

Exploring the Optimization of Student Assessment Mechanism in Vocational Colleges in the Context of Science-Education Integration

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Abstract:

Vocational education student evaluation mechanism is the “baton” of student training, which is of great significance for cultivating high-quality vocational talents and giving full play to the social value of vocational education. This paper firstly analyses the existing problems in the evaluation mechanism of students in vocational colleges and universities, and secondly, combines the changes in the education mode of vocational colleges and universities under the background of Science-Education Integration, and starts from the intelligent multi-modal collection terminal to capture the evaluation elements of the process, the “big data & algorithmic analysis” to help the evaluation data processing, the integration of the evaluation system, and the flexible changes in the evaluation standards. In this paper, we put forward the ideas and directions for optimising the student evaluation mechanism from the aspects of intelligent multimodal collection terminal capturing process evaluation elements, “big data + algorithm analysis” facilitating evaluation data processing, integration of evaluation system, flexible change of evaluation standards, construction of “credit replacement” mechanism, and improvement of students’ multi-channel path to success.

Keywords:

Student Assessment Mechanism, Vocational Colleges, Science-education Integration

1. Introduction

The assessment mechanism of vocational colleges and universities is a key pivot of the closed loop of “cultivation - evaluation - feedback” of vocational education, which is of great significance in promoting the all-round development of students, improving the quality of vocational education and giving full play to the social value of vocational education. From the perspective of students’ personal development, a scientific assessment mechanism can accurately identify the shortcomings of students’ professional abilities and potential advantages, and has the important function of guiding, motivating, and self-diagnosing students’ growth and promoting their comprehensive development; from the perspective of the quality of vocational

institutions, a reasonable assessment mechanism can effectively solve the chronic problem of “disconnection between learning and use”, and make vocational education truly become a means to support the industrial sector, and to improve the quality of vocational education. In order to make vocational education become the “talent supply side” to support industrial upgrading and give full play to the function of “supporting the development of regional industries”; from the social value level, the assessment system integrating the genes of industry-education fusion can not only strengthen the talent cultivation through the in-depth participation of enterprises, but also strengthen the appropriateness of talent cultivation with the help of the skills and skills of the students. From the social value level, the assessment system integrating the genes of industry-education integration can not only strengthen the appropriateness of talent cultivation through the in-depth participation of enterprises, but also enhance the attractiveness of vocational education with the help of the social credibility of skills certification, thus promoting the formation of a virtuous circle of “skills to become a talent-decent employment-industry revitalisation”, and injecting the kinetic energy of sustainable development into the construction of modern vocational education system.

2. Problems with the Student Assessment Mechanism

2.1. Homogenization of assessment methods: alienation from “multidimensional competence” to “flat assessment”

Early student evaluation focused mainly on academic achievement, i.e., students’ mastery of knowledge and performance of skills. However, with the continuous development of educational concepts and the deepening of educational practices, educators have paid more attention to the overall development of students, and the State Council of the Central Committee of the Communist Party of China (CPC) has put forward the “Overall Programme for Deepening Educational Evaluation Reform in the New Era”, which proposes to “improve the evaluation of results, strengthen the evaluation of the process, explore the evaluation of value-addedness, and improve the comprehensive evaluation” [1]. Professor Zhao Zhiquan of Beijing Normal University proposes that “the evaluation system for technically skilled personnel should be based on a scientific method of evaluating action ability, and should evaluate not only students’ vocational practice ability but also their vocational cognitive ability” [2]. According to the advanced education concept, educators are able to establish a relatively scientific assessment mechanism from a scientific point of view, but this multidimensional competence assessment in the implementation of vocational education in the implementation of the process can not be truly implemented, tangled in its contradictions lies in the crux of two points: the limited means of information collection and the limitations of data processing. Process assessment is an important way to assess the performance of students in the learning process, but the observation point of process assessment is often a fleeting behavioural performance, teachers can not accurately and precisely and comprehensively record the process performance of all the students in the collective teaching, so there is a certain degree of difficulty in the collection of information for process evaluation. On the other hand, to achieve a comprehensive scientific evaluation of students, a larger number of observation points are needed to support the evaluation indexes. When the number of evaluation objects increases and the time dimension of the evaluation lengthens, the more data need to be processed, and the use of what means of scientific and instantaneous processing and

feedback of the data has become an important “last kilometre” in the implementation of multidimensional evaluation.

2.2. Multi-appraisal information silos: data barriers in multi-stage and multi-subject evaluation

The current evaluation of the student level of vocational colleges and universities is not systematic in the development of various types of indicators for evaluation, data “fragmentation” management drawbacks and information dispersion [3], there are data barriers between students’ promotion file data, assessment data of various subjects, enterprise internship data, the second class data and other multivariate assessment modules, and the school-level academic affairs system, The lack of effective docking between the training platform and the enterprise assessment system, each forming a data island, so that the assessment results show a “blind man feeling the elephant” state, unable to form a complete “digital portrait”, it is difficult to support the accurate diagnosis of the talent capacity, and even the “tailor-made education”. It is difficult to implement the “teaching according to ability” and “posting according to talent”. From the vertical perspective of students’ ability growth, the information silo causes a break in the continuity of students’ ability assessment, and it is impossible to obtain the starting data of students’ ability at a certain stage of continuous assessment, so it is difficult to analyse the growth of students’ developmental ability, and it is difficult to implement value-added assessment.

2.3. Disconnection from industrial demand: the mismatch between talent training and job evolution

With the high degree of development of digital technology, there is a significant “time lag” between the current assessment standards and industrial iteration. In the field of intelligent manufacturing, for example, the annual update rate of the competency standards for the operation of industrial robots reaches 23 per cent, but the revision cycle of the relevant professional assessment syllabus generally exceeds three years. This “standard lag” leads to talent training and job demand to produce “space-time mismatch”, the corresponding assessment standards and job demand deviation. The deeper contradiction lies in the fact that the mechanism for industry enterprises to participate in the formulation of assessment standards is not yet sound, and most vocational colleges and universities are still adopting the “school-led” evaluation system, so that students’ social practice and career development ability cannot be effectively tested, resulting in a disconnect between the evaluation results and market demand, and failing to comprehensively reflect the actual effect and value of vocational education [4], and making the content of the examination and evaluation of the real requirements of the position there is a “systematic deviation”, which makes the assessment of the content of the real requirements of the position and the systematic deviation of the position. “Systematic deviation”, forming the paradoxical phenomenon of “classroom excellence” and “job discomfort”.

3. Pedagogical Transformation in Vocational Education under Science-Education Integration

Science-Education Integration is an educational philosophy and practical approach that seeks to organically integrate the fields of science, technology and education in order to promote the development of comprehensive knowledge and skills. It emphasises cross-collaboration and integration between different disciplines and

fields to address increasingly complex social and economic challenges. The pathways of Science-Education Integration to empower vocational undergraduate student development can be broadly categorised into two types: scientific research & education, and science and technology & education.

The cultivation method of “science and technology & education” can be divided into two kinds at the practical level: one is the scientific and technological means of education, which means that modern scientific and technological means, such as artificial intelligence, big data, virtual reality, and so on, can be applied as teaching means in the theoretical teaching process, practical operation process, teaching evaluation process, and management of teaching venues, etc., so that students can improve their digital literacy through immersive experiences. Students can improve their digital literacy through immersive experience. A real-time sharing platform between schools and enterprises can also be built through digital means to ensure the advancement of vocational education, promote the close integration of vocational education content and industrial practice, solve the lagging problem between vocational education and industrial development, and improve the learners’ grasp of cutting-edge technology. The other is the scientific and technologicalisation of educational content. The teaching content of professional courses and practical training settings are further aligned with the cutting-edge technology of the industry, and the co-operative enterprises of the work-learning alternation are selected from the high-end enterprises of the regional industry, so as to ensure the cutting-edge of the teaching content; the learning process of the learners further highlights the status of the main body, and the use of task-type or project-type way of teaching is carried out to guide the learners to solve problems by using technological innovations in the way of teamwork. A “second classroom” activity based on the theme of “technological innovation” is carried out to enhance the learners’ awareness of the application and innovation of science and technology.

The cultivation method of “scientific research & education” can be explored from three dimensions: teaching content scientific research results feeding the teaching process, student participation in university-enterprise horizontal project research, and students’ independent team innovation project research. Firstly, the research results of teaching content feed the teaching process. On the one hand, teachers’ scientific research in their fields can improve the depth and breadth of teaching content and influence students’ thinking and habits; on the other hand, teachers’ scientific research may bring about scientific improvements in teaching methods and make certain changes to students’ learning process. Second: students’ participation in horizontal research projects of schools and enterprises: vocational undergraduate students still have the attribute of vocational education, so scientific research is more inclined to practical application. Students’ participation in the horizontal projects between teachers and enterprises can promote students’ knowledge and skills in interdisciplinary fields, and improve their awareness of self-learning and scientific research quality. Third: Innovative project research by students’ own team: different from participating in research projects, students have absolute dominance in innovative project research, which can improve their ability in overall planning, team coordination, process control, and so on.

4. Optimizing Vocational Skill Evaluation Mechanisms through Science-Education Integration

In the context of Science-Education Integration, the help of big data statistics, algorithmic analysis, information technology and other science and technology has made the diversification and multidimensionalisation of student evaluation a reality, effectively ensuring the comprehensiveness, systematicity, scientificity and objectivity of student evaluation. The optimisation of the evaluation mechanism in the context of Science-Education Integration can be carried out in the following directions:

4.1. Intelligent multi-modal sensing terminals, capturing process-oriented assessment artefacts

Intelligent multi-modal assessment terminals, capturing the elements of processual and immediate assessment and improving the efficiency and accuracy of assessment . Process evaluation, as an effective means of overcoming the traditional unitary quantitative outcome evaluation, is an important evaluation dimension for achieving a comprehensive measurement of students' abilities. However, the occurrence of process evaluation is generally in the process of goal achievement, mostly manifested in the results of goal achievement can not be shown in the behaviour or attitude performance, and these performances often do not last a long time a little fleeting, the performance of the appearance of the behaviour is also different, relying solely on the instructor to record and evaluate the personalized process of all the learner's appearance is not possible, and the integration of scientific and technological development for the process of the scientific evaluation offers possibilities. In the process of student learning, teachers can implement the recording of student process performance through convenient intelligent terminal equipment, and student behaviour that cannot be estimated can be recorded through voice recognition or characteristic behaviour using intelligent technology, which facilitates teachers to improve process evaluation data. In addition, the evaluation of process performance cannot be purely quantitative, but requires a combination of "quantitative evaluation" and "qualitative evaluation". The content of "qualitative evaluation" needs to be summarised using artificial intelligence technology to form keywords for three-dimensional description of students.

4.2. "Big data & algorithmic analysis" empower evaluation data processing, ensuring holistically scientific assessment

"Big data & algorithmic analysis" solves the problem of huge data processing and guarantees the implementation of comprehensive, personalised and systematic evaluation. The huge evaluation data processing has been blocking the implementation of comprehensive evaluation of students, big data analysis and scientific algorithmic analysis provides the possibility of comprehensive and personalised evaluation of students. Each student is a distinctive and independent individual, and to cultivate students from the perspective of comprehensive development, it is necessary to comprehensively assess and tailor each student's different abilities. These abilities include students' theoretical knowledge, vocational skills, social competence, personal character, etc., and the assessment of these abilities is based on a rich source of basic data, which requires a large and scientific data data processing system to comprehensively process these data in order to realise the comprehensive assessment of individuals. The outcome and value-added assessment of students also requires comparative spatial horizontal and temporal vertical analyses

of students' assessment data to measure the level of an individual in a group and the span of an individual's growth over a period of time. In order to ensure the systematic assessment of students at the school training stage, it is also necessary to stabilise and store a large amount of data to form a "digital portrait" of students, so as to ensure the comprehensiveness of the assessment of students' abilities at graduation and the guidance of their career planning.

4.3. Integration of assessment systems, cultivating holistic student digital growth trajectories

Digital assessment means cross the dimension of time and space to achieve the sharing of diversified evaluation data with the same system across time and space. The systematic and objective nature of evaluation requires the joint participation of multiple evaluation subjects under the same standard, and from the viewpoint of the cultivation mode of vocational undergraduate learners, these evaluation subjects include, but are not limited to, the collection of online learning data, theoretical course lecturers, practical course instructors, skill competition instructors, counsellors, enterprise instructors, second classroom evaluation subjects, co-learners, and themselves, which originate from These subjects come from different fields and need to use digital means and information systems to achieve data sharing across time and space. Multiple synergies, establish a comprehensive evaluation system of "multiple thinking and joint evaluation by schools and enterprises". According to the evaluation indexes, establish a comprehensive evaluation digital synergy platform, set up different object permissions, collect evaluation data of students at different times and in different dimensions, and form an all-round digital growth path running through the whole cycle of students' vocational education. The comprehensive assessment of learners' basic competence in the early stage can scientifically guide the arrangement of subsequent work tasks and realise the teaching of students according to their aptitude and the suitability of the job for the individual. At the same time, the scientific and three-dimensional "digital portrait" helps students to have a clear understanding of themselves and make more reasonable learning and career planning.

4.4. Instant feedback from demand-Side talent requirements driving the transformation of talent evaluation systems from rigid to flexible paradigms

The rapid development of science and technology, the frequent changes in industry job requirements, resulting in talent training evaluation standards and job evolution of the spatial and temporal mismatch, correcting the deep-seated contradiction between the school and enterprise talent demand-side and supply-side data barriers, as well as the stability of the education system's demand for agility with the industry's needs to form a fundamental conflict, the existing standard-setting mechanism relies on the Committee of Experts for periodic revisions, and it is difficult to adapt to the pace of technological change at the exponential level. To solve this conflict, it is necessary to construct a dynamic feedback mechanism for the errors of school and enterprise talent training.

Relying on industry-industry-education integration communities and municipal industry-industry-education consortia, a cloud-based platform for dynamic monitoring of talent demand has been established. Firstly, it is necessary to track the data of graduates and collect the career development data of students within 3 years of employment, including the fitness of individual ability and job competence, job salary, career promotion space, etc., which serves as the basis for the optimisation of the

cycle of talent cultivation evaluation standards. Secondly, enterprises provide real-time feedback on the job competence data of interns through the cloud platform, and upload changes in job competence demand in real time, forming a closed loop of demand-side evaluation and dynamically updating the “industry-professional” skill mapping. Finally, relying on the industry-teaching virtual teaching and research room, we carry out thematic teaching and research meetings on talent cultivation and professional construction, and jointly discuss the predictive direction of talent demand. According to the data collected on the platform, the dynamic adjustment mechanism of talent evaluation indexes of “professional orientation & course fine-tuning” is implemented, whereby the professional side adjusts and establishes the assessment system for the next student’s talent cultivation based on the data collected and analysed on the platform, and the teacher side takes the semester as a cycle to adjust the course assessment standards by 10%~10%. Teachers will make 10% to 20% fine-tuning of the course assessment standards in the cycle of “semester”, and make a record in the system.

4.5. Constructing a “Credit Replacement” Mechanism to Enhance Multi-Channel Talent Development Pathways

With the development of science and technology and the deepening of the integration of industry and education, the ways for students to improve their skills through different channels are also enriched, and the construction of the “credit exchange” mechanism can help to break through the constraints of the traditional education model, so that the students can improve their abilities through multiple channels within the limited training cycle of vocational education, and promote the students’ independent and personalised growth and success. Detailed assessment standards for vocational special competence and vocational general competence are established in the curriculum, and students can exchange the vocational special competence and vocational general competence in the results of scientific research projects, technological improvement projects of enterprises, innovation projects, skill competitions, etc. with the corresponding assessment standards of the curriculum, and then exchange them with the corresponding assessment standards of the curriculum through the mechanism of “credit exchange”.

5. Conclusions

By exempting part of the module content or the whole course, the learning programme is better optimized, the creativity and initiative of learners are stimulated, and they are encouraged to actively explore knowledge in different fields, thus enhancing their ability to solve complex problems across disciplines.

Conflicts of Interest

The author declares that there is no conflict of interest regarding the publication of this article.

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References

- [1] CPC Central Committee and State Council issue overall programme to deepen education evaluation reform in the new era. *People's Daily*, 2020.
- [2] Zhao, Z.Q. Establishing an academic evaluation system centred on vocational ability evaluation to guarantee the quality of skilled personnel training and the level of building a strong education nation. *Vocational and Technical Education*, 2023, 44(12), 13-15.
- [3] Qian, Y.T. Dilemma and solution strategy of deepening vocational education evaluation reform in the era of big data. *Journal of Nanning Institute of Vocational Technology*, 2023, 5, 65-69.
- [4] Huang, X.Z.; Wang, B.Y.; Pan, X. et al. Construction of student development evaluation system in vocational colleges and universities in the new era - based on growth value-added and portrait perspective. *Vocational and Technical Education*, 2025, 46(02), 74-79.



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