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A Study on the Modality System of External Culture Publicity Discourse from the Multimodal Perspective

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Abstract: Based on the theory of multimodal discourse analysis and SFL, this research analyzes the modality systems of images and language in external culture publicity discourse. This research shows that: first, language and image mainly choose the median modality, which is not only conducive to establishing an equal and harmonious status relationship with the audience, better enabling the audience to accept the propaganda content. Second, compared with image, language symbols have less choice of modality expression. Language enhances the expression of images through subtitles, and increases the objectivity and credibility of publicity content. Third, because images account for the main components of discourse information flow, images use more modality, and the frequency of modality expressions is consistent with the video propaganda content, including beginning, development, climax and end. In the climax of the content, image and language symbols complement each other to strengthen the expression effect and leave a deep impression on the audience through using high modality.

Keywords: Modality System; Multimodal Discourse; External Culture Publicity Discourse

1. INTRODUCTION

In the process of the development of human society, culture is created and developed jointly by people in a specific historical, geographical and social environment, and it is the embodiment of human collective experience and wisdom. Different cultures are the synthesis of ideas, values, behaviors, art forms, social systems and traditional customs of people in different communities. Chinese culture is a series of values, ideas, art forms, ethics, customs and social systems inherited and passed down by the Chinese people. It has played an important guiding role in the history of China and has profoundly influenced the thinking, behavior and social life of the Chinese people. In today's world, with the development of science and technology, in the context of cultural exchanges and cooperation between different countries and regions, cultural publicity is of great significance. The publicity of Chinese culture is conducive to enhancing the recognition of Chinese culture by all countries in the world, promoting international mutual understanding, and showing the

unique value of Chinese culture to the world, shaping a positive international image and enhancing the influence of the international community.

From the perspective of Chinese cultural external publicity, cultural external publicity is to introduce a real China to foreign people fairly from the strategic perspective of the fundamental interests of the Party and the country by using culture as the carrier and modern media or other communication methods, so as to enhance their understanding and support for China (Liang Yan, 2015:20). As for the research on the external publicity discourse of Chinese traditional culture, the current research mainly makes a systematic and in-depth study on external publicity translation from the aspects of the attributes and characteristics of external publicity translation, the strategies and methods of external publicity translation and the principles of external publicity translation (Hu Kaibao, 2023).

With the rise of social media, the single language medium is gradually replaced by complex media composed of language, image and sound (Feng Dezheng et al., 2014). In the new media environment, publicity discourse gradually adopts multi-modal expression. External culture publicity is communicated through the interrelationship between language, images, audio, visual symbols and other elements, so as to achieve better cultural dissemination. In addition, in the face of audiences from different cultural backgrounds, it is an important issue how to spread culture in a way that is in line with the audience's habits, and how to seek for the commonality of interests, needs and emotions, and establish good interpersonal meaning. In SFL (Systemic Functional Linguistics), Halliday (2000) argued that language has three meta-functions, which can realize conceptual function, interpersonal function and textual function respectively. Interpersonal function refers to the interactive relationship between the two parties, including their own emotional attitude and the behavior and attitude that affect each other. The interpersonal meaning is mainly embodied through the modality system. Therefore, this study studies the interpersonal meaning constructed by modality system in the discourse of publicity from a multi-modal perspective.

2. THEORETICAL FRAMEWORK

2.1 Modality system in visual grammar

In multimodal discourse analysis, the construction and understanding of meaning need to pay attention not only to linguistic signs, but also to other symbolic resources. Kress & Van Leeuwen (1996) believed that multimodal is the combination of multiple symbols, and explored the phenomenon of multimodal regular expression of meaning by studying the relationship between modes and media. They construct visual grammar theory based on the three functions in SFL, extending the object of analysis from language to image. In image analysis, interpersonal relationships are realized through interactive meaning, and modality in interactive meaning is used to describe the degree of consistency between images and the objective real world, including: high, medium and low. According to Kress & van Leeuwen (2006:156-158), the level of modality values is achieved by modality markers, including: color saturation, color differentiation, color coordination, lighting, and brightness[1].

2.2 Modality system in sfl

In systemic functional grammar (SFG). Modality refers to the degree between affirmation and negation, reflecting the speaker's attitude of speaking (Halliday 1994: 356-357). Modality system means that the speaker explains his or her attitude or intention towards an event through the sentences in the text, with his or her own subjective and objective emotions and attitudes, which can be said to be the keynote of the evaluation of the event in a sense (Niu,2018). According to SFL, Halliday (2000) divided modality values into three categories: the high value, which usually expresses requirements; the medium value, which usually expresses permission; the low value, which usually expresses possible. The level of modality is related to the balance of rights and status between the communicative parties[2]. Geoff Thompson (1996: 62) argues that modality and modality structures in discourse can express the degree of responsibility of the speaker's open subjective evaluation. In cultural publicity, the relationship between rights and status between the communicative parties is crucial to cultural communication[3].

3. RESEARCH DESIGN

3.1 The corpus

In this study, "The 24 Solar Terms of China Festival", a short Chinese-English bilingual video series published by China Daily, is selected as the research corpus, and the body part of the video is 18-4:08 seconds. 4:09 SEC to 4:19 SEC is the end title of the video, and this paper chooses the body part for research. With traditional Chinese festivals and solar terms as its content, the festival combines animation and real scenes to introduce traditional Chinese culture to the audience, showing the integration of traditional Chinese culture and contemporary

development.

3.2 Research steps

This study analyzes the modality system in selected discourse from the multimodal perspective. The research analyzes language and image respectively, including the following steps: (1) To classify the characteristics of the modality system of language in external culture publicity discourse, and explore the interpersonal meaning of the modality system of language; (2) Based on the framework of visual grammar modality system analysis, Elan software was used to label the modality system of image symbols in the video by quantitative statistics, and the interactive significance of the modality system of image symbols was qualitatively discussed; (3) To explore the integration and co-construction of interpersonal meaning of the modality system in external culture publicity discourse[4].

4. DISCUSSION OF MODALITY SYSTEM IN EXTERNAL CULTURAL PUBLICITY DISCOURSE

4.1 Modality system in visual mode

By labeling the color saturation, color differentiation, color coordination, illumination and brightness of the image modes, the statistical findings of modality characteristics are shown in Table 1. The median modality is dominant, appearing 37 times, accounting for 40.7% of the time. Second, high-value modality appears 30 times, accounting for 31.2% of the time. The low modality is the least, accounting for only 28.1% of the time. In the distribution of modality system, high modality and median modality are mainly distributed in the middle part of the video, while low modality images are mainly at the beginning and end of the video[5].

Table 1 The distribution of visual modality value

| | High modality | Median modality | Low modality |
|-----------|---------------|-----------------|--------------|
| Frequency | 30 | 37 | 33 |
| Percent | 31. 2% | 40.7% | 28.1% |

In video production, images dominate the information flow. In terms of the selection of the overall modality of the image, the propagandist uses more high-saturation and bright colors, and the color differentiation of the image is also obvious. When introducing the main content, in the middle climax of the video, the propagandist expresses it through high modality, while the median modality is supplemented to highlight the content theme of the video. The image contains a variety of colors, and the color saturation and brightness are high. From the perspective of contextualization, the picture has bright colors, giving people a sense of comfort, and the content in the image is also very close to life, so that the audience can feel the beauty and charm of culture, thus stimulating the audience's curiosity and enthusiasm for understanding[6].

4.2 Modality system in language mode

In external culture publicity discourse, propagandists express their views on things and their attitudes and views through modality choice, which also affects the audience's attitudes and views on things. According to the division of modality values in SFL, in the external culture publicity discourse, the propagandist chooses less modality values to express themselves, and at the same time, only the expressions of low and medium modality are selected in the selected modality system, as follows[7].

Nowadays, the 24 solar terms could not only be applied to farming, but also guide Chinese in everyday life.

Every year at Winter Solstice, emperors of the Ming and Qing dynasties would go to the Temple of Heaven to hold a ceremony to worship Heaven[8].

In (1) and (2), the propagandist used the median modality "would" and the low modality "could". In external culture publicity discourse, propagandists mainly spread culture through narration. In (1), propagandists use low modality "could", which is conducive to maintaining an equal relationship with the audience and creating a harmonious atmosphere. The propagandist introduces the source of culture to the audience, which is not only conducive to the audience's better understanding and acceptance of different cultures, but also conducive to the development of subsequent content. In (2), when introducing traditional customs to the audience, the propagandist uses the verb "would" with a median modality. Median modality not only has the function of low modality, but also, because the introduction of traditional customs involves specific scenes and characters, the use of median modality "would" help increase the audience's sense of participation. In general, in external culture publicity discourse, the propagandists always maintain an equal status relationship with the audience through the use of low and median modalities, and both sides always maintain a harmonious and stable relationship. In the introduction of content, publicity has less choice of modality, so as to minimize the impact of its own views on the audience, while ensuring the objectivity of the content and increasing the credibility of the audience[9].

4.3 Modality system analysis in external culture publicity discourse

The purpose of external culture publicity discourse is to promote the dissemination of culture, which should not only consider the characteristics of culture, but also consider the audience's acceptance and cultural background. In addition, the integration of the meanings of different mods is not the superposition of the meanings of a single symbol, but the meaning produced by two symbolic resources is greater than the sum of the meanings produced by each (Lim, 2004). After analyzing the modality of language and images, it is also necessary to explore how to integrate the modality system of the two symbols to

realize interpersonal meaning. Through analysis, the median modality is the main part in the choice of text and image modality system. This is conducive to the establishment of an equal and harmonious status relationship between the audience. Secondly, because the video media determines that the image dominates the information flow in its transmission, the frequency of modality of the image is higher than that of the language. In the beginning and end of the video content, low modality is mainly used. In the introduction of the main content, in the climax of the video, high modality is accompanied by images of low modality, and the language of median modality is used to strengthen the expression of the video content. This makes the modality distribution of external culture publicity discourse present the beginning, development, climax and end, which is consistent with the development of video introduction content.

5. CONCLUSION

External culture publicity discourse combines images and language to construct discourse. The purpose of cultural propaganda is to promote culture, so the audience's acceptance must be considered. Through the analysis of modality system of external culture publicity discourse, this research finds that, first, in the selection of modality system, language and image are mainly based on median modality, which is not only conducive to establishing an equal, friendly and harmonious status relationship with the audience, better enabling the audience to accept the propaganda content, but also enhancing the audience's sense of participation and stimulating their enthusiasm. Second, compared with image, language symbols have less choice of modality expression. Language enhances the expression of images through subtitles, and at the same time increases the objectivity and credibility of propaganda content when introducing cultural content. Third, because images account for the main components of discourse information flow, images use more modality expressions, and the frequency of modality expressions is consistent with the video propaganda content, including beginning, development, climax and end. In the climax of the content, image and language symbols complement each other to strengthen the expression effect and leave a deep impression on the audience through using high modality. Due to the limited corpus selection in this research, more detailed research is carried out by establishing a corpus of external culture publicity discourse in the later study. The modality system research of external culture publicity discourse can be more detailed. For example, from the perspective of linguistic genre, the modality analysis can be specific to the color or the saturation of this genre, it can be carried out to explore the stylistic characteristics of this genre.

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A Review of Derived Word Processing Research

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Abstract: Derivation, as a typical morphologically complex word, has been the focus of second language research in terms of lexical processing. This study reviews and summarizes the research on derived word processing at home and abroad. Three representative theoretical models in the field of derived word processing are firstly sorted out. Based on this, the study explores the influencing factors of derived word processing. Based on the existing research paradigms, the empirical studies on English derived word processing are evaluated and summarized. Finally, the paper points out the limitations of the existing studies on derived word processing and predicts the future research direction of the topic.

Keywords: Derived Words; Processing Model; Influencing Factors

1. INTRODUCTION

Mental lexicon focuses on how words are represented and processed in the brain, and given the importance of words in language use, the study of mental lexicon is a focus of research in psycholinguistics. Early studies in this field focused on simple words; in recent years, more and more scholars have focused on the representation and processing of multi-word morphemes. Comparatively speaking, most of the relevant empirical studies on the processing of multi-word morphemes have focused on the processing of inflected words and compound words, while there are fewer studies on the processing of derived words and the factors affecting them. However, derivation is the most common method of complex word formation in all languages, and derivatives are also the most frequently used complex words by L2 learners.

Derivation, as a prolific word formation, is usually formed by adding derivational affixes to word bases. The study of derived words is the focus of vocabulary processing research, and understanding the representation and processing patterns of derived words has practical significance for the acquisition, memorization and teaching methods of derived words. With the development of relevant event potential applications, ERP experiments are gradually used in lexical processing research, and the use of technological means to study the dynamic process of lexical processing has gradually emerged, and ERP research on derived words has gradually become a

hot topic. In view of the above background, this paper summarizes representative theoretical models in the existing research, and sorts out the existing research results in terms of the influencing factors of derived words and the experimental paradigm, based on which, it points out the future research direction and trend of this topic.

2. RELEVANT THEORETICAL MODELS FOR THE STUDY OF ENGLISH DERIVED WORD PROCESSING

There are two main theories of the processing and storage of complex word: the “decomposition model” theory and the “non-decomposition model” theory. The difference between these two theories lies in whether they affirm the influence of morphological structure in the processing of derivatives, i.e., whether complex words are processed as a whole, as in the case of simple words, or whether they are decomposed into their constituent morphemes. Early studies (e.g. Taft & Forster 1975; Zwitserlood 1994; Libben 1998)000, affirmed that the morphological structure of the lexicon influences the processing of complex words. On the contrary, some scholars (e.g. Butterworth 1983)0 have proposed that complex words can be extracted directly from the mental lexicon for whole word meanings, and are characterized and processed as a whole. Based on this, more and more scholars have proposed the “dual-route model” (e.g., Caramazza et al. 1988; Schreuder & Baayen 1995)00, which advocates that the two mechanisms of whole-word processing and decomposition processing can exist simultaneously and compete in the processing process.

2.1 Decomposition model

In 1975, Taft & Forster0 first proposed that morphologically complex words are represented in the mental lexicon by their constituent morphemes and are automatically processed individually via the decomposition route. The decomposition model assumes that morphological structure is obligatory and the access to the meaning of whole words can only be achieved on the basis of morphological decomposition. Researchers and scholars who support the decomposition model argue that multimorphemic words are decomposed during recognition and processing and stored according to their morphemes. For example, for the derived word “reader”, there are only two morphemes in the mental lexicon, the base word “read” and the affix “-er”, and

the term “reader” does not exist independently in the mental lexicon. In order to understand and process the word “reader”, we can only extract “read” and “-er” from the mental lexicon. Zhang (2014) explored the processing of English derivatives by Chinese learners using a masked initiation experiment, and the results of the study acknowledged the influence of morphological structure in the processing of bilingual complex words.

2.2 Non-decomposition model

The non-decomposition model takes the opposite view and denies the role of morphological structure in the processing of complex words. The decomposition model theory asserts that complex words exist independently in the mental lexicon in the form of morphemes, and that readers need to sacrifice their time to extract their constituent morphemes individually and then combine them semantically in order to achieve semantic access. The decomposition model theory reduces the processing efficiency. Therefore, the non-decomposition model theory is supported by many researchers. Butterworth (1983) claimed that derived words exist independently in the brain, and their meanings are extracted without decomposing their morphological structure, which leads to the semantic access directly. For example, the extraction of meaning from the derived word “helpless” does not require the addition of the meanings of the constituent morphemes “help” and “-less”. The word “helpless” exists independently in the human brain, just like the simple word.

2.3 Dual-route model

To date, a growing number of research has shown that there are divergent theoretical models of derived words and other complex word processing. Based on this, some scholars have proposed a “dual-route model” (e.g., Caramazza et al. 1988; Schreuder & Baayen 1997) by combining the main advantages of the two theories, i.e., there exist both whole-word and decomposition model in the processing process. Yao et al. (2012) investigated the role of word base frequency on the processing mechanism of inflected and derived words in two Chinese-English languages. The results showed that as the frequency of word bases increases, the participants’ response speed and accuracy increase, indicating that complex words with high-frequency word bases were easier to be decomposed and processed, while complex words with lower-frequency word bases were easier to be extracted directly from the brain. Zhang (2014) examined the effect of familiarity on the processing mechanism of English bilingual derivatives in Chinese learners using a lexical decision task. The results showed that relatively high-frequency words were more inclined to whole-word processing, while low-frequency words were more inclined to decomposition processing. The results support the dual-channel model of Chinese learners’ processing

of English-derived words: whole-word processing and lexical decomposition processing co-exist.

3. INFLUENTIAL FACTORS IN THE STUDY OF ENGLISH DERIVED WORD PROCESSING

The processing of derived word is affected by both internal structural features of the material (e.g., semantic transparency, derivational regularity, lexicality) as well as language use attributes (e.g., word frequency and familiarity). In recent years, an increasing number of studies have also focused the influences on internal differences in second language learners such as second language level and second language proficiency. The discussion on the influencing factors of derived words processing in this study focuses on semantic transparency, word frequency, and familiarity.

3.1 Semantic transparency

Currently, scholars generally categorize derived words into semantically transparent derivatives (strong associations) and semantically obscure derivatives (weak associations) according to the semantic association between the whole word and its base. (Longtin et al. 2003; Morris et al. 2007; Lavric et al. 2007)

Several studies have found that semantic transparency affects the processing channel for derived words processing. Using a masked priming paradigm, Morris et al. (2007) showed that the N250 and N400 effects induced by the semantic transparency condition were the strongest, and that the effects diminished as semantic transparency, and morphological complexity decreased. Through the overt priming paradigm task, domestic scholar Zhang (2016) found that for second language learners, semantic transparency has an obvious “priming” effect in the stem, while obscure derived words need to be processed through “whole words”. This suggests that the higher the transparency of the derived words, the more second language learners tend to process them in the decomposition model.

3.2 Word frequency

Previous researchers (Cole et al. 1989; Hay 2001; Taft 2004) classified frequencies into four categories based on the whole word characteristics and components of derived words. The four categories respectively are surface frequency, i.e. the frequency of the derived whole word itself; base frequency, i.e. the frequency of the remaining constituents after the affix is detached; cumulative base frequency, i.e. the sum of the base frequency and the frequency of its corresponding complex variant; and relative frequency, i.e. the ratio of the surface frequency to the base frequency.

Studies have focused on how frequency affects derived word processing.

Giraud & Grainger (2000) found that the surface frequency high-frequency group responded faster and concluded that the higher the surface frequency, the faster the rate of access. Chen et al. (2017) showed

that Chinese intermediate English learners have different processing mechanisms for inflected and derived words, however, word base frequency has no effect on their complex word processing for both inflected and derived forms.

Then, it has also been found that word frequency affects response time and correctness of derived word processing. Regarding the processing of English derived words, Yao et al. (2012)⁰ investigated the effect of word base frequency on the processing mechanism of inflected words and derived words in Chinese English bilinguals. They found that whether it is inflected words or derived words, the higher the word base frequency, the faster the reaction speed and higher the accuracy of the subjects. which indicates that the complex words with a higher-frequency base are easier to decompose and process, while the complex words with a low-frequency base are easier to whole-word storage and processing. Zhang (2014)⁰ explored the effect of relative familiarity on the recognition of derivative words and found that relatively high-frequency words tend to the whole-word processing, while relatively low-frequency words are more inclined to decomposition processing.

3.3 Familiarity

The relative ease of perception assigned to each word is called “word familiarity” (Tanaka Ishii & Terada, 2011)⁰. For example, the words “meet” and “encounter” can be used interchangeably, but “meet” is cognitively easier than “encounter”. So far, researchers have attempted to measure word familiarity through subjective rating tasks in the field of psycholinguistics. Gernsbacher (1984)⁰ argued that familiarity, as determined by subjective ratings, may be a more comprehensive measure of word proficiency for second language learners than word frequency.

Marcolini et al.’s (2011)⁰ study found that it is the relative values of whole word familiarity and stemming familiarity, that have an effect on the processing of complex words. Based on this, Zhang (2014)⁰ used a lexical decision task, taking Chinese English learners as experimental participants and found that the processing of bilingual derived words, like monolingual processing, has two processing channels: whole word processing and decomposition processing. That is, the relative familiarity between the whole word of a derived word and its stem affects the processing of derived word by L2 learners. That’s to say, derived words with high whole word familiarity but high stem familiarity are processed as whole words, while derived words with low whole word familiarity and high stem familiarity are based on the decomposition processing.

4. EMPIRICAL STUDIES OF ENGLISH DERIVED WORD PROCESSING

With the advancement of psycholinguistic research methods, especially the development of

computer-assisted lexical recognition technical means, there is a trend of increasing research on lexical processing, especially multi-morpheme words in psychology. Besides, a large number of domestic scholars exploring the topic have emerged one after another. In this part, representative empirical studies in the field of derived word processing will be selected respectively for review and evaluation[11].

4.1 Lexical decision task

Lexical decision task is the most commonly used research paradigm in derived word processing research. In lexical decision tasks, the target words are usually true derived words, pseudo-derived words, or non-derived words. The target words are presented in such a way that the participant is required to decide whether they are true or whether they are words that the participant recognizes through some kind of action (e.g., pressing the keyboard). The response time and correctness of the judgement are collected by computer software, which is used by researchers to analyze the features of the participants’ derived word processing.

Existing studies using lexical judgement experiments overwhelmingly provide evidence of decomposition model processing, i.e., that lexical representations play a role in the processing of derived words. Casalis et al. (2014)⁰ used a lexical decision task to explore the sensitivity of low to intermediate level French-English bilinguals to lexical constituents, and found that in comparison to other pseudowords, when two groups of participants judged derived pseudowords consisting of both a true root and a true base (such as “peacher”) with higher error rates and slower recognition. Li et al.’s (2017) study found that both high and low level Chinese-English bilinguals had recognition difficulties with English derived pseudowords (composed of a true word base and a true affix, e.g. “animalful”) compared to non-derived words (composed of a true word base and a true affix, e.g. “animalfil”).

4.2 Priming paradigm task

The priming experiment is actually a lexical judgement task, referring to that the experimental procedure presents two stimulus words, the former as the prime word and the latter as the target word, and participants are required to make judgements on the target word only. The purpose of the priming experiment is to test whether the prime words have a priming effect on the target words, i.e., whether the prime words help the participants to make faster and more accurate judgements on the target words.

Lavric et al. (2007)⁰ used a study with a masked priming paradigm and found no significant differences between transparent priming effects, semi-transparent priming effects and obscure priming effects. Zhang (2014)⁰ examined the effect of semantic transparency on Chinese learners’ English derived word processing using an overt priming paradigm task with a 100-millisecond interval

between prime word and target words. It was found that derived words with different semantic transparency had significant priming effects on the processing of their stems, but to different degrees: the priming effect was stronger for semantic transparency and weaker for semantic obscurity. This suggests that semantic transparency influences learners' processing of derived words. Influenced by semantic transparency, semantically transparent derived words are based on decomposition processing, while semantically obscure derived words are based on the whole-word processing. Li (2019) employed a masked priming paradigm task to examine the priming effect of prefixed derivatives and suffixed derivatives on their lexical roots. The experimental results found that in the prefix condition, both native and bilingual speakers had priming effects on transparent words, with native speakers having no morphological priming, while second language speakers had morphological priming. In the suffix condition, native and bilingual speakers performed almost the same, referring to that transparent words having a priming effect, while form-related words have no priming effect.

4.3 ERP experiments

In recent years, with the development of ERP experimental technology and its widespread use in the fields of psychology and psycholinguistics, ERP experiments have also emerged in empirical research on derived word processing. In such studies, the target words are usually various forms of derivatives, and the measured parameters are usually electrode values, etc. ERP experiments are often used as a supplementary means for lexical decision tasks or priming experiments, i.e., EEG data are collected and analyzed by instruments while the experiment is being carried out.

Chen (2017) investigated the differences in Chinese English learners' processing of English bilingual derived and inflected words using ERP technology. Behavioral data analysis showed that there were different mechanisms for processing derived and inflected words, and that frequency affected the processing of both types of words. There was some inconsistency with the results obtained from the EEG data analysis. Observing the EEG data, the study found that the difference of both types of words evoked three EEG components: N200, P300, and N700. Therefore, there was no qualitative difference in the EEG of Chinese learners of English processing English bilingual derived words and inflected words. However, comparative analyses of the differential waves revealed significant quantitative differences between the two types of complex words, but there were no frequency effects.

5. CONCLUSION

In summary, research in the field of derived word processing has become more and more thriving, but most of the previous studies on derived word

processing are based on behavioral experiments. With the promotion of the eye-tracking experimental paradigm and the ERP experimental paradigm, the parameter system has become more abundant, and real-time reproduction of derivational word processing has become more operable. With the help of computer technology, behavioral experiments are combined with eye-tracking experiments and ERP experiments in order to better explore the processing of bilingual derived words.

In addition, in identifying the factors involved in derived word processing, existing research has centered on receptive tasks as the experimental design, such as lexical decision tasks and lexical meaning comprehension tasks. Other output-based research instruments, such as the derived word output task, may also serve as entry points for future research.

Finally, the factors affecting the processing of derived words need to be further explored, and the interactive effects between different factors also need to be further clarified. In addition to lexical feature morphology factors, empirical evidence is still needed to determine whether learner factors such as working memory and second language proficiency affect the mechanism of derived word processing, and how the interactions between these factors are as to whether learner factors such as working memory and second language proficiency influence the mechanisms of derivative word processing, and how the interactions between the factors are manifested.

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An Eye Movement Study on the Concreteness Effects of English Compound Nouns

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Abstract: Two experiments were employed to investigate the concreteness effect of English compound nouns in the study. Experiment 1 used the lexical decision task to investigate whether English compound nouns had concreteness effect. The research design of 2 (concreteness: concrete, abstract) × 2 (word familiarity: high-familiarity, low-familiarity) was conducted. The results showed that there was a concreteness effect of both high-familiarity compound nouns and low-familiarity compound nouns. The reaction data of 30 college students in experiment 1 showed that there was an interaction between familiarity and concreteness. Experiment 2 put English compound nouns in sentences for natural reading, and drew on the power of eye tracking technology to explore the concreteness effect of English compound nouns in a certain context. The results showed that there was also a concreteness effect of low-familiarity compound nouns under sentence context conditions, and this effect was manifested in the late processing stage of low-familiarity compound nouns.

Keywords: Eye Movement, Concreteness Effect, Familiarity, Compound Nouns

1. INTRODUCTION

Mental lexicon primarily studies how words are represented and processed in the brain, and given the importance of words in language use, psychological vocabulary research is the focus of research in psycholinguistics. The effect of word concreteness, as a significant role in the neural mechanism of language processing for bilinguals, has always been a heated topic in psychology research.

From the perspective of psychology research, the mental image that people form about the referent of a word of difficulty is referred to as "word concreteness". For example, the word "blackboard" can be easily represented and processed for its concreteness. Conversely, such as the word "awareness" is more difficult to make representations, so words like "awareness" belong to abstract words. Some studies (Marschark & Paivio, 1977; de Groot, 1989; Yan Guoli et al., 2014) have shown that there exists difference between concrete words and abstract words processing, specifically speaking, the concrete words are processed faster and more accurately than words that represent abstract concepts, which refers to the concreteness effect. So, the

concreteness effect of words is the phenomenon that the processing speed of concrete words is faster and the efficiency is higher than abstract words.

Compound words, as a prolific form of words, usually consist of two or more morphemes. Compound words, the meaning of whole words cannot be inferred from its constituent morpheme semantics, nor is it equivalent to a simple addition of its constituent morpheme semantics (e.g., "deadline"). The meaning of word "deadline" has nothing to do with the original meaning of "dead" and "line". So, the study selected the compound nouns as the research materials.

Most of the existing experimental studies provide evidence of the concreteness effect, that is, the concreteness of words plays a role in compound word processing. However, researchers have divergent views on which frequency of words have concreteness effects. Domestic scholars Yan Guoli et al. (2014) studied the concreteness effect of Chinese nouns, finding that the judgment time of abstract words was significantly longer than that of concrete words at low frequencies, which was consistent with previous findings of Zhang Qin and Zhang Biyin (1997). On the contrary, Chen Baoguo and Peng Danling (1998) used lexical decision task and nomenclature to investigate the influence of the concreteness of words on vocabulary recognition. The study showed that the concreteness effect of words is only manifested in high-frequency words. Based on the mentioned above, the conclusion remains controversial on this issue.

Compared with previous studies, the following changes have been made to this study. Firstly, most of the previous studies have focused on the study of native vocabulary memory, and most of the participants whose native languages are phonetic characters, and there were few studies on the vocabulary memory of participants who used Chinese as their native language. In addition, the studies on psychological mechanisms of lexical memory in bilinguals and even multilinguals were relatively few. In response to this situation, the study recruited the participants whose native language is Chinese and second language is English. Secondly, while previous studies examined the relationship between word frequency and concreteness effects, this study explored the relationship between familiarity and concreteness effects. Because many researchers (e.g.,

Gernsbacher, 1984) Oargued that for L2 learners, familiarity, determined by subjective ratings, may be a more comprehensive measure of word proficiency in L2 learners than word frequency.

2. EXPERIMENT 1

In this experiment, the lexical decision task was used. The familiarity and concreteness were taken as independent variables to determine whether there was a concreteness effect of English compound nouns, as well as the relationship between concreteness effects and familiarity.

2.1 RESEARCH METHOD

2.1.1 Research participants

A total number of 30 college students whose age ranged from 18 to 25 were recruited and took part in the study. All of them had normal visual acuity or corrected vision and were Chinese students who major in English. All the participants took part in the study voluntarily, and were awarded with monetary reward for their participation.

2.1.2 Research materials

The study selected 150 English compound nouns with a length of 8 or 9 from the CompLex Database, developed by Schmidtke, Dyke, and Kuperman (2020)0. The 150 English compound nouns were randomly arranged and subjectively rated on a seven-point scale by 20 English majors. "7" means that the thing referred to by the word can be directly perceived and is very specific, while "1" indicates the word refers to very abstract content, with no definite image. According to the scores of the participants' rating, the study selected 40 concrete compound nouns and 40 abstract compound nouns respectively. Then, the familiarity data was obtained by a subjective rating, that the 80 English compound nouns were also randomly arranged and subjectively rated on a five-point scale by other 20 English majors who hadn't participated in former rating task. "5" means the most familiarity extreme and "1" indicates the least extreme ("I don't know this word"). Based on the results of the participants' evaluation, 15 low-familiarity concrete compound nouns and abstract compound nouns, and 15 high-familiarity concrete compound nouns and abstract compound nouns were selected. In addition, 60 compound non-words made up of real words were selected as disturbing words. So, a total of 120 stimuli were formed as experimental materials. At the time of the experiment, these 120 stimuli were randomly mixed.

2.1.3 Research design

The experiment was designed as a two-factor in-participant experiment. Independent variables in the experiment respectively were concreteness level of the word (two levels: concrete and abstract) and word familiarity (two levels: high and low familiarity). The dependent variable in the experiment was the accuracy (ACC) to judge the target word is true word or not.

2.1.4 Research procedures

Experiment 1 was designed by E-prime2.0 software and participants needed to operate it on a computer. First, the fixation mark "+" was presented for 250ms at the centre of the screen. Immediately afterward, a blank screen appeared for 250ms. The blank screen was finally replaced by the target, which remained on the screen for 3000ms until a response was recorded, or if no response followed, it is removed after 5,000ms. After that, the program moved onto the next trial.

The participants were required to decide as quickly and accurately as possible whether each target was correct compound words or not. Participants gave their response by pressing the keyboard. They had to press "f" with their right hand, if the target word was a correct compound word; and press "j" with their left hand, if it was not a correct compound word. Before the formal experiment, participants were asked to practice 10 stimuli items, including 5 real compound words and 5 compound non-words. The whole experimental session lasted approximately 15 minutes.

2.2 Research result and discussion

The software Statistic Package for Social Science (SPSS) that was used to analyze the data. The mean response times (RT) and ACC were shown in Table 1. In terms of the ACC, the ANOVA showed that: the main effect of familiarity was significant, $F(1, 29) = 14.382$, $p = 0.001$, $\eta^2 = 0.332$. The responses to high-familiarity compound nouns were more likely to be correct than responses to low-familiarity compound nouns. Additionally, the result also performed that the main effect of concreteness was significant, $F(1, 29) = 19.737$, $p = 0.00$, $\eta^2 = 0.405$. The result indicated that the ACC of concrete compound nouns was higher than that of abstract compound nouns. At the same time, the result also found that the interactive effect between familiarity and concreteness was significant, $F(1, 29) = 5.166$, $p = 0.031$, $\eta^2 = 0.151$.

Table 1 RT (ms) and ACC (%) of lexical decision

| | familiarity | | | | difference | |
|--------------|-------------|------------|--------------|-------------|------------|------|
| | low | | high | | | |
| concreteness | RT | ACC | RT | ACC | RT | ACC |
| concrete | 682 (106) | 69.4(25.9) | 662.61 (91) | 75.7 (14.1) | +20 | +6.3 |
| abstract | 689 (112) | 55.0(29.2) | 667.79 (108) | 71.0 (17.3) | +21 | +16 |
| difference | +7 | +14.4 | +5 | +5 | | |

It was found that the concreteness effect of high-familiarity compound nouns was significant, along with the concreteness effect of low-familiarity compound nouns. This suggested that the ACC of concrete compound nouns was higher than that of abstract compound nouns.

The results of Experiment 1 showed that there was a significant concreteness effect in lexical recognition of English compound nouns, and the concreteness effect of compound nouns existed in low-familiarity compound nouns, which indicated that there was an interactive effect between compound nouns and concreteness effect. This result is consistent with the results of other studies (James, 1975; Zhang Qin, Zhang Biyin, 1997; Yan Guoli, 2014)000, who employed the lexical decision task and found that lexical decision for concrete words were shorter than for abstract words, and that the advantage in response time only existed in low-familiarity words. However, the current study found that the concreteness effect was also presented in high-familiarity compound nouns, and that lexical decision of concrete compound nouns was more correct than those of abstract compound nouns. Based on the comparison, the present study found that the concreteness effect of low-familiarity compound nouns was significantly more than the concreteness effect of high-familiarity compound nouns.

3. EXPERIMENT 2

Based on experiment 1, the experiment used eye tracking technology to investigate the influence of the context provided by the sentence on the concreteness effect in sentence reading.

3.1 RESEARCH METHOD

3.1.1 Research participants

The study invited the 18 participants who were English majors, 18~25 years old, and all the participants had normal visual acuity or corrected vision. All of them in the experiment received a gift as payment.

3.1.2 Research Materials

The results of Experiment 1 showed that the concreteness effects of both high and low familiarity compound nouns were significant, but the concreteness effects of low-familiarity compound nouns were more significant than those of high-familiarity compound nouns. Therefore, in Experiment 2, the low-familiarity compound nouns from Experiment 1 were chosen as keywords to create 30 declarative sentences. So, taking low-familiarity words in experiment 1 as keywords, the study selected the 30 declarative sentences that each sentence was from the CompLex Database.

After that, 10 filling sentences were randomly inserted, and in order to ensure that the participants read the sentences carefully, 10 judgment questions for experimental sentence comprehension were randomly inserted.

3.1.3 Research design

This experiment was designed as a single factor within subject. The independent variable was the concreteness of the target word in the sentence, which had 2 levels, that was, concrete level and abstract level. The dependent variables were eye movement indexes such as first fixation duration, single fixation duration, gaze duration, fixation count and total reading time.

3.1.4 Research procedures

The experiment was carried out in the Language and Cognition Laboratory. The participants were seated comfortably in a dimly lit, sound-attenuating room. A 19-inch DELL computer display was placed in a suitable distance from the participants.

Before the experiment for each participant, a short instruction in Chinese was presented on the computer. Firstly, the participants would see the fixation mark “+” for 250ms. After a while, a sentence would appear on the screen, which required the participants to understand the meaning of each sentence. After confirming the understanding of the sentence, please press the “F”; After some sentences, there would be a true or false question asking participants to determine whether the meaning of the sentence was consistent with the previous sentence. If it was consistent, please press the “F” button, and if it was not consistent, please press the “J” button. Then the experiment proceeded to the next sentence.

Before the formal experiment, there were 10 practice sentences to ensure that the participants understand the experimental process. The whole experimental session lasted approximately 15 minutes.

Table 2 Average eye movement index of target words

| | concrete compound nouns | abstract compound nouns |
|------------------------------|-------------------------|-------------------------|
| first fixation duration (ms) | 245.93 (54.24) | 227.81 (41.50) |
| single first duration (ms) | 245.93 (54.24) | 227.81 (41.50) |
| gaze duration (ms) | 522.41 (212.71) | 494.56 (163.04) |
| fixation count | 5.28 (1.12) | 6.57 (2.30) |
| total reading time (ms) | 5.28 (1.72) | 1682.54 (655.49) |

3.2 RESEARCH RESULT AND DISCUSSION

Five eye-movement indexes were studied in this study, and they respectively were first fixation duration, single fixation duration, gaze duration, fixation count, and total reading time. The former three eye movement indexes, reflect the early processing of the target word. The latter two eye-movement indexes reflect late processing of the target word. The average reading time of each index for the region of interest was shown in Table 2.

The study showed that for first fixation duration, single fixation duration, gaze duration, the differences between concrete and abstract compound nouns were not significant. The results of the study

were shown below: first fixation duration: $t(17) = 1.824, p = 0.087$; single fixation duration: $t(17) = 1.824, p = 0.087$; gaze duration: $t(17) = 0.530, p = 0.603$. On the contrary, for the latter two eye movement indexes, the difference between concrete and abstract words was significant. The results of the study were shown below: fixation count: $t(17) = -10.569, p = 0.000$. This suggested that abstract compound nouns were noted more often than concrete compound nouns. Additionally, in terms of total reading time: $t(17) = -4.164, p = 0.001$. The results of the study indicated that the total reading time of abstract compound nouns is more than that of concrete compound nouns.

Analysis of the eye-movement data showed that the difference between concrete and abstract compound nouns was not significant on eye-movement indexes reflecting the early recognition process, and that the difference between concrete and abstract compound nouns was significant on eye-movement indexes reflecting the late recognition process. This suggested that the concreteness effect of compound nouns was manifested in the late stages of processing of compound nouns.

According to the results of Experiment 2, among the eye-movement indexes employed in this study, the differences between concrete and abstract compound nouns were significant only in fixation count and total reading time, which represent late processing. This suggested that the concreteness effect of low-familiarity compound nouns still existed in sentence reading. The results of this experimental are consistent with the experimental results of Yan Guoli et al.' study (2014). That was to say, in sentence reading, the concreteness effect of compound nouns not only acted at the stage of lexical recognition, but also at the level of semantic processing.

4. CONCLUSION

In the lexical decision task, the results of Experiment 1 showed that the concreteness effect of compound nouns occurred not only in high-familiarity compound nouns, but also in low-familiarity compound nouns. The results of Experiment 1 are consistent with the dual coding theory and the contextual validity model. From the perspective of dual coding theory, although, concrete and abstract words have different representation systems, this difference does not have an effect on the processing of low-familiarity and high-familiarity words. Similarly, based on the theory of contextual validity modeling, regardless of familiarity, it is easier to retrieve contextual information

from memory for concrete words than for abstract words. Therefore, regardless of familiarity, there should be a significant concreteness effect.

In the sentence comprehension task, Experiment 2 put compound nouns into sentences to investigate the concreteness effect, that was, to examine the concreteness effect in contextual situations. With the

application of eye-tracking technology, participants could read the sentences naturally, and based on multiple dynamic behavioral indexes, eye-tracking technology could dynamically reproduce the whole process of processing compound nouns, enabling the researcher to examine the concreteness effect.

In the indexes reflecting early processing, such as fixation duration, single fixation duration, gaze duration, the difference between concrete compound nouns and abstract compound nouns was not significant; while in the indexes reflecting late processing, such as fixation count and total reading time, the fixation count and total reading time of concrete compound nouns were less than that of abstract compound nouns, which suggested that the concreteness effect of compound nouns played a role in the semantic processing level, which was consistent with the results found in many experiments that there was the concreteness effect in semantic processing. The research results indicated that given sentence context conditions, there was also the concreteness effect of low familiarity compound nouns, but this effect only existed in the late processing stage of low familiarity compound nouns.

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Research on the "245" Engineering Learning Integration Talent Training Model for Integrated Circuit Technology Majors

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Abstract: The Integrated Circuit Technology major of Zibo Vocational College conducted research on the society, industry, enterprises, and graduates related to the major in accordance with the notice on conducting research on the construction of professional groups in 2022. At the same time, research was conducted on the construction of similar or similar professional groups in sister colleges. Through research, the college has determined the talent training objectives for this major based on the job requirements of the technical field and professional positions (groups), and referred to relevant professional qualification standards. The curriculum system and teaching content have been reformed, and the "245" integrated engineering and learning talent training model has been established and implemented, which has been put into practice.

Keywords: Major in Integrated Circuit Technology; Talent training mode; Training objectives.

1. INTRODUCTION

In December 2020, the "Proposal of the Shandong Provincial Committee of the Communist Party of China on Formulating the 14th Five Year Plan for National Economic and Social Development in Shandong Province and the 2035 Long Range Goals" pointed out that we should promote digital industrialization, accelerate innovation and breakthroughs in key basic fields such as integrated circuits, optoelectronics, and high-end software, and create highly competitive digital industry clusters such as advanced computing, ultra-high definition video, new intelligent terminals, and information and innovation. Shandong Province has officially issued the "Financial Policy on Supporting the Eight Major Development Strategies" in order to combine regional industrial characteristics, focus on the development of science and technology, and strengthen advantages. This indicates that in the next decade, the province will focus on implementing the construction of a strong manufacturing province in Shandong, develop and expand the top ten equipment manufacturing industries, and focus on developing products and technologies such as integrated circuits and specialized equipment, information and communication equipment, to create a new generation of information technology industry chain,

Enhance the leading advantage of the electronic information industry[1].

The cultivation of skilled talents in the field of integrated circuits belongs to the issue of vocational education talent cultivation in an emerging field, lacking ready-made experience to learn from, and the traditional goal of cultivating skilled talents is not focused, there is a significant deviation between the training specifications and industry needs, the teaching content is updated slowly, the practical platform is single, the practical teaching is divorced from production reality, and the development level of students' professional abilities is difficult to measure and evaluate, Restricting the smooth development of vocational skilled talent cultivation work. There is an urgent need for in-depth research on the training mode of integrated circuit skilled talents.

2. ANALYSIS OF THE CURRENT RESEARCH STATUS OF THE LOCAL INTEGRATED CIRCUIT TECHNOLOGY MAJOR IN THE COLLEGE

Shenzhen Information Vocational College, which ranks first in the field of integrated circuit technology, has explored and implemented a "project penetration" integrated circuit talent cultivation model. Shenzhen Vocational College has built a vocational microelectronics technology talent cultivation model for vocational positions, adopting a "2+1" talent cultivation model of two-way participation and segmented cultivation between schools and enterprises. Haining Technician College has explored a talent cultivation model of "integration of three courses", and South China University of Technology, The "school enterprise school" sandwich style integrated circuit talent training model has been proposed, and the microelectronics technology major of Suzhou Vocational College is based on the "school enterprise cooperation, industry education integration" model to cultivate high-end skilled talents in the integrated circuit industry in Suzhou. Each school highlights the guiding role of industry demand at multiple levels and links, strengthens students' practical skills, and cultivates high-quality talents urgently needed in the integrated circuit industry. At present, there are 3 schools offering integrated circuit technology majors in Shandong Province and 23 nationwide. Each school has conducted in-depth research on the training mode of

integrated circuit vocational skills talents. Our school is one of the first schools in Shandong Province to offer an integrated circuit technology major, and also one of the earliest schools to conduct research on the training mode of skilled talents in the field of integrated circuits. It is the only vocational college in Zibo City to conduct research in this field.

Based on its own reality, Zibo City is accelerating the pace of structural adjustment, focusing on the "Four Strong" industries of new materials, intelligent equipment manufacturing, new medicine, and electronic information, and innovating and cultivating new business formats. Focus on supporting the development of integrated circuit and semiconductor microelectronics majors, and achieve the integration of industry chain, talent chain, innovation chain, and service chain. The electronic information industry in Zibo City has become one of the pillar industries of economic development, and the field of IC card sealing and testing has become the first and second IC card sealing and testing base in Jiangbei and the country. The production of smart card sealing loading belts has reached 3 billion pieces in 2020, with a market share of 30%; Chip packaging testing has reached 1 billion chips, with a market share of 20%.

3. ANALYSIS OF THE SURVEY ON THE CONSTRUCTION OF SIMILAR OR SIMILAR PROFESSIONAL GROUPS IN BROTHER COLLEGES

Through research, it was found that the talent cultivation goals of the integrated circuit technology major group in sister universities are closely related to the regional economic development industry. In terms of curriculum system construction, it is highly consistent with the demand for talent cultivation in regional industrial development, and attaches great importance to the cultivation of students' skill levels. Each school group major includes integrated circuit technology, while other related majors include microelectronics technology, electronic information engineering technology, applied electronics technology, intelligent product development and application, intelligent optoelectronic technology application, IoT application technology, etc. Generally, there are 4-5 majors.

The economy in the southern region of the Yangtze River is relatively developed, and the government's financial support for schools is strong. It can provide strong guarantees for the construction of schools' majors and software and hardware conditions. The industry chain corresponding to the integrated circuit technology professional group is relatively complete, promoting the rapid development of the integrated circuit technology professional group. After research and comparative analysis, the classic practices and experiences are as follows.

3.1 Tighten the two links

To cultivate practical talents who are oriented towards the front line of production, have strong

professional practical skills, and possess good professional qualities. The structure of school curriculum should closely adhere to the two links of "practical training" and "practicality". According to the requirements of enterprises, relevant core courses should be developed, and job skill training should be integrated into the curriculum system to fully integrate curriculum teaching with skill training.

3.2 Adhere to an open education system

Adhere to an open education system and implement the integration of production, education, and research through school enterprise collaboration. In terms of professional experimental training, by establishing industrial colleges with leading enterprises, the school can achieve the integration of production, learning, research, training, and training through methods such as school enterprise cooperation and off campus practical training.

3.3 Timely adjustment of teaching standards and curriculum settings

We should actively track the new developments and dynamics of cutting-edge technologies in the integrated circuit industry, combine local economic and industry needs, improve professional talent training goals and directions, timely open new courses, modify teaching and course standards, and meet the needs of enterprises[2].

4. EXPLORATION OF THE "245" TALENT TRAINING MODEL FOR COMBINING ENGINEERING AND LEARNING

Establish and implement the "245" school enterprise cooperation model for talent cultivation in the semiconductor components, integrated circuits, intelligent electronic products, and home appliance industries, as well as the demand for talent in regional economic development. Throughout the three-year learning process, students have been trained in a real corporate environment, with professional norms, attitudes, and habits throughout. Cultivate skilled and applied talents with integrity and dedication, who can directly engage in semiconductor component manufacturing, integrated circuit packaging, integrated circuit testing, integrated circuit layout design, intelligent electronic product design and development, electronic product installation and deployment, electronic product testing, electronic product marketing, after-sales service, and other work towards the front line of production. They have strong job competitiveness and development potential.

4.1 The connotation of the "245" talent training model

"2" is two centers: centered around students' solid mastery of basic electronic technology skills, centered around students' mastery of integrated circuit development and testing skills, as well as the use of microcontroller and embedded chip technology to develop small and medium-sized intelligent electronic products;

"4" is Four major employment areas: semiconductor component manufacturing; Integrated circuit layout design field; Integrated circuit packaging and testing field; The field of intelligent electronic product development.

"5" is Five Modernization Features: Realize the five characteristics of environmental authenticity, functional serialization, enterprise management, equipment production, and personnel professionalization.

Strengthen goal management, refine process control, comprehensively enhance students' initiative and creativity in participating in innovation and entrepreneurship, collaborate with cooperative enterprises to build high-quality courses, lean classrooms, develop characteristic textbooks, promote teaching method reform, increase the application of information and digital teaching, improve the quality of talent cultivation, and enhance the competitiveness of core elements.

Based on regional characteristics, we adhere to the open concept of "seeking support through services, promoting development through contributions, and seeking win-win through cooperation", promote scientific and technological innovation, promote achievement transformation, strengthen the construction of various platforms, actively explore new ways of collaborative innovation between government, industry, academia, research, and application, enhance social service capabilities, strive to create a new situation that serves local economic development, and promote regional industrial upgrading.

Relying on the "diversified platform" of industry education integration, we will "bridge the gap" for technical services. Establish an open service platform that integrates training, appraisal, practical training, technical services, and production, as well as a government supported platform that integrates scientific and technological research, achievement transformation, and technical services, to provide technical services for small and medium-sized enterprises. Following the concept of school enterprise collaboration, demand orientation, and project leadership, we closely rely on various platforms to provide technical services in the field of integrated circuits, including design, manufacturing, control, maintenance, and product upgrades.

4.2 Implementation of the "245" talent training model
Implement the "245" talent training model. Relying on the advantages of deep cooperation and integrated education between the college and enterprises such as Lianhua Electronics Co., Ltd., Yahua Electronics Co., Ltd., Zibo Meilin Electronics Co., Ltd., Zhiyang Technology Co., Ltd., and Xinhenghui Electronics Co., Ltd., the school enterprise dual collaboration is flexibly utilized to promote the high-quality development of electronic information engineering technology majors in higher vocational education

through methods such as theory followed practice, alternation of theory and practice, integration of theory and practice, and combination of learning and training, Strengthen the cultivation of a dual mentor team, expand resource openness and sharing, build professional courses based on work content and a professional course system based on typical work processes, develop professional teaching content and textbooks based on job content and integrated with national vocational qualification standards, and gradually improve the talent cultivation model of "dual collaboration, education and training integration".

5. CONCLUSION

In the subsequent implementation process, improvements can be made in the following areas:

Deepening the Integration of Industry and Education through the Construction of Off campus Training Bases[3].

Adopting methods such as introducing enterprises into schools and integrating schools and enterprises, we will establish an integrated training and appraisal platform for professional foundation theory and practice to meet the needs of professional internship and appraisal. Actively expanding enterprise job training platforms to further enrich cooperation content and broaden employment channels for students.

Introduce high-level talents, strengthen the construction of teaching staff, and enhance teachers' social and technical service capabilities

In recent years, we will continue to introduce high-level talents with master's degrees or above in integrated circuit application technology, enrich the teaching team, and strengthen international exchanges, specialized training, and technical services through project guidance such as professional construction, curriculum construction, teaching reform, and skill competitions. We will implement the enterprise practice requirement of no less than one month per year for professional teachers, and take multiple measures to enhance the teaching and research level and practical innovation ability of the teaching team, Cultivate a dual teacher team[4]. Actively organize teachers to participate in frontline product research and development, production services, and other links in enterprises, and effectively improve the technical skills level of teachers. Additionally, teachers are encouraged to enhance their product design skills by guiding students in various competitions.

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Teaching Reform Practice of "Dual Course Integration and Three Product Interaction" Single Chip Microcomputer Course

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Abstract: This article discusses the teaching reform practice of the single-chip microcomputer course of "dual course integration and three product interaction". Against the background of deep integration of information technology and educational teaching, and integration of innovation and entrepreneurship education into professional education, with the help of high-quality course resources, innovative thinking is integrated into professional courses. Through the curriculum reform of "dual course integration and three product interaction", concepts are updated, teachers' motivation for curriculum reform is enhanced, and courses are restructured and integrated with expertise and innovation based on learning outcomes. Cultivate students' innovative interests, improve the course support system, create a "golden course" ecosystem, and form a mechanism for the healthy development of courses.

Keywords: Innovation and Entrepreneurship Education; Professional Education; MCU.

1. INTRODUCTION

Cultivating and enhancing students' innovative awareness and ability is a new requirement for talent cultivation in vocational colleges in the construction of an innovative country, and it is also a key challenge that higher vocational education needs to solve at this stage. In the context of the deep integration of information technology and education, as well as the integration of innovation and entrepreneurship education into professional education, utilizing high-quality curriculum resources to integrate innovative thinking into professional courses, carry out innovation in classroom teaching, and create a "golden course" ecosystem, becoming a new exploration path.

2. THE CONNOTATION OF THE CURRICULUM REFORM OF "INTEGRATION OF DUAL COURSES AND INTERACTION OF THREE GRADES"

The essence of "dual course integration" is "specialized innovation integration", that is, the integration of professional education and innovation and entrepreneurship education, eliminating the gap between innovation and entrepreneurship courses and professional courses, and organically integrating the

teaching process of the two. Under innovative thinking, teachers and students engage in "three product interaction". The "three qualities" refer to students' academic works, innovative works, and graduation works formed through course learning. The "three qualities interaction" refers to the course stimulating creativity, creating works, optimizing courses, ultimately enhancing learning momentum, and promoting the upgrading of classroom teaching[1].

3. DIFFICULTIES IN TEACHING MICROCONTROLLER COURSES

At present, there are some problems in higher vocational education, such as the disconnection between talent cultivation and modern industry, weak practical ability of students, lack of ability to comprehensively apply knowledge to solve complex engineering problems, and relatively outdated professional course content that is not suitable for the current industrial development. Microcontroller application technology is widely used in various fields such as industrial control, mechatronics products, intelligent instruments and meters, and smart homes. Single chip application technology is an important professional course in the field of electronic information, but there are also common issues mentioned above.

When students first learn microcontrollers, they feel that their knowledge of microcontrollers is abstract and difficult to understand, and programming is difficult to start with, let alone application development. How to master the principles of single-chip microcontrollers in a short period of time and have the ability to apply single-chip knowledge to solve practical problems? Although the threshold for learning single-chip microcontrollers is not high, in order to truly be able to continue learning, teachers and students should resonate in the classroom and have an interest in learning. Learners not only need to have structural thinking, but also need extracurricular practice as support. There are the following difficulties in the teaching of microcontroller courses: firstly, professional knowledge is disconnected from application, and abstract and difficult to understand. The knowledge system of single-chip microcontrollers is relatively complex and messy. Although there have been significant improvements

in single-chip textbooks in recent years, the matching of knowledge points with project cases is vague, making it difficult for vocational students to understand and arouse their interest in learning. This makes it difficult for teachers to teach and for students to learn. Secondly, students have a single learning mode and lack practical engineering projects. The traditional learning time of vocational college students is limited to classroom time, and their enthusiasm outside of class is not high, and they are unwilling to use various resources to facilitate multi-dimensional learning. Under the traditional experimental teaching model with teachers as the main body, students passively imitate experiments, leading to insufficient independent design and experience training. Thirdly, there is a disconnect between students' professional development and innovative thinking. Traditional professional teaching focuses on the transmission of professional knowledge, resulting in students' low interest in technological innovation, weak awareness and ability of innovation and entrepreneurship, and inability to adapt to the needs of today's intelligent era[2].

4. STRATEGIES FOR PROMOTING TEACHING REFORM OF MICROCONTROLLER COURSES

The course of microcontroller application technology establishes an innovative thinking system, collaborates with enterprises to establish a university enterprise cooperation college student innovation and entrepreneurship studio, integrates innovation and entrepreneurship education, and after several years of exploration and practice, forms a curriculum reform model of "integration of entrepreneurship and innovation, and interaction of three products".

4.1 Update concepts and enhance teachers' motivation for curriculum reform

Since 2017, a total of 6 teachers in the professional group have participated in the "Lean Innovation and Entrepreneurship Teacher Training Camp" and obtained qualification certificates, while 2 teachers have obtained the school level "Innovation and Entrepreneurship Mentor" certificate. As a result, professional teachers receive systematic training on innovation and entrepreneurship methodology and practice, updating their concepts, enhancing their motivation for curriculum reform, and providing strong teacher protection for the integration of innovation and entrepreneurship education for college students into professional education curriculum reform.

4.2 Restructure the curriculum based on learning outcomes

Focus on the needs and personality development of students, determine learning outcomes through research, evaluation, and rectification, implement the outcomes one by one into the curriculum, and clarify the specific teaching content of the course. Through the informatization of course resources and the integration of engineering cases, the three qualities

are integrated into the curriculum, incorporating engineering cases and cutting-edge new knowledge and technologies. In response to the problem of a large amount of information and fast knowledge updates in single-chip microcomputer course resources, which makes it difficult for students to obtain useful information, we will comprehensively implement the "miniaturization" construction of digital resources. A granular course resource has been formed that is conducive to students' access and willingness to accept, including micro textbooks, knowledge point micro PPTs, knowledge point micro courses, small programming micro courses, micro simulations, and micro projects. It is stored in the cloud through intelligent three-dimensional storage, and students can access information anytime and anywhere through mobile smart classrooms[3].

Based on the online platform of Chaoxing Xueyin, a hybrid course website is reconstructed. Through the online teaching platform, teachers can dynamically supplement and improve course content on the platform. Students can independently choose the courses they want to learn and learn the course content. Teachers and students, as well as students and students, can easily communicate course content through online courses.

4.3 Integration of expertise and innovation, cultivating students' interest in innovation

In 2017, the professional group introduced the "Electronic Innovation and Entrepreneurship Education" course in the professional talent training program. Professional group teachers and innovation and entrepreneurship mentors jointly form a "Innovation and Entrepreneurship Education" course team to study the teaching methods of innovation and entrepreneurship courses and the ways of integrating expertise and innovation. Among them, the "three product interaction" of the microcontroller application technology course is a relatively successful case of the integration of expertise and innovation. Integrating innovative thinking into the professional courses of microcontroller application technology, achieving "integration of innovation and entrepreneurship". Under innovative thinking, teachers and students interact with each other through "three qualities" practice, and implant educational elements such as innovative thinking, electronic culture, craftsman spirit, and course ideology. By integrating school enterprise culture, reshaping the classroom teaching ecology, achieving "long-term technical education" and enhancing core competitiveness.

4.4 Improve the course support system and create a "golden course" ecosystem

The "ecological chain" is the best form of industrial development, and creating a "golden course" also requires a sound ecosystem as support. The professional group microcontroller application technology course team revolves around the "golden

course", creates a course ecosystem, builds three-dimensional microcontroller course resources, builds an online microcontroller course website, establishes a virtual and real intelligent training room, implements online and offline hybrid teaching, and integrates innovative education, ideological and political elements, and craftsman spirit into the course through school enterprise collaboration. The "three qualities" of academic works, innovative works, and graduation works drive continuous improvement of the course, The innovative achievements of teachers and students are constantly forming, and teachers' teaching ability is constantly improving in the ecological environment.

4.5 Create an environment and form a mechanism for the healthy development of the curriculum

In recent years, the microcontroller application technology course group has formed a virtuous cycle of teaching, research, competition, patents, and achievements promoting the growth of courses under the college's scientific research incentive mechanism. Develop a series of guidance texts for teaching, academic work production, innovative thinking, innovative work production, and graduation work production. The innovation related works of teachers and students of single-chip microcomputer have won 5 new practical patents, and the innovation works of single-chip microcomputer have won many awards in the provincial "Internet plus" innovation and entrepreneurship contest, extracurricular academic and scientific works of college students and other competitions. In conjunction with course rectification, the course content is dynamically updated, and innovative cases are constantly enriched, gradually forming a high-quality online open course for resource sharing.

5.THE MAIN ACHIEVEMENTS OF THE CURRICULUM REFORM OF "DUAL COURSE INTEGRATION AND THREE PRODUCT INTERACTION"

5.1 Establish a curriculum system that integrates expertise and creativity

Break the disciplinary curriculum system characterized by knowledge system, break the professional curriculum system that separates innovation and entrepreneurship courses from professional courses, and establish a competency based curriculum system that integrates innovation and curriculum, theory and practice. Integrating innovation and entrepreneurship education into professional curriculum teaching, integrating curriculum teaching with the practice of the third grade[4].

5.2 Innovative teaching mode

Change the traditional teaching mode of courses into a mixed online and offline teaching mode, with multiple semesters, multiple spaces, and multi-dimensional extensions of the "Three Quality Practice" course. Utilize information technology to

achieve digital synchronization of course learning and innovative production, breaking the boundaries of traditional classroom time and space.

5.3 The integration of expertise and innovation shows significant results

Collaborate between schools and enterprises to promote innovation and entrepreneurship education for college students, deeply implement the "integration of innovation and entrepreneurship", integrate innovative literacy into professional courses, implement the "three comprehensive" education, introduce innovative practice through innovative thinking education, and achieve fruitful results in students' academic works, innovative works, and graduation works related to microcontroller courses. The "three quality interaction" promotes classroom upgrading.

5.4 Innovation evaluation system

The integrated teaching model and evaluation system of "teaching, training, and evaluation" allows students to experience the joy of integrating learning and practice, and stimulates the improvement of students' innovation and practical and application abilities.

6. CONCLUSION

Society and universities are paying increasing attention to the application technology of microcontrollers. The ability of trained students to meet the job requirements and achieve high-quality employment is highly valued by schools. Although the teaching mode and classroom teaching of this major lack mature and effective designs to learn from, it is also easy to break the fixed teaching thinking of teachers, and new technologies and concepts are more easily recognized by teachers. Teaching and working classrooms The diverse teaching carriers of cloud classroom are students'.Experiential learning provides a broad platform and enhances students' sense of classroom ownership.

Applying new technologies and methods to teaching, strengthening students' experiential learning, achieving a combination of virtual and real through cloud based classrooms, broadening students' horizons, and paying attention to the unity of knowledge and action in their growth.In this classroom practice, based on the analysis of the pre class learning situation, stratified teaching practices were conducted for students. However, the sources of vocational students are relatively complex, and their learning foundations and intellectual factors are different. Further exploration and practice are needed to achieve better personal ability and team growth for students.

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Research on Direct Teaching Method for Industrial Robots Based on Impedance Control

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Abstract: As a professional high-end equipment with high degree of technology integration, industrial robots play a huge role in industrial production, but there are still many practical application problems to be solved. At present, the teaching method of industrial robot through teaching box or off-line programming is cumbersome and complex, and the use threshold is high. The traditional position control robot is often unable to meet the requirements of automatic assembly, polishing, deburring and other tasks that have requirements for environmental contact force control. Therefore, in view of the above problems, this study introduces the compliance control based on the robot position control, and designs a set of direct teaching method of multi axis robot.

Keywords: Industrial Robots; Impedance Control; Direct Teaching

1. INTRODUCTION

Robot is a great invention of mankind in the 20th century, involving machinery manufacturing, automatic control, sensor technology, computers and many other scientific fields. It is the most meaningful automation product. In the 21st century, robots have penetrated into human learning, life, society and other fields. The progress of robot technology will have a profound impact on the production mode and lifestyle of human society. In today's world with changes in population and social structure, the development of robots will be widely valued. As an important part of the global robot market, industrial robots have become an important symbol of a country's industrial automation level.

With the development of technology, the scope of use of industrial robots has become increasingly broad. When the robot completes painting, handling and other practical operations, it is necessary to move the arm of the industrial robot in advance to teach the operation sequence, motion path, motion mode, motion speed and other information [1]. At present, most industrial robots can only complete the teaching work through the teaching box and off-line programming. This teaching method not only separates the robot from the operator's workspace, but also requires the operator to have certain robot technology knowledge and experience, which greatly limits the application effect and promotion of industrial robots [2]. According to statistics, there is

still a large gap in applied talents such as robot on-site debugging, maintenance operation and operation management in China, with the number as high as 200000, and the annual growth rate is still 40-60 thousand. The high threshold for the use of industrial robots also limits the improvement of productivity to a certain extent. How to "tell" the working information of the robot in a more straightforward way in the shared space, so that the robot can obey the movement intention of the operator, reduce the use threshold of the industrial robot, and accurately and quickly reach the target position is of great significance.

Direct teaching is to realize the cooperation between robot and human through physical interaction in the same space [3], so that operators without robot experience can easily teach robot task trajectory [4-5]. The direct teaching of industrial robots is generally divided into direct teaching based on force sensor and direct teaching without force sensor [6].

The research on robot teaching based on force sensor is earlier in foreign countries, and mature robot products have appeared, among which the representative ones are iiwa robot of KUKA company in Germany and cr-35ia robot of FANUC robot company in Japan.

The robotics and Mechatronics center of Korea Institute of machinery and materials has carried out a series of research on industrial robots [7], designed serial robots and developed a direct teaching system. The joint mechanism of the robot is composed of force sensors, mechanical springs and cams. By designing a special end structure and using two force sensors, dual impedance control is achieved.

The research on robot direct teaching is relatively late in China. Hujianyuan of South China University of technology, used a six-dimensional wrist force sensor to detect the force signal, used simple stiffness control, and determined the force compliance matrix by experiment, realizing direct teaching. Cailigang of Beijing University of technology proposed a direct teaching model for industrial robots based on stiffness control, and designed a trajectory prediction algorithm to determine the moving direction of the next target point, which was successfully applied to a six degree of freedom robot. Lin Junjian of South China University of technology transformed the coordinate system of the robot's control system from the base coordinate system to the end tool coordinate

system, and realized the robot's direct teaching by using the fuzzy impedance control method. He Xiangyang of Huazhong University of science and technology realized the direct teaching of a 7-DOF humanoid manipulator by using the impedance control method.

Kushida proposed a position based zero force control scheme, which uses the method of real-time gravity and friction compensation to make the robot comply with the action of external forces, just like being in an environment not controlled by gravity and friction and successfully applied to a two degree of freedom industrial robot without changing the servo controller. Capurso proposed a direct teaching method based on force feedback for redundant robots. Without using sensors, based on the dynamic equation, Kalman filter was used in the joint space to estimate the user torque, and then the direct teaching was realized through admittance control, which was successfully applied to abb Yumi robot.

2. ROBOT IMPEDANCE CONTROL STRATEGY

Through the analysis of robot workspace, whether it is direct teaching in free space or constant force tracking in contact space, it belongs to the compliance control category of robot, and it needs to dynamically adjust the relationship between the end position of robot and the force.

Two main force position control methods have been described in the previous article: the force/position control method can control the force and position respectively through the selection matrix, which has the advantage of clear control method, but the control requirements for force and position are opposite, and direct control force is required, so it is difficult to realize,; The fundamental of impedance control is to use the impedance control model to integrate the position information and force information into a unified framework, and use the same control strategy to realize the force control and position control at the same time. Because the controllers of industrial robots are mostly closed, the impedance control method is selected in this paper.

Hogan introduced the concepts of impedance and admittance in the circuit into the mechanical system, used the power bond graph to describe the energy flow between the industrial robot and the external environment, and proposed the concepts of potential and flow. The energy transfer between physical systems can be described by these two concepts.

As a whole, the industrial robot system is composed of joint links, sensors and actuators, which can form a physical system, so it can also be described by the concept of potential and flow.

As shown in the Figure 1, the impedance control of the robot regards the relationship between the pose of the robot end effector and the contact force/torque of the external environment as a second-order "spring mass damping" system, and then constructs the system impedance control model to adjust the

relationship between the pose of the end effector and the contact force/torque of the end by adjusting the impedance parameters of the system.

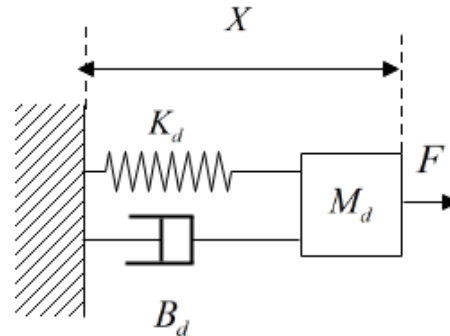


Figure 1 Impedance control model

The target impedance is usually in the form of second-order differential equation, which is used to express the relationship between the force between the robot end and the external environment and the difference between the end position and the desired trajectory.

3. IMPEDANCE MODEL OF DIRECT TEACHING

According to the above impedance control principle, first establish the model of robot and environment during direct teaching operation, as shown in Figure 2.

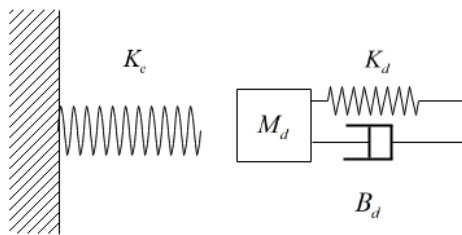


Figure 2 Contacting model of robot and environment

If the target impedance form is chosen, the impedance equation directly taught is:

$$M_d(\ddot{X} - \ddot{X}_d) + B_d(\dot{X} - \dot{X}_d) + K_d(X - X_d) = F \quad (1)$$

During the direct teaching process in free space, the robot does not come into contact with the external environment. At this point, it represents the force exerted by human hands on the robot. When the end of the robot is in free space and has not yet come into contact with the environment, there is no force between the end tool and the external environment.

4. IMPLEMENTATION OF POSITION BASED IMPEDANCE CONTROL

Impedance control is specifically divided into position based impedance control methods and force based impedance control methods. In the force based impedance control method, the end pose error of the robot can be directly adjusted to the force in the end workspace using the impedance equation, and then the motion of each joint of the robot can be directly driven in the form of a Jacobian matrix to achieve force control. However, general industrial robot control systems are closed and cannot directly obtain joint torque at the user level, making them unsuitable. The position impedance control method based on the

industrial robot's position controller as the inner loop and the impedance model as the outer loop can generate position deviation through the feedback actual contact force through the impedance controller. Then, the robot's position control system can adjust the end trajectory in real-time, which can achieve force control effect while eliminating the deviation. This article adopts this method precisely.

The motion control commands received by the robot are composed of six variables: position and attitude. The incremental position information of the robot's end can be obtained from the force deviation and can be directly superimposed and input into the robot. However, when there is a torque deviation at the end of the robot, what we calculate is the attitude angle increment, which cannot be directly superimposed with the robot's attitude representation ZYX Euler angle and needs to be transformed.

When the control cycle is small enough, we can obtain:

$$\frac{\Delta\varphi}{\Delta t} \approx \omega_t \quad \dots\dots\dots(2)$$

From this, we can establish the relationship between Euler angle increment and attitude angle increment in absolute coordinate system through the relationship between Euler angle velocity and attitude angle velocity in absolute coordinate system:

We can get the Euler angle increment that should be fed back when there is torque deviation.

The position correction generated by the impedance model is added to the expected position vector to obtain a new position control command.

Thus, force control is introduced into the position control system of the robot to achieve force control function based on position control.

5. CONCLUSION

This article analyzes the advantages and disadvantages of two commonly used force control methods based on the working characteristics of

industrial robots. Based on this, impedance control methods are introduced, and a direct teaching impedance control model is established. The specific implementation algorithm of impedance control is analyzed. The impedance control method based on position control is selected, and the two objectives to be achieved are incorporated into a unified method framework.

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"Four Dimensions and Four Promotion" to Create a New Mode of Operation of the Technical Skills Inheritance and Innovation Platform

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Abstract: In order to strengthen the cultivation and innovation of technical skills and train high-quality technical talents, our institute has launched a new operation mode of technical skills inheritance and innovation platform with talent training as the core. The model takes scientific research projects and skills competitions as the carrier, and relies on the three-teacher collaborative education system of "theoretical teacher laying the foundation, skill master passing on skills, and enterprise master teaching" to create a new platform operation model with "scientific research projects promoting innovation, skill competitions promoting technology, mentoring mode promoting learning, and social service promoting employment". The platform runs smoothly and effectively, has cultivated many high-quality technical talents with "excellent morals and excellent skills", and has gained a lot in the aspects of cultivating talents and improving technical skills.

Keywords: Technical Skills; Collaborative Education; Personnel Training; Operation Mode

1. IMPLEMENTATION BACKGROUND

Starting from the "demand side" and on the premise of training "double-qualified" teachers who meet the needs of vocational education development in the new era, the technology and skills inheritance innovation platform is committed to cultivating a large number of compound specialized talents with high moral quality, superb skills and strong innovation and creativity, providing a strong boost for deepening the reform and improving the quality and high-quality development of vocational education in China[1-3]. It is an indispensable part of the development of higher vocational education. It can be seen that it is particularly important to innovate and create the operation mode of the skill inheritance innovation platform and ensure the reasonable, stable and effective operation of the skill inheritance innovation platform. Among them, the common operation modes of the skills inheritance and innovation platform include project leading and driving mode, school-enterprise league enabling mode, mentoring pair inheritance mode, etc., but

these modes are too single and their functional positioning is not comprehensive. As we enter the new era, with the continuous advancement of higher vocational education reform and innovation and the development of cross-disciplines, the platform operation mode with multi-level and multi-dimensional characteristics has gradually become the mainstream.

2. MAIN PRACTICES

On the premise of summarizing the experience of intelligent manufacturing skills inheritance and innovation, Zibo Vocational College's high-level professional group of electrical automation technology has established two Shandong vocational education skills inheritance platforms with professional group operation characteristics, namely the modern mechanical and electrical equipment technology application innovation platform and the control center innovation platform. The platform gathers the relevant professional skill teachers in the school and external enterprise masters, and takes scientific research projects and skill competitions as the carrier, relying on the three mentor collaborative education system of "theoretical teachers laying the foundation, skill teachers passing on skills, and enterprise masters teaching", and creates a new platform operation model driven by "scientific research projects promoting innovation, skill competitions promoting technology, mentoring mode promoting learning, and social service promoting industry". The main practices are as follows.

2.1 Scientific research projects promote innovation and continue to provide power

With the purpose of "inheritance and innovation", with "project" as the carrier, with "cultivating students' skills and improving teachers' scientific research ability" as the main body, driven by the dual driving forces of "scientific research" and "innovation", through gathering the school's famous skill teachers and hiring enterprise masters as platform leaders, Relying on Shandong Skill Master Studio, Shandong Province Old and New Energy Conversion Training Base, Zibo City Public training Base, etc., we focus on cultivating students' practical ability, improving students' innovation awareness and

creativity, greatly improving teachers' scientific research level, and creating a high-quality team of teachers and students with superb skills and strong scientific research and innovation ability. "Shandong Skill Master" Pan Xuehai and "Zibo Craftsman" Qu Zhenhua led the students to help Zibo city deepen the integration of school and city to enable the future development, and successfully obtained the approval of Zibo City digital twin platform for the integration of school and city, which provided strong technical support for the development of equipment manufacturing industry in Zibo City, and improved the scientific research and innovation ability of teachers and students in the process of providing technical services to enterprises.

2.2 Skills competition to promote skills, temper skills and skills

Relying on the "professional, technical, practical" characteristics of vocational education, the establishment of "teacher-led, student-dominated" competition teachers and students team, actively guide students to participate in the skills competition, learn to apply, effectively improve skills, and cultivate a large number of high-quality technical and technical talents. Relying on the skills inheritance and innovation platform, teachers and students actively participated in mechanical and electrical products competition, innovation and entrepreneurship competition[4], Shandong Vocational College Skills Competition and other competitions, and achieved fruitful results. Through various skills competitions, teachers' education and teaching level and ability have been improved, students' skills have been enhanced, a better learning atmosphere has been created for teachers and students, and more employment and further education opportunities have been created for students.

2.3 The mentorship model promotes learning and builds a collaborative education mechanism

With "post skills training" as the starting point, with "deepening the integration of production and education, master and apprentice inheritance and innovation" as the path, we attach great importance to the training of talents and skills, and fully practice the modern new model of school-enterprise cooperation and the combination of work and learning. Through entering the campus training base, enterprises, into the production and manufacturing line, the craftsman spirit and technical skills training will be firmly integrated, strengthen the school-enterprise cooperation, and build a comprehensive and balanced collaborative education mechanism of basic knowledge, professional skills, and professional quality. Relying on the technology and skills inheritance and innovation platform, the team undertakes enterprise research and production projects, teachers guide students to do, words and examples, in practice to strengthen the students' hands-on ability, to achieve from the classroom, to

practice, truly learn to apply, to promote learning, learning and application of the combination of knowledge and action.

2.4 Social services promote employment and support mass innovation and entrepreneurship

With the extension of "social training" and the purpose of improving "professional skills of enterprise employees", a teacher service team has been established to carry out technical services such as enterprise training, process improvement and product upgrading for leading enterprises in the industry, organically integrating knowledge and skills, and greatly improving teachers' social service ability. Relying on the platform to complete various kinds of training such as retired military education certificate, "Gold Blue Collar", entrepreneurship and employment, and "1+X" certificate of the Ministry of Education, it fully helps the mass entrepreneurship and innovation.

3. RESULTS

Relying on the skills inheritance and innovation platform, we have achieved fruitful results both in educating talents and in helping employees improve their skills:

The results of talent training are remarkable, and the satisfaction of education is high. Relying on Shandong Skill Master Studio, Shandong Province Old and new energy conversion training base, Zibo City public training base, etc., to guide students to participate in various skills competitions, in recent years has won more than 80 first prizes above the provincial level, trained more than 200 Shandong Province "Qilu craftsmen reserve talent", students "double certificate" access rate of 100%, graduate employment rate of 99.47%, The professional counterpart rate is 85.39%.

Fruitful teaching results, outstanding scientific research ability. The teaching team has won more than 10 achievements such as famous teachers, famous teachers of young skills, teaching achievement awards, and planning textbooks, declared more than 150 vertical and horizontal projects, solved 37 first-line problems in the production of small and medium-sized enterprises, and transformed 13 patent achievements, with more than 10 million yuan of funds to the account and generated economic benefits of more than 90 million yuan.

The quality of social training is good, and the enterprise recognition is high. Every year, more than 10,000 people are trained in ex-servicemen's education, special operation electricians, "gold blue collar", and enterprise workers' skills upgrading, and more than 1,800 people are identified for various skills. Three digital courses for adult higher education such as "Electrical and Electronic Technology and Application" have been built, 8,000 teaching resources have been exported, and 200 teachers have been trained daily, greatly improving the production

skills of enterprise employees and teachers outside the school.

4. SUMMARY OF EXPERIENCE

On the basis of in-depth implementation of the "National Vocational Education Reform Implementation Plan" and the "Action Plan for Improving the Quality and Training of Vocational Education (2020-2023)", Zibo Vocational College's skill inheritance and innovation platform relies on the "three-teacher collaborative education system of theoretical teacher foundation, skill master and enterprise master", and takes "scientific research project"[5] and "skill contest" as the carrier. Based on the concept of "cultivating talents and morals, improving quality and promoting skills", it provides a wealth of replicable and extendable experience for talent training in higher vocational colleges. The stable and efficient operation of the platform for inheriting skills and innovation has significantly improved the training and innovation of skills and cultivated a large number of high-quality technical talents. Excellent cases of education and teaching have been reported more than 20 times by mainstream media such as Xinhua News Agency, CCTV, People's Daily and China Education Daily, etc. Typical cases of school-enterprise cooperation have been exhibited at the Asian Education Forum and promoted to the National Joint Conference of

Presidents of Higher Vocational colleges and universities, attracting many visits and exchanges from domestic and foreign colleges and universities.

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Characterization of Piston Rod Surfaces Using the Scattered Light Method Using Excel

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Abstract: With the help of a scattered light sensor it is possible to obtain five characteristic values, namely Aq, Ask, Aku, I and M. The different sizes can then be displayed in different colors, so that the surface can be clearly depicted. In the following research, a frequency distribution of the Aq values is performed as an example.

Keywords: Surfaces; Characteristic Values; Scattered Light Sensor Measurement

1. INTRODUCTION

The piston rod of the gas spring always moves in and out in a straight line in the ideal condition. However, in daily use, it is possible that this process takes place at a small angle. This can cause friction forces between the piston rod and the guide, which can destroy the oxide layer as well as the connecting layer. For this reason, the piston rod is examined by a wear test, which makes it possible to assess the wear resistance of the surface, Figure 1.

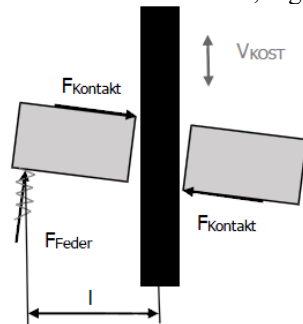


Figure 1 Principle of wear test [1]

2. EXPERIMENTAL

The following table shows the dependence of the measuring length L of the piston rods with the resulting number of measuring points per line, Table 1.

Table 1 Number of measuring points per measuring length

| L Measuring length (mm) | Number of measuring points per line |
|-------------------------|-------------------------------------|
| $L \leq 100$ | 2,500 |
| $100 < L \leq 200$ | 5,000 |
| $200 < L$ | 6,000 |

Eight standard measurements must be made to measure the entire piston rod. Each standard measurement consists of an Excel file with the five

parameters mentioned, which are stored individually on a worksheet. In each worksheet there are ten columns with measurement data (according to the 10 measurement lines). The number of measurements per line can be 2,500; 5,000 or 6,000 points are [2].

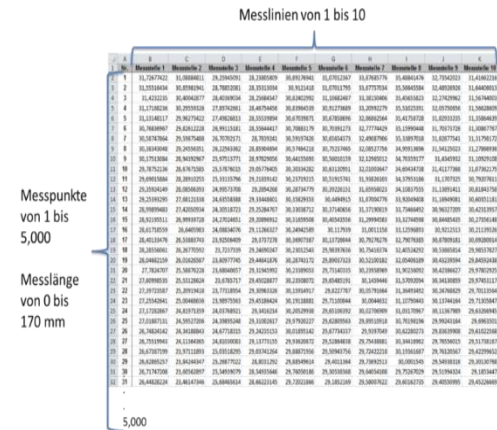


Figure 2 Aq value of one part (batch 5067)

Figure 2 shows the Aq values of a series piston rod (batch, TN polishing machine; 5067-423534-412532-3) in the form of an Excel table. The piston rod of batch 5067 has a length of 170mm. According to the measurement point criteria in Table 1, there are therefore 5,000 points per line. The Aq matrix thus consists of 50,000 point data. A color scale is used to display the Aq values in different colors [3]:

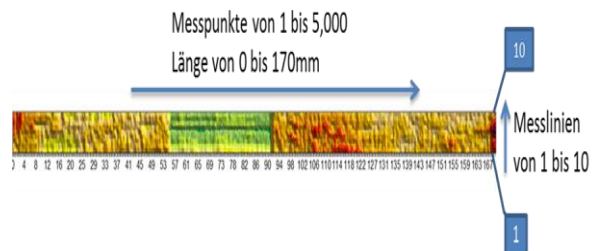


Figure 3 Color scale and Aq value representation. In addition to the Aq values, the Ask, Aku, I and M values are also obtained from the scattered light sensor. Each characteristic value provides 50,000 numbers, which can also be represented by different color scales. The one in Fig. 3 Piston rod shown has been examined in wear test and therefore has a much

smoother area in the middle, Figure 4.

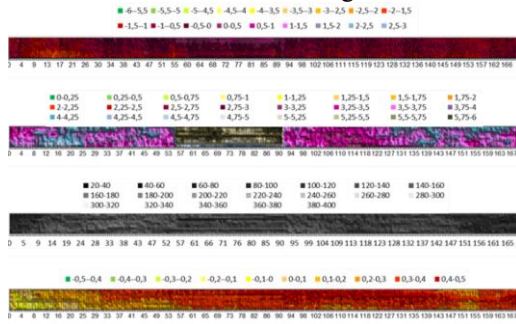


Figure 4 Color scale and Ask, Acu, I and M value representations

3. CONCLUSIONS

Ultimately, all data can be summarized in one table. This table also shows and makes it possible to compare the different parameters of the individual sections. A corresponding data connection only changes the factors in the corresponding table to determine the desired range and calculate the statistical figures.

Figure 5 is a summary table. The information on the length [mm] and the row number (from B to K with sequence) are in the cell with green letters or green letters. with grey background. This information

provides the statistical data for the respective section.

| Teil | Messpunkt in Skala (mm) | Abstand(a) zwischen zwei benachbarte Punkte | relative Zellennummer (n) | erste Zeile ist unsinn | absolute Zellennummer (n) | abgerunden |
|--------------|-------------------------|---|---------------------------|------------------------|---------------------------|------------|
| 1. | 54 | 0,034 | 1,0 | 1,0 | 2,0 | 4 |
| Statistik: | Aq | Ask | Aku | I | M | |
| Min: | 15,1 | -2,2 | 3,0 | 76,0 | -0,3 | |
| Max | 35,6 | 0,5 | 4,8 | 176,0 | 0,5 | |
| Median: | 25,0 | -0,9 | 3,8 | 145,0 | 0,2 | |
| sq: | 25,0 | -0,9 | 3,8 | 140,1 | 0,2 | |
| Liniennummer | | 1 | 10 | | | |
| 2. | 91 | 0,034 | 2676,5 | 1,0 | 1589,2 | 1589 |
| Statistik: | Aq | Ask | Aku | I | M | |
| Min: | 11,4 | -2,0 | 3,3 | 106,0 | 0,1 | |
| Max | 28,9 | 1,1 | 7,0 | 160,0 | 0,5 | |
| Median: | 14,8 | -0,3 | 5,6 | 132,0 | 0,4 | |
| sq: | 15,6 | -0,3 | 5,5 | 133,3 | 0,4 | |
| 3. | 170 | 0,034 | 5000,0 | 1,0 | 2677,5 | 2677 |
| Statistik: | Aq | Ask | Aku | I | M | |
| Min: | 15,1 | -1,7 | 2,7 | 79,0 | 0,1 | |
| Max | 40,9 | 1,0 | 5,6 | 164,0 | 0,6 | |
| Median: | 26,7 | -0,7 | 3,6 | 124,0 | 0,4 | |
| sq: | 26,9 | -0,7 | 3,6 | 123,7 | 0,4 | |

Figure 5 Summary table

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The competition promotes the exploration of teaching reform of integrated circuit layout design course

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Abstract: The integrated circuit layout design course plays a vital role in the process of training application-oriented integrated circuit talents. For the microelectronics major students can enter the layout design industry, also need to learn this course. How to teach this course well is a topic worth exploring for microelectronics teachers. The competition of "Integrated Circuit Design and Development" has provided a strong impetus for the reform of the relevant courses of integrated circuit design. Combining with the competition of "IC Design and Development", this paper timely adjusts the teaching content of IC layout design practice course, and further improves the construction of practice teaching platform.

Keywords: Layout; DRC; LVS.

1. INTRODUCTION

In June 2014, The State Council issued the Outline for the Development and Promotion of the National Integrated Circuit Industry, proposing the goal of exceeding 350 billion yuan in sales revenue of the integrated circuit industry by 2015, and reaching the international advanced level in the main links of the integrated circuit industry chain by 2030. The Outline pointed out that in order to achieve the above goals, more efforts should be made to train talents. Establish and improve the integrated circuit personnel training system, support the development of microelectronics, and vigorously train high-level, urgently needed and backbone professionals[1] in the field of integrated circuits in various forms. In recent years, through guiding students to participate in the "Integrated Circuit Design and development" competition, further realize the necessity of integrated circuit layout design course reform.

The "IC Design and Development" competition closely follows the latest development in the field of IC technology and the demand for talents in the IC design and manufacturing industry. It focuses on assessing the comprehensive skills of microelectronics technology, integrated circuit technology, applied electronics technology, electronic information engineering technology and other majors in integrated circuit design, integrated circuit manufacturing process, integrated circuit testing, integrated circuit application (including electronic

circuit design, program design and circuit assembly, etc.), which is in line with the core technical skills training requirements [2] of the above majors.

Integrated circuit layout design, as a design link of integrated circuit design, is to convert the logic and circuit functions and performance into the photomask layout that meets the relevant process requirements, so as to realize the final output of IC design [3]. The specific content of this course includes: integrated circuit and layout design concept, method and tool; The use of LINUX operating system and virtual machine; Integrated circuits involving basic software operations; Layout of common components; Layout design and verification of CMOS basic logic gate; Layout design and verification of CMOS compound logic gate; Layout design and verification of CMOS D flip-flop; Standard cell layout design, etc. Combining with the competition of "Integrated Circuit Design and Development", this paper explores and practices the teaching and assessment of integrated circuit layout design course.

2. BASED ON CANDENCE TOOL, THE PRACTICE TEACHING PLATFORM OF IC LAYOUT DESIGN IS CONSTRUCTED

The cultivation of IC design talents cannot be separated from the construction of practice teaching platform. The establishment of IC layout design practice teaching platform is mainly to select appropriate EDA tools and provide a good software and hardware environment for students. Cadence Virtuoso system design platform is a system-based overall solution that provides the function of clean Layout from a single Schematic driver IC and package simulation as well as LVS (Layout Versus Schematic, verification of layout and schematic). There are two key flows: implementation and analysis.

The validation tool is Calibre, a layout verification software from Mentor Graphics that includes design rule Check (DRC), layout and schematic consistency check (LVS), Electrical Rule check (ERC), and layout Parasitic parameter extraction (LPE). In addition to these functions, the most important feature of Calibre is the concept of Hierarchy, which is a so-called "hierarchy" processing method. The principle is actually very simple, for example, suppose a unit is called tens of thousands of times, if the unit itself has

an error, if from the "level" point of view, that is, in the Dracula view there are tens of thousands of errors, in fact, from the "Hierarchy" (Hierarchy) point of view only one unit error. Greatly reduce the error check time. The advantage of Hierarchy verification is obvious, and many problems can be solved immediately. Thus easily solve the Dracula point of view is very difficult problems, such as wire short circuit (short) and other problems.

3. BASED ON THE VOCATIONAL EDUCATION CLOUD PLATFORM, BUILD AN ONLINE AND OFFLINE TEACHING MODEL

Vocational education cloud is an online teaching platform for teachers and students in schools. Teachers can directly import courses (materials or topics) in smart vocational education, a national resource platform, into the vocational education cloud to carry out teaching. At the same time, they can grasp students' news in real time through the mobile APP, and also carry out colorful classroom activities with students through the APP. Students can complete a series of course requirements through the APP, such as learning courseware, submitting homework and taking exams. Online and offline teaching mode can not only play the leading role of teachers in guiding, inspiring and monitoring the teaching process, but also fully reflect the initiative, enthusiasm and creativity of students as the main body of the learning process, so as to truly achieve the purpose of flipped classroom.

Through the vocational education cloud course platform to publish class resources, discussion topics, unit assignments, online question-answering, course tests, etc., to conduct multi-angle and multi-level analysis of curriculum knowledge, increase teacher-student interaction, and promote teaching and learning. The online (vocational education cloud) offline (classroom) mixed teaching method is adopted to prevent students from brushing lessons and taking tests on behalf of others. Do "three" : first, there are resources online, and the construction specifications of resources should be able to realize the explanation of knowledge; Second, there are offline activities, activities should be able to test, consolidate, transform online knowledge learning; Third, process evaluation, both online and offline, process and results need to be evaluated.

4. OPTIMIZE THE COURSE CONTENT AND HIGHLIGHT THE CHARACTERISTICS OF THE COURSE

Integrated circuit layout design is a key link connecting integrated circuit design and manufacturing, and plays an important role in the learning and vocational ability training of electronic science and technology majors. Through layout design, the three-dimensional circuit can be transformed into two-dimensional plane graphics, and the three-dimensional structure based on semiconductor silicon material can be transformed

through technological processing. According to the relevant statistical institutions to study the trend of employment of graduates majoring in electronic science and technology in recent years, it is found that in the fields related to integrated circuit design represented by integrated circuit layout, including integrated circuit testing and technology, relatively speaking, the requirements for circuit design knowledge are not high, so these positions are more competitive for college students. From this point of view, integrated circuit layout design practice courses for college students in the future employment or further study has laid a solid foundation. In view of the important role of IC layout design course in the learning and ability training process of microelectronics technology major, combined with the analysis of the problems and shortcomings of the students participating in the "competition", our college timely adjusted the teaching content of IC layout design practice course.

At present, in the practice teaching process of IC layout design, by explaining the layout design process and methods, students are led to complete the design of a fully customized inverter based on standard CMOS technology. In this process, students not only learn the integrated circuit design process, but also get familiar with and master the use of Cadence tool, and further understand the role of each layer mask plate in the integrated circuit layout design process and drawing steps. After drawing the inverter layout, students are required to use Calibre tool to complete the DRC and LVS verification of the layout. After learning the inverter, students can independently complete the layout design of some basic digital units, and complete the layout design and verification of basic logic gates, compound logic gates, D-flip-flops and other unit circuits by invoking these basic units. In this process, students have further mastered the design method of hierarchical circuits. In addition, the IC layout design practice course also arranges the design content of analog circuit layout, which not only requires students to master the layout design methods of common passive devices such as poly crystalline silicon resistors, flat poly crystalline silicon capacitors and metal multi-turn spiral inductors, but also requires students to complete the layout design and verification of a simple operational amplifier.

5. IMPROVE ASSESSMENT METHODS AND ENSURE PROCESS CONTROL

The final score of traditional practical teaching is mainly determined based on students' internship reports. Whether students engage in hands-on practice and the quality of their courses cannot be effectively judged and controlled, resulting in incorrect evaluation of students' practical course grades. Our department adopts a dynamic assessment and focuses on regular performance to address the shortcomings of previous assessments.

Firstly, quantify the daily tasks that students must complete, set a timeline, and upload daily design projects to the server in the computer room. Secondly, random checks will be conducted once every 3 days and major assignments will be conducted once every 5 days, allowing students to design a layout on the spot and provide theoretical explanations. All students participate in evaluating the quality of layout design. Enable every student to feel the seriousness and time constraints of actual design work, and cultivate excellent qualities of rigorous and punctual engineers. Students' daily work is dynamically recorded on the server, and at the end of practical teaching, teachers can use this as a basis for judging grades and accurately evaluate each student's practical achievements.

The teacher extracts the errors and problems that students are prone to in their practical assignments, analyzes the reasons for the errors, categorizes and organizes them as teaching materials, reminds students to avoid similar problems, and greatly improves their design level and internship performance. At the same time, teachers communicate face-to-face with students, allowing them to explain the concept and layout of layout design assignments, which involve details such as how electrical and geometric parameters are related, how area and performance are compromised, and how symmetry requirements are met. Through these exchanges, students' basic theoretical knowledge and familiarity with engineering practice can be verified, comprehensively promoting students to master layout design theory and gain practical experience, Explore a new teaching method and talent cultivation model that combines theory with practice.

6. EPILOGUE

With the help of the competition, the course strives to help the development of microelectronics technology, integrated circuit technology, applied electronics technology, electronic information engineering technology and other majors in the country, promote the construction of teaching resources, teaching platforms and teaching materials of integrated circuit layout design course, train and reserve teachers for the professional talents, and build a platform for comprehensively improving the quality and connotation of talent training. At the same time, through the introduction of the events in the course, it will help more students to understand the competition, participate in the competition, improve their skills, expand the influence of the skills competition in vocational colleges, and create a good atmosphere of advocating skills and attaching importance to skills. It provides for the reform of integrated circuit layout design related courses a powerful push.

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Exploration and Practice of Higher Vocational Colleges in International Cooperation

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Abstract: Conducting international cooperation is an important part of the "Double High Plan" construction and an important measure for vocational colleges to face the world and improve their international education level. At present, there are still problems in the development of international cooperation in vocational colleges, such as unclear goals for international education, blocked channels, and difficulty in achieving foreign aid. To this end, the electrical automation technology professional group has deepened its connotation based development, improved its management and operation mechanism, and taken multiple measures to promote international cooperation and development. Introduce the advanced technology and skill talent training model from Germany, and build the Sino German Institute of Intelligent Manufacturing into an international brand of vocational education. Two overseas educational institutions, a talent training base for Chinese and foreign people to people and cultural exchanges, and a project approved by the Ministry of Education - the construction unit of the GF Intelligent Manufacturing Innovation Practice Base in Switzerland and the teaching resource development center have been established. Three sets of professional teaching standards have been exported to countries along the "the Belt and Road", providing "ZiZhi programme" for international cooperation of higher vocational colleges.

Keywords: International Cooperation; International Brand; Zizhi Programme.

1. INTRODUCTION

In order to deeply implement the spirit of the National Education Conference and the Implementation Plan for the Reform of National Vocational Education, the Ministry of Education and the Ministry of Finance jointly issued a plan for the construction of high-level vocational schools and majors with Chinese characteristics (hereinafter referred to as the "Double High Plan"). The Double High Plan proposes to concentrate efforts on building a group of vocational schools and professional groups that lead reform, support development, have Chinese characteristics, and are of global level, driving the continuous deepening of vocational education reform, strengthening connotation construction, and achieving high-quality development. This is a major decision made by the country in the field of

vocational education, pointing out the direction for the development of vocational education. Improving internationalization level "is one of the ten major tasks of the" Double High Plan "construction, and international cooperation is an important content of the" Double High Plan "construction. It is an important measure for vocational colleges to face the world and improve their international education level, and also an important way for vocational education modernization reform and serving the country's opening up strategy[1]. The construction of the "Double High Plan" provides more opportunities for vocational colleges to carry out international cooperation, and at the same time, the problems faced by vocational colleges in international cooperation are also evident.

1.1 Unclear goals for international cooperation

When implementing international cooperation projects in some vocational colleges, the goals are not clear enough, the overall planning is not mature enough, and cannot align with the development direction of the professional group, demonstrating the limitations of "take it one day at a time".

1.2 International cooperation channels are not smooth

Compared to undergraduate colleges, international cooperation in higher vocational colleges in China has the characteristics of blocked channels, low levels, and small scale. This is mainly due to the late start and limited resources of platform related construction in higher vocational colleges[2].

1.3 Lack of channels and models for foreign aid in vocational education

Compared to undergraduate colleges, international cooperation in higher vocational colleges in China has the characteristics of blocked channels, low levels, and small scale. This is mainly due to the late start and limited resources of platform related construction in higher vocational colleges.

2. MAIN APPROACH

2.1 Relying on the sino german institute of intelligent manufacturing to enhance the internationalization of professional groups in education

With the goal of creating a localization model for German "dual system" vocational education, forming and promoting the "dual system" and "Zibo experience", we have jointly established the China German Intelligent Manufacturing Institute, Munich Intelligent Manufacturing Research Center, and foreign "dual teacher" teacher training bases with

Germany's Rhinecost Technology Co., Ltd. to carry out international talent cultivation, academic exchange, and teacher training. Open up the "dual system" vocational education promotion channel, and implement the cultivation and transportation of international versatile talents[3]. Develop and introduce educational and teaching resources for the AHK training and certification system, formulate talent training plans and curriculum standards for German vocational standards, write AHK certification textbooks, and build international courses with Chinese characteristics.

2.2 Expand international channels for professional groups

Introduce the teaching staff, curriculum, and professional standards of foreign universities such as Bielefeld University of Applied Technology in Germany, and carry out joint education to achieve internationalization of vocational education from associate degree to undergraduate level and professional master's degree training. Carry out overseas learning and training for teachers, organize teachers to participate in international academic conferences, obtain international licenses, and create a teaching team with an international perspective. Strengthen the cultivation of humanistic literacy and internationalization ability of cultural exchange between China and foreign countries for talents in the equipment manufacturing industry, and achieve learning and exchange among domestic and foreign students through the construction of a talent training base for cultural exchange between China and foreign countries in intelligent manufacturing.

2.3 Build two overseas educational institutions and output intelligent manufacturing "zizhi programme"

Relying on Germany's Rhinecost Technology Co., Ltd., we have jointly established the Sino German Institute of Intelligent Manufacturing Technology in Germany, jointly developed international level professional teaching standards and curriculum standards, and constructed a teaching system for professional talent cultivation in the vocational stage. We have collaborated with Germany's Bielefeld University of Applied Technology to implement the one-stop talent cultivation of "Secondary vocational school-Higher vocational education-Application-oriented undergraduate".

Cooperating with the China Nonferrous Metals Industry Talent Center and Teng kai Mining, a subsidiary of China Nonferrous Metals Group in the Democratic Republic of Congo, to build the Africa Branch of Zibo Vocational College (China Congo Vocational and Technical College) in the Democratic Republic of Congo. Carry out vocational training for local employees of overseas enterprises of China Nonferrous Metals Mining Group, and provide higher education for (gold) high school graduates. With the characteristic of combining education and training, formulate teaching standards, develop professional

courses, combine length and length, and combine education and training to cultivate urgently needed intelligent manufacturing talents in the local area.

3. ACHIEVEMENT EFFECTIVENESS

Establish an AHK vocational qualification certificate certification center, conduct AHK training and certification in mechanical and electrical integration technology, electrical automation technology, and other majors, and obtain 70 AHK certificate students; Cooperate with the Chinese Council of UKNARIC (British National Academic Degree Evaluation and Certification Center) to achieve 40% of full-time teachers' overseas learning and training through Zoom and other "Internet plus" online platforms, 20 teachers attended international academic conferences and 20 obtained international certificates;

Cooperate with the Chinese Council of UKNARIC (British National Academic Degree Evaluation and Certification Center) to achieve 40% of full-time teachers' overseas learning and training through Zoom and other "Internet plus" online platforms, 20 teachers attended international academic conferences and 20 obtained international certificates;

The electrical automation technology major has passed international professional evaluation and certification, and has established one foreign "dual teacher" teacher training base, one domestic AHK professional qualification certificate certification center, and one overseas well-known expert studio. Develop 6 bilingual textbooks and 30 professional teaching and curriculum standards.

4. SUMMARIZE EXPERIENCE

Through the exploration and practice of international cooperation, the professional group introduces advanced international concepts, standards, and experiences, draws on, absorbs, and integrates advantageous international resources, and lays a solid foundation for enhancing the international competitiveness of the professional group; On the other hand, it participates in international vocational education affairs, provides China's vocational education programs and standards to countries along the "the Belt and Road", and promotes the connotative and high-quality development of higher vocational education. The professional group takes international cooperation as an important starting point, deepens the integration of industry and education, and school enterprise cooperation, and builds the Sino German Intelligent Manufacturing College into an international brand of vocational education. It provides a "Zibo Vocational Plan" for international cooperation in vocational colleges, helping China's vocational education to create more international and high-level teaching staff, and cultivating more technical and skilled talents with international perspectives.

Design a Chinese characteristic "dual system" model in an ecological way, form a systematic and market-oriented operation mechanism for deep

integration of industry and education, and build an innovative ecosystem for integration of industry and education. Integrate the resources of schools, industry enterprises, local governments, and industrial parks, jointly participate in the construction of an industry education integration platform, and build a "industry leading enterprises+universities+professional service institutions+small and medium-sized enterprise group" industry education integration development model with cross enterprise and cross school dual cross training centers as the link.

Exploring ways to build a community of interests that integrates industry and education. Explore the value demands of all parties, find common interests, and facilitate value exchange through demand docking. At the same time, improve the top-level design of value exchange, build a value exchange platform, and form a long-term cooperation mechanism between all parties based on a community of interests. Breaking through the limitations of previous organizations such as "school run factories" in terms of nature, philosophy, and perspective, and minimizing the consumption of social public resources to the greatest extent.

Explore the bidirectional transformation mechanism between education and industrial resources. Committed to finding ways to transform educational and innovative elements into practical production factors, productivity, innovation, and competitiveness for industries, industries, and enterprises. At the same time, the production process, production factors, and innovation elements of the enterprise are transformed into educational elements, educational scenarios, and educational resources of the school, truly forming a two-way transformation mechanism of industrial and

educational elements.

5. CONCLUSIONS

The exploration and practice of international cooperation in the field of electrical automation technology will form typical cases and be promoted in vocational colleges nationwide. Firstly, to enhance the international competitiveness of our school's electrical automation technology professional group, it is expected that more than 3000 people will directly benefit. Subsequently, international cooperation project construction standards, typical cases, and method systems will be formed, which will be promoted and applied in similar majors in universities within and outside the province, enhancing the internationalization level of similar universities. The expected number of beneficiaries per year is more than 20000 teachers and students.

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On the Necessity of Training and Improving the Referee Ability of College Basketball Teachers

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Abstract: As a competitive sport, basketball plays an increasingly important role in college physical education curriculum. However, compared with the popularization and development of basketball, the referee ability of college basketball teachers is particularly insufficient, especially in the interpretation of rules, game management and fair ruling. This situation not only affects the quality of competition, but also restricts the overall development of students' sports skills and sportsmanship. In view of this, this study aims to explore the necessity and innovation path of training and improving the referee ability of college basketball teachers, so as to improve the comprehensive quality and professional ability of teachers.

Keywords: College Basketball Teachers; the Ability To Judge; Path

0. INTRODUCTION

Basketball, as a popular and valued sport around the world, plays a unique role in cultivating students' physical and mental health, team spirit and competitive attitude. In this context, as a key part of the game, basketball referees are not only responsible for implementing and interpreting the rules of the game, but also play an irreplaceable role in maintaining the fairness, fluency and order of the game. A qualified referee is essential to ensure the quality, fairness and positive impact on the players' behaviour and the spirit of the game.

1. THE NECESSITY OF COLLEGE BASKETBALL TEACHERS' REFEREE ABILITY TRAINING

1.1 Improve competition fairness and compliance

In the contemporary education system, college basketball teachers, as the direct supervisors and rule enforcers of competitions, have a direct impact on the fairness of competitions and students' understanding of basketball [1]. First of all, in the process of the game, teachers need to have a deep understanding of the rules of basketball, and have the ability to judge and execute, so as to make quick and accurate decisions. The fair judgment can ensure that all students participating in the game feel the equal competitive environment, and then form the concept

of fair competition. Secondly, the correct implementation of basketball rules is not only a guarantee for the smooth running of the game, but also an important part of basketball education for students [2]. If college basketball teachers can accurately interpret and implement the rules, students can clearly understand the rules of the game, which is crucial for their correct learning of basketball skills and tactics. Through the application of the rules in practice, students are able to experience the importance of the rules in the competition, thereby improving their skills and understanding of the game in practice.

1.2 Improve teaching quality and student experience

As a collective sport, the teaching process of basketball involves not only the imparting of skills and strategies, but also the understanding and application of game rules. Therefore, improving teachers' judgment ability is of great significance for enhancing teaching effect and optimizing students' learning experience [3]. First of all, when teachers can accurately demonstrate and explain the rules in the game in class or training, students can not only master the rules faster, but also understand the principle and spirit behind the rules, which helps students to fully master basketball skills and improve the level of competition. Secondly, through teaching methods such as simulated competition, teachers can use their own judging skills to guide students to experience the real competition environment and increase the practicality and interest of learning. Such interactive experience can stimulate students' interest in basketball and help improve their teamwork ability and competitive level [4]. In addition, the fairness and professionalism of teachers in the judging process can not only set an example for students to abide by the rules and play a fair game, but also educate students how to maintain integrity and respect their opponents in the competition through practical cases, which plays an important role in the overall development of students and shaping good sportsmanship.

1.3 Promote the cultivation of students' sportsmanship and competitive spirit

In college basketball teaching, teachers' referee

ability is not only related to the imparting of technology and rules, but also affects the cultivation of students' sports ethics and competitive spirit. As the core component of physical education, it has a profound impact on students' all-round development and future social adaptability. First, when teachers are able to enforce the rules of the game impartially, students will experience the importance of fair play in every game and practice. This experience is essential for students to develop a sportsmanship that follows the rules and respects opponents. A fair referee is not only a guarantee for the fairness of the game, but also an effective way to conduct moral education for students [5]. Secondly, students' attitude towards challenges and competition in sports competitions will determine their future growth and progress. Therefore, a professional and impartial judge can convey to students the spirit of facing challenges and fair competition through his own behavior and decision-making. This kind of spiritual cultivation will not only help students to grow in the field of sports, but also have a positive impact on their challenge and competitive attitude in daily life. In addition, by improving the ability of referees, teachers will be able to deal more effectively with conflicts and injustices in the game, thus better maintaining the order of the game, ensuring student safety and educating students on how to remain calm and rational in competition.

1.4 Improve teachers' professional development and market competitiveness

Under the background of the increasingly fierce competition in the current education field, the professional development and market competitiveness of college basketball teachers have become the key factors for personal career development. The improvement of referee ability is not only an important part of basketball teaching skills, but also an effective way to improve teachers' professional level and market competitiveness. First of all, in basketball teaching, in addition to teaching technology and tactics, the accurate understanding and application of the game rules is also an indispensable part. A teacher who can act as a referee can demonstrate a comprehensive and in-depth grasp of basketball, thereby enhancing the comprehensiveness of his teaching and enhancing his professional status among his peers. Secondly, with the development of physical education and the diversification of the market, teachers' multi-skills have become an important symbol of their competitiveness. Among many teachers, teachers with the ability to judge are more likely to stand out in the professional market. This ability not only makes it more important in on-campus games and activities, but also provides more opportunities for teachers to participate in off-campus basketball events and training. Therefore, the improvement of judges' ability has a significant effect on teachers' expansion of their

professional fields and increase of additional career opportunities [6]. In addition, in a rapidly changing educational environment, teachers need to constantly update their skills and knowledge to adapt to new educational needs and challenges. The improvement of referee skills is not only the deepening of existing knowledge, but also the learning and mastering of new skills, which is crucial for teachers' lifelong learning and career development.

2. JUDGING STANDARD OF COLLEGE BASKETBALL TEACHERS' REFEREE ABILITY

2.1 Mastery of rule knowledge

In the process of evaluating the referee ability of college basketball teachers, the core of the standard of rule knowledge is to measure the teacher's comprehensive understanding and accurate application of the basketball rules. A good referee not only needs to understand the basic rules of the game, but also must have a deep understanding of the interpretation and application of the rules in a variety of complex situations, including the accurate grasp of all kinds of fouls that may occur during the game, scoring rules, time management and game procedures. Teachers should have extensive and in-depth knowledge in this field and be able to make decisions quickly and accurately in competitions [7]. In addition, the mastery of rule knowledge also involves the sensitivity and adaptability to rule changes. The rules of basketball are not fixed, and as the game evolves and technology advances, the rules are adjusted and updated accordingly. Therefore, a qualified basketball referee needs to constantly update his personal knowledge base to ensure that decisions are always in line with the latest rules.



Figure 1. Basketball game scene

2.2 Competition management and control capabilities

In the evaluation of the referee ability of college basketball teachers, the standards of game management and control ability mainly focus on the referee's ability to maintain order, deal with complex situations and ensure the fair and smooth progress of the game. A referee with good game management and control can effectively deal with unexpected situations such as player disputes, technical errors, or crowd interference, while maintaining the flow and enjoyment of the game. At the same time, the game

management ability also includes the control of the rhythm of the game, the referee needs to be able to flexibly adjust the referee strategy according to the actual situation of the game, in order to maintain the consistency and intensity of the game. In addition, this standard also concerns the referee's ability to deal with disputes arising in the game. In a high-pressure competition environment, referees need to make decisions quickly and accurately, while maintaining fairness and calmness in handling disputes, which requires not only a solid knowledge of rules and keen observation ability, but also a strong psychological quality to make a reasonable decision in a tense situation [8].



Figure 2. Judgment

2.3 Communication and decision-making skills

In the evaluation system of college basketball teachers' referee ability, communication and decision-making skills mainly consider the referee's communication effect with players, coaches and other referees during the game, as well as the ability to make accurate and rapid decisions in the tense and rapidly changing game environment. A referee's communication skills are reflected in his ability to clearly and accurately communicate decisions and interpret rules, as well as his ability to remain calm and professional when dealing with various situations that arise during the game. This includes effective communication with players and coaches during tight matches, as well as coordination with other referees when necessary. [9] Decision-making skills are another important aspect to evaluate the referee's ability, especially in the rapidly changing situation of the game, the referee needs to make key decisions in a short period of time, which requires not only a deep understanding of the basketball rules, but also the ability to quickly judge and deal with complex situations in the game.



Figure 3. Judgment

2.4 Physical and psychological quality

In the evaluation criteria of college basketball teachers' referee ability, physical quality emphasizes the referee's endurance, speed and flexibility in the game. The basketball game is fast paced and the field is wide, so the referee needs to have good physical fitness in order to maintain efficient athletic ability and position sense throughout the game, to ensure that they can follow the pace of the game and accurately observe and judge the game situation. The psychological quality is related to the referee's psychological adjustment ability in the face of pressure and challenges in the game, including the ability to resist pressure, emotional control, calm thinking and impartial mentality. The game of basketball is often accompanied by intense competition and high emotions, and referees need to maintain a clear mind in this environment, make fair decisions, while handling the communication and interaction with players, coaches and spectators. A good referee must not only be able to deal with the demands of the game physically, but also have the ability to deal with various situations in the game psychologically. Therefore, physical and psychological qualities together determine whether referees can make fast, accurate and fair decisions in the game, and whether they can effectively manage and control the process of the game [10].



Figure 4. Daily training of referees

3. WAYS TO CULTIVATE REFEREE ABILITY OF COLLEGE BASKETBALL TEACHERS

3.1 Theoretical education and knowledge updating

In the way of training the referee ability of college basketball teachers, the process of theoretical

education and knowledge updating first emphasizes the in-depth understanding of the basketball rules, including the basic rules of the game, the judgment of various situations in the game, and the role and responsibility of the referee. Colleges and universities should set up specialized courses and lectures, hire experienced referees and coaches, and provide teachers with the latest basketball rules and officiating skills. In addition to learning the rules, a theoretical education should include an understanding of basketball history, technical trends, and game strategy. Universities should encourage faculty to participate in seminars, research projects, and even international exchanges, so that they can gain a broader perspective and knowledge, such a comprehensive knowledge structure can help teachers better understand the game, so that they can be more comfortable in officiating. In addition, with the development of science and technology, basketball referees began to gradually apply advanced technology such as video replay system, so teachers need to regularly update their technical knowledge in order to be able to effectively use these tools to improve the accuracy and efficiency of referees. Finally, in order to maintain the continuity and effectiveness of theoretical education, colleges and universities should establish a sound knowledge updating mechanism, including regular textbook revision, lecture update and cooperation with professional organizations to ensure that the educational content received by teachers is always kept up to date.

3.2 Practical skills training

In the way of training the referee ability of college basketball teachers, the focus of practical skills training is to deepen the teachers' understanding of basketball rules and improve their ability to deal with various complicated situations in the game through actual referee experience. Therefore, colleges and universities should organize teachers to participate in the referee work of simulated games, or arrange them to serve as referee or assistant referee in basketball games inside and outside the school, so that teachers can exercise their personal judgment and decision-making ability in the real competition environment. In order to assist practical skills training, universities can also analyze competition data through data analysis, so that teachers can have a deeper understanding of the various situations that occur in the competition and the impact of referee decisions on the competition. For example, colleges and universities can provide a table with detailed game data such as a team's score, foul count, time allocation, etc. By analyzing this data, teachers can learn how to make quick and fair decisions under pressure and how to deal with various complex situations that arise during a game.

Table 1 Key statistics of basketball games

| quota | team A | team B | remark |
|-------|--------|--------|--------|
|-------|--------|--------|--------|

| | | | |
|--------------------------|-----|-----|---------------------------------------|
| score | 102 | 99 | - |
| The number of fouls | 18 | 20 | - |
| time occupancy | 48% | 52% | - |
| The number of judgments | 12 | 15 | Including fouls and technical fouls |
| Controversial judgment | 2 | 3 | A judgment at a critical moment |
| The number of suspension | 3 | 4 | The suspension requested by the coach |

The table above is the basic situation of the game, in which the number of disputed decisions will directly affect the direction of the game and the final result, requiring the referee to be extremely cautious and accurate when making decisions. Teachers can deeply understand the importance of referee decisions in competitions through practical analysis. In this process, colleges and universities need to provide experienced referees or coaches to evaluate and guide teachers' performance after practical activities, so as to help them identify and improve their shortcomings in referee work.

3.3 Psychological quality training

In the training path of college basketball teachers' referee ability, the core of psychological quality training is to strengthen teachers' psychological ability to resist pressure, calm decision-making and emotional control under high pressure environment. Colleges and universities should realize that in the referee work of basketball games, besides the accurate understanding of the rules and the mastery of the referee skills, psychological quality is also the key factor to determine the performance of the referee. First of all, colleges and universities should provide psychological training courses for basketball teachers, such as emotion management, pressure coping and conflict resolution. The courses can help teachers learn how to stay calm and objective in a stressful game environment by simulating high-pressure situations in the game. For example, by role-playing or simulating controversy scenarios, teachers can practice making quick and accurate decisions under a variety of pressures. Secondly, colleges and universities should encourage teachers to participate in seminars and lectures related to psychological quality, so as to help teachers understand the basic knowledge of psychology, so that they can learn how to apply this knowledge in practical competitions. For example, understanding the psychological characteristics of different types of players can help referees better understand the players' behavior and therefore make more reasonable decisions. In addition to formal

training and learning, universities should provide a supportive environment where teachers can share their psychological challenges in officiating and receive advice and help from peers and experts. This kind of communication can help solve the specific problems that individual teachers may face, and can also promote the collective growth of the whole group of teachers in terms of psychological quality. In addition, teachers should be encouraged to record and analyze their own psychological reactions and decision-making processes in the adjudication process, and make them more aware of their personal deficiencies through self-awareness.

3.4 Ethics and professional ethics education

In the path of college basketball teachers' referee ability training, ethics and professional ethics education lies in cultivating teachers' moral consciousness and professional responsibility to ensure that they can be impartial, honest and trustworthy in the referee work. First, colleges and universities should design and implement a series of ethics and professional ethics related courses that cover basic ethical norms in basketball, such as fair play, respect for opponents and teamwork, and delve into the special ethical challenges of the officiating profession, such as how to deal with conflicts of interest, avoid bias and discrimination, and maintain integrity under pressure.

Secondly, its educational activities should not only be limited to theoretical teaching, but also include practical activities such as case studies, role playing and simulated adjudication. Among them, by analyzing real adjudication cases, teachers can learn how to apply ethical principles and professional ethics in real situations. Role-playing and simulated referees can help them experience and understand the complexity and importance of moral decisions in a simulated environment. In addition, colleges and universities should encourage teachers to communicate with experts and senior referees in the field, so that teachers can learn from experience and, in the process, deepen their understanding of the importance of professional ethics. Finally, regular self-assessment and reflection is also essential for ethics and professional ethics education, and teachers should be encouraged to regularly review and reflect on their own conduct in officiating, assess whether they have complied with ethical and professional standards, and rectify themselves if necessary.

3.5 Continuous learning and development

In the training path of basketball teachers' referee ability in colleges and universities, continuous learning and development will ensure that teachers can constantly update their personal knowledge and skills to adapt to the changing requirements of basketball referee work. First of all, continuous learning means that teachers need to constantly update their theoretical knowledge of the changes in basketball rules, new officiating techniques and

methods, and the latest development trends of basketball. For this purpose, colleges and universities should provide regular training courses and access to the latest research and information. Training courses should include seminars on updating rules, workshops on officiating techniques, and lectures on basketball development trends. Second, online learning has the advantage of convenience, can be adjusted according to personal schedule and learning pace, colleges and universities can make full use of online courses and remote seminars, so that teachers can be more flexible to receive the latest education and training. In addition, colleges and universities should encourage faculty to engage in self-driven learning, including reading the latest basketball and officiating related books, research reports and journals, and participating in online forums and community discussions. Enable teachers to choose learning content according to their personal interests and needs, so as to participate more actively in the learning process. Finally, in order to ensure the effect of continuous learning, universities should establish a set of sound evaluation and feedback mechanism, so that teachers can understand their own progress and shortcomings in the process of continuous learning, so as to adjust the learning plan more pertinently.

4. CONCLUSION

To sum up, improving the referee ability of college basketball teachers is not only the key to improve the quality of teaching and competition, but also an important way to promote the professional development of teachers and the overall growth of students. To this end, we should pay enough attention and take effective measures to promote its realization.

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Investigation and Analysis of The Employment Status of Law Majors -- Based on the Data of Graduates of Law Majors in Inner Mongolia University of Technology in Recent Four Years

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Abstract: Through the statistics and analysis of the data of graduates of law major in the past four years in Inner Mongolia University of Technology, the employment situation of this major is comprehensively sorted out, and the existing problems and solutions of law major employment are studied. The quantity and quality of initial employment of law graduates are constantly improved by guiding students' employment view in stages, building school-enterprise exchange and cooperation platforms, and innovating job search paths.

Keywords: graduates, employment, school-enterprise exchange

1. INTRODUCTION

The employment of college graduates is related to education and personnel training, economic development and social stability, and is an important human resource of the country. With the increase in the number of college graduates year by year, combined with the impact of the epidemic on the job market in recent years and other comprehensive factors, it has become a serious social problem for graduates to find employment, especially for law graduates. According to the relevant data released by the government in recent years, the overall graduation destination realization rate of law graduates has been in a low position for a long time, and the proportion of studying and signing employment is not high, which needs to cause us to reflect and pay attention to, and find effective ways to improve the employment situation of law majors on the basis of research and analysis.

2. DATA AND METHOD

(1) object of study

The research object of this paper is the graduates of law major of Inner Mongolia University of Technology in recent four years

(2) data sources

The data source of this paper is the annual report of employment quality of Humanities College of Inner

Mongolia University of Technology

(3) statistical method

Excel 2010 software was used to make statistics and analysis of relevant data 错误!未找到引用源。 .

3. RESULT

(1) The overall number of graduates and the implementation rate of graduation

As shown in Figure 1, the maximum number of law graduates in recent four years is 133, while the minimum number is 118. In 2021, the completion rate of graduation was 65.3%, and the remaining years were stable at more than 74%, and the overall completion rate of first graduation was not high. In recent years, affected by the novel coronavirus pneumonia epidemic, the number of graduates has remained high every year, and the market economy has been affected, and the employment position has been further reduced, which has brought a lot of psychological pressure to all graduates, and the employment concept of students and parents has changed, showing three tendencies of seeking "high", "stable" and "research" [2]. Seeking "high" means expecting to get a higher salary at the first employment; Seeking "stability" is due to the impact of the economic environment, graduates are more eager for stable jobs within the system, including public security law system and some administrative institutions, resulting in an increase in the number of people who do not work temporarily and continue to prepare for the exam; Seeking "graduate" is due to the conflict between high job expectations and the "devaluation of academic degree". Undergraduate law graduates in ordinary universities will face the pressure of "devaluation of academic degree". At the same time, many post-90s and post-00s graduates do not want to enter social work immediately, psychologically they have not completed the role transformation from students to "social people". As a result, the realization rate of the first graduation has been affected.

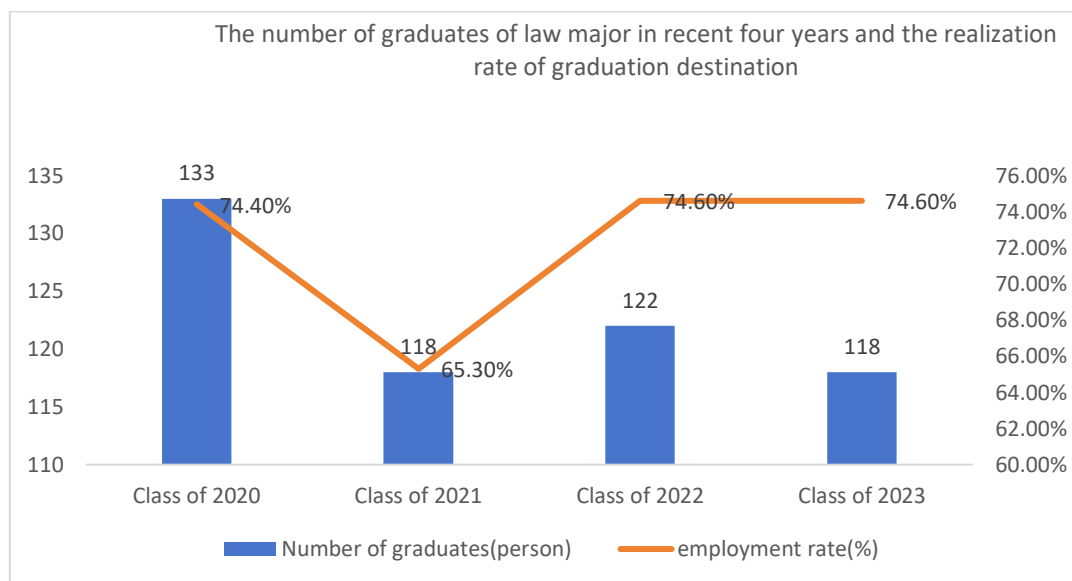


Figure 1: The number of graduates of law major in recent four years and the realization rate of graduation destination

(2) Graduation destination statistics

As shown in Table 1, after graduation in the past four years, most law graduates went to flexible employment (basic legal workers, freelance writers, online shop assistants, etc.), and least went to administrative institutions, and the law enrollment rate was relatively low. From 2020 to 2023, the admission rate of graduates will be 5.3%, 5.1%, 6.6% and 5.1% respectively. The entrance examination for law majors is highly competitive and difficult, and the proportion of undergraduates entering the graduate school is not high, which is mainly based on the exemption from postgraduate insurance. The proportion of employment in enterprises is 27.8%, 22%, 23% and 40.7%, among which the number of people who choose enterprises to sign employment contracts in 2023 is the largest, which is more than 10 percentage points higher than in previous years. It can be seen that with the effective control of the epidemic and the great importance of relevant departments and universities on employment, a series of measures taken have effectively reversed some students' initial employment intention. More and more students choose to sign contracts for employment upon graduation. Some law graduates will choose to work as accountants, copywriters,

forensic experts, legal consultants and rule of law publicity and other related jobs after graduation. Meanwhile, some graduates choose to work as legal affairs and administration in all walks of life. More effectively broaden the employment channels of fresh graduates, for many graduates to open up a new employment direction; The employment rate of administrative institutions is 2.3%, 2.5%, 4.1%, 3.4%, indicating that the examination of administrative institutions is difficult, and the chance of graduates landing for the first time is very small; The proportion of freelance work is 39%, 35.6%, 41%, 25.4%, freelance is a new form of employment, do not have to sign a tripartite agreement or labor contract with the employer, the work content can be selected according to their professional, specialty or interests, such as piano tutor, online car driver, e-commerce host, takeout rider, etc. For graduates who want to continue to prepare for the "law examination", "public examination" and "postgraduate examination", it is a buffer temporary occupation. The emergence of flexible employment will turn the crisis in the initial employment of law graduates into an opportunity for personal development, and also supplement some of the shortcomings of the emerging labor market.

Table 1 Graduation destination statistics

| person/rate (100%) | Number of graduates | enter a higher school | Enterprise employment | administrative institution | flexible employment | else |
|--------------------|---------------------|-----------------------|-----------------------|----------------------------|---------------------|------|
|--------------------|---------------------|-----------------------|-----------------------|----------------------------|---------------------|------|

| | | | | | | | |
|------------|----|-----|----------|------------|----------|------------|------------|
| Class 2020 | of | 133 | 7 (5.3%) | 37 (27.8%) | 3 (2.3%) | 52 (39%) | 34 (25.6%) |
| Class 2021 | of | 118 | 6 (5.1%) | 26 (22%) | 3 (2.5%) | 42 (35.6%) | 41 (34.7%) |
| Class 2022 | of | 122 | 8 (6.6%) | 28 (23%) | 5 (4.1%) | 50 (41%) | 31 (25.4%) |
| Class 2023 | of | 118 | 6 (5.1%) | 48 (40.7%) | 4 (3.4%) | 30 (25.4%) | 30 (25.4%) |

(3) Graduates' satisfaction with employment situation and development prospects

Employment satisfaction is an important index for schools to analyze the employment quality of graduates. Through the survey of employment satisfaction of law graduates in the past four years, more than 80% of the graduates participated in the survey feedback. As shown in Figure 2, the statistical results show that 24% of graduates are very satisfied with the current employment situation and

development prospects, indicating that they have relatively clear career development goals. 16% of graduates are satisfied, 41% are basically satisfied, 15% and 4% are not satisfied or very dissatisfied with the employment situation and development prospects, indicating that they should improve their abilities in all aspects, strengthen their ability to adapt to the society, further clarify their career development goals, and continue to improve the training mechanism at the school level.

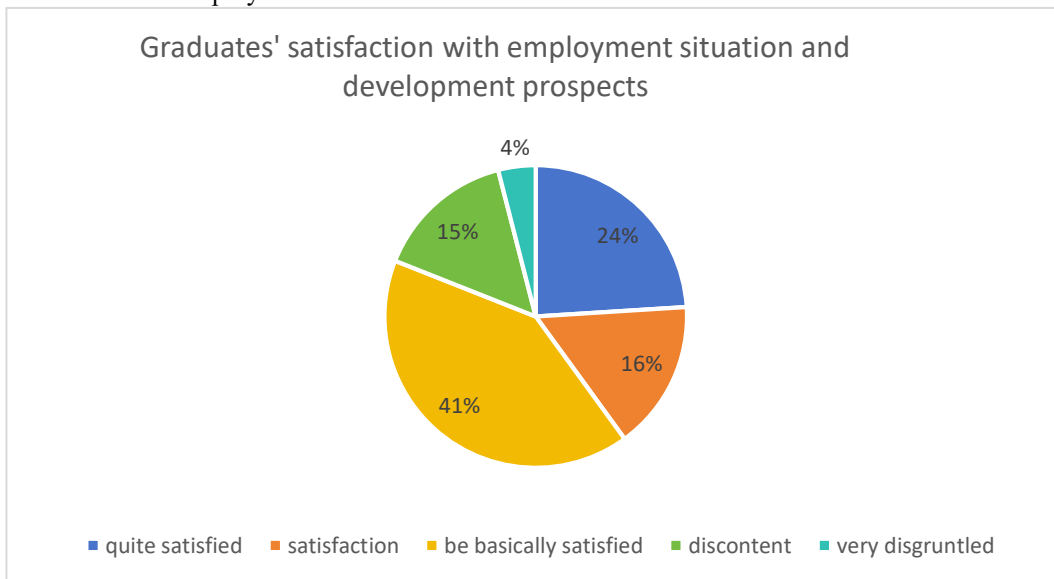


Figure 2 Graduates' satisfaction with employment situation and development prospects

4. CONCLUSION AND DISCUSSION

Identify problems based on data analysis and think about solutions

(1) Guide students to establish a correct employment view by stages

The root cause of the low realization rate of the overall graduation destination of law graduates lies in the weak employment intention. The correct employment concept is the first step to actively implement employment. The key to solve this problem lies in the daily and subtle guidance and training of students in colleges and universities after their admission. Guiding graduates to establish a correct employment concept is not the work of a counselor or a class teacher, but to do the work of all staff, in terms of the internal school to multi-platform joint guidance, of which the first classroom and the second classroom is the main channel to do employment ideological work. The first class, that is, the classroom teaching activities carried out during the teaching time, has the most direct educational

effect. Full-time teachers can not only impart professional knowledge, but also integrate curriculum ideology and politics, publicize correct employment concepts, and guide students to improve employment concepts, so that daily teaching courses such as professional courses, ideological and political courses and employment guidance courses can exert their employment promotion functions imperceptible. The second class is a platform for students' extracurricular practice. Compared with classroom teaching activities, the fun and practicality of the second class can often attract students' attention and participation. For example, the colorful employment promotion activities such as alumni lectures and offers are held with the help of the second course, so that students can get in touch with job hunting and employment as soon as possible, so as to stimulate students' enthusiasm and expectation for future work. In addition, we provide employment assistance and guidance to students of different ages through multiple channels, pay attention to ideological trends

through wechat chat, phone calls, wechat moments and other multimedia software, and carry out employment intention survey on students through random sampling in the form of forums and dormitory visits. For lower grade students, they can guide students to pay attention to career planning and personal employment through activities such as career competition, college students' policy post recruitment exam simulation competition, and seniors' sharing meeting. For graduates, we can adopt the work program of "concentrated group counseling job hunting skills", "one-on-one talk about employment" and a lifetime policy, regularly carry out statistics and analysis of employment details, vigorously publicize employment policies, encourage students to go to the grassroots and start their own businesses, and guide students to establish a positive employment view of employment after graduation.

(2) Further build a platform for school-enterprise exchanges and cooperation

Enterprises are the main body of graduates' initial employment. Jobs in all walks of life provide internship jobs for the vast majority of graduates. Meanwhile, graduates also inject fresh blood into employers, solving the demand for talents of enterprises and improving economic vitality^[3]. For law majors, both theoretical knowledge and practical ability are required. Internship is an important bridge for graduates from students to the workplace. On campus, students can improve their practical ability through moot court, debate competition and other related activities, and on campus, they can practice in practical training bases, such as law firms, judicial organs and corporate legal departments. The school should continue to strengthen the contact and cooperation with relevant enterprises, build an internship and practice platform for graduates, and explore the job market. It can also invite the relevant persons in charge of public prosecution and law agencies, law firms, and corporate legal affairs to participate in the formulation of the school's "Talent Training Program" to refine the professional training direction and cultivate compound talents in a targeted way. Plan to send students to specific units and specific posts for training and learning, establish feedback and evaluation mechanisms, and strengthen information exchange to ensure the effectiveness of employment and education. Relevant enterprises should also actively open their arms to college graduates, provide more internship opportunities, guide graduates to establish career ideals, cultivate work ability, and help graduates adapt to the needs of social work as soon as possible and complete the role transformation. At the same time, the university should make good use of the alumni resources, which are a valuable resource of the university. The teachers and students of the university should strengthen the communication with the alumni of different classes, adopt the method of "invite in + go out", regularly

invite outstanding alumni from all walks of life in the major to give lectures to the students, and build a bridge of communication between the students and the alumni. Regularly lead internship students to visit, visit and practice in some alumni enterprises, so that graduates can intuitively understand the employment industries and positions of law majors, and help students more clearly their career planning.

(3) Innovative job search path break through the barriers of employment

Explore diverse career opportunities: In addition to traditional legal careers, law graduates can consider seeking employment in government agencies, legal consulting firms, legal departments of enterprises and public institutions, and non-profit organizations. At the same time, it can broaden the horizon, the era of the integration of law and technology has arrived, and the training of legal talents also needs to have a high degree of acumen. The future training of talents must be deeply integrated with digitalization and artificial intelligence, pay attention to emerging fields such as artificial intelligence law and network law, and seek employment opportunities in these fields. Focus on skills development: In addition to the basic knowledge of the law profession, graduates can upgrade their skills through study and training. For example, IT can learn relevant IT technologies, such as data analysis, artificial intelligence, etc., to adapt to the trend of the integration of law and technology. In addition, mastering some auxiliary skills related to law, such as oral and written expression ability, public speaking ability, is also an important competitiveness; Establish interpersonal network: actively participate in various legal related activities and academic conferences, and establish contacts with peers, experts and employers. Create personal professional information through social platforms, and join relevant legal professional groups to expand human connections; Self-employment or collaboration: For graduates who are innovative and willing to start their own business, they can consider starting their own business or collaborating with professionals in other fields. Legal consulting companies can be set up to provide services such as legal consulting and contract drafting. IT is also possible to cooperate with professionals in the IT industry to jointly develop legal software or an online legal service platform, or to conduct online legal consultation through an online platform. In a word, law graduates need to respond flexibly in the process of job hunting, take the initiative to find and grasp employment opportunities, and constantly improve their comprehensive quality and practical experience to increase competitiveness. Colleges and universities should guide students to participate in the "Internet +" college student innovation and entrepreneurship competition, encourage law students to have the courage and courage to start a business with the support of their majors, and have the action and

ability to practice new ideas based on their majors. Continuous measures such as optimizing the training environment, building the platform for mass innovation and innovation, increasing practical training and building professional brands are adopted to create a good practical atmosphere for students' innovation and entrepreneurship, so that the cultivated compound legal talents can adapt to various types of employment forms and comprehensively improve the employment quality of law majors.

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Research on the Importance of Packaging Design in the Field of Ideology in Universities

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Abstract: Under the new situation, how to innovate ideological work is a prominent problem in front of college teachers. On the basis of following the law of ideological and political work, the law of teaching and educating people, and the law of student growth, we should innovate the way of ideological and political education. Integrate ideological and political education into packaging design, strengthen ideological and political education in the process of packaging design preaching and learning to solve doubts, and carry out ideological and political education edification through its unique communication after the completion of packaging works, guiding students to establish correct three views.

Keywords: Packaging Design; Ideological and Political Education; Core Values Visual Communication

1. INTRODUCTION

Under the background of globalization, information technology and network, the situation in the ideological field of our country is complex and changeable. How to unify ideas and build consensus in the multi-ideological culture is an arduous task faced by ideological work in universities for a long time. Packaging design determines its king status in many communication media with its unique visual art charm in the field of college ideology [1, 2].

Nowadays, major colleges and universities continue to promote the reform of ideological and political work, and comprehensively promote the theoretical system of Chinese characteristics in the new era into the classroom. Ideological and political courses are universal and play a positive role in the cultivation of students' personality and morality as well as the improvement of their artistic skills. But at the same time, the combination of ideological and political education and professional teaching has a phenomenon of "two skins", and the "island" dilemma pattern of ideological and political education in colleges and universities has not been fundamentally changed. At present, students do not pay enough attention to current politics, have a weak sense of dedication, and have low enthusiasm for party and league activities. Students have a weak sense of responsibility and mission for carrying forward the great thought of Marxism and promoting socialism with Chinese characteristics.

Therefore, it is extremely important for teachers to change the inherent mode of ideological and political education and adopt the mode of all-round infiltration of education first, so as to train students to understand, love and create beauty while doing a good job in ideological and political education.

2. THE RICHNESS AND ARTISTRY OF PACKAGING DESIGN IN THE IDEOLOGICAL FIELD OF COLLEGES AND UNIVERSITIES

With the progress of society and the continuous development of science and technology, the integration of Eastern and Western cultures has become increasingly frequent. Modern science and technology, culture and art have brought new ideas to the packaging art from different aspects. China is an ancient civilization with a long history and cultural heritage. Chinese traditional culture also presents a rich diversity, such as calligraphy, seal cutting, traditional Chinese painting, Beijing Opera facial makeup, shadow play, paper cutting, clay figurine, Chinese knot and so on. In addition, China has its own unique traditional festivals. Many festivals have a variety of etiquette and customs with strong local and national characteristics. If we apply these elements to the packaging design, China's packaging design will certainly be unique in the situation of visual dialogue between the East and the West, which will help establish the cultural confidence of college students, so as to achieve the purpose of establishing moral education and adhering to the guiding position of Marxism culture. Therefore, a series of packaging design culture should be established to enhance the influence of mainstream ideas in colleges and universities. Explore nationalized packaging design elements, adhere to cultural self-confidence, and resist bad culture shock. It is conducive to exerting the synergistic effect of whole-staff education, whole-process education and all-round education in the same direction, so that the ideological work of colleges and universities can be promoted in an all-round way and the participation of all staff, and ultimately promote the orderly, effective and in-depth development of the ideological work of colleges and universities in the new era.

3. THE INNOVATION AND LEADING POWER OF PACKAGING DESIGN IN THE FIELD OF COLLEGE IDEOLOGY

Attach importance to innovation and integration, and enhance the innovation and leading force of packaging design in the field of college ideology. Establish a

series of packaging designs to enhance the influence of mainstream ideas in colleges and universities. Explore nationalized packaging design elements, innovate design forms, adhere to cultural self-confidence, and show Chinese culture and socialist core values in the form that students like. These measures are conducive to strengthening the construction of the network position and seizing the commanding heights of the network propaganda position, so as to resist the adverse cultural impact.

Teachers guide the students to start with poster design practice, combine the poster theme from the heart, dig and think about the subject content, ideas and elements, finding the balance between subjective will and poster design form in continuous exploration. For another thing, teachers do a good job in the planning of teaching activities, and gradually inspire and guide students to establish a correct outlook on life, world and values through their own experience. In poster design and creation, students continue to form a deep understanding of the theme of Chinese festivals, public welfare and positive energy, and thus create excellent works. By creating an atmosphere of common discussion and mutual influence among students, the ideological and political atmosphere of the whole class is formed, so as to achieve no distinction between ideological and political affairs and poster design, transform from the inside out to improve students' correct ideological and moral qualities, and enhance their sense of responsibility and mission for realizing socialism with Chinese characteristics.

Create a college ideological position, make good use of the innovation and leading power of packaging design, vigorously carry forward the revolutionary culture and advanced socialist culture, and adhere to the college ideological position in the background of cultural diversity.

4. THE DISSEMINATION AND EDUCATION OF PACKAGING DESIGN IN THE FIELD OF COLLEGE IDEOLOGY

Integrate the relevant policy resources in the field of college ideology, and improve the all-round service of packaging design in the field of college ideology. Build various cooperation platforms to create a good public opinion environment and effective mechanism for the healthy development of ideological work in colleges and universities.

Teachers focus students' attention with different story perspectives and integrate ideological and political content, so that students change from passive acceptance to active thinking, and analyze the expression of core values. In the context of the new era, teachers can start with unique events (such as current political issues, social issues, etc.) to illustrate. The sense of events approach organically combines national and social events with design teaching. Guide students to establish their inner moral code through their own experience. For example, as the whole country is fighting against the novel coronavirus

epidemic, looking at the world, China's good social system, the great power morality of caring about the international situation, the swift action of government departments, and the professional ethics of medical workers risking their lives will naturally infect every student with appropriate national pride. Teachers can guide students to express their enthusiasm and thinking through poster design. In this way, students' subjective initiative and sense of participation can be well mobilized, and their thoughts can be transformed into behaviors that affect the society. As a result, the dominant force in the classroom changes, students learn independently, and teachers play a supporting role, so that students' potential can be brought into full play. Every student has his favorite things and is good at it. Students take it as their duty to care about current politics and society, pay attention to understand national events and international situation dynamics, and use posters as carriers, combining theories and skills in design and creation, so the works created have their own characteristics. With the improvement of the works, students' hearts resonate, so they can flexibly integrate ideological and political education into their goals and dreams, guide them to form high-level ideological pursuit, and then produce noble ideological and moral sentiments. Therefore, increase the propaganda efforts in colleges and universities, improve the awareness of teachers and students of the importance of packaging design in the ideological field of colleges and universities, and learn to systematically use packaging design to publicize mainstream ideas.

5. PACKAGING DESIGN ALL-ROUND INFILTRATING IDEOLOGICAL AND POLITICAL EDUCATION

Improve college teachers and students' understanding of the importance of packaging design in the ideological field of colleges and universities, innovate ideological and political education methods from passive acceptance by students to active learning. This process needs to be carried out through the media that students are happy to hear. Therefore, college teachers need to integrate the relevant policy resources in the field of college ideology, use packaging design to carry out publicity at all levels and channels in colleges and universities, and assist in the construction of curriculum education, scientific research education, practice education, cultural education, network education, psychological education, management education, service education and organizational education system, integrating the ideological work organically into all aspects of talent training. For example, make every wall into a "talking wall" - packaging design through the corridor, classroom, canteen and other places where students' daily presence is high. Create a silent education model, use packaging design to publicize mainstream ideas, bind good packaging works into books then circulate them, and improve packaging design in the ideological field of colleges and universities. Expand a variety of

ideological channels to create an "Internet+college ideology" model, such as packaging design exhibition using Yiban APP for exhibition, WeChat public number promotion, TikTok short video cloud promotion, friend circle display, voting participation, etc. Colleges and universities must strengthen the construction of network positions and seize the commanding heights of network propaganda positions. Through multiple integration methods, promote the combination of online and offline, on-campus and off-campus, traditional and modern means, so as to let the core socialist values into the brain and heart, so that college students can imperceptibly develop the thinking mode and behavior mode dominated by the mainstream socialist ideology. It is necessary to constantly enhance the identification of college students and teachers with mainstream ideology,

improve their ability to identify non-mainstream ideology, and strengthen the guiding power and cohesion of socialist ideology for teachers and students, so as to maintain the dominant position of mainstream ideology.

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Research on the Reform of Higher Mathematics Teaching Based on the Blended Teaching Model

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Abstract: Blended learning can strengthen the connection between online and offline teaching, fully demonstrate the advantages of the two teaching modes, improve the problems that arise in the classroom teaching process, and ensure that classroom teaching can be carried out more efficiently. Therefore, when promoting the reform of higher mathematics teaching, universities need to apply the blended learning model. This article briefly introduces the application advantages of blended learning mode and explores the measures to promote higher mathematics teaching reform under the support of blended learning mode, hoping to provide reference for the smooth development of higher mathematics teaching.

Keywords: Blended Learning Mode; Advanced Mathematics; Teaching Reform

1. THE APPLICATION ADVANTAGES OF BLENDED LEARNING MODE

The content of higher mathematics is relatively complex and requires a large amount of calculation and proof. If traditional teaching methods are still adhered to in mathematics teaching, although it can help students form a certain understanding of knowledge points, many problems will arise in the teaching process, hindering student development. In this case, the application of blended learning mode can make teaching resources more fully utilized and meet the mathematical learning needs of students.

1.1 Can enable students to actively engage in learning
The application of blended learning methods can plan learning tasks according to the preferences of students, ensure that students can achieve results in higher mathematics learning, fully understand the essence and laws of teaching, and solve problems that arise in the process of mathematics learning. Moreover, the most significant advantage of blended learning is that it can present teaching resources in different ways, making teaching more interesting. It can break the situation of only conducting theoretical explanations, enrich students' horizons with the help of videos and audio, improve their logical thinking ability, and especially effectively cultivate their self-learning ability. Under the traditional mode, the teaching methods used by teachers are relatively fixed, and students are likely to have rigid thinking and excessive dependence on teachers, which leads to the practicality of teaching not being reflected and cannot meet the

further development needs of students. the application of blended learning mode can break the constraints of time and space with the support of the Internet, making student learning more convenient [1].

1..2 Summarize educational resources

The application of traditional teaching methods may lead to lagging progress in higher education. Moreover, advanced mathematics contains relatively detailed knowledge points that require a large number of calculations, making it difficult to deeply analyze and explore the essence of the knowledge points. Students may feel repulsed when carrying out advanced mathematics learning. the application of blended learning mode can collect and summarize existing educational resources, and provide different resources according to the changes in teaching plans, teaching tasks, and requirements. Especially when conducting online teaching, it can strengthen the connection between online and offline teaching work, prevent duplicate operations, reduce the burden on teachers, and enable students to learn more flexibly.

1.3 Supplement classroom content

The application of blended learning mode can provide opportunities for communication between teachers and students, bringing them closer together. Through communication with students, teachers can make adjustments to the teaching plan, help students recognize the problems that arise during the development process, and better engage in mathematics classroom learning. Students should not only focus on classroom knowledge points when learning, but also collect learning resources to improve the problems that arise during their own development process. For example, it is necessary to apply WeChat official account, regularly push mathematical knowledge, help students build a sound knowledge framework, and ensure that students can complete learning tasks according to the schedule [2].

2. MEASURES FOR REFORMING HIGHER MATHEMATICS TEACHING BASED ON BLENDED LEARNING MODE

The reform of higher mathematics teaching based on blended learning mode is crucial, and teachers need to pay full attention to it, and carry out teaching activities from the following points to ensure the quality of mathematics teaching in universities:

2.1 Set clear teaching objectives

The formulation of course teaching objectives can provide ideas for the development of teaching activities and guide students to analyze key learning points. When designing higher mathematics teaching, teachers can set goals from three levels: knowledge, ability, and ideological and political aspects. Knowledge objectives require students to master mathematical concepts and application methods, ensuring that mathematical knowledge points can be integrated into the knowledge system. Ability goals require students to analyze and judge things around them, ensuring that they can understand the process of knowledge transfer and recognize the charm of mathematics with the support of a combination of mathematical concepts. Ideological and moral education requires students to explore valuable content in the process of conducting higher mathematics learning, so that they can actively engage in mathematics learning, enhance their logical thinking ability, innovative concepts, and patriotic spirit. When setting teaching objectives, teachers need to ensure that they are scientific and reasonable, strengthen the connection of knowledge between different units, and prevent blind setting of teaching objectives.

2.2 Flexible application of multiple teaching methods
For the current teaching analysis, it is found that blended learning mode can be applied to various teaching methods, supported by online and offline platforms, to build a comprehensive teaching system. When carrying out reforms in higher mathematics teaching, the following methods can be used to apply the blended learning model:

Firstly, flipped classroom. This is currently a relatively common method of using blended learning, which has been developing for a long time. The originally used flipped classroom teaching model only provided students with opportunities for self-directed learning. With the further improvement of the flipped classroom model, modern teaching methods such as MOOCs and micro courses can be applied during pre class teaching. And apply the project-based teaching method and thematic teaching method to the teaching of advanced mathematics in universities to improve teaching quality. Secondly, the thematic discussion teaching method requires teachers to clarify the theme during teaching, make textbook content the key, and create teaching videos. Students can answer the questions raised by the teacher by watching videos. Teachers can provide students with the opportunity to repeat exercises based on the uploaded data, ensuring that students can answer exercises and form a deeper understanding of knowledge points, thereby improving the quality of classroom teaching. Thirdly,

setting questions to promote the development of teaching. It should be noted that when setting questions, it is important to ensure that the questions are reasonable and can connect various knowledge points, helping students analyze mathematical knowledge from shallow to deep levels, improving their mathematical literacy, and providing conditions for their subsequent mathematical research [3].

2.3 Improving the teaching evaluation system

With the further deepening of teaching reform, it is necessary to create a matching teaching evaluation system for the application of blended teaching mode in higher mathematics, do a good job in process evaluation and result evaluation, guide students to analyze the shortcomings in the mathematics learning process, and supervise students from all aspects to ensure that students can form a full understanding of their self-development situation. When conducting practical evaluation work, it is necessary to strengthen the connection between student self-evaluation, mutual evaluation between students, and teacher evaluation, and establish clear evaluation indicators. By improving the teaching evaluation system, students can actively engage in learning and achieve better development.

3. SUMMARIZE

The blended learning model is an extension and improvement of the offline classroom teaching method. It can collect various resources on the Internet education platform, enrich students' horizons, enable them to actively engage in mathematics learning, reduce the difficulty of higher mathematics learning, improve their mathematical literacy, and promote their comprehensive development.

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The Relationship between Job Burnout and Turnover Intention of Vocational Colleges in Yunnan China

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Abstract: In the context of vocational education, teaching staff plays a crucial role in the development of national vocational education. Young lecturers, in particular, are considered the backbone of vocational education construction and have a significant impact on its overall progress. However, with the ongoing reforms in the vocational education system, lecturers are experiencing increasing levels of job pressure, leading to a rise in job burnout incidents. Numerous studies have found a significant relationship between job burnout and turnover intention. When employees experience high levels of burnout, they may become dissatisfied with their work, lose motivation, and feel emotionally drained. These negative feelings can lead to a higher likelihood of employees wanting to leave their jobs, resulting in higher turnover intention. This study aims to analyze the general situation of job burnout and turnover intention among teaching staff of vocational education in Yunnan, China. By exploring the relationship between job burnout and turnover intention, the research aims to shed light on the current state of teaching staff members' well-being and career development. The findings of this study are expected to draw attention to the physical and mental health of vocational college teaching staff, as well as their psychological well-being and career prospects.

Keywords: Job burnout; Turnover intention; Vocational Colleges; Yunnan; China

1. INTRODUCTION

Job burnout, first proposed by American clinical psychologist Freudenberg, mainly refers to the phenomenon of physical and mental exhaustion and negative service attitude of workers in the helping professions due to great occupational pressure. In the vocational education sector, teaching staff are crucial for the development of national vocational education, particularly young lecturers who are the backbone of vocational education construction. Their role is vital as they determine the development of national vocational education. However, with the continuous reform of the vocational education system, lecturers are facing increasing pressure, leading to a growing prevalence of job burnout. A survey conducted by Wang et al. in 2008 indicated that over 90% of vocational college teaching staff experience varying degrees of job burnout. Additionally, more than 60% of lecturers express dissatisfaction with their current job and have

turnover intentions. In vocational colleges, where employees often face high workloads, limited resources, and demanding students, burnout can be a prevalent issue. The demanding nature of vocational college work, combined with the pressure to meet students' needs and expectations, can contribute to increased levels of burnout among teaching staff.

2. RESEARCH METHODOLOGY

The study collects data through online questionnaires using a convenient sampling method. The target respondents are teaching staff in vocational colleges in Yunnan, China. A total of 350 teaching staff members are selected as the target respondents.

The primary data compiled through the questionnaires are classified into two parts as follows:

Part I the measurement of the level of the respondents on job burnout, measured by emotional exhaustion, depersonalization and reduced sense of personal accomplishment. In this study, the job burnout scale for vocational college teaching staff is based on both MBI-ES and MBI-GS. The items have been restated and adapted to fit the local context. The final scale consists of 15 questions, covering emotional exhaustion (items 1-5), depersonalization (items 6-9), and reduced sense of personal accomplishment (items 10-15). The job burnout scale utilizes Likert's 6-point scale method, ranging from "6 = strongly disagree" to "1 = strongly agree".

Part II the measurement of the level of the respondents on turnover intention.

This study utilizes the turnover intention scale developed by Fan Jingli et al. (1988). The scale consists of 4 items and has been found to possess strong internal consistency and validity. The turnover intention is assessed using Likert's 6-point scale method, ranging from "6 = strongly disagree" to "1 = strongly agree", with 2, 3, and 4 serving as transitional points.

3. RESEARCH FINDINGS

Convenient sampling was used to select the respondents, and the questionnaires were collected by online questionnaires. 294 questionnaires were recovered, and after excluding the non-standard test papers, there were 288 valid questionnaires. 110 male and 178 female participated in the survey, accounting for 38.2% and 61.8% of the total respectively. In terms of age, aged 31-40 is the largest, accounting for 42.4% of the total, and below 30 is the smallest, accounting

for 13.2%. This figure is conducive to the long-term development of the colleges. lecturers with post-doctoral accounted for 1.0% of the total, 102 lecturers with doctor's degree, 154 lecturers with master's degree, and 29 lecturers with bachelor's degree, accounting for 1.0%, 35.4%, 53.5%, and 10.1% of the total respectively. the proportion of master's degree and doctoral degree of lecturers is the highest, which shows that the academic level of lecturers is increasing, which is more conducive to the improvement of school education level. There are 38 lecturers with teaching assistant title, accounting for 13.2%, 152 with lecturer title, accounting for 52.8%, 78 lecturers with associate professor title, accounting for 27.1. 0%, and 20 lecturers with professor title, accounting for 6.9%. the proportion of teaching age from high to low is 9-15 years, 4-8 years, 16-25 years and more than 25 years, the highest is 38.2%, the lowest is 5.2%. Pearson correlation coefficient and multiple regression was used to measure the level of correlation of each variable, a range of confidence level was set at 99 percent. It can be seen that the job burnout of vocational college teaching staff and the three sub variables are positively correlated at the significant level of 0.01, and the significance coefficient is between 0.496-0.726; the three sub variables of job burnout are significantly positively correlated with turnover intention, and the correlation coefficient between reduced sense of accomplishment is the largest, which is 0.726. the multiple regression coefficients for these dimensions are 0.485 ($P < 0.001$), 0.412 ($P < 0.01$), and 0.525 ($P < 0.001$) respectively. Emotional exhaustion and reduced sense of accomplishment have a stronger impact on turnover intention, as they are closely tied to lecturers' own needs, the demanding teaching and research responsibilities they bear, and the overall employment environment.

Table 1 Hypothesis test results

| No. | Hypothesis | Results |
|----------------|--|-----------------|
| H ₁ | There is a relationship between emotional exhaustion and turnover intention in vocational colleges in Yunnan, China. | Accepted |
| H ₂ | There is a relationship between depersonalization and turnover intention in vocational colleges in Yunnan, China. | Accepted |
| H ₃ | There is a relationship between reduced sense of personal accomplishment and turnover intention in vocational colleges in Yunnan, China. | Accepted |

4. CONCLUSION AND RECOMMENDATION

The research results show that vocational college teaching staff job burnout in terms of emotional exhaustion, depersonalization and reduced sense of personal accomplishment have positive relationships with turnover intention, which is consistent with previous studies.

In order to reduce turnover intention among vocational college teaching staff, several factors should be considered. Firstly, fostering a positive interpersonal atmosphere is crucial. When experiencing job burnout, teaching staff should not shy away from discussing it. Instead, they should actively seek support from various sources and express their negative emotions with the help of others. By maintaining good relationships with students, colleagues, and school leaders, teaching staff can find solace and alleviate job burnout. Engaging in academic conferences can also expand their social networks and promote interpersonal communication. Secondly, a good organizational atmosphere can enable vocational college teaching staff, especially young lecturers, to integrate into the organization faster and better, reduce individual psychological burden and ideological pressure in the organization, and give full play to lecturers' creativity. On one hand, the communication and help among colleagues can enhance lecturers' individual emotional support and organizational identity, so as to prevent turnover intention. On the other hand, creating a good organizational atmosphere is inseparable from the support and care of leaders.

To reduce turnover intention among vocational college teaching staff, it is necessary to improve the teacher development mechanism. One of the important reasons for turnover intention is the improper management system in vocational colleges. Therefore, it is essential to establish a sound career development mechanism for teaching staff that caters to their needs and aspirations. the first step is to establish and enhance the professional development mechanism for teaching staff. This can be achieved by providing opportunities for continuous learning and growth, such as attending workshops, conferences, and seminars. Additionally, mentoring programs can be implemented to support the professional development of junior teachers. By investing in their growth, vocational colleges can reduce turnover intention and retain experienced teachers. Next, the teacher assessment mechanism should be diversified and humanized to accommodate different teaching styles. It is important to recognize and value the unique strengths and contributions of each teacher. By adopting a fair and personalized assessment system, vocational colleges can motivate and encourage teachers to excel in their teaching practices. Furthermore, a fair and reasonable promotion mechanism should be established to protect the basic rights and interests of teaching staff.

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Strategies for Cultivating Students' Learning Interest in Inorganic Chemistry Teaching in Vocational Colleges

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Abstract: This article focuses on the cultivation strategies of students' learning interests in inorganic chemistry teaching in vocational colleges. Analyzing from four aspects: practical teaching design, multimedia technology application, problem oriented learning, and integration with practical applications. This study aims to explore the effectiveness of these strategies and provide some suggestions to stimulate students' strong interest in inorganic chemistry, improve their learning enthusiasm and effectiveness.
Keywords: Vocational colleges; Inorganic chemistry; Teaching strategies; Interest cultivation

1. INTRODUCTION

The quality and effectiveness of inorganic chemistry teaching in vocational colleges are directly related to the cultivation of students' subject interests and professional qualities. However, due to the abstract and theoretical nature of inorganic chemistry, students often find it difficult to develop a strong interest in the subject. Therefore, from the perspective of teaching strategies, this paper explores how to effectively cultivate students' learning interests in vocational inorganic chemistry teaching. Through practical teaching design, the application of multimedia technology, problem oriented learning, and the combination of practical applications, feasible strategies for cultivating students' learning interests in vocational inorganic chemistry teaching can be provided, thereby encouraging students to be more proactive and actively involved in subject learning.

2. GUIDED BY PRACTICAL TEACHING DESIGN TO STIMULATE LEARNING INTEREST

Practical teaching design plays a crucial role in the teaching of inorganic chemistry in vocational colleges. Due to the abstract nature of inorganic chemistry, students often find it difficult to connect theoretical knowledge with practical life. Therefore, students can be provided with more specific and intuitive learning experiences through practical teaching design. Thereby stimulating their strong interest in inorganic chemistry. Under the framework of practical teaching, experimental operation is a powerful means. By designing vivid and interesting experiments, students can personally participate in chemical reaction processes, observe experimental phenomena, and deepen their understanding of inorganic chemistry concepts. For example, designing experiments on the

factors influencing the rate of chemical reactions, allowing students to observe the speed of chemical reactions under different conditions and understand the factors influencing the rate of chemical reactions. Through practical operation, students can feel the authenticity of chemical reactions, thereby stimulating their curiosity about the subject. In addition, on-site inspections are also an important component of practical teaching design. Organize students to visit chemical plants, laboratories, or related research institutions, allowing them to witness the importance of inorganic chemistry knowledge in practical applications [1].

3. STRENGTHENING STUDENT PARTICIPATION THROUGH THE APPLICATION OF MULTIMEDIA TECHNOLOGY

With the support of multimedia technology, teachers can create exciting experimental videos and present complex experimental processes to students. By watching these videos, students can clearly see the details of chemical reactions and the steps of experimental operations. This approach makes abstract concepts of inorganic chemistry more concrete and easier to understand. For example, by playing experimental videos on the generation of coordination compounds, students can intuitively understand the reaction process and feel the color changes of the complexes as the number of coordination molecules increases. This can enhance their understanding of coordination compounds. In addition, the application of simulation software is also an important aspect of multimedia technology. Chemical simulation software can simulate various chemical experiments and phenomena, allowing students to conduct experimental operations in a virtual environment and experience the process of real experiments in advance [2]. For example, using simulation software to simulate the process of gas diffusion. Through simulation experiments, students can experience the laws of gas molecule movement firsthand, thereby deepening their understanding of gas dynamics theory. The application of multimedia technology is not only about demonstrating experiments, but also includes rich image, animation, and sound effects. Visual and auditory stimuli can better attract students' attention. For example, the structure and periodic patterns of the periodic table can be vividly displayed through gorgeous images and

vivid sounds. This enables students to learn in a joyful atmosphere, thereby enhancing their interest in the subject of inorganic chemistry. The application of multimedia technology provides strong support for the teaching of inorganic chemistry in vocational colleges. Through vivid and intuitive demonstration of experimental videos, simulation software, and other means, students can have a deeper understanding of the abstract concepts of inorganic chemistry, stimulate their interest in the subject, and improve their learning enthusiasm and effectiveness. This innovative teaching method has laid a solid foundation for cultivating vocational inorganic chemistry talents with practical operational abilities and profound subject interests [3].

4. GUIDED BY PROBLEM-ORIENTED LEARNING, CULTIVATING STUDENTS' CHEMICAL THINKING

The problem-oriented learning method plays a key role in guiding students to actively learn and cultivate subject interests in the teaching of inorganic chemistry in vocational colleges. Teachers stimulate students' thinking vitality by designing challenging and inspiring questions, guiding them to think deeply in the process of problem-solving. This approach can enhance students' interest in learning inorganic chemistry. In problem-oriented learning, teachers can design practical problems related to inorganic chemistry and require students to apply their knowledge to analyze and solve them. For example, design a question: "How can kidney stones be removed chemically?". And students are required to use their knowledge of precipitation dissolution equilibrium to think about solutions. Through such questions, students not only need to apply the theoretical knowledge they have learned, but also need to utilize their practical application abilities. The combination of theory and practice can stimulate their interest and enhance their understanding of the subject. Problem-oriented learning can also be conducted through group collaboration, allowing students to discuss and solve problems together. In small groups, students need to communicate and analyze with each other, to cultivate teamwork and communication skills. In addition, problem-oriented learning methods can also increase the practicality of the subject by introducing real-life cases. Taking environmental issues as an example, teachers can ask students to analyze the inorganic chemical pollution problem in a certain region's environment and propose corresponding solutions. By focusing on real cases, students can better understand the application of inorganic chemistry knowledge and stimulate their enthusiasm for the subject. In problem-oriented learning, the role of a teacher is not only to impart knowledge, but also to guide and inspire. By cleverly designing questions, teachers can guide students to think actively, cultivate their thirst for knowledge and interest in the subject. The problem-oriented learning method transforms students from

passive acceptance to active exploration, thereby better understanding and applying the knowledge of inorganic chemistry they have learned. This can lay a solid foundation for future practical applications.

5. DEEPENING STUDENT UNDERSTANDING WITH THE GUARANTEE OF CONNECTING TEACHING WITH PRACTICAL LIFE

Combining theoretical knowledge with practical application is an extremely effective teaching strategy in vocational inorganic chemistry teaching. This teaching method can not only help students better understand the theoretical concepts of inorganic chemistry, but also demonstrate the widespread application of inorganic chemistry in real life and pharmacy. This can stimulate students' strong interest in the subject. Through case analysis, teachers can demonstrate to students the role of inorganic chemistry in solving practical problems [4]. For example, "What is the concentration of physiological saline for injection?" and "Why is this concentration used?". Emphasize the significance of osmotic pressure in medicine and pharmacy through practical problems. By analyzing these cases, students can not only deeply understand the relevant principles of inorganic chemistry, but also intuitively feel the practical value of the discipline in their professional field. Such case studies not only enrich students' subject knowledge, but also make them realize the importance of the subject, thereby cultivating a sense of purpose and motivation for learning. In addition, through discussions of practical problems, teachers can guide students to think about how to apply their knowledge of inorganic chemistry to solve specific problems. Taking the selection of metal materials as an example, teachers can ask a practical question: Why do we choose one metal over another as the body material in automobile manufacturing? Students need to consider factors such as the properties, corrosion resistance, and weight of metals in discussions, to apply knowledge of inorganic chemistry to make reasonable choices. Through such practical problem discussions, students can combine abstract theoretical knowledge with practical applications, cultivate their ability to solve practical problems, and enhance their interest in learning the subject.

6. CONCLUSION

In summary, the strategy of cultivating students' learning interest in inorganic chemistry teaching in vocational colleges is crucial. By combining practical teaching, multimedia technology, problem-oriented learning, and practical applications, we can effectively stimulate students' curiosity and thirst for knowledge, and enhance their interest in inorganic chemistry. This not only helps students better understand and master relevant knowledge, but also lays a solid foundation for their future practical applications. In future teaching practice, teachers should continuously summarize their experience, explore more innovative teaching methods, to better meet the subject needs of

students and cultivate vocational inorganic chemistry talents with more professional qualities and subject interests.

TOPIC

Zibo Vocational Institute, Practical research on the growth and development of "Double-Qualified and Dual-Talented" teachers in vocational institute (cultivation 14).

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Analysis of Teaching Problems and Countermeasures in the Course of "Principles of Automatic Control" in Universities

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Abstract: With the development of technology and industrial progress, the principle of automatic control is playing an increasingly important role in daily life and industrial production. Especially in applied universities, the principle of automatic control has become an important professional course. However, in the actual teaching process, there are some problems that can affect students' learning effectiveness and mastery of course content. Therefore, this article will analyze the problems existing in the teaching of the "Principles of Automatic Control" course in applied universities, and propose corresponding countermeasures to improve teaching quality and student learning effectiveness.

Keywords: Principles of Automatic Control; Teaching Reform; Countermeasure

1. THE PROBLEMS IN TEACHING THE COURSE OF "AUTOMATIC CONTROL PRINCIPLES" IN APPLIED UNIVERSITIES

1.1 Severe polarization

In the course of "Principles of Automatic Control", students exhibit a clear polarization. the main reason is that some students show strong interest and motivation in learning, and are able to understand and master the course content well; However, another group of students find it difficult to keep up with the course content and teaching progress. Over time, this polarization phenomenon will lead to students with strong interests getting better grades, while students with learning difficulties will lose confidence in the course, affecting the overall quality of teaching and future development.

1.2 Inadequate attitude towards homework

In the course of "Principles of Automatic Control", some students have an improper attitude towards homework, and usually only do homework for the purpose of completing it. They do not pay attention to understanding the knowledge points and principles behind the homework, nor do they learn according to the teaching content. This attitude can lead to students not truly mastering the course content after completing the homework, which affects the learning effect and cannot be flexibly applied [1].

1.3 Poor experimental results

The course "Principles of Automatic Control" usually includes experimental sections, which is an important means to help students better understand and master

the course content. Moreover, students will gradually enjoy the learning of this course and improve their learning enthusiasm. However, in actual teaching, the effectiveness of some experimental stages is not satisfactory. the reasons for this problem are outdated experimental equipment, unreasonable design of experimental content, or inadequate guidance from teachers. If teachers do not recognize the importance of experiments and solve these problems, it will be difficult for students to apply theoretical knowledge to practical operations, affecting the overall effectiveness of course teaching.

2. REFLECTION ON THE TEACHING REFORM OF "AUTOMATIC CONTROL PRINCIPLES" COURSE IN APPLIED UNIVERSITIES

2.1 Small class teaching

Applied universities have a wide range of students from all corners of the world, with significant differences in their knowledge structures and learning abilities, and varying levels of understanding of knowledge. Only by providing targeted teaching can teachers meet the learning needs of each student. So in actual teaching, it is necessary to implement small class teaching in order to better meet the needs of students and improve teaching quality. Small class teaching can better focus on the needs and development of each student, facilitate interaction and communication between teachers and students, and enable each student to receive sufficient attention and guidance [2]. In addition, small class teaching can also enhance students' sense of cooperation and team spirit. This can be achieved through group cooperative learning, which divides students into several small groups based on their learning situation and teaches in a way where the top students lead the bottom students. This way, the bottom students can be inspired, and the top students will become increasingly excellent, which is conducive to the cultivation of students' comprehensive qualities.

2.2 Reform teaching content

The course of Automatic Control Principles is a highly theoretical and practical course. Traditional teaching content often focuses on imparting theoretical knowledge, neglecting the cultivation of practical abilities, making it difficult for students to flexibly apply the knowledge they have learned to solve problems and making teaching more formalized. Therefore, it is necessary to reform the teaching

content. On the one hand, the proportion of practical teaching content should be increased, so that students can better grasp practical operational skills; On the other hand, theoretical knowledge should be combined with practice to enable students to better understand the course content and improve their practical abilities. For example, when explaining the basic concepts and principles of automatic control systems, practical cases can be combined for analysis and explanation, so that students can accurately understand the composition, working principles, and performance indicators of control systems, and deepen their impression of the course.

2.3 Reform homework format

For traditional homework forms, they focus on theoretical calculations and deductions, but neglect the cultivation of students' comprehensive qualities, which to some extent hinders their development. Therefore, it is crucial to reform the form of homework. On the one hand, it is necessary to increase the proportion of open-ended questions, guide students to actively think and explore problems, and cultivate their innovative and thinking abilities; On the other hand, homework should be combined with practice, so that students can consolidate their practical skills and improve their overall quality by completing homework. For example, some design homework questions can be assigned, requiring students to design control systems and perform performance analysis, etc. This can help students deeply master the basic methods and skills of control system design.

2.4 Reform the form of experiments

The experiment of automatic control principles is an important component of this course. Traditional experimental forms often focus on confirmatory and demonstrative experiments, neglecting the improvement of students' practical abilities, allowing them to only learn theoretical knowledge, greatly reducing their interest in learning. Therefore, reforming the experimental format is a key task. On the one hand, it is necessary to increase the proportion of comprehensive experiments and design experiments, so that students can better grasp the basic methods and skills of control system design and analysis; On the other hand, experiments should be combined with engineering practice, allowing students to understand the application and performance of control systems in practical engineering through experiments, gradually improving their experimental level, and learning how to demonstrate [3].

2.5 Introducing modern teaching methods to improve teaching quality and efficiency

With the continuous development of technology, modern teaching methods have become one of the important directions of teaching reform. Introducing modern teaching methods such as multimedia

technology, network technology, and simulation technology in the teaching process of automatic control principles can greatly improve the quality and efficiency of teaching. the use of multimedia technology can present abstract theoretical knowledge to students in a vivid and vivid way, helping them better understand the course content; the use of network technology can achieve online teaching and remote tutoring, making it convenient for students to access learning resources and communicate anytime and anywhere; the use of simulation technology can simulate the performance and dynamic process of control systems, helping students to correctly understand the working principle and performance indicators of control systems. Only by constantly exploring and practicing new teaching methods and means can we better meet the needs of students, improve teaching quality, and make greater contributions to cultivating high-quality applied talents.

3. CONCLUSION

The principle of automatic control is one of the main courses in the field of automation, which is a fundamental theoretical course with strong theoretical significance. It involves a wide range of theoretical knowledge, but also has significant teaching difficulties. In recent years, the education department in China has put forward new requirements for the teaching of the course "Principles of Automatic Control" in universities. It is not only necessary to focus on theoretical knowledge teaching, but also to integrate experiments into it, so that students can learn how to use their hands and brains to consolidate their knowledge foundation. First, deepen their memory of knowledge, and then learn how to flexibly apply it to improve learning effectiveness and quality. At the same time, it can also enhance students' comprehensive skills.

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Analysis of Surge Fault of Ship Main Engine Turbocharger

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Abstract: This article briefly introduces the structure of exhaust gas turbochargers and emergency measures taken during navigation, explains the mechanism and reasons for turbocharger surge, and analyzes and categorizes various factors that cause turbocharger surge, based on the description of the surge fault of the ship's main engine turbocharger, the analysis process of the cause of the fault, and the final troubleshooting. Finally, a brief summary of the entire article and the insights gained from the troubleshooting process are provided, along with some precautions that engineers need to pay attention to in the daily maintenance and management of turbochargers. We hope to do our best in the future Possible avoidance of turbocharger surge.
Keywords: Surging; Host; Booster; Diesel Engine; Management; Prevention; Ships

1. FAULT PHENOMENON

The host model is MAN B&W 6G50 ME-C9.5-HPSCR, with a rated power of 8500KW and a rated speed of 82.3RPM. It is an extremely long stroke host with HPSCR. This round adopts the HPSCR (High Pressure Selective Catalytic Reduction) high-pressure selective catalytic reduction system, with an additional SCR system added in front of the main engine turbocharger and behind the exhaust manifold.

When the turbocharger surges, the alarm RSV Unexpected Opened is displayed in the SCR system MOP screen, accompanied by an overall high exhaust temperature. the exhaust temperature at the cylinder head is above 410°C, and the combustion and exhaust conditions of each cylinder are poor. In severe cases, a large amount of black smoke is emitted, and the temperature of the exhaust main pipe sometimes reaches 610°C. the turbocharger turns red and the exhaust pipe deforms.

2. ANALYSIS OF THE WORKING PRINCIPLE OF THE TURBOCHARGER

2.1 Basic principles of turbocharger operation

During normal operation, the two blades of the compressor impeller are filled with air, and the air flows outward due to the rotation of the compressor impeller. At this time, a circumferential velocity U and a radial velocity W will be generated. After the two velocities are combined, a velocity vector C of air flying away from the impeller will be generated. Air enters the diffuser along the direction of the diffuser blades and flows out along the direction of the blades (in the figure, a small increase in the flow area produces a diffusion effect, converting speed into

pressure, and thus producing a boosting effect). From the figure, it can be seen that the arrows are long to short, indicating a decrease in speed from fast to slow.

2.2 Surge margin

When the impeller is working normally, the turbocharger always runs on the running line shown in the figure. the red line represents an equal speed line, indicating that under the same speed, the higher the air flow rate, the lower the boost pressure, the black solid line represents the isoefficiency line, and the more the isoefficiency line is in the inner circle, the higher the efficiency. Therefore, it can be seen that the operating point should try to lean towards the direction of high pressure on the equal speed line, but there is also a dashed line called the surge line. When the operating point touches the surge line, the turbocharger will surge. Therefore, there must be a certain area between the operating line and the surge line, called the surge margin. Under normal circumstances, the surge margin should be controlled at around 15% -20% to ensure that the turbocharger operates as efficiently as possible without surge. On the contrary, the closer the surge line is to the operating line, the more likely it is to experience surge.

2.3 Basic principle of turbocharger surge

When the corrosion or dirt of the compressor impeller leads to a decrease in the power capacity of the compressor impeller, the impeller speed remains unchanged, the direction and magnitude of the circumferential velocity U remain unchanged, but the radial velocity W decreases, resulting in a change in their total velocity, i. e. the direction of the velocity C at which the air leaves the impeller. the direction of the inlet velocity C_{IN} , which was originally perfectly aligned with the direction of the diffuser blades, has also changed accordingly. the change in airflow direction causes the boundary layer between the air and the diffuser blades to be broken, creating a surge, which acts as a barrier limiting the area of free air flow, ultimately weakening the diffusion effect of the diffuser and preventing the conversion of velocity into pressure. As shown in the figure, C_{IN} and C_{OUT} will undergo a change in direction, and the speed will not decrease due to conversion to pressure. When the diffusion effect of the diffuser is lost, the speed of the intake airflow cannot be converted into pressure, and the downstream pressure of the diffuser is higher than the upstream pressure, the air will flow in the opposite direction, which will cause surging.

3. FAULT CAUSE ANALYSIS AND TROUBLESHOOTING

From the above fault analysis, we have come to the conclusion that the opening of two valves in the SCR system increases the back pressure of the exhaust system, which is the main reason for the surge of the main engine turbocharger in this round. After understanding this point, troubleshooting becomes less difficult. By contacting the device service provider, we have processed the following steps

- (1) A speed reduction program from sea speed to "forward four" has been set in the host control system, allowing the host to have a certain delay buffer from high load to low load.
- (2) By modifying the parameter values of the SCR system, the opening of the RTV is 0.9% when the pressure difference reaches 0.3 Bar.
- (3) A manual shut-off valve has been added to the RSV control air supply pipeline to prevent it from opening by closing the control air supply.
- (4) Regularly clean the air cooler

Keeping the flow channel of the air cooler unobstructed can reduce the scavenging resistance, maintain good cooling effect, and increase the intake density. Observation shows that for every 1 °C increase in the temperature of the turbocharger, the

exhaust temperature increases by an average of 3-5 °C. Under limited conditions of the ship, the method of chemical soaking and circulating flushing can be used for flushing. If the chemical ACC-9 is used for cleaning the air cooler, the effect is good and the operation is convenient. While cleaning the gas side, attention should also be paid to the scaling on the water side.

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Exploration of Teaching Strategies for Public English in Higher Vocational Education Based on Vocational Ability Cultivation

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Abstract: Vocational education and teaching in higher vocational schools have professional characteristics. Therefore, when carrying out public English teaching work, vocational teachers should base themselves on the guidance of professional abilities, explain English knowledge to students, and enhance their professional abilities to provide assistance for their future work. However, in practice, there are many problems in the teaching of public English in vocational colleges, including unclear teaching objectives, unclear teaching guidance, and traditional teaching methods. In the face of this situation, if vocational college teachers want to improve the original situation of public English teaching, they need to clarify teaching guidance and goals, choose diversified teaching methods, and develop a comprehensive teaching and training plan based on actual learning situations, gradually improving the vocational abilities of vocational college students themselves.

Keywords: Professional Ability; Vocational Education; General English

1. INTRODUCTION

Vocational education is an important component of China's education industry. The effective development of vocational education can output high-quality professional and technical talents for society and meet the practical needs of current social and economic development. In the context of economic globalization, English has become a professional ability that market talents need to possess. Therefore, when conducting public English teaching for students, vocational college teachers should fully understand their career development needs and be guided by cultivating their professional abilities, in order to scientifically improve English teaching, perfect the original English teaching system, and enhance the effectiveness of English teaching.

2. ESTABLISHING THE IDEOLOGICAL CONCEPT OF VOCATIONAL EDUCATION

Vocational education itself belongs to vocational education. Therefore, when carrying out educational and teaching work, attention should be paid to its own vocational characteristics, and past educational ideas and concepts should be changed in a timely manner. Vocational education concepts should be established, and in daily public English teaching, the unity between vocational ability cultivation and vocational education

should be achieved. As a vocational English teacher, we should improve our previous subject knowledge based teaching philosophy and focus on teaching students public English based on professional abilities. And vocational colleges should also optimize English teaching according to the actual professional needs of different students, so as to enhance its depth and breadth. They should also organically combine English knowledge with students' professional courses and job positions, fully reflect the humanistic nature of English teaching, highlight the application value of English knowledge, and make vocational English teaching more professional [1]. In addition, in terms of English teaching objectives, it is also necessary to appropriately incorporate some comparative content between China and foreign countries to help students understand the generation and application of English knowledge, and improve their cognitive level. In addition, in terms of educational philosophy, teachers should also infuse correct ideological values. After students understand the cultural differences between the East and the West, they can correctly see the cultural ideas of the East and the West, enhance their cultural confidence, and actively learn to continuously improve their English professional ability, laying a good foundation for future employment. For example, in English teaching, it is necessary to integrate theory with practice, organize various English learning activities, exercise students' oral communication and expression abilities, improve their English oral proficiency, and also strengthen their professional abilities.

3. OPTIMIZE ENGLISH TEACHING MODE AND INCREASE ENGLISH TEACHING METHODS

Many educators are deeply influenced by traditional educational ideas, resulting in less than ideal teaching outcomes, including vocational college teachers. Many vocational colleges have students from multiple regions, and there are significant differences in their educational environment, family environment, learning ability, and other aspects. Therefore, their English proficiency varies greatly. Most students have a low interest in learning English knowledge, and their English foundation is also poor. In addition, most vocational colleges still use large class sizes and public classrooms when conducting English teaching, which is too traditional and outdated, the entire process of English teaching is also quite dull, making it difficult

to stimulate students' interest in learning. Many students, due to a lack of supervision, have engaged in bad behaviors such as skipping classes, which can affect their learning and development. The teaching methods of vocational colleges themselves are also relatively single, without tailored teaching and weak targeting. Long term use of traditional teaching methods will lead to a more rigid English teaching mode, which cannot scientifically cultivate students' professional abilities. In the face of the above situation, vocational colleges and teachers need to improve traditional teaching modes and methods when carrying out English teaching. They should choose appropriate teaching modes based on specific learning situations, and adopt diversified teaching methods to enhance the fun and attractiveness of English teaching, promote students to actively learn, and also pay attention to the professionalism of teaching in order to better cultivate students' professional abilities.

3.1 Information based teaching

In specific English teaching, vocational college teachers can construct an information-based teaching model, introduce information technology in English teaching, use this technology to create teaching scenarios, present English knowledge in the form of sound, image, video, etc., stimulate students' curiosity, and connect with vocational positions, thereby cultivating students' professional abilities in the teaching process. For example, when explaining "business trips", teachers can combine specific teaching content and use multimedia to set up corresponding virtualization scenarios in advance. They can first ask students, "What kind of business trip do you imagine?" Use this question to guide students to make associations, then show students simulated scenarios, encourage students to actively participate, choose their favorite roles, and receive simulation tasks. Utilize learned English knowledge to complete tasks, flexibly apply spoken English, and thereby exercise students' professional abilities [2].

3.2 practice teaching

Vocational schools and teachers can establish practical teaching models, build specialized English training rooms, and scientifically cultivate students' vocational English abilities through practical teaching. In the process of setting public English class hours, it is necessary to allocate theoretical and practical teaching hours reasonably, strengthen the connection between the two, and enable students to master more English knowledge in practical training. For example, for students studying hotel management courses, when conducting public English teaching, teachers can combine the teaching content, build realistic and representative work scenarios, introduce role-playing methods, set up "foreign tourists" and "waiters" roles,

let students choose roles to substitute for work scenarios, and use English for communication and exchange, thereby exercising students' English communication skills.

3.3 Organize diversified teaching activities

Vocational college teachers should also organize various activities in their teaching to encourage students to enhance their professional abilities through these activities. For example, vocational colleges can cooperate with relevant foreign companies and, at appropriate times, lead students to visit foreign companies. Internships can also be conducted to better exercise students' vocational English abilities. Teachers can also integrate more resources and build a platform specifically for students to communicate with foreign friends. In English teaching, they can lead students to use this platform to have friendly exchanges with foreign friends in terms of career, learning, and other aspects. This also helps to cultivate students' English language sense, establish their professional awareness, and provide certain guarantees for their future employment.

4. CONCLUSION

If effective cultivation of students' vocational abilities is carried out in public English teaching in vocational colleges, it can greatly enhance their job seeking ability and lay a good foundation for their future career development. Therefore, vocational schools and teachers should recognize the importance of cultivating students' professional abilities, and have a deep understanding of the problems in public English teaching. Targeting specific problems, teaching should be optimized to improve teaching quality, in order to better and faster cultivate students' professional abilities.

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The Learning Strategy of Folk Music in Music Appreciation Teaching in Senior High School

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Abstract: High school music appreciation course has become a key link to cultivate students' aesthetic and cultural identity. Folk music, as an important cultural heritage, not only reflects the national history and culture, but also reflects the cultural diversity of the country. However, at present, music appreciation teaching in senior high schools usually lacks in-depth discussion and systematic teaching strategies of ethnic music, which limits students' understanding and appreciation of their own ethnic culture and other ethnic cultures. In view of this, this study aims to explore the effective learning strategies of folk music in senior high school music appreciation teaching, and provide theoretical basis for educational practice.
Keywords: Folk Music; High School; Music Appreciation

1. INTRODUCTION

With the continuous development of globalization and increasingly frequent cultural exchanges, the international community has put forward new requirements for the protection and inheritance of various ethnic cultures. Under this background, folk music education, especially music appreciation teaching in high school, plays a key role. As a special art form, music can not only cross the boundaries of language and region, connect different cultures and nationalities, but also deepen students' understanding and identity of their own national culture. Therefore, incorporating national music into music appreciation teaching in senior high school is of great significance for cultivating students' cultural consciousness and aesthetic ability.

2. THE CORRELATION BETWEEN HIGH SCHOOL MUSIC APPRECIATION TEACHING AND FOLK MUSIC

The relationship between senior high school music appreciation teaching and folk music is reflected in several key aspects. Firstly, as a kind of cultural heritage, folk music is not only rich in historical and cultural value, but also an important content of music appreciation teaching. In the teaching of music appreciation in high school, through the study of folk music, students can not only understand various musical styles and forms of expression, but also deeply understand the close relationship between music and culture and history. This learning process helps to develop students' musical aesthetic ability,

Table 1 Students' understanding and appreciation ability before and after deepening the folk music education

| quota | Before the | After the | change (%) |
|-------|------------|-----------|------------|
|-------|------------|-----------|------------|

while deepening their understanding and respect for the national and international cultures. Secondly, because folk music has distinct regional characteristics and ethnic customs, it is usually connected with students' daily life experience, so it is easier to arouse students' resonance and interest. Through the study of folk music, students can not only enjoy the beauty of music, but also learn the diversity of different musical elements such as rhythm and melody, thereby broadening their musical vision and enhancing musical creativity and imagination. Finally, in the context of globalization, it is particularly important to understand and respect different cultures. Folk music is not only the expression form of music, but also the carrier of culture. Through the study and appreciation of the music of different ethnic groups, students can better understand and respect the musical performance in different cultural backgrounds, thus promoting cultural exchange and integration.

3. DEEPEN THE SIGNIFICANCE OF FOLK MUSIC

3.1 Promote the inheritance and development of folk music

Folk music is not only a form of artistic expression, but also a cultural heritage, including national history, culture and tradition. First of all, through the in-depth teaching of folk music in senior high school music education, students can directly contact and learn these music, so as to deepen their knowledge and understanding of local folk music, which not only helps to inherit traditional music, but also stimulates students' interest in and love for folk music, laying a foundation for future music creation and development. Secondly, by studying the music of different ethnic groups, students are able to understand and appreciate the artistic expressions of other cultures, thus promoting awareness and respect for cultural diversity. Such cross-cultural understanding and respect are essential to building a harmonious and pluralistic society. In order to more specifically demonstrate how deepening ethnic music education promotes the inheritance and development of ethnic music, the following table shows the students' understanding and appreciation ability of their own ethnic music and other ethnic music after a period of time of teaching ethnic music to high school students (See table 1 and figure 1):

| | implementation of education (%) | implementation of education (%) | |
|--|---------------------------------|---------------------------------|-----|
| Understanding of the history of folk music | 30.05 | 70.89 | +38 |
| Master of folk music styles and techniques | 25.86 | 65.69 | +40 |
| Interest in and engagement in traditional music | 20.47 | 60.25 | +30 |
| Innovative number of attempts to combine traditional musical elements | 15.98 | 55.63 | +45 |
| Frequency of participation in ethnic music-related activities | 10.01 | 50.98 | +45 |
| Understanding and respect for other folk music | 30.85 | 70.86 | +35 |
| The application of traditional music knowledge in innovative projects | 20.15 | 60.63 | +40 |
| Understanding of the protection and development of national music heritage | 25.14 | 65.13 | +30 |

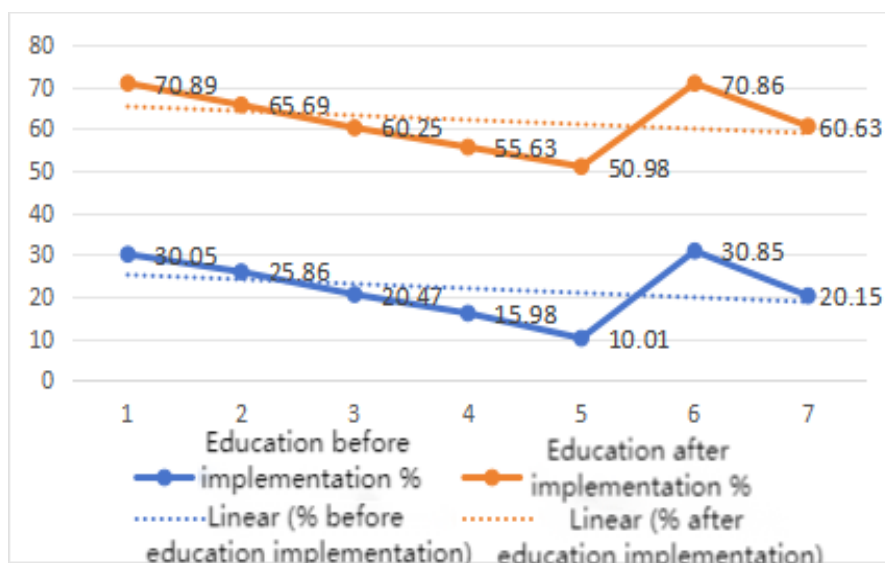


Figure 1 Comparison trend between before, and after the implementation of education

The above table clearly shows the positive impact of deepening ethnic music education on enhancing students' understanding of their own ethnic music history, mastery of musical styles and techniques, interest in and participation in traditional music, and understanding and respect for other ethnic music. Its data highlight the important role of folk music education in the inheritance and development of folk music. Through this education, students will not only be able to understand and respect folk music, but will also increase their understanding and respect for other cultures in a global multicultural context.

3.2 Promote social cohesion and communication

Deepening the education of folk music in the teaching of music appreciation in senior high schools is not only the teaching of music art form, but also a powerful social and cultural cohesion tool. Through the teaching and promotion of folk music through the

education system, students are able to understand and appreciate their own musical heritage as well as that of other cultures, thereby promoting exchange and understanding between different cultures. In music resonance, students not only learn the music itself, but also find the similarities and differences of different cultures in music, so as to establish an understanding and respect for diverse cultures. Such cross-cultural understanding and respect are the cornerstones of social cohesion and cultural exchange. In order to more concretely demonstrate the impact of deepening ethnomusic education on enhancing social cohesion and communication, the following table shows the situation of students in terms of social cohesion and cultural communication after a period of time of ethnomusic teaching for high school students: (See table 2 and figure 2):

Table 2 Social cohesion and cultural exchange of students before and after deepening ethnic music education

| quota | Before the implementation of | After the implementation of | change (%) |
|-------|------------------------------|-----------------------------|------------|
|-------|------------------------------|-----------------------------|------------|

| | education (%) | education (%) | |
|---|---------------|---------------|-----|
| Understanding and appreciation of this folk music | 40.89 | 75.52 | +35 |
| Interest in and understanding of other folk music | 30.04 | 70.69 | +40 |
| The willingness to participate in the multicultural exchange activities | 25.31 | 65.69 | +45 |
| The willingness to participate in the multicultural exchange activities | 35.24 | 75.06 | +40 |
| Respect for and acceptance of different cultural backgrounds | 30.98 | 70.89 | +40 |
| Social skills in a multicultural context | 20.15 | 60.04 | +45 |
| Self-positioning in a globalized society | 25.66 | 65.49 | +40 |
| The awareness and respect for cultural diversity | 35.96 | 75.57 | +35 |

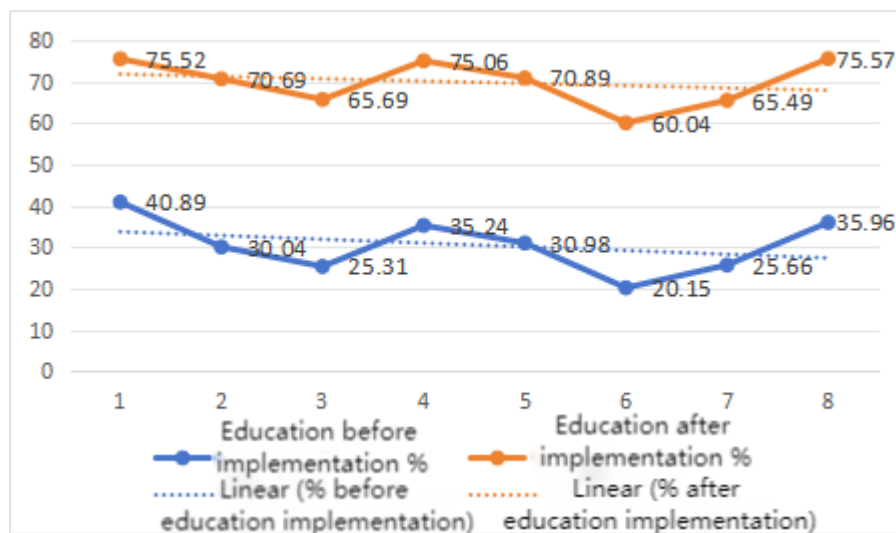


Figure 2 Comparison trend between before, and after the implementation of education

The above table clearly shows that deepening ethnic music education can effectively enhance students' knowledge, interest and appreciation of local and other ethnic music, enhance their willingness to communicate and social skills in a multicultural environment, and enhance their understanding and respect for different cultural values. These data not only demonstrate the role of ethnic music education in fostering students' cultural identity and respect for multiculturalism, but also highlight its importance in promoting social cohesion and cultural exchange.

3.3 Improve innovative thinking and artistic expression

Folk music is not only a carrier of cultural inheritance, but also contains a wealth of creativity and expression, providing students with a unique opportunity to explore novel ways of artistic expression. Through folk music education, students can not only learn traditional musical skills and cultural background, but also develop their innovative thinking and artistic expression ability on

this basis. With its unique musical structure, rhythm and melody, folk music provides a platform for students to explore and experiment with different musical elements. This exploration is not only limited to the music itself, but also extends to the culture and history behind the music, so that students can create novel and unique works of art through the understanding and application of traditional music forms, combined with modern music elements in the process of learning folk music. This innovative attempt to combine tradition and modernity will significantly enrich students' forms of artistic expression and enhance their ability to innovate. In order to more specifically demonstrate the impact of deepening folk music education on improving innovative thinking and forms of artistic expression, the following table shows the situation of students' innovative thinking and forms of artistic expression after conducting folk music teaching for high school students over a period of time: (See table 3 and figure 3):

Table 3 Students' innovative thinking and artistic expression forms before and after the deepening of folk music education

| quota | Before the | After the | change (%) |
|-------|------------|-----------|------------|
|-------|------------|-----------|------------|

| | implementation of education (%) | implementation of education (%) | |
|---|---------------------------------|---------------------------------|-----|
| The improvement of innovative thinking ability | 30.32 | 70.85 | +35 |
| The number of attempts to combine the traditional and modern musical elements | 20.16 | 65.36 | +45 |
| Understanding of the culture behind the folk music | 35.34 | 75.20 | +40 |
| Originality in music creation | 25.65 | 70.69 | +45 |
| Diversity of artistic expression | 30.98 | 70.78 | +40 |
| Master and application of different musical styles | 25.06 | 65.85 | +45 |
| Development and maturity of personal artistic styles | 20.17 | 60.23 | +40 |
| Confidence in music creation and performance | 25.25 | 65.98 | +40 |

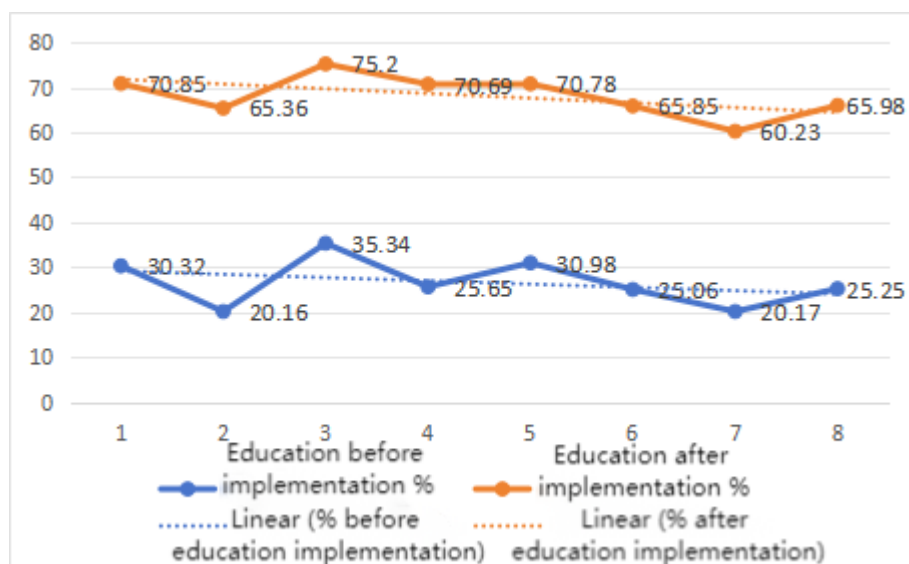


Figure 3 Comparison trend between before, and after the implementation of education

The above table shows that through the deepening of folk music education, students have significantly improved in terms of innovative thinking ability, attempts to combine traditional and modern musical elements, understanding of the culture behind music, originality and diversity of music creation, and development of personal artistic styles. The above data not only shows the positive impact of deepening folk music education on students' artistic ability, but also emphasizes its important role in promoting students' innovative thinking and artistic expression forms.

3.4 Enhance students' sense of identity

Folk music is not only a form of musical expression, but also the carrier of culture and history, reflecting the spiritual outlook and cultural characteristics of a nation. Through ethnic music education, students can gain an in-depth understanding of their own ethnic musical traditions, thereby enhancing their sense of identity with their own national culture, and enhancing understanding and respect for diverse cultures around the world, thus facilitating the

Table 4 Students' sense of identity before and after deepening folk music education

formation of their own identity in a multicultural context. First of all, the study of folk music enables students to have direct access to their own national cultural heritage. By learning the history, style and performance of traditional music, students can not only increase their understanding of their own folk music, but also have a deeper sense of the culture and history associated with music, which helps to cultivate a sense of pride and belonging to their own cultural roots. Secondly, through the study and appreciation of the music of different nationalities, students can enhance their understanding of and respect for other cultures, which will help to cultivate their global vision and cross-cultural communication ability in a multicultural world. In order to more specifically demonstrate the impact of deepening ethnomusic education on enhancing students' sense of identity, the following table shows the status of students' sense of identity after ethnomusic teaching for high school students over a period of time: (See table 4 and figure 4):

| quota | Before the implementation of education (%) | After the implementation of education (%) | change (%) |
|--|--|---|------------|
| The identity degree of the own national culture | 40.86 | 80.89 | +60 |
| Interest in and participation in this folk music | 35.28 | 75.53 | +40 |
| Respect for other folk music and cultures | 30.10 | 70.87 | +40 |
| The ability to understand the different cultural backgrounds | 25.98 | 65.95 | +35 |
| The willingness and ability to communicate across cultures | 20.15 | 60.06 | +40 |
| The appreciation of cultural diversity | 30.23 | 70.85 | +45 |
| Identity of a global cultural identity | 25.16 | 65.36 | +30 |
| An enhancement of personal cultural pride | 35.21 | 75.87 | +40 |

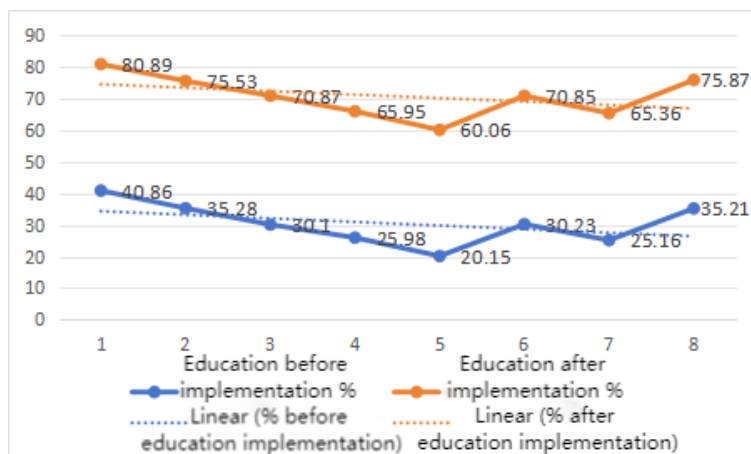


Figure 4 Comparison trend between before, and after the implementation of education

The above table shows the positive impact of deepening ethnic music education on students' recognition of their own ethnic culture, interest in their own ethnic music, respect for other ethnic music and culture, and cross-cultural communication ability, which can prove the effectiveness of ethnic music education in enhancing students' sense of identity. It also highlights its important role in developing students' global perspective and respect for cultural diversity.

4. LEARNING STRATEGIES OF FOLK MUSIC IN SENIOR HIGH SCHOOL MUSIC APPRECIATION TEACHING

4.1 Make reasonable use of multimedia teaching equipment to improve students' music appreciation level

In the appreciation and learning of folk music in senior high school, this teaching method requires teachers to master multimedia technology and innovative application ability, as well as to carry out in-depth planning and design of music teaching content. Firstly, teachers should incorporate multimedia elements in the course design stage. For example, when planning to teach a piece of folk music, videos of performances of the music, demonstrations of instrument playing skills, or even

documentaries about the background of composition can be advanced. So that students can not only hear the music, but also see the music playing process, thus enhancing understanding. Secondly, teachers should flexibly use multimedia tools in the teaching process and play music performance videos so that students can observe the performers' techniques and expressions and understand the emotional expression of music, so as to enhance students' classroom learning experience. At the same time, students can also use projection slides to show the history and structure of the instrument, or music production software to show the structure and melody lines of the music to help students understand the composition of the music from a technical point of view. Finally, teachers should encourage students to actively participate in multimedia learning, arrange students to use music editing software in the classroom to reproduce or create music, or record videos to demonstrate playing skills.

Unique Ethnic Styles, for example, focuses on ethnic music from around the world. The goal of the course is to help students discover the cultural meaning behind music, understand different musical styles, and develop their musical appreciation. In the teaching process, first of all, teachers can introduce

the subject of the course through multimedia presentations. Display a series of pictures and short video clips of different ethnic music, such as African tribal inspiration, Indian classical instrument playing, etc. , to attract students' interest and provide them with an intuitive cultural background. Next, the teacher chooses a particular folk music as an example, such as the Chinese Guzheng. Through videos showing the history, structure and playing techniques of the guzheng, students can gain a more comprehensive understanding of the instrument. Then, a video of guzheng performance was shown, so that students could listen carefully and observe the skills and expressions of the players. After watching the performance video, the teacher should guide the students to discuss their perception and experience. Questions can include: "How does Guzheng music make you feel?" "What do you think are the unique elements of Guzheng music?" "Enhance students' sense of participation and depth of thinking through multimedia. Teachers can then use slides to detail the place of Guzheng in traditional Chinese music and how it reflects Chinese history and culture, helping students to understand the music in a broader cultural context. Finally, teachers encourage students to use multimedia software to try to create ethnic music, so as to deepen the understanding and application of music styles.

4.2 Combine modern pop music to stimulate students' interest in learning

In the appreciation and learning of folk music in high school, the key of this strategy is to create a bridge to connect the modern music elements that students are familiar with and love with the folk music that may be relatively unfamiliar, so as to enhance students' participation and learning enthusiasm. First of all, teachers should seek innovation in curriculum design and find the connection point between modern pop music and folk music. Through comparative analysis of folk music elements and modern music elements in the works, such as melody, rhythm, harmony, etc. , students are guided to discover the mutual influence and fusion between different musical styles. Secondly, teachers should make use of the hot elements in modern pop music to attract students' attention. For example, you can analyze how some pop singers or bands use ethnic music elements in their works, or explore how famous music festivals showcase multicultural musical styles. Finally, teachers should organize students to try to combine their favorite modern pop songs with folk music elements to create new music works, so as to enhance students' practical ability of music and deepen their understanding of the characteristics of different music styles.

Taking Sizhu Xianghe as an example, the course focuses on the musical characteristics of silk instruments (such as the guzheng and pipa) and bamboo instruments (such as the flute), aiming to allow students to explore the musical appeal of

traditional instruments. In the teaching process, first of all, the teacher needs to play an audio that integrates the guzheng, pipa and modern electronic music, so as to show the beauty of traditional instruments and reflect their innovative application in modern music, so as to arouse students' interest. Next, the teacher can play a pure playing of Guzheng or flute, so that students can feel the unique timbre and expression of these instruments. Then, the teacher will show the application of silk and bamboo instruments in modern pop music. For example, playing some modern songs or electronic music pieces that incorporate elements of traditional instruments enables students to understand how the fusion of traditional and modern music works. In this process, teachers can appropriately ask the question: "What characteristics do you think traditional instruments have in modern music?" "What new musical experiences has this fusion given you?" Lead students to discuss their views on the fusion of traditional and modern music. Finally, teachers should encourage students to choose a traditional instrument timbre, combine their favorite modern music style, and use music production software to create a short song. Through this teaching process, students are able to appreciate and understand traditional music while discovering the new life of traditional elements in modern music.

4.3 Combine background story and dance to render appropriate musical atmosphere

In the appreciation learning of folk music in high school, the implementation of this strategy aims to enable students to understand and feel music more deeply in a multi-sensory environment through the integration of narrative and visual arts. First of all, teachers should deeply study the cultural and historical background of each folk music work and integrate the information into music teaching. For example, when teaching a specific national song, it can first tell the historical significance of the song, cultural meaning, the composer's inspiration source and other creative background, so as to stimulate students' interest and help them better understand the deep meaning of the music work. Secondly, teachers should integrate dance elements into music teaching. For example, students can be arranged to learn traditional dances related to a particular musical piece, or encouraged to create dances that match the music. Through actual dance moves, students can experience the rhythm and emotion of the music on a physical level. Finally, teachers should design classroom activities, organize students to create and perform dances around the storyline of a certain national song, and deepen their understanding of music stories through practical operations.

Taking Peking Opera Master Mei Lanfang as an example, the course aims to focus on the life story of Master Mei Lanfang and his innovation in the art of Peking Opera, so that students can understand the

artistic characteristics of Peking Opera and feel the deep connection between Peking Opera and Chinese culture. In the teaching process, teachers should first introduce Master Mei Lanfang's life and artistic achievements through photos and document fragments, and tell about his innovation in Peking Opera art and breakthrough in the role of male Dan. Later, teachers can play recordings of Mei Lanfang's Peking Opera performances, especially excerpts from his classic plays such as Farewell My Concubine. The students can feel the rhythm and melody characteristics of Peking Opera music while listening to the real Peking Opera performance. Next, teachers can show videos of Mei Lanfang's performances, especially her body movements and expression art. In this process, teachers should guide students to observe how dance and music are closely integrated in Peking Opera performances, and how emotions and stories are expressed through body language and expressions. In the form of discussion, students are guided to share their feelings and understanding of Peking Opera performances, and how these performances help them better understand the plot and characters. Finally, teachers can arrange simulated Peking Opera performance activities, so that students can try to use the basic movement and expression art of Peking Opera, combined with

simple music rhythm to perform, so as to help students personally experience Peking Opera art and deepen their understanding and appreciation of this art form.

5. CONCLUSION

To sum up, exploring the learning strategy of introducing ethnic music into music appreciation teaching in high school will help promote the cognition of cultural diversity, enrich students' music education experience, cultivate more comprehensive music literacy, and provide a new way of thinking and practice for educational innovation in the field of music education.

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Research on Case-Driven Software Unit Testing Practice Teaching Based on JUnit

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Abstract: On the basis of analyzing the connotation and role of software unit testing, the paper describes the design concept of unit testing practical teaching. The teaching practice process of unit testing based on JUnit is elaborated from the aspects of teaching philosophy, design ideas, technological application, implementation process, and teaching practice activities.

Keywords: Unit Testing; Practice Teaching; JUnit

1. INTRODUCTION

Software testing is the most important measure and means of software quality assurance. And unit testing is the lowest level of testing activity in the software lifecycle, which uses software code as the object of testing. Unit testing is a core technology and practice in software development, whether in the traditional development model of "code first, test later" or in the test driven agile method of "test cases first, code based". The theory and practice of software testing have repeatedly proved that unit testing is the earliest, lowest cost and most efficient way to find software defects [1].

Unit testing is a series of testing activities performed on the smallest testable unit of software [2]. The smallest testable unit is usually a function, class, or module of the program. Code-first unit testing is performed based on the software detailed design documentation and program code. In unit testing, black box testing strategies are usually used to check and verify the software functionality and observable software behavior of the unit, while white box testing techniques are usually used to analyze the program structure within the software (logic and data flow) of the unit.

Software testing courses have been widely offered in software engineering and software technology majors in universities. As an important part of software testing, how to effectively improve the quality and efficiency of software unit testing practical teaching has become a practical problem that is widely valued and needs to be effectively solved in teaching activities.

2. DESIGN IDEAS FOR UNIT TESTING PRACTICAL TEACHING

The prerequisite for the implementation of unit testing practical teaching activities is that learners have the ability to read, understand and write Java applications, and are familiar with common

black-box and white-box testing methods [3]. Through the practical teaching of unit testing, learners are expected to have a deeper understanding and mastery of the concepts, processes, methods and tools used in unit testing, and be able to flexibly use what they have learned to carry out the process of unit testing activities such as test analysis, test design, test implementation, test execution, etc., so as to improve the skills of practical work [4].

The design of practical teaching is based on the ideas of case driven and engineering enlightenment.

1) Case-driven. Case-driven teaching design, follow the principles of knowledge coverage, content inclusion and difficulty progression. Several typical unit testing practical scenarios have been designed, reflecting the hierarchical progression, logical correlation, and engineering factors of the cases. Through case-driven learning, learners are guided to experience the content of an actual testing project, learning how to connect theoretical knowledge, how to use technology to discover, think, and solve problems, thereby improving the effectiveness of their practical learning and gradually enhancing their practical abilities.

2) Engineering Enlightenment. In the industry, a complete software project is organized and advanced in the form of engineering, from planning, design to implementation. In the design and implementation process of practical teaching, testing projects incorporate engineering content and elements such as planning, design, deployment, organization and implementation, schedule control, project management, and project summary. In this way, through practical learning, not only knowledge application and skill training are cultivated, but also engineering awareness, engineering concepts, and engineering process experience are gained.

3. INSTRUCTIONAL DESIGN FOR UNIT TESTING PRACTICE

The first task in unit testing is to choose a suitable unit testing framework. The choice of test framework is closely related to the implementation language of the object under test. JUnit is a unit testing framework created by Kent Beck and Erich Gamma. In fact, it has become an industry standard for Java program unit testing [5] [6].

The practical teaching is designed as 6 teaching scenarios based on the unit testing workflow, as shown in Table 1.

Table 1 Unit Testing Workflow

| No. | Workflow | Description |
|-----|---------------------|---|
| 1 | Test analysis | Analyze the project under test and identify which methods of which classes require well-developed dynamic unit tests and which methods require only static tests. |
| 2 | Test plan | Develop a test strategy (including selecting appropriate test methods, defining exit criteria, determining personnel requirements, making test schedules) |
| 3 | Test design | Design and review test cases using white-box or black-box testing methods |
| 4 | Test implementation | Build test environments, create test classes and test methods, and script the designed test cases |
| 5 | Test execution | Run the tests and log the results to a file |
| 6 | Test evaluation | Analyze the execution result record file and evaluate the defects of the tested project. |

The following is an example of Java program unit testing for the triangle problem.

3.1 Test Analysis

Test analysis refers to the process of extracting test items to be tested in the software under test based on the test basis. In unit testing analysis under the code-first model, the test basis is usually the detailed design specification of the software, the source code under test, etc. The tested source code provided for the triangle problem project is a correct program, and every method of every class in the project is to be tested dynamically with sufficient logical coverage of all tested source code.

3.2 Test Plan Development and Review

The test plan includes defining the test scope, formulating the test strategy, determining the quality requirements of testers, and planning the test schedule. Its work deliverables and process is to submit the test plan and review it, and pass the review to carry out the subsequent test design. In teaching practice, it is the teacher who guides the learners to prepare the test plan based on the results of the test analysis. The content of the testing plan includes: *a)* test scope: all classes and all methods in the source code of the triangle project. *b)* testing method: analyzing the program structure (white-box testing) is the main focus, and verifying the program function (black-box testing) is the supplement. *c)* exit criteria: all test cases are executed and passed, branch coverage is 100%, and variation (program changes, test cases remain unchanged) test score is over 90%. *d)* testing tools: JUnit testing framework is used to build the project environment and implement tests.

3.3 Test Design

Test design refers to the process of selecting appropriate test case design methods to write test cases based on testing basis. The deliverables of this activity are test case specifications. The testing team needs to conduct a static review of the document, and after passing the review, it will proceed to the subsequent testing process. In this teaching session, the teacher first consolidates the technical points of test case design, and then under the guidance of the teacher, test groups (3 people) are formed to complete the test case design of the entire project based on the project source code. Next, the test cases are subjected to cross group review to correct any issues identified during the review and make modifications for confirmation, before proceeding to subsequent testing activities.

3.4 Test Implementation and Execution

The main activities of test implementation include building test environments, writing automated test scripts. And the deliverables of this activity include automated test scripts, test environment readiness reports, and so on.

This session is a process in which the instructor guides the students to use JUnit to complete the test case scripting (for automated testing) in the test design through the process of teaching case studies and guiding the learners to practice.

1) The process of writing simple tests using JUnit.

First of all, students are guided to think about what steps are needed to execute test cases manually, and then the new strategy is introduced: to complete the test using the JUnit test case structure, which is called the "four phases of testing". *a)* test preparation phase: create instances of the class under test, set the internal state of the class under test, and inject its external dependencies (generally replaced by simulated objects); *b)* test execution phase: interact with the system under test (SUT) to execute the test; *c)* results verification phase: verify that the results of the test meet the expectations; *d)* environment cleanup phase: restore the system and the environment to the pre-test state. Testing should not cause persistent changes to the system and environment.

The instructor demonstrates how to write and run simple tests using the @Test annotation, and assigns homework, such as scripting test cases related to isTriangle() using the JUnit simple test approach.

2) The process of writing parameterized tests using JUnit.

Based on the completed assignments above, students are guided to discover problems with code written using simple testing methods, such as mixed data and scripts, poor maintainability, and repetitive and cumbersome code. This introduces the use of JUnit parameterized testing strategy.

The teacher uses examples to demonstrate the process of writing parameterized tests: using @CsvSource annotation to define parameter source data, replacing

@Test with @ ParameterizedTest, test methods need to define parameters, etc. Analyze and compare the differences between the two testing strategies. Assign new tasks, such as optimizing the isTriangle () simple test script with parameterized tests.

3.5 Test Evaluation

Coverage analysis is performed using the coverage analysis tool built into the IDE (JaCoCo built into IntelliJ IDEA). In IntelliJ IDEA, you can run "All Tests" with coverage to generate a coverage analysis report and save it as an html document while the test is running.

4. CONCLUSIONS

Focusing on cultivating students' abilities, we use the mainstream JUnit framework technology in the industry, driven by case studies and work processes, to reconstruct teaching design, reform teaching processes, and optimize practical connotations. This teaching strategy not only enriches the connotation of practical teaching, improves the quality and effectiveness of practical teaching, but also trains students in practical professional skills, obtains engineering enlightenment, enhances employment competitiveness, and achieves the teaching goal of

"applying what is learned".

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A Study of Software Engineering Instructional Design under the Background of Engineering Education Accreditation

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Abstract: In the context of engineering education accreditation, research has been conducted on the teaching reform of *Software Engineering* course. Active explorations are made in course objectives, teaching content design, evaluation and assessment, aiming to cultivate innovative and versatile talents who can analyze and solve complex engineering problems while possessing a spirit of teamwork.

Keywords: Engineering Education Accreditation; Software Engineering; Instructional Design

1. INTRODUCTION

In June 2016, China officially joined the Washington Agreement, which is the most influential international system of mutual recognition of engineering education degrees, and engineering education has become an important part of China's higher education [1]. Improving the level of engineering education and cultivating talents that meet the current requirements of economic and social development is the current work goal of colleges and universities, and passing engineering accreditation is an important way to improve the level of engineering education [2]. Domestic colleges and universities actively participate in engineering education accreditation. The engineering education accreditation standards are developed by professional engineering associations, usually including requirements for teaching quality, teaching facilities, faculty, student outcomes, etc. The level of engineering education programs and professions is reviewed and evaluated by experts, and obtaining accreditation means that the engineering education programs and professions have reached the industry recognition, and can provide assurance to students and employers [3]. The professional certification of engineering education is based on the concept of OBE (Outcomes-based Education), which is a student-centered, output-oriented, and continuous-improvement-oriented talent training system [4]. That is, by the graduation requirements as a benchmark for comprehensive evaluation of the quality of training, the curriculum system needs to meet the graduation requirements, the curriculum teaching content to support the graduation requirements, to achieve the graduation requirements of the purpose of the final implementation of the

curriculum, the construction of the many courses offered by the university is to achieve the fundamental purpose of engineering education.

Software Engineering is a comprehensive course to guide the development and maintenance of computer software. It mainly teaches software engineering requirements acquisition, requirements analysis methods, software outline design, detailed design methods, coding specifications, coding tools, coding integration, unit testing, module testing, integration testing methods, etc., which are used in the process of software development. Through the study of this course, master the basic concepts, basic principles and basic methods of software engineering, be able to learn to use the idea of software engineering to analyze software requirements and software design, and use a software development tool for software development, and learn to analyze the requirements, design, coding and testing in the process of actual engineering project training [5]. Cultivate better teamwork ability and practical ability, good communication and expression ability, with a certain degree of problem analysis and problem solving ability, to lay the foundation for future work in software development. As the most important core course for software engineering majors, *Software Engineering* course should take the opportunity of engineering certification to reform the teaching and realize the purpose of engineering education.

2. DESIGN OF COURSE OBJECTIVES

Software engineering is a theoretical, comprehensive and practical course, aiming at cultivating students' complete and rigorous software engineering concepts, training software project development and management capabilities [6]. Through the theoretical teaching of this course, students are required to understand the general process of software project development and maintenance, establish good software design and development concepts, be able to consciously carry out software development and maintenance work in accordance with software engineering methods, master the latest methods and technologies of software development, learn to use analysis and design tools, and cultivate the students' abilities and qualities of software development with engineering methods. Through the practical teaching of this course, students will be able to carry out

software engineering project analysis, design and realization, as well as effective project management and document writing ability. Combined with the course's support for the graduation requirements of the major and its index points, the specific objectives of the course are designed as follows:

- 1) Ability to apply advanced mathematics and science fundamentals, engineering and technology fundamentals, social science fundamentals, and software engineering knowledge to the solution of complex engineering problems in software engineering and application areas;
- 2) To be able to design solutions to complex engineering problems in the field of software engineering and to develop software systems that meet specific needs, and to be able to demonstrate a sense of innovation in the design process, taking into account social, health, safety, legal, cultural and environmental factors;
- 3) Strong sense of teamwork and collaboration, with the ability to assume the roles of individual, team member, and leader in a team in the context of software engineering and related interdisciplinary disciplines, as well as the ability to cope with unforeseen events.

- 4) Understand and master the principles of software engineering project management and economic decision-making methods, and apply them in a cross-disciplinary environment of software engineering and application areas.

3. INSTRUCTIONAL DESIGN OF COURSES BASED ON ENGINEERING EDUCATION ACCREDITATION

The teaching chapters of the software engineering course cover all aspects of the software project from the initial feasibility analysis, software project to requirements analysis, outline design, detailed design, implementation, testing, maintenance, etc., which is completely consistent with the actual software project development process. Therefore, software engineering courses are very suitable for teaching using the project-driven approach. Taking chapter content as the coverage standard, we reform the traditional software engineering teaching process. We chose the online bookstore system, which students are more familiar with, as the software project throughout the course, and redesigned the teaching process of the course based on the project-driven approach, as shown in Table 1.

Table 1 Project-Driven Instructional Design for Software Engineering Course

| Project Phase | Process Design |
|---------------------------|--|
| Preliminary | Assign tasks, group members, and determine development language |
| Feasibility Analysis | In small groups, students gather information, conduct a feasibility analysis of an online bookstore system, and write a feasibility analysis document |
| Software Project Approval | In small groups, students write separate project proposals and software contracts for the online bookstore system based on the template documents they have collected |
| Requirements Analysis | Assign tasks among team members to conduct requirements analysis for the online bookstore system, including requirements modeling and writing requirements specification. |
| Outline Design | Assign tasks among team members to conduct an outline analysis of the online bookstore system, including architecture design, data design, interface design, and writing the outline design specification. |
| Detailed Design | Assign tasks among team members to carry out the detailed design of the online bookstore system, including the design of algorithms, process design and writing detailed design specifications. |
| Software Implementation | Assign tasks among team members to develop each module of the online bookstore system in parallel programming. |
| Software Testing | Assign tasks among team members to test the online bookstore system, including unit testing, integration testing, system testing, and writing software testing documents. |
| Software Maintenance | Assign tasks among team members, simulate real-life scenarios, maintain the online bookstore system, and write maintenance documents. |

The project-driven instructional process of Software Engineering course is described as below.

- 1) At the beginning of the course, the teacher assigns the students the tasks of the course project, including the documents and source codes to be submitted in each development process; since the online bookstore system is a small software system that students are very familiar with, the number of project team members is usually more appropriate at 10~12, so the number of students in the group is explained to the students; according to students' familiarity with and

mastery of the programming language, the language of the project development is selected.

- 2) Feasibility analysis is an important link before project establishment. In traditional teaching, the teaching of this chapter is usually boring: the teacher lists various types of feasibility analysis, including policy feasibility, technical feasibility, cost/benefit analysis, SWOT analysis, etc. After listening to these theories, students may still feel that they have not been put into practice, and when they encounter a real project, they may feel that they have no way to start. In the project-driven approach, students collect

information on their own, do a good feasibility analysis of each type and write a good feasibility analysis document. In this process, students think independently, and through teamwork to complete the investigation of information and document writing, the feasibility of the content of the analysis will have a deeper understanding.

3) There are two sources of real software projects, one for ordered software and one for non-ordered software. The signing of a contract and the creation of a software project signify the creation of a software project from these two sources, respectively. In the project-driven approach, students collect document templates and try to write contracts and project proposals on their own, which they seldom have access to, and this lays a good foundation for them to establish real projects in the future.

4) The tasks of software requirements analysis mainly include requirements modeling and writing requirements specification. Requirements modeling includes building data models, behavioral models and functional models. Within the group, students assign themselves to different modeling tasks, such as building data dictionaries, ER diagrams, statecharts, data flow diagrams, or various UML diagrams. Students who are responsible for different modeling tasks are also responsible for writing the relevant parts of the requirement specification. At this stage, students can utilize various software tools to improve the efficiency of requirements analysis, such as IBM Rational Rose.

5) The tasks of software outline design mainly include architecture design, data design, interface design and writing outline design specification. In groups, students undertake different outline design tasks, such as designing database tables, constructing software structure diagrams, designing human-computer interaction interfaces or module interfaces, and so on. Students can utilize various software tools to improve the efficiency of outline design, such as Microsoft Visio, SQL Server and so on.

6) The tasks of detailed software design mainly include the design of algorithms within the module, process design and writing the detailed design specification. Students undertake different outline design tasks, such as drawing program flowcharts and NS diagrams.

7) Software implementation is a part of turning the design into runnable code. Within the group, students are each responsible for the programming tasks of some modules, so that each student's hands-on practical skills are practiced.

8) Software testing finds and corrects errors in programs. The progressive relationship from unit testing to integration testing and system testing makes each level of testing very clear to the students.

9) Since there will be no real users of the online bookstore system developed in the final course,

students will cross play the role of users among their groups. Bugs reported during use can be submitted to the project development team for corrective maintenance, with the project development team writing the maintenance documentation.

In the classroom as well as in the whole process of project development, the teacher always plays only the role of an observer or puzzler, puzzling and explaining the common problems and key knowledge points encountered by the students. Each student participates in the whole process of the project from feasibility analysis to maintenance, learns theories and thinks about problems in practice, which not only exercises the hands-on ability and strengthens the understanding of theoretical knowledge, but also cultivates the good habits of teamwork, mutual communication and active learning. These abilities and qualities are exactly the requirements of engineering education certification for graduates.

4. COURSE ASSESSMENT

The assessment of *Software Engineering* course should try to be objective, comprehensive and accurate in evaluating students' abilities in all aspects, and promote students' self-learning ability and comprehensive quality. We have upgraded and optimized the assessment scheme of software engineering courses. The assessment mechanism takes the concept of "students' ability output" as the starting point, combines in-class and out-of-class assessment, complements online and offline assessment, and attaches importance not only to the assessment results but also to the learning process.

The current general evaluation method for this course consists of two major parts: the final paper and the usual process-oriented assessment. The process-oriented assessment is further divided into in-class and out-of-class assessment. The in-class assessment is mainly the accompanying test in the theory and experiment class. The extracurricular assessment includes the assessment of project cases and the assessment of innovation and entrepreneurship competition, in which the project cases are the training projects specified by the teachers, and the innovation and entrepreneurship competitions are the projects in which the students independently participate in all kinds of innovation and entrepreneurship and discipline competitions as well as enterprise internship projects.

5. CONCLUSIONS

In the context of engineering education certification and the construction of new engineering disciplines, this paper researches the teaching reform of software engineering courses, and makes active exploration in the aspects of course objectives, teaching content design, course evaluation and assessment respectively, aiming at cultivating innovative and compound talents who can analyze and solve complex engineering problems, and at the same time, have the spirit of teamwork and cooperation, so as to deliver

high-quality talent reserves for the software industry. As a core course of computer class, this teaching reform research will have certain radiation demonstration effect and reference promotion value for other courses of the same course group.

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