Practical Test Questions and Performance Analysis of Industrial Analysis and Testing Skills Competition

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Abstract: The industrial analysis and inspection skills competition highlighted the basic theory and operation of chemical analysis and instrumental analysis. In view of the practical examination questions of the industrial analysis and inspection skills competition in 2020, the examination contents, examination difficulties, proposition ideas and other aspects are analyzed. The examination contents not only reflect the knowledge and requirements of analytical chemistry courses in higher vocational colleges, but also reflect the post requirements of Chinese enterprises for analytical talents. Then, the author analyzes the achievement of a province, analyzes the reasons for the unsatisfactory achievement and the countermeasures to solve the problem.

1. Introduction

The vocational skills competition has been widely recognized by all walks of life and has played a positive role in promoting China's vocational education [1]."General education has college entrance examination and vocational education has skills competition". As an important platform to promote students' growth and success, the competition has received high attention from governments and schools at all levels [2].The vocational skills competition helps to improve the students' professional core accomplishment and their employability [3].Since the Industrial Analysis and Testing Skills Competition was held in 2006, it has been supported and recognized by all provinces, cities and schools. The professional posts in this competition involve petroleum, chemical industry, medicine and other fields. The basic theory and basic operation ability of the players will be mainly assessed. The specific assessment items of the Industrial Analysis and Testing Skills Competition are theoretical knowledge, simulation operation and skill operation, accounting for 25%, 5% and 70% respectively. Skill operation is divided into chemical analysis and instrument analysis, accounting for 50% respectively.

In 2020, the technical operation test questions of the industrial analysis and testing skills competition adopted by a province are close to the actual production and highly connected with the actual positions of enterprises. Its content not only reflects the knowledge and requirements of analytical chemistry courses in higher vocational colleges, but also focuses on the examination of students' professional core literacy, and combines with the requirements of national standards [4].This test question not only meets the "local atmosphere", but also reflects the technical requirements of our enterprises for analytical talents. This paper analyzes the contents of examination questions, difficulties in examination, ideas of proposition, and countermeasures for improving achievements, etc. in order to elaborate the connotation and extension of the industrial analysis and examination skills competition.

2. Analysis of Test Questions

2.1 The basic situation of examination questions

The courses involved in this test include "Chemical Analysis", "Instrumental Analysis" and "Industrial Analysis". The chemical analysis part mainly involves the relevant contents of the redox titration analysis chapter in "Chemical Analysis". The instrument analysis part mainly involves the relevant contents of the ultraviolet-visible spectrum analysis chapter in "instrument analysis", and the specific contents are shown in table 1.As can be seen from table 1, the skills competition is based on the professional foundation of industrial analysis technology and assesses the professional quality of students from the perspective of quantitative analysis. Table 2 lists the contents that the players need to understand in this skills competition. These contents need to be combined with professional basic knowledge, basic skills and can be understood and solved through careful thinking. A correct understanding of the test principle and analysis method has laid a solid foundation for implementation.

Table 1. Analysis on Examination Contents of Practical Test Questions in Industrial Analysis and Examination Skills Competition

chemical analysis	Experimental principle	Redox reaction, standard solution, solution to be tested, pretreatment before titration, indicator, titration end point, stoichiometric point and error analysis.
	Experimental operation	Sample weighing, solution preparation, titration basic operation, titration end point judgment and result calculation.
Instrumental analysis	Experimental principle	Ultraviolet visible spectrum, maximum absorption wavelength, dilution theorem, lambertian theorem, external standard method, buffer solution, error analysis.
	Experimental operation	Use of UV-Vis spectrometer, dilution of solution, constant volume, preparation of standard curve and calculation of results.

Table 2. Analysis of Contents Needed to Be Understood in Practical Test Questions of Industrial Analysis and Testing Skills Competition

Assessment form	It is necessary to understand what is well understood.
chemical analysis	1. The effect of stannous chloride, titanium trichloride, dilute potassium dichromate, tungsten blue and other reagents. 2. Blank test operation and formula understanding. 3. Unknown Sample 1 Calculation and Formula Understanding.
Instrumental analysis	1. Determination of dilution multiple of unknown sample 1. 2. Preparation and understanding of color gradation solution. 3. Making and application of standard curve. 4. Determination of dilution multiple of unknown sample 2. 5. Calculation of Unknown Sample 1 and Understanding of Formulas.

2.2 Thinking of Test Paper Design

The chemical analysis test questions first examined the preparation of potassium dichromate standard solution, then the unknown sample 1 was reduced to make all the iron elements become ferrous ions, then the ferrous iron solution was titrated with potassium dichromate standard solution, and the concentration of the unknown solution 1 was calculated through the results. The instrument analysis test questions first examined the dilution of the solution, that is, the unknown solution 1 was diluted, then appropriate diluted solutions were removed to make standard curves according to the operation steps, and the unknown solution 2 was diluted at the back left and its concentration was obtained according to the operation steps. The results of chemical analysis form the basis of instrumental analysis. The former influences the latter, which shows the originality of the proposer. The proposer sets three obstacles when designing the test questions:

(1) The first obstacle is that the weighing quality of potassium dichromate is uncertain. The pre-competition guide does not give specific quality, which requires students to explore by themselves. This quality obviously has a certain range, and more or less weighing will have a greater impact on the test. During the competition, the test questions gave the weighing range, which requires the students to weigh accurately, and to be able to contact the pre-competition training experience and feel right to complete the titration. During the competition, we found that some students failed the experiment because they consumed too much or too little standard solution due to inaccurate or unqualified weighing.

(2) The second obstacle is the uncertainty of the concentration of the standard solution. Theoretically speaking, the concentration of the standard solution is known, but the object used to prepare the standard solution in the test questions is the unknown sample 1. The concentration of the unknown sample 1 needs to be obtained through chemical analysis, which requires correct chemical analysis in the first step. Failure or failure in this step will surely lead to failure in instrument analysis. However, the difficulty of chemical analysis is usually less than that of instrumental analysis, so the proposer set up a difficulty gradient here and pushed it forward layer by layer. Instead of breaking away from chemical analysis and instrumental analysis, they formed an organic whole.

(3) The third obstacle comes from the uncertainty of dilution factor required for unknown sample 1 to make standard curve and unknown sample 2 to determine. As we all know, chemical analysis is a constant analysis, while instrumental analysis is a microanalysis, and the results of constant analysis cannot be directly used for microanalysis. This requires dilution, but the multiple of dilution is also uncertain, which also requires the contestants to be flexible in their pre-match groping and competition. The handling is not appropriate and the standard curve cannot be obtained, thus the sample 2 cannot be effectively analyzed.

From the above analysis, it can be seen that the contestants can't "take medicine according to the prescription" and finish the experiment mechanically. The three obstacles more inspect the contestants' ability to understand the experiment principle and steps. Examine the players' ability to deal with problems flexibly. These three obstacles step by step, there is a problem in one link, which will affect the follow-up test, thus unable to effectively complete the competition task. The final goal of this competition is to obtain the concentration of two unknown samples through constant analysis and micro analysis. The inspection indexes are accuracy and precision, which is rather difficult.

3. Performance Analysis

According to the results of a province's industrial analysis and inspection skills competition in 2020, the results are shown in table 3. From table 3, it can be seen that the average simulation results are relatively high, reaching 85.55 points, with a relatively small gap. The theoretical average score is 65.79, with a slight difference. The gap in performance is greatest, and the performance can best reflect the real level of the players. Given the proportion of the performance, the performance actually determines the final performance of the players. There is a big gap between this result and that of the national competition [5].

Table 3. Results of 2020 Industrial Analysis and Testing Skills Competition in a Province

School	Theoretical average	Simulation average score	Implementation average
S-1	46.25	95.23	17.38
S-2	82.50	98.86	14.75
S-3	54.75	84.09	12.50
S-4	37.00	42.14	27.38
S-5	92.00	99.55	44.38
S-6	82.25	93.43	37.50
Overall	65.79	85.55	25.65

Taking the six participating schools as the comparison objects, the comparison focuses on the implementation results. The results are shown in Figure 1. Figure 1 shows that the implementation results of the six participating schools are uneven and the overall level needs to be improved. The reasons may be as follows:

(1) Instruments and equipment and other hardware need to be perfected and improved. Some participating schools do not have the same brands and models of instruments developed in the competition, resulting in students not familiar with the instruments and unable to operate the instruments during the competition.

(2) The level of instructors needs to be improved. Generally speaking, the theoretical level of instructors does not have much problem, but the understanding of experimental principles and operating procedures is not necessarily in place. The standardization of operation cannot be controlled accurately. Due to the limited energy of the instructors. Not giving effective guidance to students; Limited by the guidance experience, the guidance teachers cannot effectively predict and solve the problems that may occur before and during the competition.

(3) The students' pre-competition training is not in place, and due to various factors, the students who plan to participate in the competition do not have enough time and intensity to implement the training, which leads to a complete understanding and understanding of the principles of the test questions in the competition, and a complete grasp of the analysis methods and operation steps.

(4) The students lacked experience in the competition. During the competition, some students suffered from excessive psychological pressure, high mental stress, shaking hands and feet, blank mind again and again, completely abnormal operation, some broke glassware, and some forgot the experimental steps. The result is naturally either impossible or impossible. Judging from the practical part of this competition, there are few really complete ones, and most of the players can only finish part of them.

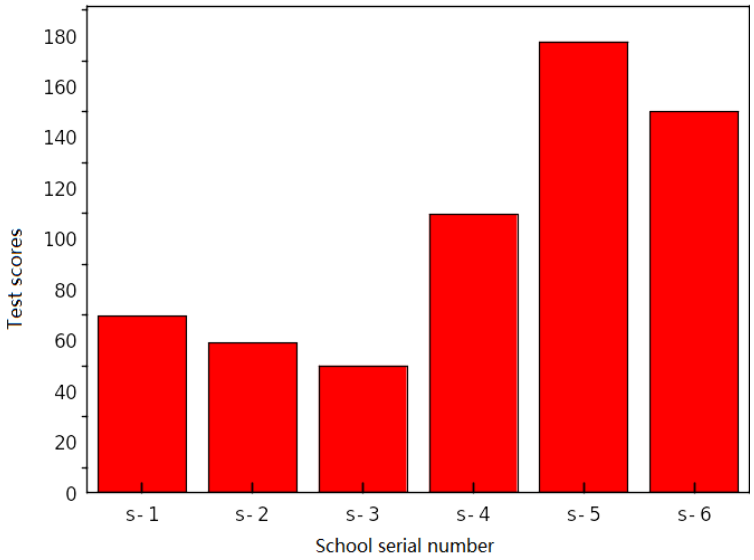

Figure 1. Intercollegiate Comparison of Implementation Results in 2020 Industrial Analysis and Testing Skills Competition

4. Countermeasures for Improving Performance in Skills Competition

4.1 Improve the Quality of Instructors

Skills competition has improved teachers' professional ability and enhanced their professional happiness. At the same time, it has challenged teachers' professional ability and requires a large number of good teachers with both ability and political integrity [6].In the process of guiding students, the theoretical level of teachers needs to be improved, the ability to analyze problems needs to be further refined, the practical ability needs to be further strengthened, and the idea of skills competition can be brought into the classroom, thus improving the quality of theoretical and practical

teaching and further improving the overall core accomplishment cultivation of students. On the other hand, the skills competition is conducive to the cultivation of double-qualified teams. The two complement each other.

4.2 Strengthen the theoretical teaching of specialized courses

The improvement of the results of the industrial analysis and testing skills competition is not limited to "preparing for the competition". The so-called kung fu in normal times, only by continuously strengthening the courses of analytical chemistry, instrument analysis, industrial analysis and other subjects of the specialty, learning the theoretical courses well, mastering the basic principles of various analytical methods, processing and calculating the results, and improving the theoretical level of all students, can we better understand the principles, procedures and other links of the test questions of the competition. Using the guiding function and incentive function of skills competition to promote vocational education and improve the quality of education and teaching [7].

4.3 Improving Hands-on Ability

From the above analysis, the short board of this skill competition in this province is the students' practical ability. Therefore, it is necessary to adopt diversified practical teaching modes to cultivate students' practical ability [8], to give good experimental and practical lessons, to do more experiments, to do better experiments, and to cultivate students' practical ability in a solid and multi-dimensional way. Select potential students to join the teachers' research team. Many teachers in my school have various research projects. With the help of research platform, it is beneficial to expand students' vision and imperceptibly improve students' comprehensive ability and innovation ability [9].Only when the students' overall theoretical and practical abilities are high can they select more excellent students to participate in the skills competition. In fact, the industrial analysis and testing skills competition not only evaluates the highest level of students in a school, but also reflects the average level of students in that school.

4.4 Scientific preparation

The author believes that the preparation for the competition should not be limited to the competition guidelines provided by the competition, but should carefully analyze the competition and examine the core abilities of the students. These abilities are difficult to break through and improve in a short period of time. Even if they are barely mastered, the abilities of the students are difficult to show in the tense and unfamiliar environment of the competition. Many students complain that they practice well at home and have beautiful data. How can they not do it and finish it in the competition Therefore, we should change "short training" to "long training" and abandon the concept of "examination". Instead, we should start to cultivate students' ability and professional quality, promote the reform of the existing curriculum system, and promote the construction of talent training system [10].The main contradiction of scientific preparation is to cultivate students' practical ability. For example, theoretical and simulation tests can be given to students for self-study. Teachers mainly play a supervisory role. From the author's practice, giving students self-study and teachers' supervision can fully meet the requirements of the competition. Scientific preparation also requires the construction of a reasonable skills competition system, which is in line with the actual conditions of the school and the requirements of the skills competition [11].

5. Conclusion

In the past 13 years, the industrial analysis skills competition has been popular mainly because it combines the professional actual situation with the actual situation of the enterprise. The instruments used are usually economical and simple, and reagents are easily available. The materials used are from the actual situation of the enterprise and the national standards. They are scientific and operable, and can examine the students' theoretical level and practical ability [12]; taking this as a benchmark is conducive to the overall development of industrial analysis and inspection and other specialties. It is conducive to the training of analysis and testing personnel that meet the actual requirements of

enterprises; it is conducive to improving the theoretical and practical level of professional teachers. It is conducive to improving students' professional core literacy [13].

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