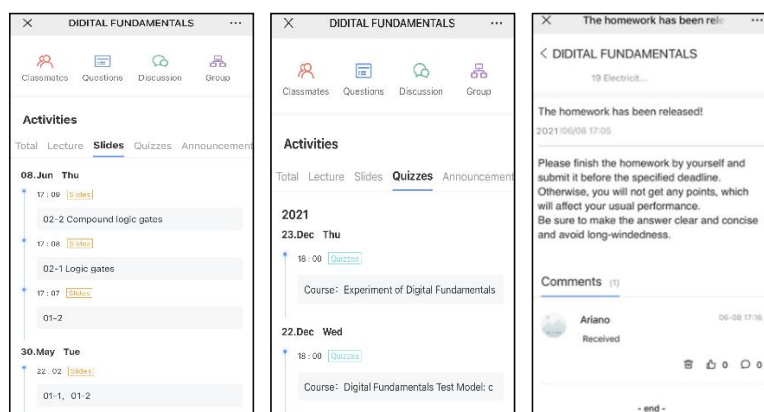


Fig. 5. Operation interfaces of Digital Fundamentals on Rain class mobile platform

### 3.2.2 Cooperation and communication

Cooperation and communication can be carried out among students, as well as between students and teachers. The discussions, summaries, questions, debates, and group cooperation involved can achieve high-quality learning outcomes only when they are able to understand and use English for learning supplemented by teacher' guidance. Therefore, it needs to be continuously progressive and repeated. There are two forms of cooperation and communication including online and offline. Offline classrooms are conducted on knowledge difficulties, in-depth learning of practical applications of digital circuits, EDA software simulation. Accordingly, three teaching environments including Split classroom (SC) <sup>[10]</sup>, Team-Based Learning (TBL), and Flipped-Class (FC) <sup>[11]</sup>, are created to promote communication between teachers and students. Online interactive discussions and Q&A sessions are provided to offer multiple channels for collaborative learning opportunities for teachers and students.

#### 1) Split classroom

The SC teaching model is mainly aimed at the knowledges that students have difficulty learning independently and require explanation and filtering from the teacher to understand complex concepts. The teacher first analyzes and teaches the problematic points and then leaves half the time to discuss pre-prepared questions or new questions raised by students, with the teacher and students participating as the main body to answer.

#### 2) Flipped classroom

Students engage in independent discussion and exploration of practical application problems in the Flipped classroom. The FC teaching model is aimed at the practical extension and application of knowledge and belongs to inquiry-based learning. The teacher provides the questions for discussion in advance, guides and summarizes the discussion in class. This teaching model stimulates students' learning initiative, broadens their horizons, and provides them with more opportunities to express themselves, significantly contributing to developing English language application skills.

#### 3) Team-Based Learning

The TBL teaching model is mainly used to help students learn how to use EDA simulation software to scientifically verify the theories they have learned and cultivate a rigorous learning attitude. In teaching, students are divided into several groups based on differentiated principles, ensuring that the group members' gender and ability levels are stratified within the group and balanced between groups. In group work, students collaborate to design, build, and simulate circuits based on given functional requirements, independently solve problems, and analyze simulation results. The group that first produces the correct results can obtain a relatively high score. This learning mode with group competition motivates students and requires communication and discussion in English, significantly improving professional English language skills.

The practice process of the three teaching models can be described as Fig.6. In Fig.6, information technology and activity teaching are two supports to achieve the teaching goal. Information technology is relied to construct the entire teaching model architecture, unifying

various links in the teaching process, and the meticulously designing activity teaching is to complete the knowledge internalization.

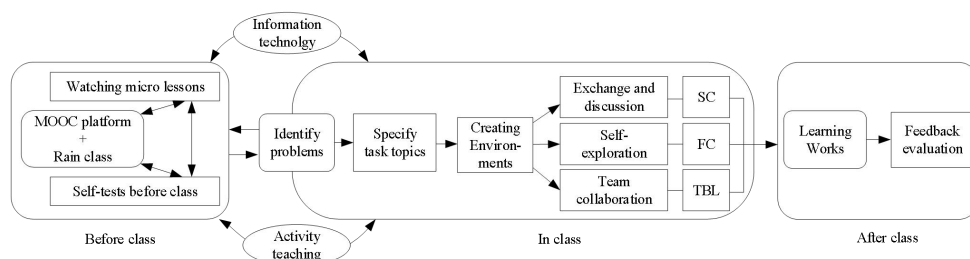


Fig. 6. Practice process of the three teaching models

According to the autonomous learning results before class, teachers identify problems and create a reasonable teaching environment, like FC, teachers generate questions, divide tasks among groups, students discuss and exchange learning experiences, share learning outcomes, to complete the internalization of knowledge difficulties. During the process, teachers observe and record students' behavior, evaluate group members, then receive feedback evaluation based on learning workings after class, providing experience for the next round of teaching. For details about teaching evaluation, see part 4.

#### 4. Multiple Teaching Evaluation Mechanism

Teaching evaluation is one of the important means to improve teaching quality. The content used for teaching evaluation must be consistent with the teaching objectives. The teaching evaluation is divided into three categories: Diagnostic evaluation, Formative evaluation, and Summative evaluation, see Fig.7. Diagnostic evaluation is conducted before teaching, which helps teachers understand students' prior knowledge and level of understanding to arrange teaching content and organize teaching reasonably. We use MOOC platform to take the pre-course questionnaires and pre-knowledge tests to conduct diagnostic evaluations.

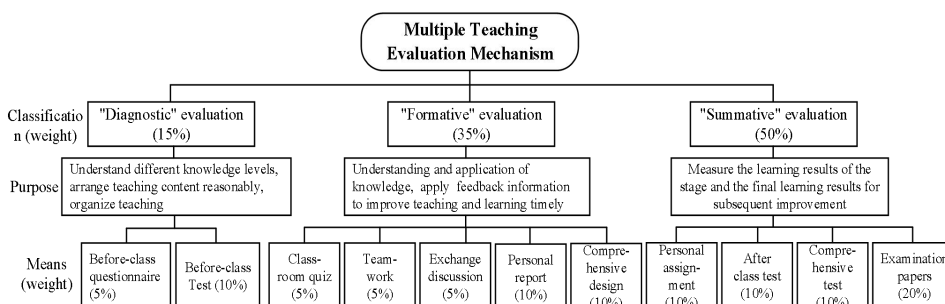


Fig. 7. Multi-teaching evaluation mechanism

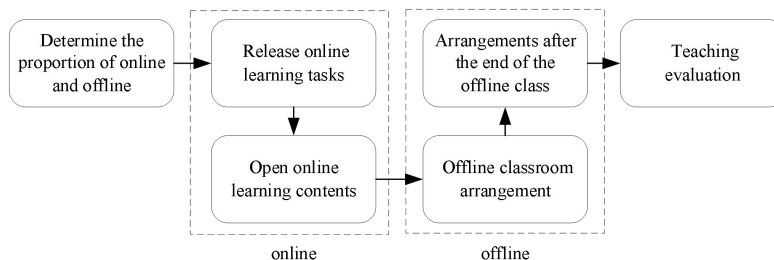
Formative evaluation is a process evaluation that can help teachers grasp students' understanding and application of knowledge in a timely manner. The feedback information is continuously used to improve teaching and learning. In addition to the teacher's evaluation of student's abilities, the formative evaluation also includes students' self-evaluation and peer evaluation, which can stimulate students' subjectivity and promote the achievement of the teaching objective of knowledge transfer. We use classroom questioning, group cooperation, problem discussion, individual reports, comprehensive design, and other methods to conduct formative evaluation.

Summative evaluation is used to measure students' stage learning and final learning results and has reference significance for subsequent teaching reforms of this course. We use personal assignments, post-class tests, comprehensive tests, and examination papers (mid-term and final) to conduct summative evaluations. The weight of each evaluation method and the multi-dimensional evaluation mechanism is shown in Fig.7, which provides a quantitative basis for the objective and fair assessment of students' learning effects.

## 5. CLIL teaching practice

### 5.1 Measures for the Implementation of CLIL and evaluation mechanism

The measures for the implementation of CLIL and evaluation mechanism can be expressed as Fig.8.



**Fig. 8.** Measures for the implementation of CLIL and evaluation mechanism

1) Determine the proportion of online: The ratio of online and offline course components meet the stipulated standards. In particular, the course aims to allocate approximately 20% of the total course hours (54 hours) to online instruction.

2) Release online learning tasks: Every week, the teacher will arrange this unit's learning tasks on the MOOC and Rain class classrooms' bulletin board. It is required to complete viewing several micro-class videos and related test questions before the start of the offline class. Prepare for the topics to be discussed next, such as in Flip classroom.

3) Open online learning contents: Open each micro lesson and pre-class knowledge point test for a unit individually rather than opening them all at once. Students can enter additional videos or exam questions to watch or respond to questions at any time in addition to the required ones. This provides them with additional possibilities for independent learning.



4) Offline classroom arrangement: Two times every week, offline lessons are held for a total of 4-6 hours (40 minutes per class hour). The SC, FC, or FBL are implemented depending on the teaching material, knowledgeability needs, and teaching progress of this unit. Moreover, the teacher participates as an equal subject with the students in the online interactive discussion area where students can explore every topic covered in the course.

5) Arrangements after the end of the offline class: Upon course completion, the instructor will publish a set of assignments and test questions on the MOOC bulletin board, which students are expected to complete independently. As students finish studying each unit, a corresponding set of test questions will be made available to them. Upon concluding each unit, students are encouraged to compile and review any challenging questions they encountered, followed by offline peer review sessions. This iterative learning approach allows students to actively engage in the learning process and gain a deeper understanding of the course material. Furthermore, the course design includes two comprehensive online assessments, as well as midterm and final paper-based exams, to evaluate the student's understanding and progress. These assessments are designed to gauge the student's grasp of the course content and provide valuable feedback to both the students and instructors.

6) Teaching evaluation: Based on the evaluation criteria and weight specified in Fig.7, the teacher scores and records each student's performance, summarizes their overall performance for each unit, and adjusts the teaching progress of the next unit accordingly. Additionally, the teacher redesigns offline classroom assessments to gauge better students' depth of understanding of the course material.

## 5.2 Implementation example of one unit

### 1) Distribution of contents and class hours

In accordance with the teaching objectives, this unit's knowledge content is divided into three parts: foundation (2 hours) + difficult points (4 hours) + applications (2 hours) +simulation (2 hours), The specific content can be represented in Table 1.

**Table 1.** Contents of logic gate teaching

Class form	Teaching methods	Class hours	Week	Contents
Online	Micro lesson	2	1 <sup>st</sup>	1. The Inverter (8 min, Section 3-1), 2. The AND Gate and OR Gate (10 min, Section 3-1), 3. Truth table (8 min, Section 3-1), 4. Digital waveform (10 min, Section 3-1), 5. The NAND and NOR gates (10min, Section 3-2), 6. The XOR and XNOR Gates (10min, Section 3-2).
			2 <sup>st</sup>	7. IC Definition and IC Classification (10min, Section 3-6); 8. 74 Series Logic Gates and IC Packages (14min, Section 3-7).
Offline	SC	4	1 <sup>st</sup>	1. Construction and working principle of Logic gates (40 min, Section 3-3),

				2. discuss a problem (40min)
				1. External characteristics of logic gates (40min, Section 3-4), 2. discuss two problems (40min)
	FC	2	2 <sup>st</sup>	1. Fixed function logic gate and Programmable logic device (40min, Section 3-7); 2. Discuss the applications of basic logic gates (40min, Supplementary expansion);
	TBL	2	2 <sup>st</sup>	1. Use Multisim to simulate before class: 2. Display and discuss in Class. (80 min)

## 2) Teaching effect

Based on the results of the supervision and evaluation, student feedback, and course assessment for the three academic semesters, the teaching effectiveness was outstanding, with a pass rate of 98% and a 35% proportion of excellent performance, shown in Fig.9. The teaching quality has significantly improved as a result of these positive outcomes.

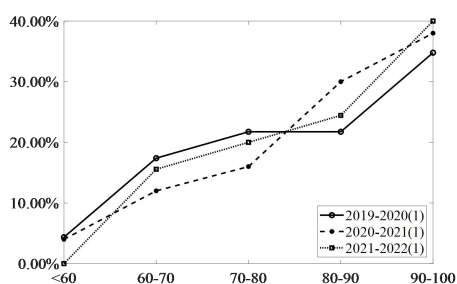


Fig. 9. Teaching effect

## 6. Conclusion

With the support of modern smart information technology and various activity teaching methods, the CLIL teaching model proposed in this paper can give full play to students' subjectivity, greatly improve opportunities for interaction and communication between students and teachers, and achieve the teaching goal of dual improvement of professional knowledge and English proficiency. It is highly significant in positive guiding and practical reference for other all-English specialized courses. However, in the practical process, there are still several issues that need to be addressed:

- 1) The lack of prior language proficiency among teachers and students is an important factor affecting the quality of teaching in the all-English specialized courses.
- 2) In the process of applying teaching evaluation mechanisms, how to accurately observe and record students' behavioral performance, evaluate group members, and obtain feedback based on learning outcomes to provide experience for the next round of teaching require deep-going research.

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