

# DEVELOPMENT OF A LEARNING MODEL THROUGH VIRTUAL REALITY TECHNOLOGY FOR ENHANCING COMMUNICATION SKILLS OF UNDERGRADUATE



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# การพัฒนารูปแบบการเรียนรู้ผ่านเทคโนโลยีเสมือนจริงเพื่อเสริมสร้างทักษะการสื่อสารในนักศึกษา ปริญญาตรี



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# DEVELOPMENT OF A LEARNING MODEL THROUGH VIRTUAL REALITY TECHNOLOGY FOR ENHANCING COMMUNICATION SKILLS OF UNDERGRADUATE STUDENTS



A Dissertation Submitted in Partial Fulfillment of the Requirements for the Degree of DOCTOR OF PHILOSOPHY (Curriculum Research and Development) Graduate School, Srinakharinwirot University 2023

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### THE DISSERTATION TITLED

## DEVELOPMENT OF A LEARNING MODEL THROUGH VIRTUAL REALITY TECHNOLOGY FOR ENHANCING COMMUNICATION SKILLS OF UNDERGRADUATE STUDENTS

ΒY

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The aims of this research are as follows: (1) the definition, and components of communication skills among undergraduate students; (2) the development of learning model through Virtual Reality Technology (VRT) for enhancing communication skills; and (3) to assess the effectiveness of the learning model through VRT for enhancing the communication skills of undergraduate students. The quantitative sample of this study consisted of 50 students from Class One in the 2023 undergraduate law program at the School of Political Science and Law, Zhoukou Normal University, Henan Province, They was selected by multi-stage sampling method and the collection tool was the Undergraduate Communication Skills Survey Questionnaire. The researcher examined the literature on communication theory, VRT theory and problem-based learning (PBL) theory, and constructivist theory, and designed a learning model based on VRT, incorporating the results of semi-structured interviews with five teachers. After the experiment, analysis data by descriptive statistics and Content Analysis. The study found that Chinese undergraduates' communication skills, which included expression, listening, understanding, and emotional control,

Keyword : Communication skills, Undergraduate students, Learning model, Virtual reality technology (VRT)

can be improved through a learning model based on VRT, PBL, and constructivism theories.

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# CHAPTER 1 INTRODUCTION

#### 1.1 Statement of the Problem

Since the twenty-first century, international organizations and education experts have had many different views on skills. The World Economic Cooperation Organization believes that ability is crucial for individuals to thrive in a rapidly changing world and for society to make progress without leaving anyone behind; Among all abilities needed, communication skills is one of the most important skills, and effective communication and appropriate coordination among different teams are key to the success of many jobs (OECD, 2019). The International Society for Educational Technology believes that in an increasingly digital world, students need to possess skills in several areas, including communication and collaboration, in order to adapt to society (ISTE, 2007). Education experts believe that in the new era, learning or studying not only include the tradition 3R aspects, i.e. reading, writing and arithmetic, but also the importance of critical thinking, creativity, collaboration and communication - these skills are crucial for students to thrive in the 21st century (Liego, 2022). From this, it can be seen that the 21st century is an era of competitive ability, such as communication and collaboration is the focus of emphasis (Gong, 2019). Where there is human activity, there is communication (Saputra, 2021), Communication skills is a necessary ability for a person's survival and development, and also a necessary condition for determining a person's success (Liu&Liu, 2020). The university stage is a crucial stage of life development, and improving their communication skills is not only directly beneficial to the development and interpersonal communication of undergraduates, but also related to if they can better adapt to society and have good career development after graduation (Song, 2018). Therefore, improving the communication skills of college students is a worthwhile research topic and also a concern for researcher.

Communication skills are the necessary skills for a person to communicate comprehensively with others through both verbal and nonverbal means, in order to establish good interpersonal relationships smoothly and effectively (Zhou, 2021). The

cultivation of communication skills is an important component of the comprehensive ability cultivation education for college students (Yani&Xiao, 2014). Research has found that communication skills are closely related to students' academic achievements, future career development, and happy lives (Kang et al., 2020). Effective communication can make education touch the hearts of students, and students with communication anxiety often have poor academic performance and are prone to dropping out of school (Gong, 2019). Communication skills is not only directly related to college students' interpersonal communication and growth, but also related to whether college students can adapt to the society after graduation, which largely affects college students' success and career development (Song, 2018); Excellent talents needed by enterprises should have strong communication skills, which not only contribute to the success of interviews (Wang, 2014), but also help them get promoted in work (Kang et al., 2020). People with good communication skills are happier, healthier, enjoy more satisfactory interpersonal relationships, and perform better in school and work (Wagner, 2015; Adler, Proctor, 2017; Lai et al., 2017). Good communication skills are even very beneficial to individual physical and mental health (Lai et al., 2017; Liu, 2006).

Communication skills is so important for college students, but their communication skills is not optimistic. Teachers in universities generally believe that the current communication skills of Chinese college students are not optimistic. Most students have a narrow range of communication, lack communication experience, are not good at communicating with others, and even fail to achieve true emotional communication between classmates. They tend to prefer online socializing and have less face-to-face communication. Students lack the patience to listen to others' opinions, and they also lack the practice of using oral expression, physical expression, and corresponding understanding skills for communication. Teachers believe that the most important factors affecting the communication skills of Chinese college students are mainly their ability to express themselves, listen to others, understand others, and control emotions.

Communication deficiency will bring great difficulties to college students' study and life, and even cause some extreme events. From the "Zhu Ling case at Tsinghua University" in the 1990s to the "Huang Yang case at Fudan University suspected of poisoning to death" and the stabbing death case of students at Golden City College of China Southern Airlines, these shocking events all reflect the insurmountable obstacles and difficulties that contemporary college students have encountered in dealing with interpersonal relationships, and the cases are often caused by some trivial things in daily life. When encountering contradictions that need to be reconciled, good communication skills can make the contradictions more smoothly resolved, while poor communication or failure to communicate will lead to the deterioration of contradictions and lead to interpersonal crisis (Wang, 2020). These seemingly insignificant communication barriers and contradictions, accumulated over time, eventually led to the outbreak of extreme events (Du&Li, 2020).

China's "National Mediumand Long Term Education Reform and Development Plan Outline (2010-2020)" emphasizes that education should prioritize ability, optimize knowledge structure, enrich social practice, strengthen ability cultivation, educate students to learn knowledge and skills, gain the ability to deal with things, and help them to strengthen communication skills as well as actively adapt to society. Therefore, universities should not only focus on professional education, but also teach students how to communicate and exchange, understand and respect (Song, 2018). Reviews of the college impact literature by Feldman and Newcomb and Pascarella and Terenzini indicate that the first year of college is a particularly important time in the lives of students (Pascarella et al., 1996). The first year of university study is in many ways the most formative (Cox et al., 2005). Communication skills of undergraduate students are certain actions beneficial for people to finish certain objectives. It is of critical significance to the construction of university support systems (McEwan & Guerrero, 2010). Therefore, strengthening the cultivation of communication skills for freshmen is extremely necessary for the future learning, employment, as well as life of undergraduate students.

For the importance of communication skills to college students, many scholars have conducted effective research on the path to improve college students' communication skills. The current research mostly focuses on the development of new paths in the real scene, such as focusing on students' mental health, focusing on the educational roles of schools and teachers, strengthening the relationship between students and their teacher, and actively counseling and communicating with students. researcher believe that due to the fast arising of electronic technology, developing virtual situational learning models to improve students' communication skills should become an important technology in the new era. This study attempts to start with developing learning models and explore how to develop virtual situational learning models to improve students'.

Virtual reality technology (VRT) is a human-computer interaction technology (tussyadiah et al., 2018). VRT has great advantages in communication skills training because of the "31" characteristics of immersion, interaction and imagination. As early as the 1990s, scholars had conducted research specifically on the impact of VRT on social skills training. Research has shown that with contrast to real contexts (such as some medical discussions), VRT has lower costs as well as risks, finding it proper for practicing communicative skills (Gillies & Pan, 2018). The most shining point of virtual reality is its ability to integrate with various industries and fields in society. In the field of education, it can be integrated with subject courses in culture, literature, art, and other fields, allowing students to achieve overall quality improvement (Gao, 2022). Virtual reality enables users to participate in the computer-generated environment, which is supported by the Computer graphics system and uses various display and interface devices, which provides teachers with various teaching methods and tools (Gudoniene & Rutkauskiene, 2019). Many scholars have studied the role of introducing VRT in improving communication skills in different fields: some scholars have introduced VRT into various Flipped classroom, believing that the communicative nature of language determines the important factors of interaction opportunities for improving students' communication skills (Xiao & Hong, 2020); Some experts in this field have carried on certain studies on the role of VRT in the training of nonverbal communication skills in children with autism, and believe that VRT performs well in the area for autism (Lee, 2020); In the field of architecture, the use of VRT increases students' exploration and divergent thinking of design spaces, enhancing their communication skills (Sopher et al., 2022); VRT based interventions can also help train health professionals and other communication partners (Bryant et al., 2020). These studies fully demonstrate that VRT has significant advantages in communication skills training due to the "31" feature.

A learning model is a conceptual aggregation based on a certain learning theory, consisting of several elements and their relationships. It has a certain value orientation and can guide the implementation, strategy formulation, and practical application of the learning process (Tyler, 2013). The theoretical basis of the learning model developed in this study includes communication theory, VRT theory, problembased learning theory, and Constructivism theory. Problem-Based Learning (PBL) is student-centered and utilizes issues in the social context to initiate the learning process and cultivate students' ability to deal with kinds of problems. It is a learning method that utilizes problem models, in order to find the best possible solution. constructivism theory assumes that students see knowledge not in an inactive way, but base on their experience and previous knowledge to gain new cognition, integrating fresh knowledge. Through constructivism teaching methods such as problem-solving, group collaboration, and open discussion, students are able to communicate with others, jointly build knowledge and understanding. We will design based on these theories when developing VRT based learning models, in order to fully mobilize students' enthusiasm and enhance their communication skills.

However, current research on the impact of VRT on communication skills is mainly focused on the medical field and special populations, with relatively little research on the impact of communication skills on undergraduate students. researcher are attempting to develop a learning model based on VRT in order to provide strategic references for improving students' communication skills. The most important factors that affect undergraduate communication skills include expression skills, listening skills, understanding skills,, and emotional control skills,. Therefore, the learning model developed in this study will evaluate the communication skills of Chinese university undergraduate students from these four fields.

#### 1.2 Research Questions

1) What are the definitions and components of communication skills for undergraduate students in universities?

2) How to develop a learning mode based on VRT?

3) How to evaluate the impact of new learning models on students' communication skills?

#### 1.3 Purpose of the Research

1) Study the definition, components of communication skills in undergraduate students;

2) The development of learning model through VRT for enhancing communication skills;

3) Assess the effectiveness of the learning model through VRT for enhancing communication skills of undergraduate students.

#### 1.4 Contribution to Knowledge

Developing a learning model based on VRT aimed at improving undergraduate communication skills has the following significance:

Through research, the level of communication skills among undergraduate students can be understood;

Obtained a new learning model based on VRT that can improve undergraduate communication skills;

This learning model emphasizes students' centrist part in the teaching and learning, as well as the part of teamwork, which can improve their communication skills, as well as to enhance collaborative and autonomous abilities of studying. University teachers can use this learning model to develop teaching strategies and smoothly carry out teaching work, improving students' learning efficiency.

#### 1.5 Scope of the Research

Before designing the learning model, the researcher studied relevant literature. Based on a review of the literature, a learning model is an abstract representation that encapsulates the characteristics and principles of the study process. It is designed according to specific learning theories to aid students in achieving their educational objectives. This model incorporates environmental situations and interactive processes to enhance the effectiveness of learning. The learning model in this study is built on the foundations of VRT theory, communication theory, constructivism, and PBL. The integration of VRT theory, constructivism, and PBL within the teaching framework can significantly enhance students' communication skills.

Afterwards, the researcher interviewed five award-winning teachers in the Henan Province College Teachers' Teaching Skills Competition. The interviewed teachers generally believed that the utilization of VRT in studying can improve students' communication skills. All the interviewed teachers agreed that the learning model contributes to teaching effectiveness and improves the teaching results. Promote the improvement of communication skills. After the interviews, the researcher obtained some information to design a learning model.

#### 1.5.1 Identifying Population and Sample

Population: According to the 2023 Henan Province education statistics, which is publicized by the education department in Henan Province in March 2023, current number of undergraduate freshmen in Henan Province is 409800.

Sample: In the selection of schools and majors, researcher use a multistage random sampling method. In the first stage, Zhoukou City was randomly selected from 18 Prefecture-level city in Henan Province. In the next period, the researcher adopted a simple random sampling method in two universities in Zhoukou City to extract to Zhoukou Normal University; In the third stage, a simple and random method is used to select the law major of Zhoukou Normal University as the school's professional sample. In the fourth stage, the researcher randomly selected the students of Law Class 1, Grade 2023, College of Political Science and Law, Zhoukou Normal University as samples from two classes in the first year of law.

Chinese university teachers use the learning model to conduct teaching activities on a classroom basis, so the researcher used multi-stage random sampling to select one class, Law 1, Class of 2023, in the School of Political Science and Law at Zhoukou Normal College, from all undergraduate universities in Henan Province. According to China's moral and ethical requirements, if students under the age of 18 participate in the experiment, researcher need to obtain consent from the students' parents, and all schools in Henan Province that enroll undergraduate students are open to enrollment from all over the country, and class assignments have to take into account all geographic regions, so university classes are filled with students from all over the country, and it would be difficult for the researcher to communicate with the family of the under eighteen-year old students to obtain their consent, so the researcher only selected students who had already eighteen years old. Therefore, the researcher only conducted the experiment with undergraduate students who had already reached the age of 18 and volunteered to participate in the study, and 50 students in the selected class who had reached the age of 18 is the sample size.

#### 1.5.2 Variables

1.5.2.1 Independent variable

Learning model through VRT for enhancing communication skills.

1.5.2.2 Dependent variable

Communication skills.

#### 1.6 Definition of Terms

#### 1.6.1 Undergraduate Communication Skills

Undergraduate communication skills refer to the ability of undergraduates to establish good interpersonal relationships, to express their intentions in an appropriate way, to listen carefully and correctly understand the other party's intentions, and to maintain a stable mood during the information exchange process so that the communication can proceed smoothly. The communication skills of Chinese undergraduates are mainly composed of the following four factors.

1) Expression skills are the ability of college students to convey their ideas, information, opinions, and intentions clearly and effectively using verbal or nonverbal means. The way of expression includes not only verbal expression, but also non-verbal expression. Verbal expression refers to the correct use of vocabulary and grammar to convey a message, ensuring clarity and accuracy; non-verbal expression refers to the use of media other than language and words, such as facial gesture, body movements or tone, to assist in explaining one's intentions when conveying information.

2) Listening skills refers to the skills to continuously receive and perceive the thoughts, information, opinions, and intentions of others, and respond promptly to nonverbal signals such as nodding, following with interest, and making eye contact with the person in conversation.

3) Understanding skills refers to the skills to accurately interpret and infer the information and intentions conveyed by others, and find appropriate expressions to facilitate a smooth conversation.

4) Emotional control skills refers to the ability of individuals to effectively manage and express their emotional reactions in the process of communication. It involves the individual's ability to remain calm, rational and moderate in the expression of emotions such as nervousness, timidity, agitation, etc., or when conflict arises, in order to ensure that communication is effective and constructive.

#### 1.6.2 Learning Model Through VRT for Enhancing Communication Skills

The learning model of improving communication skills through VRT is a learning model that combines VRT theory, communication theory, constructivism theory, PBL learning theory and other related theories. It guides students to learn independently in virtual scenes through learning scenarios constructed by teachers on the virtual reality platform. This learning model is divided into 5 parts, namely creating learning scenarios, group inquiry learning, sharing and commenting on results, comprehensive evaluation and teacher guidance. Teacher guidance can appear in the first four parts as needed.

### 1.7 Research Hypotheses

After participating in the Learning model through VRT for enhancing communication skills, undergraduate students' communication skills evaluation scores were higher than the levels before participating in this study.

### 1.8 Conceptual framework



FIGURE 1 The conceptual framework

# CHAPTER 2

## LITERATURE REVIEW

The objective of this chapter is to give a theoretical foundation, as well as review the previous study that supports the research in this paper. This chapter includes the following content that the researcher has studied:

- 2.1 Communication Skills
  - 2.1.1 Definition of Communication
  - 2.1.2 Types of Communication
  - 2.1.3 Communication Skills
- 2.2 Virtual reality technology(VRT) Theory
  - 2.2.1 Overview of VRT
  - 2.2.2 The Impact of VRT on Undergraduates' communication skills
- 2.3 Problem-based Learning Theory
  - 2.3.1 Overview of PBL Theory
  - 2.3.2 Problem-based Online Learning
- 2.4 Constructivism theory
  - 2.4.1 Definition of Constructivism theory
  - 2.4.2 Characteristics of Constructivism theory
  - 2.4.3 Application of Constructivism theory in the Perspective of Virtual

#### Technology

- 2.5 Learning Models
  - 2.5.1 Definition of Learning Models
  - 2.5.2 Elements and Structure of Learning Models

#### 2.1 Communication Skills

### 2.1.1 Definition of Communication

Communication originates form the Latin lexicon communicate and means "sharing" or "building relationships with" (Cobley, 2008), is a "clear answer to the differences between self and others, private and public, and internal thoughts and the external world" (Peters, 2012).

"Communication" is an abstract word, which originally meant to convey, communicate, communicate and communicate. Denis McQuail, a famous British communication scholar, believes that communication is a social interaction through information. Domestic research on communication focuses more on interpersonal communication. For example, some scholars believe that interpersonal communication is a discipline that studies the characteristics and laws of people's exchange of information, mutual influence and interaction (Jia, 2010). It is the exchange of thoughts and feelings among people (Peng & Wang, 2014). It is also a discipline that people use certain language symbols to exchange information, thoughts and feelings in order to set goals. It is the process of sharing thoughts and feelings (Tan, 2022).

The existence of communication activities is universal. Individuals begin to communicate with the world from the moment of birth (even during the fetal period). As they age, they gradually move out of communication within the family and into different organizations in society: schools, public places, and workplaces. Communication activities run through the entire process of an individual's life and are the most concentrated manifestation of human social attributes. Communication shapes and shapes the world. The material and spiritual civilization of human society are both the results and products of communication, and the results of communication are also communicating with the world (Jiao, 2018).

Ronald believes that the main elements of interpersonal communication are language, listening and nonverbal communication (Ronald& George, 2006). Zhao Shengkui believes that the communication element is the flow of information through channels by the sender and receiver, and in the process of information flow, they will also face various obstacles or obstacles (Zhao, 2005). The process of communication consists of six elements: information background, information sender, information, information dissemination channels, information receiver, and feedback (Huo & Li, 2009). In summary, due to different research objectives, different experts have long defined communication from different perspectives, some focusing on sharing, some on information transmission, and some on the function of communication. Our research focuses on the communication issues of contemporary college students, so we believe that communication mainly means the exchange of information, ideas, as well as emotions between individuals.

#### 2.1.2 Types of Communication

Different experts have defined communication differently from different perspectives, and in various contexts, communication appear in varied modes (Watzlawick et al., 2011). As it implies, communication in formal contexts is formal communication; while for some informal situations, it belongs to informal communication. In view of information carriers, there are verbal as well as nonverbal communication. The former include oral or written communication methods. While the latter refers to the use of media in order to get to the point of information exchanges (Du & Zhu, 2014). As for feedback results from communication, it consists of one-way as well as two-way communication. Unidirectional also called one-way communication means the one-way information exchange. The latter contains a two-way information exchange. (Sun & Xu, 2006).



FIGURE 2 Types of communication

In addition, Zhang Zhiguang summarized and proposed that there are five types of communication. The first type is verbal v.s. non verbal communication: the former is expressed through the use of verbal symbols, while non verbal words use non verbal symbols, such as body movements, facial expressions, etc. The second category is oral communication and written communication. The third category is purposeful communication and purposeless communication. The fourth category is formal communication and informal communication; The fifth category is internal and interpersonal communication. Internal communication refers to internal communication such as self communication, while interpersonal communication refers to communication with others (Zhang & Jin, 1996).

Ronald believes that the main elements of interpersonal communication are language, listening, and nonverbal communication (Adler et al., 2006). Zhao Shengkui believes that the communication element is the flow of information through channels between the sender and receiver, and there are also barriers for flowing the information (Zhao, 2005). The process of communication consists of six elements: information background, information sender, information, information transmission path, information receiver, and feedback (Huo & Li, 2009).

In summary, communication can be classified according to different research purposes. Some focus on communication functions, some focus on communication scenarios, some focus on information carriers during communication, some focus on feedback results of communication, and some focus on different subjects of communication. Our research focuses on the communication issues of contemporary college students, so we classify communication based on the different carriers of information, dividing it into verbal communication and nonverbal communication.

#### 2.1.3 Overview of communication skills

Human beings are inherently social creatures, and society itself emerges from their interactions. An individual's development is influenced by the development of others with whom they interact, both in direct and indirect ways (Marx & Engels, 2018). Communication skills is an important literacy in building harmonious interpersonal relationships and an essential tool in social interaction (Han Yexu et al., 2 0 2 1 ). Therefore, communication skills are essential for people all around the world (Liu & Liu, 2020).

Helms, a sociolinguist, believes that Communication skills refers to "when to say, when not to say, and when, where and how to say what to whom". That is to say, Communication skills refers to the ability to communicate in an appropriate manner in a specific context, including the ability to judge grammar (legitimacy), psychology (feasibility), socio-cultural (appropriateness), and probability (actual occurrence) (Hymes, 1972).

Many scholars believe that Communication skills is a binary concept, meaning that a person who is good at communication can not only achieve their own goals, but also achieve them in a way that satisfies the other party (Greene & Burleson, 2003). Similarly, communication skills are related to communication goals, which include two aspects: personal goals and relationship goals, "The level of interpersonal Communication skills refers to the degree to which the behavior conforms to the situation and helps to achieve personal or relationship goals (Reardon, 1987). Spitzberg takes effectiveness and appropriateness (or flexibility) as the two criteria to measure communication skills. The former means people's capacity to achieve communication aims; the latter is communication skills consistent with the context and relationship constraints, also known as flexibility (Spitzberg, 1991). He views Communication skills as the ability of a communicator to choose appropriate behaviors among various possible communication behaviors to achieve personal and relationship goals under situational pressure.

From the perspective of social psychology, communication is a social and psychological process in which people interact with each other. The realization of communication goals is affected by the communicator's background knowledge, skills, attitudes and cultural background. For the first time, Wiemann included social emotional abilities such as empathy into his communication literacy. His communication literacy connotation includes five dimensions: (1) empathy (empathy), 2) belonging and support, (3) social relaxation (in a relaxed state in social situations), (4) behavioral flexibility, and (5) interaction (Wiemann, 2003). Adler and Rodman also believe that competent communicators should have the following characteristics: a wide range of behavior choices, the ability to choose appropriate behavior, the ability to complete behavior, empathy, the ability to anticipate or imagine the main ideas of others, cognitive complexity, self-monitoring, and involvement in relationships (Alder & Rodman, 1994).

In interpersonal communication, Trenholm, the representative of process theory, defined communication literacy as "the ability of individuals to use effective and appropriate methods to communicate socially". He divides communication literacy into two levels: the surface level, which is the visible ability that is actually demonstrated in daily behavior. The second is the deep level, which includes everything we must know in order to communicate effectively, called process ability. It is composed of all the cognitive behaviors and knowledge necessary to produce appropriate performance. He also divided communication process abilities into five categories: comprehension ability, role ability, self ability, goal ability, and information ability (Trenholm, 2000).

Zhang Shuhua takes the system structure of interpersonal communication literacy proposed by Spitzberg as the framework, and puts forward the ternary structure of interpersonal communication literacy. Communication skills refer to the behavioral expression skills of communication, which is a series of skills formed by people in longterm interaction and communication with others, including information expression skills and information reception skills; Communication cognition refers to the ability to accurately understand and make correct judgments about oneself, others, and communication situations, including self-awareness, self-awareness of others, and selfawareness of situations; Communication tendency refers to the preference and behavioral motivation for communication, including communication motivation, communication anxiety, confidence, and trust (Zhang, 2003).

In a report released in 2018 by the 21st Century Learning Alliance of the United States, communication skills were seen as the use of effective verbal, written, and nonverbal communication methods to achieve multiple goals (such as informing, teaching, inspiring, persuading, and sharing viewpoints), including effective listening in different contexts, using technological means for communication, and being able to evaluate the effectiveness of communication. (Cuiping et al., 2020).

Other scholars who hold the trait theory believe that interpersonal Communication skills is the trait or tendency that individuals have in communication that is not limited by content and situation. And this trait can guide individuals' communication behavior and enable them to have similar behaviors when dealing with different stimuli. Spanot proposed two traits: communication flexibility and rhetorical sensitivity. Communication flexibility refers to the ability of communication behavior and strategies to adapt to changes in the environment, so that excellent communicators can recognize the situation and rely on individual choices to take a necessary part in the social contexts; Rhetoric sensitivity is the ability to deal with different demands and expectations of others and various communication situations in communication (Matthew, 2005).

Some experts believe that communication is diverse and includes different elements, such as oral, cross-cultural, written, etc (Riemer, 2007). Communication skills mainly emphasizes the ability of independent individuals to identify information through listening, speaking, reading, and writing, and then transmit information. It is a core item in personal qualities (Liu, 2021). Some people believe that communication skills include four core elements: listening, speaking, reading and writing (Khambayat, 2017).

Specialist	Definition	Composition factors	
Ronald B.Adler	The ability to obtain what	A wide range of behavior choices, the ability to	
(1994)	you want from others in a	choose appropriate behavior, the ability to	
	way that is acceptable to	complete behavior, empathy, the ability to	
	both you and others and	anticipate or imagine the main ideas of others,	
	maintains mutual	cognitive complexity, self-monitoring, and	
	relationships	commitment to relationships	
Hymes (1972)	Hymes (1972) The ability to communicate This includes the ability to judge		
	in an appropriate manner	(legality), psychology (feasibility), socio-cultural	
	in a specific context	(appropriateness), and probability (actual	
		occurrence), among other aspects	
Spitzberg (1991)	The ability of	Effectiveness and appropriateness	
	communicators to choose		
	appropriate behaviors		
	among various possible		
	communication behaviors		
	under situational pressure		
	to achieve personal and		
	relationship goals		

TABLE 1 Different experts' definitions of communication skills

## TABLE 1 (CONTINUE)

Specialist	Definition	Composition factors	
Reardon (1987)	The degree to which the	Communication goals include two aspects:	
	behavior aligns with the	personal goals and relationship goals	
	context and helps achieve		
	personal or relational goals		
Wiemann (2003)	Communication skills is a	Empathy, belonging and support, social	
	binary concept, meaning	relaxation (in a relaxed state in a social context),	
	that a person who is good	behavioral flexibility, interaction.	
	at communication is not		
	only able to achieve their		
	own goals, but also able to		
	achieve them in a way that		
	satisfies the other party		
Canale&Swain	Same Hymes	Grammatical competence, sociolinguistic	
(2003)		competence, strategic competence,	
	JAL	discourse competence	
Trenholm (2000)	The ability of individuals to	One is the surface level, which refers to the visible	
	communicate effectively	ability that is actually demonstrated in daily	
	and appropriately in social	behavior. The second is the deep level, which	
	interactions	includes everything we must know in order to	
		communicate effectively, called process	
		capability. Process ability is divided into five	
		types: understanding skills,, role ability, self	
		ability, goal ability, and information ability	

## TABLE 1 (CONTINUE)

Specialist	Definition	Composition factors
21st Century Learning	Utilize effective	Ability to understand
Alliance of the United	communication methods,	express oneself
States (2020)	verbal, written, and	
	nonverbal, to achieve	
	multiple goals (such as	
	informing, teaching,	
	inspiring, persuading, and	
	sharing viewpoints),	2.0.
	including effective listening	
	in different contexts, using	
	technological means for	
	communication, and being	
	able to evaluate the	
	effectiveness of	
	communication	
Spanot (2005)	The trait or tendency of an	Communication flexibility, rhetorical sensitivity
	individual in	
	communication that is not	
	limited by content or	
	context.	
Riemer(2007)	Communication is	Oral, written, listening, visual,intercultural,
	multifaceted and	interdisciplinary, etc.
	incorporates various	
	elements	

From the above table, we can find that the current definition of communication skills in the academic community focuses on the social function of communication, some focus on the components of communication skills, some focus on the information transmission process of communication skills, and some focus on the level of communication.

#### 2.1.4 Undergraduate Communication Skills

In recent years, Chinese researcher have delved deeper into the study of communication skills. These skills involve employing various communication methods tailored to different audiences, explaining issues in a comprehensible language, considering problems from the other person's perspective, and striving to reach a mutual understanding to ensure both parties' intentions are smoothly realized (Hou, 2023). They encompass the ability to listen actively, express oneself effectively, and seek common ground while respecting differences to achieve consensus (Xiao, 2023). Communication skills are more than just articulating clearly or being eloquent; they are rooted in professionalism (influence), expression skills, negotiation skills (rational analysis and situation control), empathy (role transformation), and tolerance (open-mindedness). These skills enable individuals to handle pressure and various environments calmly and interact with diverse people with different viewpoints (Tong, 2 0 2 0 ). Thus, communication skills are the capability to engage with others comprehensively through both verbal and non-verbal means to establish effective interpersonal relationships (Zhou, 2021).

Regarding the elements of communication skills, some scholars argue that undergraduates need effective expression, listening, and the ability to empathize with others' thoughts for successful communication. Additionally, they must actively think, judge, and fully understand the other person's intentions (Ai & Ye, 2 0 2 1 ). Communication skills encompass not only proficient expression but also listening, analyzing, and integrating opinions. This includes clarifying disorganized dialogue and identifying key points (Qing et al., 2021). Enhancing undergraduates' communication skills can focus on five aspects: making friends, expressing oneself, listening to understand others, managing conflicts to foster deep communication, and understanding and accepting differences from the other's perspective (Qiu & Zhou,

2020). Effective communication also requires emotional control, being tactful, friendly, and emotionally stable, which encourages positive feedback and outcomes (Pan, 2017).

Specialis	Definition	Composition
t		factors
Hou	The so-called communication skills is to have different ways of	Explain the
	communication for different communication objects, and to be able to	problem, think
	use the language that the other party can understand to explain the	about the
	problem, to think from the other party's point of view, to strive for	problem, and
	consensus, so as to ensure that the intentions of both parties can be	reach a
	reached smoothly.	consensus
Xiao	It is the ability to listen readily, express well, and then seek common	Listen well,
	ground while reserving differences and form a consensus.	express well, seek
		common ground,
		build consensus
Tong	Communication skills are not just the ability to speak in a simple and	Influence,
	clear way or to speak well, nor is it enough to speak well. Rather, it is	empathy,
	based on one's professionalism (influence), ability to express oneself,	tolerance,
	ability to negotiate (rational analysis and control of the situation),	adaptability
	empathy (transformation of roles), and tolerance (openness to change),	
	and so on, so that one can face different kinds of pressures and	
	environments, and various kinds of people with different ideas with ease	
	and comfort.	
Zhou	Communication skill is the ability to exchange information with others in	Use of language
	a comprehensive manner through verbal and non-verbal means, which	or non-verbal
	is necessary to build good interpersonal relationships smoothly and	language,
	effectively.	exchange of
		information,
		interpersonal
		relationships

TABLE 2 Definitions of undergraduate	communication skills by different experts
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## TABLE 2 (CONTINUE)

Specialis	Definition	Composition
t		factors
Ai&Ye	Effective communication skills of undergraduate students should not	Expressing
	only be able to express effectively, but also to listen effectively, and	effectively,
	more importantly, to be able to feel the thoughts of others, and at the	listening
	same time, your inner mind should actively think and judge to fully	effectively,
	understand the other party's intentions	sensing thoughts,
		understanding
		intentions
Qing et	The ability to communicate is not only about the ability to express	Expression skills,
al.	yourself, but also about the ability to listen, to analyze and integrate	listening,
	opinions (to clarify what the other person is saying and to list the key	analyzing and
	points in a disorganized and fragmented conversation).	integrating
Qiu&Zho	Five aspects of improving communication skills of undergraduates: first,	Good at meeting
u,	to be good at making friends; second, to be good at expression; third,	people,
	to be good at listening, so that they can better understand each other;	expressing,
	fourth, to be good at dealing with conflicts, to create an atmosphere of	listening, dealing
	in-depth interaction, and fifth, to stand in the other person's point of view	with conflicts,
	to understand the other person, to accept the other side of the	understanding
	differences between them and their own.	each other
Pan	If you want to get a good communication effect, we must control our	Self-control of
	own emotions, try to do when communicating in a tactful tone, friendly	emotions,
	expression, smooth emotions, the other party will have good feedback,	tactfulness of tone,
	will receive good results!	friendly
		expression,
		smoothness of
		emotions

From domestic and foreign research, there are many elements of communication skills, but for Chinese undergraduates, good communication skills should at least include the ability to express effectively, listen effectively, understand effectively (analyze and judge), and have stable emotions.

Effective expression: Expression includes not only language expression, but also non-verbal expression. Non-verbal expression refers to the use of media other than language and text, such as facial expressions, body movements or tones, to assist in explaining one's intentions when conveying messages (Zhao, 2012). Many experts believe that expression skills is a basic element of communication skills. It includes both verbal expression of "when to say, when not to say, and about when, where, how and to whom to say what" (Hymes, 1972), and non-verbal expression of "sharing and giving meaning simultaneously through symbolic interaction" (Seiler & Beall, 2005). Good expression skills should include a variety of expressions, including the ability to use voice, body language, text, and auxiliary equipment (Qing et al., 2021).

Effective listening: Effective listening in different situations is an important way to achieve the purpose of communication (Cuiping et al., 2 0 2 0). Listening, oral communication, written communication, non-verbal communication, and feedback together constitute the definition of communication (Nur'ashiqin Najmuddin, 2 0 1 0). When college students communicate with others, they should pay attention to cultivating good listening skills. They should not interrupt others at will when listening. When they have questions, they can convey feedback to the other party through facial expressions, body language or short answers when others signal or pause. Pay attention to your body language during the listening process, be focused and sincere (Ai, 2021).

Effective understanding (analysis and judgment): The ability to understand is the ability to accurately understand and correctly judge oneself, others, and communication situations (Zhang Shuhua, 2003), and the ability to anticipate or imagine the main points of others (Alder & Rodman, 1994). Good understanding ability is an important part of good communication skills. Communicators should be able to analyze and integrate opinions, clarify the content of the other party's expression from the chaotic and unsystematic dialogue, and list the key points (Qing, 2021). Communication problems are big problems of knowledge and action. It is a comprehensive reflection of one's own ideas, knowledge and action abilities, and life realm. Communication must respect and understand each other (Zhu, 2022). Failure to correctly understand the problems that the communication object wants to express may directly lead to communication failure.

Stable emotions: 70% of the communication between two people is emotion and 30% is content. In face-to-face communication, whether a person has emotions can be seen, such as blushing, sweating, tears, trembling, clenching fists, voice inflection, etc. These non-verbal behaviors can convey emotions (Chen, 2021). As long as you know how to control your emotions, you can resolve many unnecessary conflicts and build a bridge of communication (Liu, 2021). It involves the ability of individuals to remain calm, rational and moderate in emotional expression when they are emotionally excited or conflicts arise, so as to ensure the effectiveness and constructiveness of communication (Sun Wanyan, 2023). Contemporary undergraduates are self-centered. Emotional control is the ability of individuals to regulate emotions, which enables individuals to actively manage emotions when dealing with problems and keep conflict events in a stable development state (Yao, 2019).

In summary, we can conclude that undergraduates' communication skills are the ability to express their intentions in an appropriate way, listen carefully and correctly understand the other party's intentions in order to establish good interpersonal relationships, and maintain a stable mood during the information exchange process to ensure smooth communication. From domestic and foreign research, there are many elements of communication skills, but for Chinese undergraduates, good communication skills should at least include the ability to express effectively, listen effectively, analyze and judge effectively, and have stable emotions.
## 2.2 Virtual reality technology(VRT) Theory

This section is an overall description of VRT, as well as introduces the theoretical basis for its application in cultivating communication skills among undergraduate students

#### 2.2.1 Overview of VRT

Virtual reality (hereinafter as VR) is a computer-generated simulation of realworld experiences (Mann et al., 2018). VRT is a technology by which people can keep into contact with a computer simulation context, regardless of whether it is fictional or real (Mandal, 2013). The foundation of VRT is graphics and the essence of humancomputer interaction, which allows users to interact with the virtual environment by simulating factors such as the appearance, sound, and even touch of the real environment.

#### 2.2.1.1 Definition of VRT

"Virtual Reality" was proposed by American computer scientist and founder of VPL Company, Jay Lanier, in the 1980s. He pointed out that VR is a digital multidimensional environment generated by comprehensive use of computer network technology, multiple sensor technologies, simulation technology, artificial intelligence technology, display technology, and other technologies. VR creates a virtual situation which has certain similarity with the real situation as for vision, listening, feeling, and smelling by using science and technology centered on interactive computer technology to keep contact with things in the virtual situation, and can generate cross temporal and on-the-spot experiences similar to those in the real world (Zhou & Deng, 2009). The focus is making a real interactive situation through computer simulation which can be applied by kinds of technologies, providing users with a sense of immersion, reality, and virtual reality. Breakthrough technology and innovation have promoted the improvement of VR. VRT has gone through more than 3 0 years. Nowadays it has applications in aviation research, architecture, national defense, education, and training. (Shen et al., 2019). Defined by its technical nature, VRT is a human-computer interaction technology (Tussyadiah et al., 2018).When using VR, users can immerse themselves in a computerized situation and interact in a natural way with the computerized situation (such as the cockpit and so on). The interaction depends on the sensor device and is controlled by a dedicated graphical process. Aukstakalnis uses VR to describe an interactive way in which people can view through a computer, Operating and interacting with additional complex data(Aukstakalnis & Blatner, 1992). From a technical device perspective, VR refers to the software and hardware providing situations for three-dimensional reality, which can be made into reality through certain sensor devices (such as headworn displays, data gloves, etc.), and simulates a real world where users can use special interactive methods (such as input systems, transmitters with two ways, and eyeglasses) to hold and manipulate the virtual situation (Martín-Gutiérrez et al., 2017).

VRT has a variety of applications and features in terms of simulation functions. The following is a detailed description of its simulation function.

VRT has a wide range of applications in the field of robotics teaching and training. For example, the VRT software provided by LEGO Robotics can simulate projects, and users can perform virtual building and programming tests by mouse operation. In addition, industrial robot simulation trainers use real control systems and handheld instructors to control virtual industrial robots to complete on-site demonstration programming teaching. This highly simulated virtual experimental environment enables students to carry out experiments in the virtual environment, and the experimental effect and feedback are completely consistent with the real experiments, thus achieving and exceeding the teaching requirements of the syllabus.

In the field of medical imaging, spiral CT volumetric roaming technology 3 D reconstruction plays an important role in clinical diagnosis. It can effectively measure and diagnose joint subluxation and fracture, and has been widely used in the ventricles of the brain, the urinary tract, the gastrointestinal tract, etc. VRT can avoid the loss of information caused by intermittent scanning or respiration by completing the scanning of consecutive regions of interest with the help of computer assistance, and at the same time, it can reflect the consecutive anatomical details. In addition, VRT can display anatomical structures with different tissue densities, with soft image edges and a translucent effect.

VRT is also used in video repair and restoration techniques. This technique utilizes computer vision and image processing techniques to improve, repair and restore video content, with the main aim of eliminating noise, blurring, distortion, jitters and other problems present in the video, making the video content clearer and more stable, and improving its visual quality and viewing experience. For example, Video Recovery Transformer is capable of simulating long time dependencies, using information from multiple neighbouring frames during the reconstruction of each frame, adaptively exploiting features in the support frame and fusing them into the reference frame.

Variable input technology is also used in agricultural machinery. Agricultural implements fitted with advanced equipment such as computers and DGPS can automatically adjust the rate of input of a certain agricultural material in the material box according to the location of the cultivated land.

VRT is also used in voltage ride-through test software, particularly in the photovoltaic and wind power industries. The software provides simulation testing of low voltage ride-through anomalies, and collects voltage data in real time by connecting to a PA power analyzer, which enables intuitive and fast positioning to identify problems when abnormal changes in voltage data are monitored.

From the perspective of the user's psychological state, virtual reality can be defined as: if immersing in the situations created in peoples' hearts, the fictional situations are seen as virtual reality. Because our recognition of any creature relies on the understanding or thought (Zhou et al., 2008), in the original thinking of technology. It is to enable people to obtain the sense of de facto, and the degree of mental flow is a measure of mental perception.

Starting from the characteristic that "people are participants in the environment," virtual reality can be defined as the kind of technology which gives men a

sense of feeling as if they are in a computerized context (Seibert & Shafer, 2018), or more specifically, they are in an interactive situation based on computer. The emphasis of VRT on participation is not to achieve people's bystander participation in the environment, like other technological media in the past, but rather to make people feel the false sense of existing in certain contexts and feeling that they belong to the situation.

From the perspective of education and teaching, it provides an immersive sense or feeling, allowing users to keep in contact with the virtual reality environment. The 3 D simulation environment can change abstract parts into real visualization effects. This kind of feeling will promote the user's cognition of things and situations that could not be observed in the opposite way (Paes et al., 2017). Studies provide students with high imagination, as well as strong interactivity. The use of 3D VRT systems in education is the most suitable alternative to traditional text-based and V} ebbased systems (Hauptman & Cohen, 2011).

Although some scholars believe that VRT actually does not have a fixed definition, it is a term in some schools of thought, which is interpreted as non-existent "reality" (Chalmers, 2017). In a series of definitions of virtual reality, researcher emphasize different levels of characteristics - technical features, systematic roles, domain uses, and so on. However, from the above definitions, it is possible to tease out the commonalities and features of VRT. It has characteristics such as real-time interactivity, immersion, as well as active participation, which can provide a new perspective and optimized experience for training and teaching in various fields.

# 2.2.1.2 Features of VRT

In 2003, two experts conducted detailed analysis and research on the definition, features, structure, and applications of VR systems in various fields (Burdea & Coiffet, 2 0 0 3). They concluded the main features of VRT as follows: Immersion, Interaction, and Imagination. These three words with "I" are generally accepted as the "3I" feature, as shown in Figure 3.



FIGURE 3 Characteristics of Virtual Reality (Burdea & Coiffet, 2003)

In the study of VRT in the educational area, it is commonly accepted to use 3 I features to represent virtual experiences. 3 I features are often seen in the studies in education fields, such as medical, military, education, sports, culture, entertainment, and so on.

2.2.1.3 Application status of VRT in various fields of society

Based on the 3 I features for VRT: Immersive, Interactive, and Imagination, it has so far been commonly accepted in medical, military, education, sports, culture, entertainment, and other fields.

In medical treatment, VRT has been adopted in kinds of fields such as virtual human anatomy, surgical simulation, and psychological rehabilitation medicine. Han Xu used VRT to construct a rehabilitative landscape based on the Tingtao Scenic Area of Wuhan East Lake for elderly people with depression tendencies, and conducted empirical research to verify its effectiveness with elderly people with specific depression tendencies as experimental subjects (Han,2016).

In the military field, VRT is used to construct virtual battlefields, conduct individual simulation training, remote network command, and other operations, which greatly improves training efficiency while ensuring security (Anxing et al., 2011). The United States Army Command first developed the virtual environment combat system SIMNET in 1983, which is used to train tank formation combatants to react quickly to different battlefields and improve their combat level. Later, the United States Air Force designed and developed a virtual reality weapon system DEPTH, which was used to analyze the maintainability of fighter jets(Glor & Boyle, 1993). In recent years, China's Chang Hailing and others have built a virtual battlefield environment using a virtual scene engine. Based on this virtual scene, they have built a portable anti-tank missile simulation training system. This system can effectively improve training quality and reduce exercise costs, and is an important means to enhance the combat effectiveness of the army (Chang et al., 2019).

In education, VRT is widely used in various training industries, such as chemical operations, aircraft operations, automobile driving, fire prevention training, machine tool operation training, and so on (Li & Kong, 2014). In order to overcome the difficulty of traditional mine fire training, Hong Yang and others constructed a mine fire virtual scene, designed and completed mine fire interaction using the Unity 3D engine, and verified through a series of evaluations that the virtual training system had better effects than traditional training systems (Hong et al., 2019).

In sports, VRT has been widely used in the field of competitive sports in recent years, such as diving, skiing, trampoline, golf, etc. (Chen & Yao, 2006). Li Xulong developed a real-time rendering system for virtual golf scenes using a 3 D graphics engine, physics engine, and ocean scene library, and completed the development of a virtual golf system using an integrated parameter measurement system (Li, 2012). Liu Min combines virtual speed skating scenes with computer animation to visually reproduce the standard technical actions of speed skating athletes in the competition venue, providing assistance for physical education and speed skating training (Liu, 2009).

In terms of culture, VRT is very important and essential for the protection of traditional Chinese culture and intangible cultural heritage. Zhang Qing combined shadow play art and VRT to develop an immersive interactive experience software for VRT shadow play "Tianji Horse Racing". This software not only retains the cultural connotation of shadow play, but also gives it interesting interactive functions, promoting the innovative development of traditional Chinese shadow play culture (Zhang, 2020).

In terms of entertainment, the combination of virtual reality and video games has provided new forms of entertainment for the general public, such as the Beat Saber game commonly seen in offline VRT experience halls. Virtual reality's body feeling interaction technology, stereoscopic display technology, three-dimensional space's virtual sound generation technology, and direct tactile feedback technology give fresh possibilities for the design and improvement of electronic games (Zhang, 2012).

In summary, computer science and technology has developed in a fast speed and has provided convenience to VRT. The immersion and interactivity of it help VRT penetrate into applications in various industries. The current VRT has made a convenient and feasible fresh path for the cultivation and training of communication skills among college students. We can provide assistance for the cultivation and improvement of communication skills for each student by building our own electronic laboratory.

2.2.1.4 Application of virtual reality in education

The most shining point of virtual reality is its ability to integrate with various industries and fields in society, which means that the education and cultivation of VRT should not be limited to the development of hardware and software, but should also be integrated with subject courses in culture, literature, art, and other aspects, so that students can achieve overall quality improvement (Gao, 2022).

The application forms of VRT in education mainly include the following:

One is Virtual campus. This is the earliest form of VRT application in education. In recent years, online education has already received high attention and favor from all sectors of society, which is why major universities have actively responded to the development trend of the times by introducing new technologies to build campus websites and create virtual campuses to achieve three-dimensional development of campus teaching, academic affairs, and life, allowing students to learn and obtain more freely. In particular, distance education based on distributed virtual campus systems, as well as related settings for campus environments in sub campuses, is achieved through the use of VRT VRT. This teaching method is more conducive to the development of education for all, and can directly help more social personnel participate in the learning of higher quality education (Hu, 2019).

The second is virtual laboratory. Using VRT VRT can create a very realistic virtual experimental environment, thereby enabling students to achieve situational goals in the virtual experimental environment. The earliest American universities applied VRT VRT to human anatomy to build a virtual laboratory, and let students watch the entire process of cancer surgery through live streaming. Since then, other countries have also begun to apply VRT VRT to build virtual laboratories. In recent years, some universities in China have also begun to actively use VRT VRT to build and develop their own virtual experimental systems, in order to reduce the risk factors and costs that may occur in the experimental process in different education and teaching fields. For example, in the virtual teaching of aircraft driving, VRT VRT can be used to conduct simulation operations to avoid accidental crashes caused by students' inexperience in driving. At the same time, relying on VRT VRT can also build different types of virtual training scenarios based on different teaching activities, set up training modes required for teaching, and achieve repetitive operation of training skills, so that students can master relevant skills through repeated training in the virtual environment. This is just conducive to reducing the actual investment in education and teaching

funds, better saving teaching and experimental resources, and achieving the maximum utilization of resources (Gao, 2020).

The third is the usage of VRT in education. Introducing VRT into teaching is conducive to the innovation of educational and teaching models and the expansion of educational and teaching content. This is because VRT's usage can optimize the procedures of classes and make the contents vivid and vivid, thereby improving education's effectiveness. Meanwhile, VRT can also realistically reproduce situational learning, and human-computer interaction may arouse students' interest in studying, which takes a necessary part in ensuring the quality of learning and teaching. For example, in mathematics, chemistry, physics, and other disciplines, VRT VRT can be used to build physical models required for classroom teaching, to help students better understand and learn more abstract concepts. Students can also act as a role in virtual teaching situations, enabling students to actively gain the knowledge they have contacted through learning methods such as collaboration and conversation. For example, when learning Chinese and English, students can play a role in the created virtual environment, substituting themselves into the role, deeply experiencing the scenes depicted in the book, and improving teaching effectiveness (Shi, 2008).

2.2.2 The Impact of VRT on Communication Skills of Undergraduates

2.2.2.1 The application of VRT in the process of cultivating communication skills: Taking law undergraduate students as an example

VRT enables users to participate in certain situations, and teachers can make full use of kinds of methods and equipment. However, one big characteristic of VRT is to stimulate students ability to deal with problems and research certain concepts or skills (Gudoniene & Rutkauskiene, 2019).

The biomedical criminology-related course at the University of Leuven uses VRT to create a new program that helps students examine virtual crime scenes and gain useful practical experience. When they arrive at the virtual crime scene, a virtual police officer informs the student of the situation, after which the student enters the house to search. Virtual environments, like physical crime scenes, allow students to open cabinets and doors, identify traces and conduct tests; Taking DNA samples and making blood traces visible with chemiluminescent spray or infrared light; Use blue light to search for sperm traces, visualize fingerprints, and take photos. The program monitors and tests the collected samples in real time, making it easy for teachers or students to evaluate. In addition to simulating crime scenes, VRT also simulated courtrooms in the course. Faculty develop and draft a report after students complete a virtual survey that allows students to defend themselves in a moot court, providing future lawyers with internship opportunities in a virtual environment. In addition, the new program led by VRT systems is also very useful for police: in real life, police have a limited number of investigations of crime scenes, but in a virtual environment, police can quickly identify improvement points or become familiar with the challenges of investigating crime scenes(Ni,2022).

The Experimental Teaching Center established a legal virtual simulation experimental education system in 2 0 1 6 , with four virtual simulation laboratories as the main body, "forming a multi-module integrated training mechanism of 'network investigation and inspection simulation, simulation system, and real case file simulation'.". With the help of VRT simulation teaching equipment, this course can achieve a combination of experimental and practical aspects, starting from theory, simulation, and full reality. It is taught by front-line judges and prosecutors through virtual reality environments, and at the simulation level, VRT is used to carry out simulation court and role experience. At the same time, legal clinics and legal aid practice courses are also offered. In addition, the laboratory has also set up an online crime investigation experimental teaching course that integrates resources from schools, research institutes, and judicial authorities. By building a crime scene in virtual reality, it helps students understand and master investigation theoretical skills more fully and concretely (Wang & Chen, 2019).

The simulated court trial virtual simulation program of the School of Law in Hunan University truly restores the entire process of civil litigation. Based on real cases in judicial practice, students can choose to participate in the exercise from three identities: plaintiff's attorney, defendant's attorney, and judge. This virtual simulation project has many breakthroughs in the traditional offline simulation court. This experimental teaching project utilizes virtual simulation 3 D modeling and interactive techniques such as WEB, Unity3D, GL, and information technology to highly reproduce scenes such as law firms and courtrooms, and is accompanied by animation simulations, enhancing the immersive experience of students and enhancing the sense of role substitution. Secondly, it achieves comprehensive visualization of the litigation process. The entire process of the project is to integrate and refine the legal process, starting from the plaintiff's attorney accepting the client's entrustment and handling the entrusted agency procedures, to the production and delivery of the judgment. Divide the entire litigation process into several nodes, and each role can clearly see the litigation actions completed by themselves and other roles at each node. Timely arrangements can be made to develop appropriate litigation strategies. At the same time, an investigation session was set up to require students to explain the reasons for the production of litigation documents, to help students review substantive and procedural law knowledge, and truly apply what they have learned. At the same time, it is also convenient for teachers to objectively grasp and evaluate the process of students' thinking about legal issues, and form feedback in a timely manner. With the help of computers and the Internet, the real-time and compact transmission of information has been achieved. Through interactive control, the real-time transmission of court information is achieved, and each role can receive information feedback from the other party in a timely manner. The information exchange between each role is closer, the confrontation between the original and the defendant is more intense, and the court process is more compact. In addition, the simulation program comprehensively breaks the limitations for real environment, and students can cross time and space to study. Even if they are scattered around, they can use the system to conduct simulated court exercises (Qiu, 2021).

In March 2022, the School of Law of Sichuan Normal University first launched an immersive VRT virtual simulation training course - "Indoor homicide crime scene investigation VRT virtual simulation experiment", using the VRT virtual simulation experimental platform curriculum resources. The goal of the course is to enhance students' awareness to investigate the crime scene and to practice their ability. This course uses simulation technology to realistically simulate and restore process elements such as the scene of a homicide case and the case resolution of a project team. It allows students to wear immersive VRT helmets in the first person form from the perspective of the investigator, in accordance with the criminal case investigation logic and process, using the modern criminal investigation tools provided by the experimental system, and through the operation of the VRT control terminal to enter a three-dimensional simulated crime scene for on-site recording Search and retention of physical evidence. This virtual simulation training course not only improves students' participation in the course and gives them a relatively complete understanding of the entire criminal case handling process, but also is an important measure taken by the Ministry of Education (Zhao, 2022).

The School of Law of Northwest Normal University has launched a demonstration virtual simulation experimental teaching project to orient towards the informatization content of experimental teaching in the law major. It builds a demonstration virtual simulation experimental teaching project, actively explores a fresh learning and teaching model that combines online and offline education, and forms a new system for demonstrating informatization experimental teaching projects in higher education with effective sharing, Supporting the overall improvement of the quality of outstanding legal talent cultivation (Academic, 2020).

Although the application of VRT in Chinese law classrooms is still relatively limited, as for the progress of science and technology, other law schools will begin to try and apply VRT in the future, so that students can better grasp legal knowledge and practice.

2.2.2.2 The impact of VRT on communication skills of law undergraduates

Many scholars have conducted fruitful studies about the positive influences of VRT on students' communication skills.

Some scholars have introduced VRT into flipped classrooms. Some scholars have conducted studies on the role of VRT in the training of nonverbal communication skills for autistic children, and believe that VRT is of big significance. Internships have shown that communication plays an important role in the legal profession. Through VRT, students can communicate and collaborate with clients, colleagues, etc. in a simulated law firm environment, and this simulated experience can significantly enhance their communication skills and practical abilities. (Lee, 2020).

Some scholars have studied the impact of immersive virtual reality on student-tutor communication in architectural design. The use of VRT in legal education has a significant impact on the communicative competence of law students. Enhancement of legal awareness and understanding can be seen. The VRT metauniverse platform enables students to visualize courtroom procedures and judicial decision-making processes, enhancing their legal awareness and understanding. This simulation environment not only helps students acquire legal knowledge, but also enhances their practical skills by participating in the case investigation and resolution process. (Sopher et al., 2022).

Some scholars have specifically studied the impact of virtual reality on social skills training. The importance of intercultural communication in legal education is widely recognized, and VRT can create virtual scenarios with multiple cultural backgrounds, allowing students to communicate in a simulated intercultural environment, thus improving their intercultural communication skills. This is particularly important for future legal careers, as legal work often involves legal systems and cultural differences in different countries and regions. (Gillies & Pan, 2018).

Digital technology, including VR, has a significant impact on the effectiveness of communication and knowledge dynamics of course subjects. This means that through VRT, students not only get more opportunities for interaction and participation, but also better grasp and apply their legal knowledge. The application of VRT in legal education not only enhances students' legal awareness and understanding, but also significantly improves their communication skills, especially intercultural

communication skills and practical communication experience. These skills are crucial to the future career development of law students.

In summary, VRT has great advantages in Communication skills training due to its "3 I" characteristics. However, current studies of VRT on communication skills are mainly concentrated in the medical field and special populations, with relatively few studies on the impact of university undergraduate students' Communication skills. The researcher used the 3D legal training system built on the basis of virtual training technology by Zhoukou Normal University, a university where the university is located, to develop a virtual situational learning model in order to provide strategic reference for improving students' communication skills.

## 2.3 Problem-Based Learning Theory

# 2.3.1 Overview of Problem-Based Learning Theory

2.3.1.1 Definition of problem-based learning theory

The current teaching mode in universities is mostly an indoctrination teaching approach that is "teacher led and students passively accept" (Guan et al., 2010). The process is for students to preview textbook knowledge before class - teachers explain and students listen - students independently complete classroom exercises - students complete homework after class. This teaching model cultivates students with low learning enthusiasm, and lacks awareness of problem-solving, cooperation, and innovation.

Problem-based learning (PBL) is an educational approach which put students in the center of the teaching process and the real situations are the foundation. It was firstly put forward by Barrows, an American professor of neurology. PBL is one of the most important recent developments in university education across various majors (Boud & Feletti, 1998). It began in medical education in North America and has spread globally and to most disciplines (Savin, 2 0 0 0). Since the 1 9 6 0 s, PBL has been continuously expanding worldwide, in addition, as it spreads, the concepts related to PBL are converting, becoming more diverse than in previous situations.

PBL is a learning method focusing on students' participation that applies problem models to encourage students to learn, in order to find the best possible solution (Hmelo, 2004). From the perspective of teachers, for educational strategies, PBL is an effective technique that motivates learners to take action to address problems. This technique is student-centered, and teachers play the role of students.

2.3.1.2 Ideas and elements of the theory and its relationship with the cultivation of communication skills

The teaching ideas of PBL's learning mode mainly include four aspects: teachers asking questions before class, students searching for materials, group discussions, and teachers summarizing. During this process, the teaching philosophy of "the classroom is the soul, students are the subject, and teachers are the key" was highlighted. Teachers gradually "retired" and only played a role as mentors and coaches at critical moments. Teachers no longer answered students' questions, but were facilitators of knowledge construction.

The basic elements of PBL mainly include: 1. using certain problems to lead in the teaching and learning process; the teaching contents for students is structured around problems as the main focus; 2. The problem should be as real as possible that may appear in students' future life and job; 3. Students should develop their abilities and collaborative capability by interaction and communication; 4. With students as the center, students should engage in learning themselves; 5. The role of a teacher is to guide students' cognitive ability and skills as a coach; 6. Various evaluation methods should be conducted as soon as the question is finished and also for each class is ended.

Problem-based learning takes students as the center and takes problem-solving as the beginning (Savin, 2000). In each component (module/unit) of course design, problem scenarios are taken as the core of students' learning.

The most important objective of PBL is to help students gain intrinsic motivation. Intrinsic motivation occurs when learners complete tasks based on their own interests, challenges, or satisfaction. Problems are taken as the lead in part for learning. All learning content for students is structured around problems. Problems are problematic things for students; Some problems that cannot be solved using the current level of knowledge and/or way of thinking (Carlile & Jordan, 2005). The question should be attractive, interesting and challenging for students. Such questions will stimulate students to further study, research, elaborate, analyze, and synthesize. Therefore, this question must be an open-ended one; The real problems, those solutions that are unknown. Students need to extensively collect knowledge, and show how knowledge can become a good way to deal with kinds of problems. Effective questions can cultivate students' communication skills when presenting students' ideas and thoughts.

In PBL, the problem-solving process is team centered and includes the following steps: (1) each member observes or collects information; (2) Each member proposes their ideas and hypothesis development for the issue; (3) Exploring cooperation among members; (4) Adopting the optimal solution for action planning; Reflect on (5) (Beringer, 2007). Collaborative problem-solving teams is the essence part. In problem-based learning, teams seek collaboration to complete kinds of problems. Group work helps to allocate group members, utilizing the professional knowledge allocated by group members to allow the entire group to solve problems that are usually too difficult for each student. Group discussions and debates enhance problem-solving and higher-level thinking (Yusof et al., 2016).

From a socio-cultural perspective, knowledge is constructed through social interaction. When a heterogeneous group solves a problem through discussion, and students make assumptions and defend themselves against other students. Students openly express their opinions and recognition of certain knowledge. In addition, reflection is beneficial for students to connect fresh knowledge with their previous recognition (Hmelo, 2004). After completing a question, students will reflect on the whole learning process and their performances and feelings. When students make connections between some knowledge and ability researched, students should establish a much effective learning system. The important point is to reflect on their current situation. During the entire process and when completing the problem, multiple reflections are required, which have extraordinary significance for the construction of students' knowledge system and thinking ability.

Effective collaboration can lead to the construction of knowledge (Hmelo, 2004), as students can construct joint interpretations. The discourse of each member in a group often focuses on responding to and improving the ideas already proposed, and the process of improvement is actually the process of reconstructing knowledge. In PBL, students are encouraged to participate in collaborative processes through their reflection and interdependence in group learning.

PBL is a flexible and diverse learning method that can be implemented in various ways across different disciplines. Therefore, at different points in time, different people may appear very different. They are observing, observing, listening, stimulating, and stimulating students' learning (Carlile & Jordan, 2 0 0 5). Students' learning is their focus. It is crucial that PBL courses enable students to become lifelong learners and learn to take on their own learning processes.

PBL has a significant impact on the development of students' communicative competence. PBL pedagogy is problem-oriented, emphasizes student-centred and interactive learning environments, and these features make it outstanding in enhancing students' communicative competence.

The PBL method promotes communication and cooperation among students by setting realistic and meaningful problems that stimulate students' initiative and motivation. This problem-based learning approach requires students to engage in a great deal of discussion and communication in the process of problem solving, thus enhancing their oral communication skills.

The PBL approach emphasizes teamwork and group discussion, which not only increases students' opportunities for language input and output, but also improves the quality of their conversations. Through teamwork, students can use English in authentic and meaningful contexts, and this interactive learning environment helps to enhance their communicative competence. In addition, the PBL method focuses on students' independent learning and participation. Students need to learn through independent inquiry, co-operative discussion and hands-on practice, etc. This participatory learning approach can effectively improve students' creativity, teamwork and problem-solving skills. These skills are all important components of communicative competence.

In specific applications, the PBL teaching method has achieved remarkable results in different disciplines. For example, in secondary English teaching, the use of PBL teaching method can significantly improve students' English communicative competence, stimulate students' individual participation, and cultivate talents in line with social requirements. In primary school language teaching, the oral communication teaching strategy based on project-based learning has also been proved to be effective, which can quickly activate students' original life experiences, touch their hearts and make them think in new ways.

Through its interactive communicative function, the PBL teaching method provides students with rich communication opportunities and changes the way they communicate and solve problems, thus significantly enhancing their communicative competence. This student-centred teaching model not only improves students' language input and output opportunities, but also develops their teamwork and problem-solving skills, thus enhancing their communicative competence in general.

2.3.2 Problem-Based Online Learning

Online learning offers a great deal of flexibility and convenience, allowing students to study on their own schedule, without the constraints of time and place. This flexibility allows students to study at any time and any place, which is very favourable to busy students. Online learning enables personalized teaching that respects students' individual differences and motivates them to learn. Students can choose course content that suits their needs, and teachers can adjust their teaching strategies based on student feedback. Online learning platforms usually have rich teaching resources, and students can acquire knowledge through videos, documents and other forms. In addition, online learning can also conveniently achieve interaction and collaboration among students, so that students can exchange ideas with others in a timely manner and solve problems together. Online learning breaks the time and space limitations in traditional teaching and learning, and students can communicate and collaborate with other students globally. This cross-temporal learning experience not only broadens students' horizons, but also enhances their international perspective and co-operation skills.

PBL emphasizes learning in authentic contexts, by creating real-life problem situations that trigger in-depth thinking and active research to solve problems. This approach enables students to apply what they have learned to real life and improves the practicality and effectiveness of learning. It is a comprehensive learning approach that requires students to apply knowledge from multiple disciplines in the process of problem solving. This method not only cultivates students' comprehensive ability, but also stimulates their innovative thinking and creativity. PBL emphasizes the student's subjective position and encourages students to learn, think and solve problems on their own. At the same time, this learning approach also focuses on teamwork, and students need to collaborate in groups to complete project tasks. Project-based learning consists of four parts: posing a problem, planning a programme, solving a problem and evaluating and reflecting on it. This systematic learning process helps students to fully grasp all aspects of the project, thus improving the systematicity and completeness of learning.

Combining project-based learning with online learning can make full use of the rich teaching resources and tools of the online platform to provide students with more comprehensive learning support. The interactive features of the online platform can enhance teamwork and communication in project-based learning, and students can communicate and collaborate effectively through online discussions and collaboration tools. The flexibility and convenience of online learning can provide more possibilities for project-based learning, enabling students to conduct project research and implementation at any time and any place.

Online learning platforms can provide personalized learning paths and resources according to students' needs, further enhancing the level of autonomy and

personalization of project-based learning. In summary, the combination of project-based learning and online learning can not only provide a flexible and personalised learning experience, but also cultivate students' comprehensive ability and innovative thinking through authentic contextual learning, integrative and innovative approaches. This blended teaching model has significant advantages and is an important direction for future educational development.

The combination of online education and PBL is of great demands for teachers and students, as both PBL and online education require employees and students to have relatively high abilities, and sure it can be considered as a powerful integration (Savin, 2007). Nevertheless, it is currently unclear whether they can fully integrate learning methods. The essence and procedures of interactive media have undergone significant changes in the past few years. Problem-based learning refers to the use of questions as prompts for learning in an online environment. These questions usually have a correct answer and do not require students. In addition to training linear problem-solving skills, it is not conducive to cultivating students' communication skills. In recent years, there have been many criticisms that the interactive media environment cannot create an effective learning environment. One reason is that the focus of the interactive media environment has always been on technology rather than instructional design. There are suggestions that the concept of learning design needs to be reconstructed, rather than simply repackaging the interactive media format of course content.

#### 2.4 Constructivism Theory

#### 2.4.1 Definition of Constructivism Theory

Constructivism is a theory which is applied in the teaching and learning process and assumes that individuals or students should not passively perceive new things through the traditional teaching by teachers. Instead, students can gain fresh things and new cognition based on their previous experience. For children, this includes knowledge acquired before entering school (Nola & Irzik, 2006). Vygotsky's "Cultural and Historical Development Theory" inspired constructivism theory, which emphasizes

the situational and social elements in students' learning procedures; Constructivism theory also incorporates Piaget's theory, emphasizing the initiative of learning.

#### 2.4.2 Characteristics of Constructivism Theory

In summary, the learning concept proposed by constructivism can be summarized in the following aspects:

### 2.4.2.1 Student-centered, teacher-led

The cultivation of communication skills among undergraduates under the guidance of constructivism should focus on students' subjectivity and participation, encourage learners to actively take part in certain communication activities, and teachers should supply appropriate guidance and support to help or assist students to enhance communication skills. (Li & Liu, 2 0 1 8). The role of teachers is of great significance in Constructivism theory. In this theory, teachers act as facilitators, focusing on students and their learning to help them understand. Constructivism believes that individuals actively construct knowledge and understanding through interaction with the environment, and therefore, communication skills take a big part in individuals' cognitive and communicative development (Miller, 2 0 0 2). Therefore, teachers constantly communicate with students, create learning experiences, and innovate learning experience directions according to students' needs as learning progresses. Constructivism teaching methods help students actively participate in and actively build knowledge, and promote their critical thinking and problem-solving ability (Phillips, 2000).

#### 2.4.2.2 Autonomy, Collaboration, and Cooperation

As for constructivism, communication in the teaching and learning process emphasizes dialogue, communication, and cooperation, cultivating students' communication skills and the ability to understand others' perspectives. It helps students to actively participate in and actively build knowledge, and promote their critical thinking awareness and practice their capacity to deal with kinds of situations. Students' collaborative skills and teamwork abilities are promoted by constructing shared understanding and meaning construction in collaboration with peers (Phillips, 2000). Constructivism theory encourages autonomous learning, collaborative learning and cooperative learning. Constructivist analysis reveals the diversity, power relationship and meaning building process in organizational communication (Pearce & Pearce, 2000). Constructivism theory not only emphasizes the active participation of individual group members, but also requires the full cooperation of group members. If a student does not truly participate in classroom activities, it is difficult for them to construct meaning from them.

In the field of education, research has found that a constructivism perspective helps students develop communication skills. Through constructivism teaching methods such as problem-solving, group collaboration, and open discussion, students are able to communicate with others, jointly build knowledge and understanding. This learning environment can promote students' critical thinking, cooperative skills, and autonomous learning abilities (Phillips, 2000). That is to say, the construction of meaning requires learners to autonomously discover problems, continue to participate deeply in group discussions, critically absorb the viewpoints of group members, reconstruct the knowledge they are learning, and then create and apply it. Learning is active mental labor, not passive teaching (Woolfolk, 2015). Language learning requires learning in context, which means we cannot construct meaning from these facts in isolation. Therefore, it is particularly important to encourage learners' awareness of autonomy, collaboration, and cooperation in the process of meaning construction. Constructivism theory emphasizes the interactivity and constructiveness of language communication. Research has shown that through constructivism teaching methods and practices, individuals can improve their understanding and interpretation of others' perspectives, enhance their skills in resolving conflicts and handling misunderstandings, and promote the construction of shared meaning (Foss, 2009).

2.4.2.3 Diversified learning scenarios

Constructivism believes that individuals actively construct knowledge and understanding through interaction with the environment. Therefore, communication skills are of great necessity in individuals' cognitive and communicative development (Hook et al., 2 0 0 2 ). Constructivism theory emphasizes the creation of learning environments and learning scenarios, advocating for educators to create a relaxed atmosphere for learners and activate their active participation in learning. Supplying learners with diverse learning contexts, they can construct new thoughts according to their previous knowledge and content, thereby achieving knowledge externalization and self feedback. Teaching under the guidance of constructivism can help to improve students' communication skills (Yang & Wang, 2013). Researcher suggest using the following methods to cultivate communication skills: (1) creating a real communication environment and encouraging students to take part in real conversations and interactions; (2) giving individualized support, focusing on students' perspectives and experiences; (3) cultivating students' team-word spirit and communication skills through group collaboration and role-playing activities; (4) encouraging students to improve the expression and thinking ability, and assisting their competence to think critically and to solve certain problems.

2.4.3 Application of Constructivism theory in the Perspective of Virtual Technology

Use hypermedia tools to promote students' metacognition and communication skills. The research results show that students can better manage and monitor their learning process when using hypermedia tools, and improve their communication skills and knowledge building ability (Azevedo, 2018). Internet learning systems can help improve students' academic performance and increase their interest and retention rate in learning content. The interaction and communication functions in the system provide students with opportunities to communicate and collaborate with teachers and peers, thereby promoting the development of constructivism learning and communication skills (Olagbaju & Popoola, 2020). The theory and practice of computer supported collaborative learning (CSCL), which emphasizes interaction and communication (Koschmann, 2012)

VRT provides necessary technical assistance for the in-depth integration of constructivism theory and teaching practice. Virtual reality environment can provide learners with an ideal environment, simplify and improve the learning process, help learners focus, actively discover and solve problems, and promote learners to actively construct meaning (Li, 2021).

The virtual experimental environment constructed in virtual simulation experiments has a high degree of simulation, which can provide students with a contextualized learning environment, stimulate their thirst for knowledge, actively explore and solve problems, deepen knowledge understanding, and promote learners' own meaning construction (Huang, 2022). Therefore, VRT can form various virtual scenarios for undergraduates to connect in cultivating college students' communication skills, which not only enriches the diverse needs of communication scenarios, but also promotes students' concentration, active communication and problem-solving, and improves their learning efficiency.

#### 2.5 Learning Models

#### 2.5.1 Definition of Learning Model

Models are abstractions or simplifications of phenomena, things and systems in the real world. Models are divided into mathematical models, program models, logical models, structural models, method models, data models, system models, etc. Different research perspectives have different definitions of the concept of model, but there is a consensus that model is an abstract description of the intrinsic nature of things (Zhong, 2023). Branch believes that the model is a representation of real problems and a standardized description of the links between different elements in the system (Sun, 2007). The purpose of establishing the model exists in that people may perceive various things in a unique way of thinking, so as to grasp the internal logic of things (Zhao & Yang, 2017). Through the research model, we can deeply understand the shape, characteristics, essence and development law of the studied object, which is of great significance to reveal the internal structure and operation law of things (Dakhi et al., 2020).

According to some scholars, there are two kinds of learning, one is broad sense learning, and the other is narrow sense learning. In a broad sense, learning is a relatively lasting change of behavior potential generated by certain experience in the process of life. Learning in the narrow sense usually refers to purposeful, planned and organized learning activities undertaken by students under the guidance of teachers in a schooling environment. This type of learning focuses on the process of systematically acquiring knowledge and skills in a specific field and using them to enrich themselves. In any case, learning is a dynamic, complex and changeable process (Zhong, 2023).

Taylor believes that the learning model is based on a certain learning theory and consists of several elements and the relationship between them. It has a certain value orientation and can guide the implementation of the learning process, strategy formulation and practical application (Tyler, 2013). Some experts believe that, learning model is also a kind of teaching method, which is an effective way of teaching (Eggen & Kauchak, 2012).

The core of learning model construction is to clarify the constituent elements and structural relationships of learning model. Therefore, it is necessary to study the learning model to reveal its internal structure and operation mechanism. With the largescale and universal usage of science and technology for the learning and teaching process, the learning model has been further expanded in terms of connotation and characteristics (Zhong, 2023).

#### 2.5.2 Elements of Learning Model

The construction of learning model needs to be selected and designed according to the characteristics of the research object, the research purpose and the actual situation of the research.

Domestic and foreign scholars' research on learning model initially focused on using intelligent technology to provide learning resources and support environment to meet learners' autonomous learning. Autonomous learning means that learners can decide what kind of learning way they use, and the learning contents and learning places, so as to take part in the real learning purposefully and selectively, and realize learners' autonomous and comprehensive development. Winne and Butler proposed an autonomous learning model from the aspects of knowledge beliefs, goal setting, learning strategies, learning monitoring, and learning outcomes. The model includes a three-tier structure of cognitive system, behavior performance, and external feedback (Pang, 2 0 0 0). Yu Xiaohua and Zhu Zhiting adopted the design perspective of hierarchical fragmented Association, and proposed an autonomous learning model consisting of five elements, namely, learning objectives, learning activities, learners, learning content and learning tools, including a three-tier structure system of goals, themes, action plans and activities, which was tested on the ple-srl platform, The rationality and feasibility of the model are verified (Yu & Zhu, 2013). Duan Jinju formed a learning model with combination of social cognition network in four aspects: the role level of learners, the interactive behavior level, the content unit level and the social knowledge network environment level (Duan & Yu, 2016). Combined with the analysis of connotation, features and functions of the online autonomous learning environment, Zhang Kunying and others built an autonomous learning model under the Web3.0 learning environment, including personalized information search, personalized content customization, learner interest construction, learning resource recommendation, and learning portal construction (Zhang et al., 2012).

Along with the wide application of internet in teaching, domestic and foreign scholars' studies about model of learning has turned to mobile learning. Based on the in-depth analysis of mobile learning theory, Wang Wei proposed the conversation CAD, and constructed the College English mobile learning system model based on CAD, which is composed of learners, and other elements. In addition, he proposed the four layers in this model (Wang, 2011).

As for the continuous development of virtual simulation technology, the learning model turns to use virtual simulation technology in order to build an immersive learning situation for learners and to support students' deep and immersive learning. Hakkarainen and other scholars created a deep learning model from the dimensions of some metaphors of studying and learning support environment (Hakkarainen et al. 2 0 0 4 ). Based on the learning meta platform, Yu Shengquan et al. Proposed the composition of learners (instructors), the content of teaching and learning, some activities, the evaluation system, and other elements, are integrated into a deep learning model, which effectively supported the construction of group social knowledge space and promoted learners' deep learning (Yu et al., 2017). Based on VRT and the concept of learning field, He Juhou and others constructed a deep learning field model consisting of a cornerstone (Learning Space Tower), a core (student input), and three support points (technicians, teachers, and demand tools), including four hierarchical structures of context, interaction, experience, and reflection (He et al., 2019). Li Hongxiu and others, based on the Constructed a deep learning model which is made up of learning resources, problems, methods, interaction, evaluation and so on and so forth, covering the preparation of deep learning, knowledge construction and transfer, and deep learning evaluation (Li et al., 2019).

To sum up, through literature analysis, a lot of experts all through the world have defined the learning model from different perspectives, but most scholars have described learning from the aspects of model elements, correlation, hierarchical structure and so on. Therefore, on the basis of the current studies, this study constructs a learning model based on VRT and tries to test its impact on undergraduates' communication skills.

# CHAPTER 3 RESEARCH METHODOLOGY

This study evaluates the changes in communication skills of undergraduate students after implementing a Virtual reality technology(VRT) based learning model. The study objectives are as follows. Firstly it is aimed to understand and sort out the research theories and the results of previous studies to lay a solid theoretical foundation for the successful implementation of this study. Secondly, it is necessary to collect and effectively collate the results of the interviews with frontline teachers to provide strong support for the learning model, and to gain an in-depth understanding of the frontline teachers' understanding of the elements of undergraduate communication skills, the issues that need to be paid attention to when designing the questions to test undergraduates' communication skills, and the design of the specific aspects of the learning model when developing a learning model that aims to improve students' communication skills. The practicality and feasibility of the development of the learning model were improved by collating information from the results of interviews with frontline teachers. This chapter describes in detail the methodology used to conduct the study, which included the following three phases:

Phase 1: Analyzing the Problem

1.1 Related Literature

1.2 In-depth Interviews with University Teachers

1.3 Integration of Literature Analysis and Teacher Interviews

Phase 2: Developing Research Tools and VRT Learning Model

- 2.1 Developing Research Tools
- 2.2 Identifying the Elements Included
- 2.3 Developing a Learning Model
- Phase 3: Implementing the Learning Model
  - 3.1 Participants
  - 3.2 Pre-Test
  - 3.3 Implementation

# 3.4 Data Collection

3.5 Data Analysis



FIGURE 4 The development and research process of the VRT learning model

#### Phase 1: Analyzing the Problem

This stage provides basic information for the development of this research project by researching relevant literature and conducting interviews with teachers.

## 1.1 Related Literature

Studies on the following theories are conducted, which provide the basis for the development of this research:

Firstly, the Ministry of Education has studied policies and documents related to talent cultivation in universities, such as the "Outline of the National Medium and Long Term Education Reform and Development Plan (2 0 2 0 -2 0 3 0 )" and "Opinions on

Accelerating the Construction of High Level Undergraduate Education", and has gained a preliminary understanding of the goals of talent cultivation in universities.

Secondly, to study the communication theory, clarify the definition and types of communication, master the concept and components of communication skills, and have a certain understanding of the problems in undergraduate communication skills.

The third is to study VRT theory, understand the application of VRT in various industries in society, especially in the field of education, and study the impact of VRT on students' communication skills.

The fourth is to study constructivism and Problem-Based Learning(PBL) theory, as well as to understand the deep combination of these two learning theories with VRT in teaching, as well as their role in improving students' communication skills.

The fifth is to study the relevant theories of learning models, and get a overall understanding of the definition, elements, significance, and construction of learning models.

Researchers combined with the interviews on the status quo of relevant course construction in colleges and universities and the analysis of relevant literature, and found that the current development trend of colleges and universities on improving undergraduates' communication skills is just right, and some learning models to improve undergraduates' communication skills have been formed, but there are still some problems in the learning models and course construction of improving undergraduates' communication skills have been formed, but there are still some problems in the learning models and course construction of improving undergraduates' communication skills through VRT, such as: the theoretical system of developing learning model through VRT is not sound, and there is no systematic model; the construction of teachers is not satisfying, and there are few course programs for reference; the structure of course team is single, and there is no appropriate personnel to lead the course; the target system as well as the course content system of improving undergraduates' communication skills are biased, and most of schools don't pay enough attention to the value of VRT; the teaching methods are still traditional and single without keeping pace with the times, and they neglect students' subjectivity; in addition,

there is a lack of variety of the media resources, which can not effectively support the course and lead to students' weak interest.

#### 1.2 In-depth Interviews with University Teachers

During the total steps of designing learning models to enhance undergraduates' communication skills, it is crucial to gather insights from front-line educators in teaching practice. In order to incentivize them to contribute more valuable information for qualitative research, gain a comprehensive understanding of college teachers' perspectives on the current state of undergraduates' communication proficiency, and identify strategies for improving students' communication skills, the researcher conducted semi-structured interviews with 5 teachers who were recipients of the Teaching Skills Competition at colleges and universities in Henan Province.

The researcher primarily consider the following criteria when selecting interviewees: Firstly, they prioritize teachers with extensive teaching experience and professional expertise to provide deeper insights and expert perspectives. Secondly, they focus on faculty members with relevant research field or topic backgrounds to ensure direct relevance to the research question. Lastly, teachers from various disciplines are chosen to enhance the comprehensiveness and diversity of the research.

The interviewees of this study are five teachers who won the Teaching Skills Competition for Higher Education Teachers in Henan Province, all of whom have outstanding teaching skills, excellent classroom effects, and are well-liked by students. These five teachers teach in different majors and have long been committed to the frontline work of teaching in colleges and universities, of which four have worked for 6-10 years and one has worked for more than 10 years; two teachers have doctoral degrees and three have master's degrees. Therefore, through face-to-face communication with these interviewers, the data we obtain will have high reference value and credibility.

The researcher obtained the contact information of the teachers they planned to interview through publicly available teacher contact information within the schools. The researcher sent invitation letters to them one by one, in which they briefly introduced themselves, the purpose of the research, why the teacher was chosen as the interview object, as well as the general content, length and form of the interview. At the same time, they emphasized the respect and value of the interview to their work, and clearly informed the teachers that the interview contents would be treated confidentially, and anonymity would be ensured if the research results were published. Unless explicitly agreed to. End the letter by thanking the teacher for any help they may have, even if they are ultimately unable to accept the interview invitation.

serial	gender	age	major	Teaching	Educational	Award time	job title
number				years	qualifications		
А	female	36	English	12 years	PhD degree	2021.12	Associate
			8/+		2/4		Professor
В	female	38	applied	11 years	Master's degree	2020.12	lecturer
		- V.	statistic				
		2	s			č –	
С	female	36	Motors	11 years	Master's degree	2019.12	Associate
			and	1 T 1			Professor
			electric	A STREET			
			al	านข			
			applian				
			ces				
D	female	57	Choir	35years	Ph.D. candidate	2023.2	Professor
			conduct				
			or				
E	female	36	physics	6 years	Master's degree	2023.12	lecturer

TABLE 3 Interview Teacher Information

The teachers accepted the invitation and the researcher asked them to set a time and place for the interviews and conducted semi-structured interviews with them one-on-one. The research instrument for this interview was the outline of the interviews with college teachers about undergraduate communication skills (see Appendix 3 for a detailed outline), with questions such as: what do you think are the elements of undergraduate communication skills, what do you think should be kept in mind when designing questions to test undergraduate communication skills, what do you think should be kept in the design do you think needs to be strengthened to develop a learning model that is aimed at improving the communication skills of the students and so on.

This interview went through the following processes: (1) Once the interviewees are identified, keep in touch with them through various channels. (2) Before the formal interview, discuss the topics with the interviewees via social media platforms. (3) During formal interviews, do a good job of data collection. On the one hand, with permission, use a recording pen for recording; On the other hand, the pen quickly records key information. The interview will take approximately 60 minutes. (4) After the interview, timely organize relevant data. Convert the voice part of the recording pen into text, and save the converted word manuscript in a timely manner.

1.3 Integration of Literature Analysis and Teacher Interviews

Through literature analysis and expert interviews, it was found that there is overlap in some elements of undergraduate communication skills. The researcher, along with research assistants, analyzed and discussed the content following the principles outlined below:

(1) For identical details, the details were directly selected. Such as undergraduate communication skills primarily include oral and written aspects.

(2) For similar details, a reasonable and professionally understandable term was chosen. For example, in terms of oral communication, undergraduates need to learn to express their positions and feelings clearly and to learn to listen to the needs and ideas of others. This requires good oral communication and understanding skills. In written communication, undergraduates need to learn to write e-mails, reports, etc. in an appropriate style and with appropriate terminology. This requires them to acquire basic writing skills and norms and to be able to express themselves accurately and logically. (3) For different details, an comprehensive analysis was made to compare the differences. For example, one teacher thinks that the main elements of communication skills for undergraduates are firstly to clarify the communication objectives, which helps them to better organize their thoughts and language to ensure the effectiveness of communication; secondly to express themselves clearly and understand others accurately to establish a good communication relationship. While another one holds that it is necessary to master certain non-verbal communication skills, such as facial expressions, body language, eye contact, etc., which help to better convey their intentions and emotions. Also some holds that the most important point is to respect others, avoid attacking or belittling others in communication, and promote communication and co-operation between both parties.

(4) For details that appeared in different elements, they were categorized into the most representative element based on frequency and discussion with the research assistant. For instance, according to the teachers interviewed, there are two main problems in communication skills of current undergraduates, one is the lack of self-confidence, not daring to take the initiative to communicate with others or express their own views; the second is not being able to express themselves clearly, not being able to express their own ideas and views accurately and concisely, which leads to ineffective communication.

((5) For some controversial details, a discussion was conducted to decide whether some details should be retained. For example, for the the problems of current teaching models in improving students' communication skills, some teacher hold that lack of practical opportunities is the most important issue. They think many teaching models still focus on knowledge transfer, and students lack practical communication opportunities. As a result, students are unable to master communication skills and apply what they have learned in real situations to improve their communication skills. While others hold that lack of personalized guidance is the most important issue. They think that students have obvious individual differences, and everyone has different communication styles and abilities. However, many teaching models lack personalized

instruction to meet the specific needs of each student. This may result in some students not being able to receive effective help and guidance in communication.

Following the principles above, the details involved in each element of undergraduates' communication skills were organized.

However, a challenge arises as some of these details are too general, lacking operational clarity, making assessment inconvenient. Therefore, the researcher and research assistants engaged in discussions, reviewed interview transcripts, consulted literature, and reexamined the essence of these elements. They proceeded to analyze the specific details, outline their meanings, and transform them into behaviorally measurable objectives for convenient assessment.

Based on interview information and the practical experience of researcher and research assistants, an explanation of the acceptance detail is provided, outlining its behavioral objectives.

## Phase 2: Developing Research Tools and VRT Learning Model

# 2.1 Developing Research Tools

2.1.1 Research instruments

Outline of interview requirements for the undergraduates' communication skills was the first interview tool in this step.

This semi-structured interview outline was designed based on the elements of undergraduate communication skills. The interview outline includes two main sections: basic information and interview topics. The basic information section is used to collect the interviewee's basic data, with a particular focus on their relevant experience in the field of college teaching. The interview topics section aims to understand the professionals' views on the definition and elements of undergraduate communication skills. It covers the status of the current teaching models for improving students' communication skills, and the problems existed, and as well as the strategies adopted by them to solve the problems.

The outline of interview requirements was sent to five experts for review. The experts provided the following suggestions for revising the interview outline: Remove some questions that are not directly related to the main theme; Clarify certain questions; Make adjustments to the format and wording of certain questions.

The study revised the interview outline based on expert feedback and then organized detailed interviews applying this updated outline, including semistructured interviews with front-line teachers. It's also important to ensure the reliability of the collected data. Building a trusting relationship between the researcher and interviewees can influence the accuracy of the information. The researcher verified the information by carefully recording interview results. If there were any unclear points, they contacted the interviewees to clarify and confirm the information.

The other research tool of this study is the undergraduate communication skills questionnaire. The design of the questionnaire will be discussed in details in the next section of this paper.

2.1.2 Questionnaire design

Through the analysis of related literature and the results of interviews with teachers, this study, based on the conceptual definition and the conception of the structure of college students' interpersonal communication skills established in this study, draws on the measurement scale of related studies to clarify the structural elements of the communication skills, and initially develops a questionnaire for undergraduates' communication skills test. In order to make sure that the questions can reflect the actual situation of interpersonal questionnaire's communication, the researcher repeatedly modified the questionnaire in three aspects, including whether the questions could reflect In order to make sure that the questions can reflect the actual situation of interpersonal communication, the researcher repeatedly revised the questions to see whether they can reflect the contexts and features of college students' communication skills, whether they are proper for real things of college students' communication skills, and whether the statements of the questions are appropriate and free of ambiguity.

The questionnaire was developed according to the four main dimensions of undergraduate communication skills as suggested by the interviewed
teachers. The first dimension, "Expression", had 4 items; the second dimension, "Listening", had 4 items; and the third dimension, "Understanding", had 4 items; The fourth dimension, "emotional control", had 4 items, and the whole questionnaire had 16 items, all of which were randomized, using a self-assessment point scale.

For the questions with normal scoring, the answers of "Strongly Agree", "Agree", "Neutral or Neither Agree nor Disagree", "Disagree" and "Strongly Disagree" were scored as 5, 4, 3, 2, and 1 in that order; and for questions with reverse scoring, the answers "Strongly Agree", "Agree", "Neutral or Neither Agree nor Disagree", "Disagree" and "Strongly Disagree" are scored as 1 point, 2 points, 3 points, 4 points, and 5 points respectively. The higher the final score, the better the undergraduate student's communication skills.

TABLE 4 C	Questionnaire	scoring	sheet

Score	Meaning of normal statement (+)	Meaning of reversed statement (-)
5	Strongly Agree	Strongly Disagree
4	Agree	Disagree
3	Neutral or Neither Agree nor Disagree	Neutral or Neither Agree nor Disagree
2	Disagree	Agree
1	Strongly Disagree	Strongly Agree

2.1.3 Testing the reliability and validity of the questionnaire

2.1.3.1 Evaluate the quality of the questionnaire

The consistency and applicability of the data collection instruments were evaluated by 5 scholars (2 experts of law and 3 experts of education).

Experts checked consistency of various components of the data collection instrument. After collecting the data, it was analyzed and evaluated. The results for the project goal consistency indicator (IOC) are in Appendix 5. The evaluation shows that the IOC is between 0.8 and 1.0, higher than the standard of 0.5. This means

that each component of the data collection instrument, as evaluated by experts, is consistent with each other.

Experts checked the suitability of various components of the data collection instrument. After collecting the data, the researcher analyzed the data and conducted an evaluation. The applicability evaluation results include the average score, standard deviation and project suitability grade. The results are shown in Appendix 6. The applicability evaluation results show that the average score is between 4.0 and 4.8, the standard deviation is between 0.447 and 0.837, and the average applicability score is higher than 3.51, which is at a very high level. Experts assessed suitability of each component of the data acquisition instrument as having good suitability. Specifically, the design of the data collection instrument is reasonable and can guide practice, the goal is clear and specific, measurable, evaluable and suitable for the target group, and the content of data collection instrument can meet the goal.

2.1.3.2 Conduct reliability and validity tests on survey questions

So as to test the reliability and validity of the communication skills questionnaire, data collection and testing were conducted on students in nonexperimental classes. The objects of data collection are 50 students from Class 2 of the 2023 Law Major of Zhoukou Normal University, a parallel class of the experimental class. The undergraduate communication skills questionnaire was conducted anonymously, and all questions in the questionnaire did not involve basic personal information. The questionnaire is filled out in the WeChat mini program on the students' mobile phones. The filling time is 10 minutes. After the undergraduates fill in the questionnaire on site, they submit it directly in the WeChat mini program. The teacher can check the number of submitted copies in the WeChat mini program background and list all 50 students. Export data after submission.

After data collection, the researcher imported 50 pieces of recovered data into computer software and tested the reliability and validity. The test results are shown below:

Evaluation at a	Results (N=50)			
glance	Mean	S.D	Reliability	Validity
Expression skills	3.13	1.207		
Listening skills	2.97	1.165	_	
Understanding skills	2.15	0.878	0 707	0 600
Emotional control	2.25	1.070	- 0.707	0.009
skills	5.25	1.079		
Overall performance	2.87	1.082	_	

FIGURE 5 Results of Descriptive Statistics on Communication Skills of Students in Non-Experimental Classes

Finally, the items in the questionnaire were analyzed and found that the item reliability was greater than 0.70 and the item validity was greater than 0.6. It can be inferred from the data analysis that the quality of the questionnaire was acceptable and could be used for formal testing.

# 2.2 Identifying the Elements Included

The goal of developing the learning model is to enhance students' communication skills through VRT. Its purpose is very clear. The learning model was mainly designed using the goal-oriented curriculum development model. So, it mainly includes theoretical foundation, developing principles, objectives of the learning model, contents of the learning model, learning activities, curriculum resources and curriculum evaluation. Among them:

(1) Foreword: This mainly introduces the structure of the learning model and the precautions for teachers and students when using it.

(2) Theoretical Foundation of the Learning Model: Mainly introduces several theories of developing the learning model.

(3) Developing Principles: This mainly introduces the basic principles of developing this learning model through VRT.

(4) Objectives of the Learning Model: This mainly introduces the objectives of developing this learning model through VRT.

(5) Contents of the Learning Model: Consists of learning units, objectives, and other content. Specifically for each learning unit, content, and learning time.

(6) Learning activities: a learning process aimed at enhancing the communication skills of undergraduates is emphasized and suitable activities are designed.

(7) Curriculum resources: refer to the resources required to achieve the objectives and complete learning activities.

(8) Curriculum evaluation: are the tools and method developed to evaluate whether the objectives of this learning model have been achieved.

In a word, it is of great significance to develop a learning model through VRT to improve the communication skills of undergraduate students by utilizing the relevant elements, and finalize the learning model draft by amalgamating the gathered information with the researcher's expertise.

The researcher used the Consistency Check Form and Appropriateness Check Form to assess the consistency and appropriately of the interviews, and through open conversations, understand expert suggestions for modifications.

(1) Consistency check form

The consistency check form is mainly used to check whether the various elements of are consistent, such as whether the principles and objectives are consistent, whether content and learning activities are consistent, etc. The scoring criteria of the consistency check form are +1, 0, and -1. Among them, +1 represents high consistency between the elements of the project, 0 represents uncertainty about whether the elements of the project are consistent, and -1 represents inconsistency between the elements of the project.

The formula for calculating the IOC index is as follows:

IOC = 
$$\frac{\sum R}{N}$$
  
IOC: Objective Consistency means Index of Item  
 $\sum R$ : Summation of expert's opinion marks  
N: Number of experts

If the IOC is greater than 0.5, it means the elements of the project have internal consistency.

(2) Appropriateness check form

Appropriateness check form is mainly used to check whether the elements are suitable. It consists of 6 major items and 18 questions. Taking principles as an example, it includes three questions: Reasonable, Theoretical concepts used to support and lead to practice. The scoring criteria of the appropriateness check form are 5.4.3.2.1. The scores for appropriately level of each statement are shown below.

# TABLE 5 Appropriateness Scoring Table

The Appropriateness level	Scale value (points)
Very high level	5
High level	4
Low level	3
Very low level	2
Moderate level	1

Calculate the average value based on the ratings of 5 experts. Compare the average to the criteria in the table below to determine the appropriateness of the model.

TABLE 6 Appropriateness Rating Scale
--------------------------------------

Mean scores	The Appropriately level
4.51 – 5.00	Very high level
3.51 – 4.50	High level
2.51 – 3.50	Moderate level
1.51 – 2.50	Low level
1.00 – 1.50	Very low level

If the average score of the appropriateness check is greater than 3.5, it means that the developed learning model has high appropriateness.

The researcher sent the electronic files of the complete set of learning model draft materials, consistency check form and appropriateness check form to the experts via email or social software, such as QQ or WeChat. After expert reviewed within one week, the two check forms sent back. After receiving the check form, the researcher contacted the experts by phone to collect data on their recommendations. The procedure is as follows.

According to the standards, a list of experts determined through recommendations from friends, contacted by the researcher themselves, etc., and the experts were contacted to ask for their consent to participate in the research.

Researcher kept in touch with the Graduate School to schedule interviews according to the experts' availability. The university sent out invitation letters to help with the process. With the experts' consent, the researcher conducted the interviews, and if they did not agree to audio recording, the researcher took notes by hand. Finally, the reliability of the collected data is checked.

After sending the learning model materials, the researcher sent the phone number to the experts. If the experts encountered problems while reviewing the learning model they can contact the researcher at any time.

2.3 Development of the VRT learning model

2.3.1 Objective

Learning model plays a crucial role in developing communicative skills. First of all, good interpersonal relations are one of the most important conditions for success in learning, and psychologists emphasize that intelligence includes not only the ability to learn, but also interpersonal skills. This suggests that interaction, communication and co-operation between teachers and students in the educational process have a significant impact on learning outcomes.

Research in educational psychology has shown that its application in teaching can be better implemented to effectively develop learners' intercultural communication skills. This approach helps learners to form language habits through repeated stimuli and responses, thus improving their communicative competence.

In addition, teaching interactions and classroom interactions are also important ways to improve communicative competence. Positive interaction and codevelopment between teachers and students during the teaching process help students to better apply what they have learned in actual communication. This interaction involves not only behavioral exchanges, but also emotional and cognitive interactions, which are key factors in building effective communicative competence.

The overall goal of this learning model is to use VRT to cultivate students' communication skills. Specifically, it aims to achieve the following goals:

First, to enable students to develop a positive attitude towards communication;

Second, to enable students to have the desire to communicate and certain communication skills;

Third, to enable students to communicate smoothly and effectively with people other than classmates and teachers, and actively cooperate as needed.

2.3.2 Step of the design to create the learning model

This study draws on constructivism theory, PBL theory and other theories to build a virtual context learning model, taking the enhancement of students' communication skills as the purpose of designing the study, so as to teach and learn in a virtual scenario and make an explanation of it, and on the basis of which to form a learning model that promotes the communication skills of college students and enhances the level of their skills in communication. The development process of this learning model is as follows:

Step 1: Research and analyze all the information at the beginning of the first stage, and design the learning model.

Step 2: According to the policies and document requirements of the Ministry of Education regarding talent cultivation in universities, such as the "National Medium - and Long Term Education Reform and Development Plan Outline (2020-2030)" and "Opinions on Accelerating the Construction of High Level Undergraduate Education", and in combination with the current situation of communication skills problems among undergraduate students, determine the curriculum objectives.

Step 3:Interview teachers to obtain their suggestions for designing a learning model.

Step 4: researcher determine the content and implementation cycle of the course based on the curriculum arrangement of universities and the professional requirements of the research subjects.

Step 5: Using constructivism theory, PBL theory, and VRT theory as the main theoretical frameworks, write the first draft of this learning model.

VRT has traditionally been used mainly in the fields of video restoration and image processing, its core technology, the VRT module can provide a new way of thinking for constructing a learning model for communicative competence. By drawing on the feature propagation mechanism of VRT, we can design a model specifically for simulating interpersonal communication scenarios, which is able to capture various nonlinear factors in the communication process, and thus better understand and predict the outcome of interpersonal interactions.

Specifically, the VRT-based learning model can include the following key components.

Input Layer: this layer is responsible for receiving input data from the user, such as speech, text, or emoji information. This data will be converted into a format that the model can handle and fed into the next layer.

Feature extraction layer: this layer uses the VRT module to deeply analyse the input data and extract key features related to the communication. For example, in speech communication, the model can identify features such as intonation, rate of speech, pauses, etc., while in text communication, features such as lexical choices, sentence structure, etc. can be extracted.

Interaction analysis layer: this layer further analyses the interactions between features to understand how different communicative strategies affect communication effectiveness. For example, the model can assess whether a particular communication style is appropriate for the current communication context and the background of the participants.

Feedback Generation Layer: Based on the results of the analyses in the previous layers, this layer generates targeted feedback suggestions. For example, if a communication strategy is found to be ineffective, the model can suggest alternatives or provide recommendations for improvement.

Output Layer: Finally, this layer generates the final output, such as suggested communication strategies, improvement measures, etc.

2.3.3 Quality check of the VRT learning model

The researcher will invite experts to quality check the learning model so that the experts can consider the usefulness and consistency of the learning model and suggest modifications to the learning model. The researcher will modify the learning model based on the experts' suggestions and identify the learning model to be implemented.

# 2.3.4 Tools

Tools are media and learning resources. Media include blackboards, whiteboards, slides, courseware, digital videos, etc. Learning resources include textbooks, virtual reality technology, etc.

#### 2.3.5 Data Analysis

Before and after the implementation of the VRT learning model, students will be assessed on their communication skills, and the researchers will use computer software to analyze the results.

#### Phase 3: Implementing the VRT Learning Model

This stage is the specific implementation stage of the research, aimed at collecting data on how this learning model and teaching affect students' communication skills.

# 3.1 Participants

When constructing a learning model through VRT to enhance undergraduate communication skills, the following aspects need to be taken into account when conducting participants selection.

Diversity: students from different backgrounds and cultures should be taken into account when selecting participants to ensure the comprehensive enhancement of undergraduate communication skills. Undergraduate communication skills involves not only the use of language, but also non-verbal elements, social etiquette and other aspects. Therefore, the diversity of participants can help students better understand and adapt to different cultural environments.

Motivation: The participants' motivation has a significant impact on learning outcomes. Selecting students who are strongly interested in and motivated to improve their communication skills can make them more active and engaged in the learning process. In addition, allowing students to make mistakes and adopting a tolerant and patient attitude can enhance their motivation and self-confidence.

Language proficiency and communicative strategies: Selecting students who have some basic language and communicative strategy skills can lead to more effective communication and interaction. Communicative strategies include the mental ability to use various linguistic knowledge in communication, which is crucial to improving communication skills. Through training and practice, students can gradually acquire and apply these strategies to improve their communication skills. Avoiding bias: When selecting participants, random selection should be avoided as much as possible, as it may lead to biased data sets, which may affect the credibility of the results. Through guided participants selection, representativeness of the data and maximization of learning outcomes can be ensured.

Collaboration and cooperation: in the VRT constructive learning model, collaboration and cooperation among participants are also important in enhancing undergraduate communication skills. Through group activities and collaborative tasks, students can practise and apply the communicative strategies they have learned in real-life exchanges, thus improving their undergraduate communication skills.

Continuous tracking and feedback: It is very important to continuously track students' progress and provide timely feedback throughout the learning process. This not only helps students understand their shortcomings, but also allows them to adjust their teaching strategies to better meet their needs.

Based on the above principles of participants selection, the participating teachers in this stage are the researcher themselves, and the participating students are 50 students from Class 1 of Law, 2022, School of Political Science and Law, Zhoukou Normal University. The researcher will use the learning model constructed in this study to conduct teaching in this class.

#### 3.2 Pre-Testing Sessions

Prior to the implementation of the VRT learning model, a series of pre-testing sessions are required to ensure the validity and usefulness of the model. The following are the detailed pre-testing sessions.

The first one is needs analysis.

(1)Goal clarification: firstly, the specific goals and expected outcomes of improving communication skills are clarified. This includes understanding students' current level of communication skills, identifying their major barriers and deficiencies in communication. (2)Needs research: through questionnaires and interviews, students' needs and expectations for communication skills enhancement are collected. This helps to understand their major concerns and directions for improvement.

The second one is competence assessment.

Current situation assessment: a comprehensive assessment of students' current communication skills. This can be done through a variety of methods such as observations, questionnaires, and tests. For example, a standardized communication skills test instrument can be used to assess students' ability to express themselves in listening, reading, writing and speaking.

Data analysis: students' scores on various elements of communication skills were tabulated to identify their weaknesses and strengths in communicative competence. This helps to provide a basis for subsequent modeling.

The third one is environmental analysis.

Social scenario analysis: to understand the common social scenarios in students' daily life and study, which helps to design a more relevant communicative training content.

Interaction pattern analysis: Analyse students' interaction patterns in different social scenes to understand their behavioural habits and psychological states in communication.

The fourth one is technical feasibility assessment.

Technical resource assessment: to assess whether the existing technical resources and equipment can support the implementation of the VRT model. This includes hardware equipment, software platform, network environment, etc.

Technical solution design: based on the assessment results, design a practical technical solution to ensure the smooth implementation of the model.

Last but not least is the ethics and privacy protection.

Privacy protection measures: strict privacy protection measures were developed to ensure the security of students' personal information during the use of the VRT model.

Ethical review: ethical review is conducted to ensure that the design and implementation of the model is in accordance with ethical norms and does not infringe upon the rights and interests of students.

Through the above pre-testing sessions, a solid foundation can be laid for constructing a learning model through VRT in order to enhance the communication skills of college students and ensure the validity and practicality of the model. Before the implementation of the learning mode, the researcher pre-tested the communication skills of Class 1, Grade 2023, College of Political Science and Law, Zhoukou Normal University. The researcher organized students to fill in the questionnaire of undergraduate communication skills in the WeChat mini program. The test time was 15 minutes, and the researcher could check the number and time of submission through the mini program background. Through the questionnaire data filled in by students, the researcher conducted statistics and corresponding T-test to obtain the communication skills level of all students before the teaching experiment.

#### 3.3 Implementation

The researcher broadly took the following steps to implement the VRT learning model:

3.3.2 Analyzing problems

The "problem" is the starting point and focus of the learning context created by this learning model. Teachers need to carefully study the students' professional characteristics and learning habits, and combined with PBL learning theory and constructivism and VRT theory, carefully analyze the content of the course to be carried out, find the key to the problem, and make sure that suitable knowledge for students to learn in the VRT environment is selected. knowledge that is suitable for students to learn in a VRT environment.

3.3.2 Creating learning scenarios

Teachers carefully select legal cases that are suitable for students to use according to teaching needs, and set the required roles for the case in the 3D legal

teaching laboratory system (Figure 6). They can also select existing legal cases in the system as needed and edit and modify them to meet their own teaching needs.



FIGURE 6 Interface for 3D Moot court Training Teaching Software Teachers to Input Legal Cases

# 3.3.3 Group inquiry learning

Students can enter a simulated trial to choose legal cases provided by the teacher or select cases within the system, choose the roles they need to train, use their knowledge, and participate in the trial from the perspective of court roles. Students can form a team, and team members can choose different roles from the same case to cooperate in simulation training; When there are insufficient members, students can choose a separate role, and other roles required for the trial will be simulated by the system and trained through human-machine interaction.

Students can ask questions within the system and interact with teachers, as well as post on communication forums to interact with others. Students can refer to the laws and regulations stored in the system when needed (Figure 7).



FIGURE 7 3 D Student Interface of Moot court Training Teaching Software

3.3.4 Achievement sharing and evaluation

Students first share their use of inquiry learning resources in groups, report on the results of conducting inquiry learning through writing with others, and evaluate their own performance; Based on the sharing of other classmates in the group, provide feedback on their performance. Teachers can participate in group discussions and provide guidance to them.

3.3.5 Comprehensive evaluation

Students submit their own tasks, and teachers evaluate and interact with students based on their work. According to the teacher's evaluation, students can choose to re-stimulate training or start a new simulation training in their ample time as needed.

# 3.3.6 Teacher guidance

In the process of constructing the learning model through VRT to enhance college students' communication skills, the teacher's guidance is of great necessity. Providing professional knowledge and skills training: Teacher can use VRT to provide relevant courses such as interpersonal psychology and social etiquette to help students acquire the necessary communication knowledge and skills. For example, by simulating different social scenarios, students can practice how to communicate with others, express their views and handle conflicts in a safe environment.

Enhancing self-awareness: Teachers can help students improve their self-awareness through VRT so that they can better understand their behaviors and reactions in interpersonal interactions. For example, through role-playing in virtual reality, students can observe their own behaviour from a third-person perspective and identify and improve their problems.

Promoting teamwork and collective building: teachers can use VRT to organize teamwork tasks to enhance collaboration and collective awareness among students. For example, by working together to complete project tasks in virtual reality, students can learn how to communicate effectively, divide labour and cooperate as well as resolve conflicts in a team.

Provide personalized feedback and guidance: Teachers can provide personalized feedback and guidance by monitoring and assessing students' performance in real time through VRT. For example, the teacher can make specific suggestions for improvement based on the student's performance in virtual reality to help the student continue to improve.

Stimulate students' positive attitudes: teachers can help students develop positive attitudes towards interpersonal interactions through positive psychological cues and incentives. For example, through positive feedback and reward mechanisms in virtual reality, students are encouraged to remain optimistic and positive in the face of difficulties and challenges.

Expanding horizons and social adaptability: Teachers can use VRT to help students understand and adapt to social and professional environments, and prepare them for future employment. For example, through simulated work scenarios in virtual reality, students can familiarize themselves with workplace culture and workflow in advance and enhance their social adaptability.

To sum up, teacher can play an important leading role in constructing learning models through VRT to enhance the communicative competence of college students by providing professional knowledge and skills training, enhancing self-knowledge, promoting teamwork and collective building, providing personalised feedback and guidance, stimulating positive attitudes, and expanding students' horizons and social adaptability in a variety of ways. During the implementation of the learning mode, teacher observe students' performance throughout the whole process, provide guidance to students when necessary, and make comments on students after they finish their work. When implementing the learning model, the researcher himself will act as a teacher to guide students in their studies so as to observe the students closely and obtain the most intuitive materials.

3.3.7 Evaluation of communication skills

The wave of globalization has had a profound impact on people's study, work and life, and communication skills has become one of the necessary qualities for talents in the 21st century. Therefore, it is of great practical significance to improve the communication skills of college students. VRT can provide a highly simulated communicative environment so that students can practice communication in a safe and controlled environment. This simulated environment can help students overcome the psychological barriers of actual communication and enhance their communicative confidence. VRT can also increase the fun and engagement of learning through multimedia and interactive elements, thus enhancing students' motivation and effectiveness.

When designing the VRT learning model, the theories of positive psychological capital and sociality are combined to explore how these factors play a role in VRT environments and reveal their underlying mechanisms through moderation analyses. By continuously adjusting and optimizing the model, teaching can be personalized according to students' feedback and performance to achieve the best teaching results.

After completing all teaching activities, students are required to conduct a survey questionnaire for undergraduate communication skills assessment. The undergraduate communication skills has significant differences between different grades and gradually improves as the grades increase. This indicates that college students have much room for improvement in communication skills.

#### 3.4 Data Collection

When constructing a learning model through VRT to enhance the undergraduate communication skills, there are several aspects of data collection that need to be taken into account. The researcher should adopt multiple data collection methods, focusing on questionnaires. In addition, it is possible to record students' behaviors and reactions by observing them in a communicative training scenario using VRT.

Focusing on data quality is of great significance. The researcher should ensure the accuracy and completeness of data to avoid data loss or errors. The validity and reliability of the questionnaire can be tested through pre-testing.

During the implementation phase, data was collected from participating students in the experiment. These data were obtained at different times to compare the communication skills evaluation scores of students before and after participating in learning model learning.

#### 3.5 Data Analysis

Using electronic questionnaires or face-to-face interviews, data on students' communication skills before and after using the VRT learning model were collected. The collected data were sorted and cleaned, and the data were analyzed using computer statistical software. Descriptive statistical analysis, correlation analysis, regression analysis and other methods can be used to explore the relationship between different variables.

According to the results of data analysis, the impact of VRT learning model on college students' communication skills is explained. On the basis of data analysis, the advantages and shortcomings of the VRT learning model in enhancing the communicative competence of college students are summarised. Based on the results of the study, suggestions for improvement are made, such as adding more interactive VRT scenes or adding more simulations of actual communicative situations in the VRT environment.

For the collected research data, researcher will input it into computer software. On the one hand, descriptive statistics will be used to analyze the research results to understand the overall sample situation; On the other hand, the independent sample T-test method will be applied in comparing the differences of the two parts in the pre and post test data, in order to analyze whether the course can effectively improve the communication skills of law undergraduate students.



### **CHAPTER 4**

### RESEARCH RESULTS AND ANALYSIS

This chapter introduces the implementation of the learning model developed through Virtual reality technology(VRT) and analyzes the data results. The research results are divided into the following parts:

4.1 Results on the Definition and Components of Undergraduate Communication Skills

4.2 Results of the Development of a VRT Learning Model to Improve Undergraduate Students' Communication Skills

4.3 Evaluation Results of the Effectiveness of the VRT Learning Model for Improving Undergraduate Communication Skills

# 4.1 Results on the Definition and Components of Undergraduate Communication Skills

4.1.1 Results of Research on Relevant Literature

Through CNKI, VIP data, Wanfang data, Hong Kong academic literature database platform, Thailand Srinakharinwirot University Library document retrieval platform and Zhoukou Normal University Library collection of books and journals, as well as a number of Chinese education department websites related to academic research, "communication skills" was used as the search term to obtain relevant literature on communication skills at home and abroad.

In this study, the researcher wanted to study undergraduates' communication skills in the context of establishing a VRT-based learning model. Therefore, the researcher combined the establishment of a VRT-based learning model with undergraduates' communication skills. In this context, the definition and components of undergraduates' communication skills need to take into account the current characteristics and future development of university undergraduates. From domestic and foreign research, there are many elements of communication skills, but for Chinese undergraduates, good communication skills should at least include the ability to

express effectively, listen effectively, understand effectively (analyze and judge), and have stable emotions.

Expression skills are the ability of college students to convey their ideas, information, opinions, and intentions clearly and effectively using verbal or nonverbal means. The way of expression includes not only verbal expression, but also non-verbal expression. Verbal expression refers to the correct use of vocabulary and grammar to convey a message, ensuring clarity and accuracy; non-verbal expression refers to the use of media other than language and words, such as facial gesture, body movements or tone, to assist in explaining one's intentions when conveying information.

Effective listening refers to the ability to receive and perceive other people's thoughts, information, opinions, and intentions without interruption, and to respond in a timely manner with nonverbal signals such as nodding, following with amusement, and making eye contact with the person talking. Undergraduates, who are usually around 20 years old, are quite rare in their ability to stay focused and patiently listen to different opinions while listening. When listening, it is important not only to hear what the other person is saying, but also to listen attentively to the other person's inner emotions, and to actively feed back encouraging messages to the other person with their eyes and body language so that the other person feels valued.

Effective comprehension (analyzing and judging) refers to the ability to accurately interpret and infer the message and intent of another person, and to find the right verbal response to make the conversation go smoothly. Effective comprehension is not only about understanding others, but also about understanding one's own way of expressing oneself, and choosing the right words to reach the other person's range of understanding more directly. When listening to the other party, the communicator should not only pay attention to the other party's verbal information, but also be able to perceive and interpret the other party's emotions, attitudes, and other non-verbal information. By repeating the other party's words for confirmation or asking the other party to explain his or her opinion in full, the communicator not only demonstrates that the other party's information is valued and respected, but also provides himself or herself with the

opportunity to understand and confirm the information again, which can help to grasp the other party's intention more accurately. The communicator can not only show the importance and respect for the other party's message, but also provide himself with the opportunity to understand and confirm the message again, helping to grasp the other party's intention more accurately.

Emotional stability refers to an individual's ability to effectively manage and control his or her emotional responses during the communication process. It involves the individual's ability to maintain calm, rational and moderate emotional expression when emotions such as nervousness, timidity and agitation occur or when conflicts arise to ensure effective and constructive communication. Undergraduates are new to society and lack communication experience, so they are prone to nervousness, timidity or excitement when communicating, especially with unfamiliar people, and since undergraduates are still at the age of impulsivity, they are prone to unstable emotions causing conflicts. Therefore, undergraduates need to be well-prepared before communication, build up self-confidence and a relaxed mindset, express their emotions naturally, and cope with the pressure of long conversations with ease.

#### 4.1.2. Teacher Interview Results

The interviewees of this study are five teachers who won the Teaching Skills Competition for Higher Education Teachers in Henan Province, all of whom have outstanding teaching skills, excellent classroom effects, and are well-liked by students. These five teachers teach in different majors and have long been committed to the frontline work of teaching in colleges and universities, of which four have worked for 6-10 years and one has worked for more than 10 years; two teachers have doctoral degrees and three have master's degrees. Therefore, through face-to-face communication with these interviewers, the data we obtain will have high reference value and credibility.

4.1.2.1 Definition and elements of undergraduate communication skills

The teachers interviewed believe that communication skills are the most important skills for undergraduates and play an important role in their study, life and work. The teachers believe that it is reasonable for researcher to define undergraduate communication skills as four elements: effective expression, effective listening, effective understanding (analysis and judgment) and stable emotions.

"Undergraduate communication skills include many aspects, but these four elements are the most important and all are essential. Especially in today's society, where all kinds of ideas collide, undergraduates are still very young, and it is easy for them to lose control of their emotions, resulting in communication failures." (Teacher B)

"Undergraduate students, whether they are seeking employment or studying, are always faced with the problem of communication, and only by mastering the skills of effective communication can they succeed in the shortest possible time, so it is necessary to strengthen their communication skills training in terms of the four elements." (Teacher E)

However, faculty suggested that the current description of the four elements is not standardized enough and that a more standardized description of the elements of undergraduate communication skills is needed.

"I recognize your four elements, but I feel that the standard of expression of the words is not quite uniform, for example, stable emotions is not consistent with the first three." (Teacher A)

"Your division of undergraduate communication skills into these four elements is great, but I think there could be a more standardized description of these four elements, for example, it would be sufficient to categorize effective comprehension (analytical judgment) as comprehension, and comprehension would include analytical judgment." (Teacher D)

"I think it is possible to unify these four elements into a certain skill, such as the skill to express, the skill to listen, the skill to understand, and the skill to stabilize emotions." (Teacher E)

The researcher accepted the interview faculty's suggestion to summarize the first three elements of undergraduate communication competence as the skills of expression, listening, and comprehension, and further discussed with the interview faculty the canonical description of the fourth element. "Stable emotions is the more commonly used term, and if we call the fourth element the ability to stabilize emotions there is nothing wrong with that, but it feels a bit colloquial." (Teacher C)

"I feel that using the Emotional Control skill presents the communication technique more clearly than the Emotional Stability skill, it also seems more actionable, and it feels more compatible with the expression of the first three elements." (Teacher D)

Based on the results of the literature study and faculty interviews, the researcher ultimately summarized the four elements of undergraduate communication competence as the ability to express, the ability to listen, the ability to understand, and the ability to control emotions.

4.1.2.2 Characteristics of undergraduate students' communication skills

The researcher discussed the characteristics of each element of undergraduate communication skills with the interviewing faculty. The interviews about expressive competence were as follows:

"Speech intonation has a certain expressive function. As soon as a person opens his mouth to speak, it involves voice intonation, such as lightness and weight, high and low, pitch and tone, etc. Undergraduates should be able to utilize voice intonation to express correct meanings; learning to accurately express one's own worries and feelings in order to get closer to one's true self, and also to better establish deeper connections with others." (Teacher A)

"Eye contact, gestures, and posture are all very important nonverbal factors when communicating with people. As an undergraduate student, it is important to learn to maintain appropriate eye contact and respect for the other person, as well as to be aware of your gestures and posture so that they harmonize with your words." (Teacher B)

"Undergraduates should be courageous to express their views, not be afraid to say anything unwilling to say, there are bitter and difficult to open is not able to communicate, to overcome the nervousness and timid thoughts, and be brave to communicate with people. When communicating, pay special attention to your voice and intonation, learn to adjust your way of speaking according to different situations and conversational objects, and make sure that your thoughts and feelings can be accurately conveyed to others." (Teacher C)

"Eyes are the windows of the soul, I think eyes are very important in communication, you can use your eyes to express affirmation and recognition, so that the other party can see sincerity and enthusiasm from your gaze, so that the other party is happy to communicate with you." (Teacher E)

The interview teachers analyzed the characteristics of expression skills from different perspectives, and they believed that college students, as social elites, should master nonverbal expressions more as follows:

Elements	Characteristics
	The ability to breathe freely even when calling someone you don't know
	very well;
	Being able to remember things to express when speaking with a stable
Emotional control skills	mind and without nervousness;
	Being able to express one's emotions in spoken language with ease;
	Being able to cope easily with continuous conversations.

TABLE 7 Characteristics related to expression skills

Based on the results of literature research and teacher interviews, the researcher believe that college students' communication skills is the ability of college students to express their intentions in an appropriate way, listen carefully and correctly understand the other party's intentions to establish good interpersonal relationships, and maintain stable emotions during information exchange to ensure smooth communication. Based on the results of literature research and the suggestions of interviewed teachers, the researcher standardized the elements of college students' communication skills and determined that college students' communication skills

consists of four elements: expression skills, listening skills, understanding skills, and emotional control skills.

4.1.2.2 Components of undergraduate communication skills

Based on their own teaching experience, teachers believe that undergraduate communication skills are mainly composed of four factors: expression, listening, understanding and emotional control.

"The main elements of undergraduate communication skills are first to be able to express oneself clearly, listen carefully to the other party's language, accurately understand others, and establish a good communication relationship; secondly, to be able to control one's emotions, avoid attacking or belittling others during communication, and promote communication and cooperation between the two parties." (Teacher A)

"The elements of undergraduate communication skills mainly include: clear expression and correct interpretation, active listening, non-verbal communication, and controlling one's emotions to ensure smooth communication." (Teacher B )

"I think good communication skills include clear language expression, strong logic, quick thinking, good listening skills, the ability to understand and respond to other people's views, and the ability to effectively control one's emotions in order to communicate smoothly." (Teacher D)

4.1.2.3 Suggestions on the design of a questionnaire to test communication skills

The teachers made some suggestions on designing communication skills test questions, such as paying attention to non-verbal communication methods such as facial expressions, eye contact, and gestures, and subdividing the options of the questions. Some teachers also proposed things to pay attention to when designing questions.

"We must not ignore nonverbal communication when designing questions to test communication skills. Posture, gestures, eye contact, and body movements can convey many messages, such as confidence, anxiety, excitement, etc. Eye contact can express the importance, trust, and interest of the conversation, but too much or too little eye contact can cause discomfort. Combining these nonverbal communication skills can help people understand the intentions and emotions of others more effectively, and better express their own thoughts and feelings." (Teacher E)

"When designing question options, don't just provide two or three levels of options for questions like whether you can express or understand. I suggest that you break down the options into five levels. For example, for a question about language expression, we should find out whether the student can't express at all, can't express clearly, can express relatively clearly, can express very clearly, or can't be sure which of the above situations they have. Don't just simply give two options of "yes" or "no". (Teacher A)

"When designing questions to test undergraduate students' communication skills, the following aspects should be taken into consideration: First, clarity and conciseness: questions should be clear and concise, and avoid using vague or ambiguous language. Second, diversity: design questions that cover different types of communication skills and situations, such as oral communication, written communication, non-verbal communication, etc. Third, targeting: select questions related to the learning content based on the course objectives and the grade level of the students. Fourth, open-endedness: try to design open-ended questions to encourage students to think deeply and express freely. Fifth, clear evaluation criteria: ensure that the evaluated objectively and fairly. Sixth, practicality: the designed questions should be practical and help students improve their actual communication skills. Consider designing questions related to students' future career development to provide more practical training and evaluation." (Teacher B)

### 4.1.3. Develop a Questionnaire to Test Communication Skills of Undergraduates

According to the information from the literature research and the interview results of the teachers, the definition of communication skills and the four components are very clear. Therefore, according to the suggestions of the teachers, the researcher designed sixteen questions according to the four components of communication skills, four questions for each component.

Expression skills refers to the ability of college students to clearly and effectively communicate their ideas, information, opinions and intentions verbally. Expression includes not only verbal expression, but also non-verbal expression. Non-verbal expression refers to the use of media other than language and text, such as facial expressions, body movements or tones, to assist in explaining one's intentions when conveying messages. Therefore, the test questions designed include the following four: Are you good at expressing care and enthusiasm with your eyes or touch; Are you good at expressing with voice and tone; Are you appropriate in eye contact, gestures and postures when communicating with others; Are you unable to express your troubles.

Listening skills refers to the ability to continuously receive and perceive other people's thoughts, information, opinions, and intentions, and to respond promptly with non-verbal signals such as nodding, following in an interesting way, and making eye contact with the person being talked to. Therefore, the designed test questions include the following four: whether you lean forward when facing the speaker; whether you are good at listening to others' emotions, not just what he (or she) says; whether you can listen to a wide range of opinions and views; and whether you can listen attentively when talking to others or when others explain something.

Understanding skills refers to the ability to accurately interpret and infer the information and intentions conveyed by others, and to find appropriate language responses to make the conversation go smoothly. Therefore, the researcher designed the following four test questions: Is it difficult to choose accurate and appropriate words when expressing your emotions? When talking with others, do you often repeat what the other person says and ask questions after clarifying it? When talking with others, do you often sk others to fully explain their opinions? Many times, do you not understand why others are angry?

Emotional control skills a person's capacity to effectively manage and control his or her emotional response during communication. It involves one's capacity to remain calm, rational, and moderate in emotional expression when emotions are aroused or conflicts arise, to ensure the constructiveness of communication. Based on this, the researcher designed the following four test questions: Do you feel it difficult to breathe when calling someone you are not familiar with? Do you forget some familiar things because you are too nervous about giving a speech? Can you express your emotions freely in spoken language? Do you find it difficult to have a continuous conversation?

Based on the teachers' suggestions, out of the 16 questions in the entire questionnaire, 9 were normally scored questions and 7 were reverse scored questions, each question states a fact in the first person. For the questions with normal scoring, the answers of "Strongly Agree", "Agree", "Neutral or Neither Agree nor Disagree", "Disagree" and "Strongly Disagree" were scored as 5, 4, 3, 2, and 1 in that order; and for questions with reverse scoring, the answers "Strongly Agree", "Agree", "Neutral or Neither Agree nor Disagree" or Disagree", "Disagree nor Disagree", "Disagree" and "Strongly Disagree" and "Strongly Disagree" and "Strongly Agree", "Agree", and for questions with reverse scoring, the answers "Strongly Agree", "Agree", "Neutral or Neither Agree nor Disagree", "Disagree" and "Strongly Disagree" are scored as 1 point, 2 points, 3 points, 4 points, and 5 points respectively.

4.2 Results of the Development of a VRT Learning Model to Improve Undergraduate Students' Communication Skills

#### 4.2.1. Basic Research Results

4.2.1.1 Literature research results

According to the literature, a learning model is an abstract representation that captures the characteristics and principles of the study process. It is designed according to specific learning theories to assist students reach their educational goals. The model includes environmental situation and interactive components to facilitate more effective learning outcomes.

The learning model of this study is built on the foundation of VRT theory, communication theory, constructivism theory and Problem-Based Learning(PBL) theory. VRT Theory, Constructivism theory and PBL theory can be effectively combined in

teaching to improve students' communication skills. The learning model constructed by teachers is a collection of concepts that guide the implementation of the learning process, strategy formulation and practical application (Tyler, 2013). Teachers are only facilitators of knowledge construction. Students, as the main body of learning, learn autonomously according to the learning model. When they use VRT to solve problems, they can better manage and monitor their own learning process, while improving their communication skills and knowledge construction ability (Azevedo, 2018).

4.2.1.2 Teacher interview results

When interviewing teachers, most of them believed that applying VRT in learning and teaching can improve students' communication skills . All teachers agreed that the learning model is conducive to teaching quality and promotes the improvement of communication skills. Teachers believe that the problems of China's current teaching model in improving communication skills are mainly low student classroom participation, lack of personalized guidance, and few practical opportunities. Case analysis, group discussion, student mutual evaluation, role-playing, and the use of smart teaching tools can be used to increase students' engagement in the teaching and learning process and promote students' communication skills .

"I think the learning model is very useful for improving teaching quality. It can assist students better gain fresh things, and also can provide students with personalized learning experience and promote the T-Ss relationship and interaction." (Teacher A )

"VRT can create an immersive learning environment for people to engage in, making it easier for them to engage in communication and interaction, thereby improving their communication skills." (Teacher C )

"Personally, I think we should strengthen the setting of student activities and enhance effective communication between students and between teachers and students." (Teacher E )

4.2.2 Design the VRT Learning Model

Based on the teacher interviews, the researcher designed the VRT learning model for improving students' communication skills as follows:

4.2.2.1 Learning model design principles

Aiming at enabling students to achieve satisfactory results in improving their communication skills, the design of this learning model should follow the following principles:

First of all, the function of VRT should be properly utilized. Integrating VRT into undergraduate teaching is a major innovation of this study. Therefore, in the design process of the learning model, the functions of VRT that distinguish it from traditional teaching technology should be utilized as much as possible, the teaching content should be carefully selected and combined, and their use methods should be reasonably designed to ensure that they can play an appropriate role in the course, so that students' communication skills can be effectively improved.

Secondly, it should be able to effectively play the dual advantages of VRT and PBL. Whether from the common characteristics of undergraduates as adult learners or from their individual differences, PBL is a very appropriate teaching method. So how can this "appropriateness" be transformed into a real advantage? This is a problem that we must always think about and seriously solve in every design link of the course. In addition, while VRT gives new features and connotations, it will inevitably put forward new requirements and challenges in the design of implementation strategies. Whether PBL and VRT can be effectively integrated to play the dual advantages is of great importance to the effectiveness of the learning model.

Finally, in the law course, cultivating students' communication skills is not like learning mathematical formulas and English words, which can be done step by step, nor can it be simply taught and accepted like learning a certain operational skill. We regard the cultivation of students' communication skills as a complex learning task. In addition, this course should be active, life-like and supportive, so this learning model always treats the learning task as a complex whole, so that learners can receive various types of support and guidance in the activities of "real" learning tasks, so that they can coordinate and comprehensively use all knowledge and skills and form a target attitude.

4.2.2.2 Learning model objectives

Learning model plays a crucial role in developing communicative skills. First of all, good interpersonal relations are one of the most important conditions for success in learning, and psychologists emphasize that intelligence includes not only the ability to learn, but also interpersonal skills. This suggests that interaction, communication and co-operation between teachers and students in the educational process have a significant impact on learning outcomes.

Research in educational psychology has shown that its application in teaching can be better implemented to effectively develop learners' intercultural communication skills. This approach helps learners to form language habits through repeated stimuli and responses, thus improving their communicative competence.

In addition, teaching interactions and classroom interactions are also important ways to improve communicative competence. Positive interaction and codevelopment between teachers and students during the teaching process help students to better apply what they have learned in actual communication. This interaction involves not only behavioral exchanges, but also emotional and cognitive interactions, which are key factors in building effective communicative competence.

The overall goal of this learning model is to use VRT to cultivate students' communication skills. Specifically, it aims to achieve the following goals:

First, to enable students to develop a positive attitude towards communication;

Second, to enable students to have the desire to communicate and certain communication skills;

Third, to enable students to communicate smoothly and effectively with people other than classmates and teachers, and actively cooperate as needed.

4.2.2.3 Basic ideas for learning model design

Focusing on the overall goal of using VRT to cultivate students' communication skills, this learning model establishes the design concept as "let every student experience the joy of communication through VRT". The basic philosophy of designing is to achieve the emotionalization of the course and reflect the supporting role of VRT, so as to maximize the development and cultivation of students' communication skills.

First, we should make the course emotional and create interactive and mutually beneficial T-S and S-S relationships. In teaching, we should increase the proximity between teachers and students, and between students, and shorten the physical and psychological distance between each other. Teachers should provide love and care to students, respect the dignity and value of each student, and lead students to learn to appreciate each other. Only when T-S, and S-S have established a sense of security and closeness can they express their true thoughts and communicate effectively.

Second, reflect the supporting role of VRT. The previous article has discussed that VRT takes a unique part in the cultivation of undergraduates' communication skills, breaking through the time and space limitations of students' communication and cooperation, which is conducive to the acquisition of resources and efficiency of students' cooperation process, expanding students' communication and cooperation horizons, helping students experience the results of cooperation, reflect on communication and cooperation behaviors and attitudes, deepen their understanding of communication and cooperation, and enhance cooperation awareness and communication skills, etc. Therefore, in the process of teaching design and teaching, this supporting role of VRT should be reflected and effectively utilized.

4.2.2.4 Media and learning resources

Media include blackboards, whiteboards, slides, courseware, digital videos, etc. Learning resources include textbooks, VRT, etc.

4.2.2.5 Specific steps of the VRT learning model

According to the teacher's suggestion, the learning model was implemented for 6 weeks, once a week, two classes each time. The designed learning model is as follows:

Step 1: Analyze the problem. Based on PBL learning theory, "problems" are the starting point and focus of creating learning situations in this learning model. First, "problems" are created based on learners' learning goals and learning content. Secondly, they should be open-ended questions that come from real life. Such questions have no fixed answers or solutions. Learners need to communicate with their peers based on their actual experience to get answers. Finally, it should inspire learners to explore and discuss related knowledge areas. Therefore, teachers will adhere to the above principles and lead students to analyze the corresponding problems.

For law students, different cases have different levels of difficulty. Teachers will select simple cases that can be applied to summary proceedings and classify them into one category for students to use in the early stages of implementing the learning model. Teachers will classify cases that must be used in ordinary procedures into one category. These cases are relatively complex and involve more roles in the trial. These cases are for students to use in the later stages of the learning model.

Example: Mr. Zhang and Ms. Li are neighbors. Mr. Zhang has a dog at home, and the dog usually roams freely in the yard. One day, Ms. Li noticed that a flower pot she had placed in her yard was knocked over by Mr. Zhang's dog and the flowers in the pot were damaged. Believing that the dog had entered and exited her yard several times, causing damage to her belongings, and providing photos of the damaged flower pots and flowers as well as evidence of the dog's entry into her yard, Ms. Li sued Mr. Zhang in court for RMB 1,000 yuan in damages. And Mr. Zhang expressed his willingness to negotiate a settlement. The amount in dispute in this case was relatively small, and the procedure was simple and could usually be resolved in a single court hearing, saving both parties time and costs, so summary proceedings could be applied to the court hearing. Step 2: Creating Learning Contexts. Constructivism believes that individuals actively construct knowledge and understanding through interaction with the environment . Creating a learning situation is to arouse and increase students' interest in learning, arouse the desire to explore, as well as build a bridge between new knowledge and old knowledge. Teachers carefully select legal cases suitable for students based on teaching needs, set up the roles required for the case in the 3D legal teaching laboratory system, or select existing legal cases in the system as needed, and edit and modify them to meet their own teaching needs and guide students into situational learning.

Step 3: Individuals team up with virtual people to explore and learn. The cultivation of college students' communication skills from a constructivism perspective should focus on students' subjectivity and participation, encourage students to actively take part in communication activities, as well as supply appropriate guidance and support to help undergraduates to enhance communication skills. In this step, students use the 3D legal teaching laboratory system, select a trial role in a case in the system, and team up with virtual people in the system to simulate a court trial.

Step 4: Individuals team up with classmates to explore and learn. According to the relevant theories of communication, communication is to exchange information with others in all directions through the use of language and non-verbal means. After the students have completed the previous stage of teaming up with virtual people, they have already had a preliminary understanding of the learning process. This stage is to conduct individual teaming up with other classmates, and the students in the group cooperate with each other to conduct a mock court trial.

Step 5: Mutual evaluation within the group . After completing the study, students will conduct mutual evaluation among their classmates in the group . This is a stage that can reflect students' ability to express, listen, understand and control emotions. Students will express their evaluation of other students' performance in group study one by one, and listen carefully to other students' evaluation, especially their own evaluation, and understand the true meaning of the other party's expression. Moreover,

when evaluating others and being evaluated by others, they should effectively control their emotions so that everyone's communication can proceed smoothly.

Step 6: Comprehensive evaluation. After the peer evaluation within the group, students will conduct self-evaluation, pointing out their own strengths and weaknesses in the whole process, proposing improvement measures, and estimating their own performance; each group of students will collectively summarize the difficulties appeared in the whole process and the improvement plan. Teachers will evaluate the individuals and groups according to the performance of the individuals in each group and the whole group.

Step 7: Teacher guidance. In essence, teacher guidance is not a part of this learning model, but according to the Constructivism theory, the role of teachers is also very important. As a facilitator, teachers focus on students and their learning and help them understand. Therefore, in addition to "analyzing problems" and "creating learning situations" which are mainly led by teachers, teacher guidance also plays an auxiliary role in the other four links.

Designed learning model is shown in the figure below.


FIGURE 8 VRT learning model

## 4.2.3 Results of Quality Check on the Learning Model

The researcher contacted some experts to conduct a quality check on the learning model. The consistency and applicability of the learning model were evaluated by five experts ( two experts in the field of law and three experts in the field of education ).

The experts checked the consistency of each component of the learning model. The data was collected, and then analyzed and evaluated. The results for the project goal consistency index (IOC) are in Appendix 7. The evaluation shows that the IOC ranges from 0.6 to 1.0, which is above the standard of 0.5. This means that each component of the learning model evaluated by the experts is consistent with each other.

The experts checked the suitability of each component of the learning model. After collecting the data, the researcher analyzed and evaluated the data. The suitability evaluation results include the mean score, standard deviation and item suitability level, and the results are shown in Appendix 8. The suitability evaluation results show that the mean score is between 3.8 and 4.8, the standard deviation is between 0.447 and 0.894, and the average score of the learning model suitability learning model evaluated by the experts have good suitability. Specifically, the design principles of the learning model are reasonable and can guide practice, and the selected theoretical concepts can effectively support the learning model. The goals of the learning model are clear, specific, measurable, evaluable, and suitable for the target group; the content and learning activities of the model can meet the goals of the model . The learning activities and teaching materials are interesting and can achieve the learning goals. The evaluation of the learning model meets the goals of the model , is suitable for the target group, and can be used in practice.

### 4.2.4 Adjust the Learning Model Based on Expert Advice

Experts made some suggestions for modification based on their evaluation of the learning model. Taking the experts' opinions into consideration, researcher modified the learning model. The comparison table before and after the modification is as follows:

## TABLE 8 Learning mode modification table

Before fixing	After	Reasons for modification			
		"Analyzing the problem" is the			
Analyze problem	none	teacher's preparation work, not a step			
		in the learning model.			
Constructing looming situations	Creating Learning Contexts	The modified expression is more			
	Creating Learning Contexts	accurate			
Individual and virtual human	Students team up with virtual	The modified expression is more			
team-up inquiry learning	humans to explore and learn	accurate			
Individual and team-based	Teamwork among	The modified expression is more			
learning	classmates	accurate			
	Croup discussion	The modified expression is more			
	Group discussion	accurate			
Overview	Overview				
Teacher guidance	Teacher guidance	2:			

After modification, the model was changed from 7 parts to 6 parts. The specific steps are the first 5 items, and the last item is teacher guidance throughout these 5 steps.

The adjusted learning mode is shown in the figure below.



FIGURE 9 The VRT learning model

4.3 Evaluation Results of the Effectiveness of VRT-Based Learning Model for Improving Undergraduate Communication Skills

## 4.3.1 Implementation of learning model

The experimental samples of this study are 50 students aged 18 and above from Class 1, Law School, Grade 2023, Zhoukou Normal University. The researcher used the 3D legal practice laboratory system built on virtual practice technology by the School of Politics and Law of Zhoukou Normal University to develop a virtual situational learning model and implemented the learning model in the laboratory for a total of 6 weeks, once a week, two class hours each time.





The implementation steps are as follows:

1) Creating Learning Contexts

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FIGURE 11 Teacher management interface

The teacher carefully selects legal cases suitable for students according to the needs of teaching, sets up the roles required for the case in the 3D legal teaching laboratory system, or selects existing legal cases in the system and edits and modifies them to meet their own teaching needs.



FIGURE 12 Teachers design interfaces for learning content

(2) Students team up with virtual people to explore and learn

The teacher guides students to enter the simulated trial and select the legal cases given by the teacher or the cases in the system, select the roles they need to train, use their own knowledge, and participate in the trial from the perspective of the court role.

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FIGURE 13 The interface for students to select cases

The other roles required for the trial will be simulated by the system, and the human-computer interaction will be simulated for training. When selecting cases, the teacher guides students to select simple cases for training first, and then select relatively difficult cases for training after they are familiar with them.

(3) Teamwork and Inquiry Learning

Several students can form a team to participate in the same case training. Team members choose different roles in the same case to cooperate in simulation training. When selecting cases, they also follow the principle of starting with the easy and then the difficult.

Students can ask questions in the system to interact with teachers, or post in the exchange forum to interact with others. Students can consult the laws and regulations stored in the system when necessary.



FIGURE 14 The interface after students enter the system

## (4) Group discussion

Students first share the inquiry learning resources they use among the group, report the results of the inquiry learning conducted by writing with others, and evaluate their own performance; based on the sharing of other students in the group,

they comment on the performance of the students in the group. Teachers can participate in group discussions and provide guidance to them.

(5) Comprehensive evaluation

Students submit their own tasks, and teachers evaluate students' work and interact with them. Based on the teacher's evaluation, students can choose to re-simulate or start a new simulation as needed in their own time.

(6) Teacher guidance

The VRT is used to construct a learning model to improve college students' communication skills. The teacher's guidance can be reflected in many aspects:

1) Providing professional knowledge and skills training. Teachers can choose professional materials suitable for students' learning stage and put them into the system, such as legal and regulatory compilation materials, case compilation materials, etc.; they can also put some common knowledge materials such as communication and etiquette into the system so that students can learn and refer to them at any time.

2) Constructing learning situations. Constructing learning situations is the most basic and core link in the development of learning models. PBL theory and constructivism theory provide a theoretical basis for constructing learning situations with students as the main body and teachers as the guide, and collaborative interaction. However, teachers must design suitable for students in combination with the characteristics of their majors.

3) Promote teamwork and collective building: Teachers can use VRT to organize teamwork tasks and enhance students' collaboration and collective awareness. For example, by completing project tasks in virtual reality together, students can learn how to communicate effectively, divide work and cooperate, and resolve conflicts in a team.

4) Provide personalized feedback and guidance: Teachers can use VRT to monitor and evaluate students' performance in real time and provide personalized feedback and guidance. For example, teachers can make specific suggestions for improvement based on students' performance in virtual reality to help students make continuous progress.

5) Inspire students' positive attitudes: Teachers can help students establish a positive interpersonal attitude through positive psychological hints and incentive mechanisms. For example, through positive feedback and reward mechanisms in virtual reality, students are encouraged to maintain an optimistic and positive attitude when facing difficulties and challenges.

6) Expand horizons and social adaptability: Teachers can use VRT to help students understand and adapt to social and professional environments and prepare for future employment. For example, through simulated work scenes in virtual reality, students can become familiar with workplace culture and work processes in advance and enhance their social adaptability.

During the implementation of the learning model, teachers observe students' performance throughout the process, provide guidance when students need it, and comment on students after they complete their work.

4.3.2 Results of Pre- and Post-experimental Tests

The researcher implemented a VRT-based learning model to improve undergraduate communication skills in Class 1, Law School, 2023, Zhoukou Normal University. The model was implemented for 6 weeks, once a week, and two class hours each time. Before and after the implementation of the learning model, the researcher conducted a communication skills test on all students in the class . A total of 50 people participated in the test, with a participation rate of 100%. 50 test papers were collected , of which 50 were valid test papers , with an efficiency of 100%. The experimental class questionnaire used computer software to conduct pre-test and post-test of students' communication skills and conduct descriptive statistics. The mean score, standard deviation (SD) and level are shown in Table 9:

	Results (N=50)							
Evaluation at a glance	Pre-test		Post-test	t	Р			
	Mean	S.D	Mean	S.D				
Expression skills	2.87	0.71	3.40	0.57	5.10	<0.001		
Listening skills	2.83	0.60	3.21	0.67	3.67	0.001		
Understanding skills	2.06	0.59	2.51	0.60	4.74	<0.001		
Emotional control skills	2.90	0.64	3.53	0.65	5.87	<0.001		
Overall performance	10.65	1.63	12.65	1.50	9.27	<0.001		
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TABLE 9 Descriptive statistical results of communication skills of students in experimental classes

From Table 9, after applying the learning model in certain classes, the four elements of undergraduates' communication skills and overall performance showed significant improvement after pre- and post-tests, with corresponding t values of 5.10, 3.67, 4.74, 5.87, and 9.27, respectively, and the corresponding p values were all less than 0.001, proving that this learning model is significantly effective in improving students' communication skills.

## 4.3.3 Results of Student Interviews After Implementation of the Learning Model

After concluding the VRT learning model, 5 students from the experimental class were randomly selected for interviews to assess their learning outcomes. The main points from the interviews are summarized below.

(1) Students' experience of the learning model of VRT to enhance students' communication skills

Students generally hold that the advantage of the VRT learning model is that the constructed scenarios are more realistic and the operation is relatively free, but the VRT learning model must rely on the external teaching environment and has certain limitations in the use of equipment.

"Through the VRT learning model, I can clearly see the overall layout of the scene, the number of people, and the seating arrangement. It is more realistic than the scenes shown in pictures by the teacher in traditional teaching, and it also allows me to operate freely in this class. This teaching method is more interesting than ordinary classes. I can learn some knowledge intuitively and it is also very interactive. The disadvantage is that the VRT learning model is more dependent on the device, and the software needs to respond in time during the operation." (Student 1)

In terms of sensory experience, students believe that the VRT learning model is more immersive than the traditional learning model.

"The VRT learning model is more immersive than the traditional learning model. The scenes created by VRT can put you into the role, but the sense of reality needs to be further enhanced. Because I usually learn from books, this is my first time to come into contact with VRT, so I am a little unfamiliar with the software operation." (Student 2)

The biggest feeling that the VRT learning mode brings to students is that they find the course learning interesting and can effectively remember the relevant operations and knowledge. In the VRT learning mode, students can control the distance of the field of view to zoom in and out, understand the details of the scene in detail, and remember the knowledge points more deeply.

"The VRT learning model is very novel and fun. It makes learning less boring and allows me to take the initiative to learn and explore. In previous classes, I mainly listened to the teacher and imagined things myself. But without the real objects in front of me, there were many things I couldn't imagine. The VRT learning model has dynamic content and can show many realistic scenes. I can also switch perspectives and observe and operate in all directions." (Student 3)

(2) The influences of VRT on students' communication skills learning model

Using the VRT learning model can improve students' communication skills .

"The virtual reality learning model can effectively improve my communication skills. In traditional classrooms, we just passively listen to the teacher's lectures and rarely have the opportunity to express our own opinions. In the 3D virtual training platform, I must communicate with other students or virtual people and cooperate with each other to complete the task. When evaluating within the group, I must think carefully, express my own opinions accurately, and listen carefully to other students' evaluations of me, otherwise it may be difficult for me to understand their true meaning of their evaluation of me. Of course, when I evaluate others, I must control my tone and expression to avoid misunderstandings from my classmates; when others evaluate me, I must be able to control my emotions, not show special happiness, and not get angry because of other people's criticisms. We are a team, classmates, and we must cooperate with each other to complete our tasks. This kind of classroom is the stage for us students to be the protagonists, and everything is decided by us. I think this method can improve my communication skills very well ." (Student 2)

Using the VRT learning mode could arouse and increase students' interest in learning.

"The VRT learning model can stimulate my interest in learning and focus my attention more than the teacher's blackboard writing. Because the VRT learning model can show the learning knowledge more intuitively, I have a deeper grasp and memory of the knowledge, which meets my learning needs in this class." (Student 4 )

Compared with previous traditional classrooms , the VRT learning model can improve students' practical skills.

"In previous classes, there were role-playing exercises, but before, we simulated the exercises according to the content in the textbook, so the knowledge points were relatively general and the understanding of the role was not so threedimensional. During the exercise, we might not understand the next action very well and get stuck. However, in the practical exercises after the VRT teaching, I will remember the knowledge points more clearly and will not forget them after the class." (Student 5)

Five students interviewed supported the application of VRT in teaching. They believed that the virtual reality learning model was beneficial to learning and hoped that this method could be used in future classes and that VRT could be applied to other subjects. They also made suggestions on the use of VRT in teaching.

" It is great to apply VRT to learning. It is very beneficial to learning. I hope more courses will use VRT in teaching. " (Student 1)

"The system is relatively simple and easy to learn. The operation can be made more difficult in the future . However, the teaching content can be simplified. Only the important knowledge points should be kept on the page ." (Student 4)

" I hope that teachers can see all students' computer screens through the electronic whiteboard and understand each student's learning progress . In addition, the practical part of the exam can be assessed using VRT. " (Student 5)

### 4.3.4 Effectiveness Evaluation Results

After modification, the model was finally divided into five parts, namely creating a learning situation in VR, group exploration and learning in VR, sharing and commenting on results, comprehensive evaluation, and teacher guidance. The specific steps are the first four items, and the last item, teacher guidance, runs through these four steps.

After modification, the model was finally divided into five parts, namely creating learning situations in VR, group exploratory learning in VR, sharing and commenting on results, comprehensive evaluation, and teacher guidance. The specific steps are the first four items, and the last item, teacher guidance, runs through these four steps.

Step 1: Creating learning contexts. Teachers carefully select legal cases suitable for students based on teaching needs, set up the roles required for the case in the 3D Legal Teaching Laboratory system, or select existing legal cases in the system and edit and modify them to meet their own teaching needs. Step 2: Group Inquiry Learning. Students can enter the mock trial and select the legal cases given by the teacher or the cases in the system, choose the role they need to train, use their knowledge, and participate in the trial from the perspective of the court role. Several students form a team, and the team members choose different roles in the same case to cooperate in the mock training; when there are insufficient members, students can choose a role alone, and the other roles required for the trial will be simulated by the system, and the human-computer interaction will be used for the mock training.

Step 3: Group discussion. Students first share their own inquiry learning resources with other groups, report the results of their inquiry learning with others, and evaluate their own performance; based on the sharing of other students in the group, they comment on the performance of their classmates in the group. Teachers can participate in group discussions and provide guidance to them.

Step 4: Comprehensive evaluation. Students submit their own tasks, and teachers evaluate and interact with students based on their work. Based on the teacher's evaluation, students can choose to re-do the simulation training or start a new simulation training in their own time as needed.

Step 5: Teacher guidance. Teacher guidance is not a specific link in this learning model, but runs through the first four links. Among them, "creating a learning situation" is mainly led by the teacher, while teachers take the part of assistance in the other links.

Final learning model determined after the experiment is shown in the figure below.



FIGURE 15 The VRT learning model

Before the modification, the learning model had 6 links, and after the modification, there were 5 links. The researcher merged the "students and virtual people team up for inquiry learning" link and the "classmates team up for inquiry learning" link in the learning model into "Group Inquiry Learning". The main reason is that the original model allowed students to team up with virtual people for inquiry learning first, and then team up with classmates for inquiry learning. However, in students' practice, some students directly choose to team up with classmates for inquiry learning when there are enough people, and only team up with virtual people for inquiry learning when there are not enough people. The researcher believe that the main role of students should be given full play, allowing them to freely choose how to team up to better meet the individual differences of students. Therefore, the modified learning model has become the above 5 links.

# Chapter 5

### Conclusion

This chapter summarizes and discusses the research status of the paper, as well as give some suggestions for the application of this learning model and suggestions for further research in the future. The discussion is divided into the following parts:

- 5.1 Major Findings
- 5.2 Discussion
- 5.3 Suggestions

## 5.1 Major Findings

The purpose of the current research is to develop a Virtual reality technology(VRT)-based learning model in order to provide strategic references for improving undergraduate students' communication skills.

1. Based on the relevant literature research, the researcher prepared a framework for interview questions for front-line college teachers and conducted semistructured interviews with 5 teachers who won the Henan Provincial College Teachers Teaching Skills Competition. Taking the literature research information and interview results of teachers as the foundation, the researcher determined the definition and components of undergraduate communication skills: undergraduate communication skills refer to the ability required for college students to communicate with others in all aspects through verbal and non-verbal means in order to smoothly and effectively establish good interpersonal relationships. The communication skills of Chinese undergraduates mainly include four aspects: expression skills, listening skills, understanding skills and emotional control skills.

2. According to the suggestions of semi-structured interviews with 5 teachers who won the Henan Provincial College Teachers Teaching Skills Competition, the learning model was implemented for 6 weeks, once a week, two class hours each time. The learning model designed by the researcher consists of seven steps: analyzing

problems, building learning situations, exploring learning in teams with virtual people, exploring learning in teams with classmates, mutual evaluation within the group, comprehensive evaluation, and teacher guidance.

The researcher invited experts to conduct a quality check on the learning model. The experts checked the consistency and suitability of each component of the learning model. After collecting the data, the researcher analyzed the data and the results showed that each component of the learning model was consistent with each other and had good suitability. Based on the experts' quality check of the learning model and the experts' suggestions, the researcher modified the learning model into six parts.

After implementing the learning model on students, the researcher modified the learning model again based on the experimental data analysis and students' feelings, and finally determined it to be divided into 5 parts, namely creating a learning situation, group inquiry learning, sharing and commenting on results, comprehensive evaluation, and teacher guidance. The specific steps are the first four items, and the last item, teacher guidance, runs through these four steps.

3. The researcher implemented a VRT-based learning model to improve undergraduate students' communication skills. Before and after the implementation of the learning model, the researcher conducted a communication skills test on all students in given classes. Results of the test supported the research hypothesis: after one and a half months of implementation, the undergraduates who participated in the learning model experiment had a certain improvement in their expression skills, listening skills, understanding skills, and emotional control skills , and the students' communication skills was significantly improved.

This test proves the effectiveness of VRT-based learning model developed in improving undergraduate communication skills. This result supports the existence of an effective combination of Problem-Based Learning(PBL) theory, Constructivism theory and VRT Theory in improving communication skills, which helps to fill the current research gap. Moreover, according to the experience interviews with students after the experiment, the use of this learning model not only improved their communication skills, but also significantly increased their interest in learning. Therefore, the learning model constructed in the study can be used directly or for reference by other college teachers in teaching; universities can also obtain a plan to improve undergraduate communication skills, allowing more teachers to intervene in students' learning to improve their communication skills.

### 5.2 Discussion

The discussion of the research results is divided into the following three aspects:

1. Definition and components of undergraduate communication skills

The researcher collected relevant literature on communication skills at home and abroad, studied the definition and components of communication skills, and on this basis, selected five teachers who won the Henan Provincial College Teachers Teaching Skills Competition for interviews. The interviewed teachers analyzed the communication skills of undergraduates based on the characteristics of Chinese undergraduates.

Communication is a social and psychological process of interaction between people. The realization of communication goals is affected by the communicator's background knowledge, skills, attitudes and cultural background. Communication skills is "the ability of communicators to choose appropriate behaviors to achieve personal and relationship goals under situational pressure and among various possible communication behaviors" (Spitzberg, 1991), and can "use effective oral, written and non-verbal communication methods to achieve multiple purposes (such as informing, teaching, inspiring, persuading and sharing ideas), including effective listening in different situations, using technological means to communicate, and being able to evaluate the effectiveness of communication" (Cuiping et al., 2020). Moreover, communication skills is a binary concept, that is, a person who is good at communication can not only achieve his or her own goals, but also achieve them in a way that satisfies the other party (Greene & Burleson, 2003). However, the teachers interviewed generally believe that the current communication skills of Chinese college students is not optimistic. Most students have a narrow range of communication, lack communication experience, are not good at talking to others, and even have not achieved real emotional communication between classmates. They prefer online social networking and rarely communicate face to face. Students neither have the patience to listen to other people's opinions nor the practice of using verbal expression, body expression and corresponding understanding to communicate. Therefore, when encountering conflicts that need to be reconciled, good communication skills can make the conflicts more smoothly resolved, while poor communication or no communication will lead to the deterioration of conflicts and thus cause a crisis in interpersonal relationships (Wang Jieying, 2020).

Expression skills is considered by many experts to be a basic element of communication skills. It includes both verbal expression of "when to say, when not to say, and what to say when, where, how and to whom" (Hymes, 1972), and non-verbal expression of "simultaneous sharing and attribution of meaning through symbolic interaction" (Seiler & Beall, 2005).

Listening skills refers to the ability to continuously receive and perceive other people's ideas, information, opinions, and intentions, and to respond promptly with non-verbal signals such as nodding, following in an interesting way, and making eye contact with the person being talked to. "Effective listening in different situations" (Cuiping et al., 2020) is an important way to achieve the purpose of communication. Listening, oral communication, written communication, non-verbal communication, and giving feedback together constitute the definition of communication (Nur'ashiqin Najmuddin, 2010). The interviewed teachers believe that many undergraduates do not have the patience to listen to other people's opinions and therefore cannot communicate effectively.

Understanding skills is the ability to accurately interpret and infer the information and intentions conveyed by others, and to find appropriate language responses to make the conversation go smoothly. It is the ability to accurately understand and correctly judge oneself, others, and communication situations (Zhang Shuhua, 2003) ; it is the ability to anticipate or imagine the main points of others (Alder & Rodman, 1994). Failure to correctly understand the issues that the communication partner wants to express may directly lead to communication failure.

Emotional control skills refers to the ability of an individual to effectively manage and control his or her emotional response during communication. It involves the ability of an individual to remain calm, rational and moderate in emotional expression when emotionally excited or conflict occurs, so as to ensure the effectiveness and constructiveness of communication (Sun Wanyan, 2023). Contemporary undergraduates are self-centered. Emotional control is the ability of an individual to regulate emotions, which enables individuals to actively manage emotions when dealing with problems and keep conflict events in a stable development state (Yao Yao, 2019). A survey in China showed that common negative emotions among college students are mostly anger, anxiety, depression, inferiority and sadness (Elibek & Chen Ziyan, 2022). A survey abroad showed that the top three negative emotions are: anxiety 27.89%, depression 27.87%, and anger 27.54% (Bravo et al., 2018). The interviewed teachers believe that the vicious incidents that have caused casualties in Chinese colleges and universities in recent years are often caused by trivial matters in life. Many college students lack communication experience, are self-centered, act capriciously, and do not pay attention to controlling their emotions, which leads to the intensification of conflicts and bad consequences.

Therefore, based on the study of communication theory and interviews with college teachers, researcher believe that Undergraduate communication skills refer to the ability of undergraduates to establish good interpersonal relationships, to express their intentions in an appropriate way, to listen carefully and correctly understand the other party's intentions, and to maintain a stable mood during the information exchange process so that the communication can proceed smoothly. The most important factors of undergraduate communication skills include: expression skills, listening skills, understanding skills and emotional control skills.

#### 2. Development of learning model

The development of the learning model in this study is based on communication theory, Constructivism theory, PBL learning theory and virtual reality related theories.

The learning model is a collection of concepts based on certain learning theories, composed of several elements and the relationships between them, with certain value orientations, and can guide the implementation of the learning process, strategy formulation, and practical application (Tyler, 2013). The learning model developed in this study has clear goals, principles, ideas, specific steps, and activities. Taking the results of the non-experimental class and the guidance of experts as the basis, the components and structural relationships of the learning model are clarified, which is studied to reveal its internal structure and operating mechanism (Zhong Zhuo, 2023). The learning model designed initially is adjusted to a certain extent, and after passing the consistency test and adaptability test, the teaching of the experimental class is officially carried out.

According to the PBL learning theory, while applying the learning model in the real teaching and learning context, the subject status of students is greatly respected, and students are put at the center of learning (Ning Shuquan, 2021). Teachers should provide guidance and coaching at critical moments. Teachers no longer answer students' questions, but are promoters of knowledge construction (Guo Xueqing, 2007). The PBL teaching method drives students to actively solve difficult problems (Kong Jia, 2019). This difficult problem is created by the teacher before class based on the teaching content and teaching knowledge points (Zhang Huanhuan, 2019). The "group inquiry learning", "comprehensive evaluation" and "results sharing and commenting" links in the learning model are all designed to promote students' active participation, "encouraging students to find the best solutions as much as possible" (Hmelo-Silver, 2004).

The cultivation of college students' communication skills from a constructivism perspective focuses on students' subjectivity and participation,

encourages undergraduates to engage in communication activities, and provides appropriate guidance and support to assist undergraduates to increase communication skills (Li Ming & Liu Lin, 2018). The virtual experimental environment constructed in the virtual simulation experiment is highly simulated, which can provide students with a situational learning environment, stimulate students' curiosity, actively explore and solve problems, deepen their understanding of knowledge, and promote learners' own meaning construction (Huang Yuxing, 2022). This learning model uses VRT to provide learners with learning situations that not only enrich students ' needs for diverse communication scenarios, but also promote students to concentrate their attention, actively communicate, and actively solve problems, thereby improving learners' learning efficiency.

3. Effectiveness of learning model

The main research method adopted in the learning model developed through VRT is quasi-experimental research. At the same time, the data obtained from teacher interviews and expert evaluations are used as a reference for adjusting and improving the learning model.

The researcher used a multi-stage sampling method to randomly select 50 students from Class 1, Law School, Grade 2023, School of Politics and Law, Zhoukou Normal University as a sample. The researchers implemented a six-week VRT learning model for students, once a week, two classes each, and each class lasted 50 minutes.

Researcher used data collection instruments to conduct certain tests on the sample population.

Data results of these tests show that the average score of the pre-test of undergraduates' communication skills is 2.66, standard deviation is 1.021; the average score of the post-test is 3.16, standard deviation is 1.017. Total score of the post-test and the scores of the four dimensions of communication skills have improved compared with the pre-test, proving that this learning model is helpful to increase undergraduates' communication skills. It is proved that after six weeks of VRT learning, the communication skills scores of the samples showed a significant upward trend compared with before participation, with a significance level of 0.05.

This result supports the existence of an effective combination of PBL theory, Constructivism theory and VRT Theory in improving communication skills, which helps to fill the current research gap.



4. The further new knowledge from this study

FIGURE 16 New knowledge

Constructing a learning situation is the most basic and core part of developing a learning model. PBL theory and Constructivism theory provide a theoretical basis for constructing a learning situation with students as the centre of learning, teachers as the guide for students, and collaborative interaction. However, teachers must design it to suit students based on the characteristics of their profession.

Introducing VRT into the learning model can solve the problem of many people conducting multiple training sessions at the same time, so that each student can get sufficient and effective training with relatively fewer time, which saves a lot of teaching time and greatly improves training efficiency.

This learning mode allows students to continue to use it independently and repeatedly after the experiment to continuously improve their communication skills.

### 5.3 Suggestions

The development and implementation of a VRT-based learning model aims to improve undergraduate communication skills. As for further improving the effects of this learning model so as to promote students to gain the expected learning results, researcher recommend taking the following measures:

5.3.1 Recommendations for This Research

1. Teachers who use this learning model should pay more attention to students' centre role in the teaching and learning process. Teachers should master the knowledge of designing learning activities based on learning theories such as constructivism and PBL. Teachers should participate in training in developing teaching situations, teaching techniques and learning management to strengthen their understanding and application of knowledge such as student-centered learning model development, teaching techniques and evaluation.

2. Teachers should acquire knowledge of VRT and have basic computer skills, receive training from professionals, establish awareness of information-based teaching, enhance teaching research and development capabilities, and develop new teaching and education methods, such as virtual preparation before class, virtual teaching during class, and virtual examinations after class, to promote the efficient development of undergraduate teaching. In addition to ensuring that they can operate the system smoothly, teachers should also be able to design cases that require practical training for students.

3. This learning model can be widely applied to various subjects, but it requires teachers to comprehensively analyze the various needs of students and design learning situations and questions based on students' majors, grades, and learning goals.

4. Before teaching, teachers should explain the characteristics of the VRTbased learning model, the roles of teachers and students, and the characteristics of the virtual interactive roles. They should also introduce the evaluation criteria for students to stimulate their learning awareness. This can also benefit the learning model's effects.

5.3.2 Suggestions for Further Research

1. Limitations of this study. This study used a non-immersive virtual reality system. The virtual environment was only a primary non-immersive virtual reality environment with pictures, images, text, etc. Students did not have a strong sense of involvement and immersion, so the effect was not perfect. The mainstream virtual reality systems currently used in teaching are higher-level non-immersive virtual reality systems. A few laboratories even use immersive virtual reality systems. This system gives students a strong sense of involvement and immersion, and the learning situation is relatively realistic, more interactive, and more conducive to student communication. If funds are sufficient, a higher-level immersive virtual reality system laboratory should be used to carry out experiments.

2. researcher can conduct in-depth research on communication theory based on their own majors, explore other dimensions in the communication skills structure that are suitable for undergraduate students in this major, and conduct more detailed analysis on students from different majors to reveal the characteristics of different dimensions of communication skills in various fields.

3. The learning model constructed in this study can be used directly or as a reference for other college teachers in their teaching. However, the selection of experimental subjects should take into account various types of schools and more majors to verify the learning model's positive effects from different angles. Topics and questions of the interviews with the teachers should be broader and more in-depth to obtain more representative data. The learning model can be implemented with more time to test its effectiveness much more clearly, and the experimental results can also be for much more time to verify the long-term effects and positive impacts of the learning model.

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APPENDIX

# APPENDIX A

UNDERGRADUATE COMMUNICATION SKILLS QUESTIONNAIRE

Dear students:

Thank you sincerely for participating in this survey! This survey is conducted anonymously for academic research purposes, with the aim of promoting the healthy growth and overall success of college students. Please fill in the questionnaire carefully and truthfully according to the prompts of the questionnaire, in order to provide scientific basis for this research. There is no right or wrong answer to this questionnaire, good or bad. We will keep all your information confidential. Thank you for your support!

Finally, I wish students success in their studies! Happy life!

Basic information filling:

College: Major:

Grade: Class:

Gender:

Only one answer can be selected for each question in this test. Please choose the answer that best suits your actual situation and tick "  $\sqrt{}$  " in the table. (Format)

	Project	Strongly	Agree	Neutral or	Neither	Disagree	Strongly
		Agree	- 1	Agree	nor		Disagree
		141	12	Disagree			
1. *When calling	Emotional	••••					
someone I'm not	control						
familiar with, I feel							
like I can't							
breathe easily							
2. *I was so	Emotional						
nervous during	control						
my speech that I							
forgot everything							
l did know							
3. *I am unable to	Emotional						
express my	control						

emotions freely in					
spoken					
language.					
4. * I find it	Understanding				
difficult to choose					
accurate and					
appropriate					
vocabulary when					
expressing my					
emotions.					
5. * Difficulty in	Emotional				
continuous	control	31	25		
conversations		STREET,		20	
6.During a	Understanding		F.		
conversation with	4 / _				
others, your		-			
reaction is usually				12:	
to repeat their	140.			5:1	
words, clarify	15	1.1			
them, and then		The second			
ask questions.		้นง	12		
7.During a	Understanding				
conversation with					
others, your					
response is					
usually to ask for					
a complete					
explanation of					
their opinion.					
8. Facing the	Listening				
speaker, lean					
forward.					
9. Proficient in	Expression				

expressing care					
and enthusiasm					
through eyes or					
touch.					
10. Listen to	Listening				
others' emotions,					
not just what they					
say					
11. Be good at	Expression				
expressing your					
meaning with			•••		
pronunciation		31	21-5		
and intonation		COLUMN TO A	and a second		
12. Appropriate	Expression			0	
expression of eye	4/_				
contact,	1 1 -	-		Y e	
gestures, and					
posture in	146				
communication	15.	- T -			
with others.		States of States			
13.Many times, I	Understanding	141	12		
don't know why		••••			
others are angry.					
14. It is difficult to	Expression	_			
speak about					
one's own					
troubles.					
15. * I cannot	Listening				
widely listen to					
various opinions					
and opinions					
16. * When	Listening		_		
someone talks to					

me or explains			
something to me,			
I find it difficult to			
concentrate on			
listening			

(Note: Questions marked with \* are scored in reverse)



#### APPENDIX B

.

OUTLINE OF POST EXPERIMENTAL STUDENT INTERVIEW

Dear classmates:

Hello! In order to understand your views on the application of VRT in law undergraduate courses, I hereby conduct an exclusive interview with you. Your interview record will be one of the important contents of my research. Thank you for your cooperation!

Interviewee: Interview Date:

1. Have you ever experienced VRT before?

2.Do you like this teaching method? Why?

3. Are you willing to use VRT to assist learning in the future classroom?

4. What is the biggest feeling left by the VRT experience for you? Does it have an impact on your learning outcomes compared to traditional classrooms?

5.Do you think there are any areas or suggestions for improvement in the virtual reality assisted teaching experience?



## APPENDIX C

...... OUTLINE OF POST EXPERIMENTAL TEACHER INTERVIEW .....

Dear teacher:

Hello! You are an award-winning teacher in the Henan Province Undergraduate University Teacher Classroom Teaching Innovation Competition, with exquisite teaching skills and deep affection from students. In order to understand the communication skills of undergraduate students and find effective ways to improve their communication skills, I am conducting an interview with you. Your outstanding teaching experience will provide important reference for my research. Thank you for your cooperation!

Interviewee:Gender:Age:Major:Length of teaching:Academic Degrees:Professional title :Award time:

1.What do you think are communication skills for undergraduate students? Is it important for undergraduate students?

2.What do you think are the elements of communication skills for undergraduate students?

3. What do you think should be paid attention to when designing questions to test undergraduate communication skills?

4.What are the problems with the current teaching model in improving students' communication skills?

5.What measures have you taken in class to mobilize students' enthusiasm for learning and encourage students to strengthen communication?

6.Do you think the application of VRT in teaching can help improve students' communication skills?

7.Do you think learning models are useful for improving teaching quality?

8. Do you think that developing a learning model aimed at improving students' communication skills requires strengthening the design of which links?

# APPENDIX D

INFORMATION ABOUT INTERVIEW TEACHERS · · · · · ·

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serial	gender	age	major	Teaching	Educational	Award	job title	Intervie
number				years	qualifications	time		w time
А	female	36	English	12 years	PhD	2021.12	Associat	
					candidate		е	
							Professo	
							r	
В	female	38	Applied	11 years	Master's	2020.12	Lecturer	
			statistics		degree			
С	female	36	Motors	11 years	Master's	2019.12	Associat	
			and		degree		е	
			electrica				Professo	
			T	31/18			r	
		÷.,	applianc	CTARGE S	00			
		- 15	es		2/4			
D	female	57	Choir	35 years	Ph.D.	2023.2	Professo	
		Y (	conduct		candidate		r	
			or			7 6		
E	female	36	Physics	6 years	Master's	2023.12	Lecturer	
		2	and the second	1 1 1	degree			
			52	Anne Part	1			

## APPENDIX E

CONSISTENCY EVALUATION OF DATA COLLECTION INSTRUMENTS

Serial Number	Project	1	2	3	4	5	IOC
1	Can you express care and enthusiasm through eye contact or touch	+1	+1	+1	+1	+1	1
2	Can you express ourselves with pronunciation and intonation	+1	+1	+1	+1	+1	1
3	Can you express ourselves through eye contact, gestures, and postures	+1	+1	+1	+1	+1	1
4	Can you express your troubles	+1	+1	+1	+1	+1	1
5	Your posture when facing the speaker	+1	+1	+1	+1	0	0.8
6	Can you listen to others' emotions	+1	+1	+1	+1	+1	1
7	Can you widely listen to various opinions and perspectives	+1	+1	+1	+1	+1	1
8	Can you concentrate on listening to what others say to you	+1	+1	+1	0	+1	0.8
9	Can you choose accurate and appropriate vocabulary to express your emotions	+1	+1	+1	+1	+1	1
10	Do you often need to repeat what others say when talking to them, and then ask questions after clarifying	+1	+1	+1	0	+1	0.8
11	Do you often communicate with others by asking them to fully explain their opinions	+1	+1	+1	+1	+1	1
12	Do you often not understand why others get angry	+1	+1	+1	0	+1	0.8
13	Do you feel difficulty breathing when calling unfamiliar people	+1	+1	+1	+1	+1	1
14	Is it because I was too nervous during the speech and forgot everything I knew	+1	+1	+1	+1	+1	1
15	Can I express my emotions fluently in spoken language	+1	+1	+1	0	+1	0.8
16	Do you find it difficult to have continuous conversations	+1	+1	+1	+1	+1	1
Overall av	erage					0.9	94

APPENDIX F

APPLICABILITY EVALUATION OF DATA COLLECTION INSTRUMENTS

Evaluation items	5	Exp	ert eva	aluatio	on resi	ults	averag	20	adaptatio
Componment	Items	1	2	3	4	5	e value	50	n
Expression	Can we express care and enthusiasm through eye contact or touch	4	5	4	5	5	4.60	0.548	Very high level
	Can we express ourselves with pronunciation and intonation	5	4	4	5	5	4.60	0.548	Very high level
SKIIIS	Can we express ourselves through eye contact, gestures, and postures	4	5	5	5	5	4.80	0.447	Very high level
	Can you express your troubles	4	5	5	4	5	4.60	0.548	Very high level
	Your posture when facing the speaker	4	5	4	5	5	4.60	0.548	Very high level
	Can you listen to others' emotions	4	4	5	5	5	4.60	0.548	Very high level
Listening skills	Can we widely listen to various opinions and perspectives	4	5	4	5	5	4.60	0.548	Very high level
	Can you concentrate on listening to what others say to you	4	5	4	5	5	4.60	0.548	Very high level
Understandin	Can you choose accurate and appropriate vocabulary to express your emotions	5	4	5	4	5	4.60	0.548	Very high level
	Do you often need to repeat what others say when talking to them,	5	4	5	4	5	4.60	0.548	Very high level

	and then ask questions								
	after clarifying								
	Do you often								
	communicate with others	Б	Б	4	Б	1	4.60	0 5 4 9	Very high
	by asking them to fully	5	5	4	5	4	4.00	0.040	level
	explain their opinions								
	Do you often not								Venyhiah
	understand why others	4	5	4	5	5	4.60	0.548	
	get angry								16461
	Do you feel difficulty								
	breathing when calling	5	3	4	4	5	4.20	0.837	High level
	unfamiliar people	1/	3	5					
	ls it because I was too	1000					4.80	0.447	
	nervous during the	5	5	5	5	6 4			Very high
Emotional	speech and forgot	5			D				level
	everything I knew								
CONTROLSKINS	Can I express my				. #	7			Venyhiah
	emotions fluently in	4	5	4	5	5	4.60	0.548	
	spoken language	T.		ß		<u> </u>			16461
	Do you find it difficult to	tores:	SER.	-	2				
	have continuous	3	4	4	4	5	4.00	0.707	High level
	conversations	•							
Overall average	Overall average								

## APPENDIX G

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CONSISTENCY EVALUATION OF THE LEARNING MODEL

Serial		E>	pert con	sensus			100
Number	Project	1	2	3	4	5	IOC
1	Teaching model background and basic concepts	1	0	1	1	0	0.60
2	Basic concepts and goals of teaching model	1	1	1	0	1	0.80
3	Goals of teaching model and learning activities	1	0	1	1	1	0.80
4	Teaching objectives and teaching content	0	1	1	0	1	0.60
5	Teaching objectives and learning activities	183-	0	1	1	0	0.60
6	Teaching content and learning activities	0	1	1	1	1	0.80
7	Teaching content and learning materials	0	0	1	1	1	0.60
8	Teaching content and learning resources	1	1	1	1	1	1.00
9	Teaching content and study time	1	0	1	1	1	0.80
10	Teaching evaluation and course objectives	219		C			0.80
Ov	erall average						0.74

#### APPENDIX H

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APPLICABILITY EVALUATION OF THE LEARNING MODEL

	Expe	ert eval	uation r	results		Average	00	
Assessment project list	1	2	3	4	5	value	50	Adaptation
1. Principles of teaching model								
1.1 The teaching model is reasonable in principle	5	5	4	4	5	4.60	0.54 8	Very high level
1.2 The principles of the teaching model are clear and practical	4	5	4	5	5	4.60	0.54 8	Very high level
1.3 Teaching model principles and basic concepts are accurate	5	4	5	4	5	4.60	0.54 8	Very high level
1.4 The teaching model principles are supported by theory	4	5	4	3	3	3.80	0.83 7	High level
2. Teaching model goals		-	and the second second	18	20			
2.1 The teaching model has clear goals	5	4	5	4	5	4.60	0.54 8	Very high level
2.2 The objectives of the teaching model are feasible	5	4	5	5	4	4.60	0.54 8	Very high level
2.3 The objectives of the teaching model are suitable for students	5	5	5	4	3	4.40	0.89 4	High level
3. Teaching media	1000	Care of	and the	1			I	
3.1 The selection of teaching media can meet teaching needs	5	4	5	5	4	4.60	0.54 8	Very high level
3.2 The selection of teaching media is suitable for the teaching mode	5	5	4	5	4	4.60	0.54 8	Very high level
4. Learning resources								
4.1 Learning resources are consistent with course objectives	4	5	4	4	3	4.00	0.70 7	High level
4.2 Learning resources are suitable for students	5	4	5	5	4	4.60	0.54 8	Very high level
4.3 Learning resources are suitable for learning activities	4	5	5	5	5	4.80	0.44 7	Very high level

4.4 Can encourage students' learning activities and achieve goals	4	5	4	4	3	4.00	0.70 7	High level
5. Teaching steps	•	•	•	•				
Step1: analysis of questions	5	4	5	4	5	4.60	0.54 8	Very high level
Step2: create a learning context	4	5	5	5	5	4.80	0.44 7	Very high level
Step3: teachers' guidance	5	4	4	4	3	4.00	0.70 7	High level
Step4: making use of the learning platform	4	4	4	5	3	4.00	0.70 7	High level
Step5: inquiry learning in groups	5	4	4	5	3	4.20	0.83 7	High level
Step6: evaluation within groups	5	4	5	4	5	4.60	0.54 8	Very high level
Step7: comprehensive evaluation	4	4	5	3	4	4.00	0.70 7	High level
6. Learning evaluation		1		1				
6.1 Evaluation indicators are suitable for students	4	5	4	3	4	4.00	0.70 7	High level
6.2 Evaluation covers measurement and evaluation objectives	5	5	4	5	4	4.60	0.54 8	Very high level
Overall average	0.62 4							



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