

Research on the Construction of a Multi-dimensional Evaluation System for Industry-Education Integration in Higher Vocational Education Empowered by Artificial Intelligence

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Abstract

Due to the fast growth of artificial intelligence, big data, and other emerging digital technologies, the interaction between industry and education in higher vocational education is experiencing changes towards digitalization and intelligence. A good evaluation system is necessary to enhance the quality of industry-education integration and enhance the extensive cooperation between vocational colleges and enterprises. Nevertheless, the modern methods of evaluation are confronted with issues like low involvement of many stakeholders, lack of criteria, narrow use of data resources and poor dynamics of feedback. There are previous researches which can prove that industry-education integration evaluation should be a systematic framework involving several dimensions, such as cooperation foundation, implementation process, and development effectiveness. At the same time, multi-source data fusion and intelligent evaluation systems offer different tools to enhance vocational education evaluation systems. The authors discuss the issues in the evaluation of industry-education integration in higher vocational education and suggest the artificial intelligence-based multi-dimensional evaluation system by utilizing multi-source data integration, multi-stakeholders collaboration, and optimizing the intelligent feedback. The given strategy will help facilitate the change in the evaluation of the experience-based assessment to data-driven decision-making and give theoretical support and practical solutions to enhance the quality of higher vocational education.

Keywords

Artificial Intelligence, Higher Vocational Education, Industry-Education Integration, Intelligent Evaluation.

1. Introduction

The integration of industry and education is also one of the main features of the contemporary vocational education and it has a significant part in enhancing the flexibility of vocational education to industrial progress. The constant development of industries requires higher vocational colleges to continue to develop new forms of school-enterprise cooperation. Nevertheless, the question of how to assess the effectiveness and quality of industry-education integration in a scientific manner still appears to be vital.

According to the existing research, assessment tools of industry-education integration must not only evaluate the results of cooperation, but also evaluate the cooperation process, sharing of resources, the quality of cultivating talents, and social contribution [1]. Existing studies have further explored the construction of scientific evaluation indicator systems for higher vocational colleges from the perspective of industry-education integration, emphasizing the importance of comprehensive indicators covering multiple dimensions such as cooperation

effectiveness, resource integration and talent cultivation [2]. Meanwhile, performance evaluation systems and quality evaluation frameworks for school-enterprise cooperation have been developed to improve the scientificity and operability of evaluation practices [3,4].

Conventional evaluation approaches are based largely on manual statistics and regular testing, which makes it impossible to track the whole process dynamically. Empirical studies on the development level evaluation of industry-education integration have shown that traditional evaluation methods still face limitations in reflecting dynamic changes and complex interactions among different stakeholders [5]. With the development of digital technologies, multi-source data fusion has gradually become an important approach for improving the accuracy and comprehensiveness of educational evaluation [6].

Artificial intelligence and big data technologies have offered new possibilities in the field of educational evaluation reform over the past few years. Artificial intelligence could enhance the precision and effectiveness of evaluation by intelligent data collection, analysis and feedback. Research on intelligent evaluation systems driven by industry demand has demonstrated the potential of artificial intelligence in supporting teaching evaluation and promoting the integration of industry and education [7]. Integrating artificial intelligence into the evaluation system of industry-education integration has thus become a key means of enhancing the high-quality development of higher vocational education. Furthermore, the reform of vocational education evaluation has increasingly emphasized intelligent, diversified and process-oriented evaluation approaches, providing a theoretical foundation for the application of artificial intelligence in educational assessment [8].

2. Construction Logic of an AI-driven Multi-dimensional Evaluation System

2.1. Intelligent Data Collection as the Foundation of Comprehensive Evaluation

Integrated industry and education means a close partnership of vocational schools with companies in the spheres of training personnel, developing curricula, technological advancement and sharing resources. The main objective is to enhance the alignment between the training of talents and their needs in industries.

Evaluation of industry-education integration is also a vital instrument in assessing efficacy of cooperation since it does not only assess the results of cooperation but it also supports the process of ongoing improvement. According to research, a successful evaluation system must consist of various levels including goals, standards, and measures that encompass the state of cooperation, implementation, and development results.

Since vocational education will be moving away from increasing its scale to the level of quality, evaluation system ought to move away quantitative assessment towards a holistic quality evaluation. Performance evaluation systems of industry-education integration in higher vocational colleges have found out that there are indicators that include cooperation effectiveness, talent cultivation quality, and social service capacity that need to be integrated in evaluation frameworks.

2.2. Technical Logic of Artificial Intelligence Empowering Educational Evaluation

Artificial intelligence has strong potential in the field of data processing, pattern recognition, forecasting, and decision support, which opens up new opportunities in the field of educational assessment reform. Artificial intelligence is more flexible than conventional evaluation models that are dependent on manual judgment because it can synthesize a variety of sources of information such as learning behavior, practical training results, feedback of enterprises and employment advancement data.

The multi-source data fusion technology will help to eradicate the constraints of the conventional assessment due to lack of enough data sources. Through combining various categories of educational and industry information, artificial intelligence could enhance accuracy in evaluation as well as provide real-time monitoring of the whole education system. Consequently, the process of artificial intelligence empowerment is not just the use of technological tools but a systemic change in the concepts, methods and mechanisms of evaluation.

3. Problems Existing in Current Evaluation of Industry-Education Integration in Higher Vocational Education

3.1. Single Evaluation Subjects and Insufficient Collaborative Mechanisms

The integration of the industry and education can be described as a collaborative model of education where the participants include vocational colleges, enterprises, governments, industrial organizations and the students. Nonetheless, the existing assessment methods in certain higher vocational colleges are mostly implemented by the internal educational units, whereas enterprises and other partners do not play much role.

Enterprises are also key players in the development of talents since they have firsthand information on the demands of industries, job skills and the practical work experience of the students. Ineffective participation of the enterprise will make the evaluation findings highlight the educational viewpoint but not be able to represent the real situation of the effectiveness of industry education relationship.

As it was previously noted in other works, evaluating the quality of the school-enterprise partnership must involve enterprise participation, cooperation processes and the results of talent cultivation, which will help to develop a multi-subject evaluation system to enhance the validity of the evaluation.

3.2. Incomplete Evaluation Indicators and Limited Reflection of Integration Quality

The assessment measures of the integration between industry and education in higher vocational education have some drawbacks. The current evaluation mechanisms tend to focus more on quantitative measurements, in terms of the number of cooperative enterprises, training bases, cooperation projects, and ignore the factors of deeper integration, which include the joint development of curricula, involvement of enterprises in the educational process, technology-related services, and joint innovations.

Industry-education integration evaluation can be used not just to identify if there is cooperation, but also to quantify the extent and effectiveness of the cooperation. It follows that an overall assessment system must comprise several facets of it, including the basis of the cooperation, sharing resources, the implementation process, the quality of developing talents, and the social contribution.

Studies in the area of evaluation indicator systems in higher vocational colleges indicate that the assessment of vocational education needs to go further than conventional single dimension indicators and create a development based evaluation system that suits the nature of vocational education.

3.3. Insufficient Data Utilization and Lack of Dynamic Evaluation Capability

Conventional assessment practices of industry-education integration largely depend on questionnaires, document analysis and expert rating. These methods tend to have lengthy evaluation processes and lack data updating ability which makes it hard to have continuous monitoring.

An example would be that vocational schools typically have some information on the students learning processes whereas companies have some information on their work performance processes and professional requirements. The industrial organizations offer information on technological development trends and labor market requirements. Nevertheless, such data sources tend to be separated and are unable to be used in a combined way to evaluate the situation thoroughly.

The integration of multi-source data is a recent solution owing to the creation of artificial intelligence and big data technologies. Through the combination of educational, industrial and student development data, the evaluation systems will be able to do real-time monitoring which will enhance the scientific aspect of the evaluation decisions.

4. Construction of an Artificial Intelligence-driven Multi-dimensional Evaluation System

4.1. Overall Framework of the Evaluation System

An artificial intelligence-based evaluation system is being built which means that it is necessary to overcome the shortcomings of the traditional evaluation models. Its basis should be data-driven decision-making, its foundation multi-stakeholder participation, and its technical support intelligent technologies.

Conventional assessment is primarily concerned with end results, whereas smart assessments center on the consistent gathering of information, processing it and optimizing it in the course of the whole education program. According to available literature on evaluation systems of industry-education integration, a complete framework must consist of evaluation goals, criteria, and indicators so that the evaluation can be systematic and scientific.

The proposed evaluation framework in this study is multi-dimensional comprising four layers which include; evaluation subjects, evaluation indicators, data support as well as intelligent feedback mechanism.

(1) Evaluation subject layer.

The assessment system must change into a multi-stakeholder assessment system which will include colleges, companies, teachers, students and industry associations. The various stakeholders in the process of evaluating the integration between the industry and education are to assess it through various perspectives.

(2) Evaluation indicator layer.

The assessment indicators need to be based on the main goals of industry-education integration, namely, the basis of cooperation, quality of talent cultivation, involvement of enterprises, sharing of resources, technology innovation and social contribution.

(3) Data support layer.

The artificial intelligence technologies are to be applied in gathering and synthesis of various types of data sources such as teaching data, internship performance data, enterprise feedback data, and employment data.

(4) Intelligent feedback layer.

With the help of artificial intelligence algorithms, the results of the evaluation may be automatically analyzed and producing intelligent reports that will assist in curriculum reform, professional development and optimization of cooperation.

4.2. Construction of a Multi-stakeholder Collaborative Evaluation Mechanism

The fundamental principle of the industry-education integration assessment is in being able to reflect the involvement and cooperation of various stakeholders. Artificial intelligence has the

ability to break down information barriers between various participants through the creation of digital evaluation systems.

To begin with, vocational colleges need to review the way talent cultivation programs are implemented, the way curricula are designed, the quality of teaching and the attainment of educational goals.

Thirdly, enterprises have a greater role in assessment. The assessment of an enterprise should center on professional competence of students, their ability to adapt to the workplace environment as well as practical learning results. Research on quality evaluation of cooperation between schools and enterprises highlights that the involvement of enterprises is critical to enhancing consistency between the cultivation of talents and industry needs.

Fourth, in order to ensure that technology trends and industry needs are reflected, industry organizations need to be involved in evaluation. Their participation may enhance the social responsiveness of the evaluation system.

To conclude, students must also be seen as the significant evaluators. The direct evidence of the quality of education is given by their learning experience, competencies gained, and employment results.

With the help of data integration based on artificial intelligence, the evaluation information of various stakeholders can be integrated to produce more objective and holistic evaluation outcomes.

4.3. Construction of a Multi-dimensional Evaluation Indicator System

A scientific indicator system forms the basis of a successful evaluation mechanism. Taking into consideration the features of higher vocational education, an artificial intelligence-based evaluation system ought to involve the following dimensions.

(1) Evaluation of School-enterprise Cooperation Foundation

The dimension is aimed at stability and sustainability of cooperation, i.e. the number of cooperative enterprises, cooperation agreements, joint platforms and the level of participation of enterprises in cooperation.

It reflects the basic conditions supporting industry-education integration.

(2) Evaluation of Talent Cultivation Quality

Industry-education integration aims at talent cultivation quality. The indicators are professional skills, occupational competence and workplace flexibility as well as quality of employment.

In contrast to conventional approaches, an artificial intelligence could use learning behavior data, practical training logs, and employment feedback in order to give more precise evaluation outcomes.

(3) Evaluation of Resource Sharing

A combination of industry and education includes as well as interaction on the issue of cultivating talents, the exchange of educational and industrial resources. This aspect measures the degree to which businesses participate in the provision of equipment, technology and professional skills to learning activities.

(4) Evaluation of Technological Service and Innovation Capability

One of the factors of integration quality that can be used to assess the ability of vocational colleges to serve industrial development. Contents of evaluation are joint research projects, achievements in technological services, and social training capacity.

The study on the assessment of the level of industry education integration development shows that the assessment ought to be based on the real impact of the coordination of educational and industrial resources instead of simply evaluating the forms of cooperation.

(5) Evaluation of Continuous Improvement Capability

One of the major benefits of evaluation through artificial intelligence is the possibility of developing dynamic feedback mechanisms. Problems within the cooperation process may be detected by constant monitoring and analyzing of the data which would allow coming up with improvement measures.

5. Implementation Strategies of Artificial Intelligence-enabled Evaluation System for Industry-Education Integration

5.1. Establishing an Artificial Intelligence-driven Evaluation Data Platform

Building and running of an intelligent evaluation system relies both on successful data integration and platform support. The higher vocational colleges need to create an integrated evaluation data platform through the integration of current teaching management systems, practice, training platforms, enterprise cooperation platforms as well as employment service platforms.

Due to data sharing and integration, the platform has the ability to gather and process all kinds of data, such as students learning activities, practical training, enterprise assessment, and employment growth. The next step is to use artificial intelligence technologies in order to determine patterns, assess the direction of development and produce information that supports decisions.

According to the study on multi-source data fusion-based assessment, it is found that merging heterogeneous data sources may enhance the precision and dependability of vocational education assessment and also facilitate innovations in assessment systems [6]. The creation of an intelligent evaluation platform thus becomes a critical pillar towards the realization of data-driven evaluation of industry-education integration.

5.2. Improving the Dynamic Adjustment Mechanism of Evaluation Indicators

The industrial development and technological innovations are constantly undergoing changes, and it is therefore necessary that evaluation system should have the ability of adaptability and flexibility. Conventional evaluation indicators tend to be fairly constant and can overlook new industrial demands at an early stage.

Artificial intelligence technologies are able to evaluate the data of industrial development, enterprise demand data, and employment trends and determine the mismatch between the talent cultivation and industrial needs. The evaluation indicators may be dynamically changed according to such analyses.

As an example, if the new industries that are emerging require new occupational skills and competency requirements, vocational colleges may be able to modify their evaluation criteria accordingly and include new competency dimensions in the evaluation of talents. Such a dynamic adjustment mechanism allows the evaluation system to be more responsive to industrial transformation and upgrading.

5.3. Enhancing Teachers' Capability in Applying Artificial Intelligence for Evaluation

The usefulness of an assessment system based on artificial intelligence is determined by the technological infrastructure and the capacity of teachers to use digital technologies.

The teachers also play significant roles in vocational education assessment. They should be able to know how to gather, analyze and apply the educational information that will enhance the quality of teaching and professional growth. Consequently, the higher vocational schools ought to enhance the process of training teachers on the use of artificial intelligence, data analytics, and electronic assessment software.

The use of artificial intelligence technologies in the field of curriculum evaluation, professional development as well as assessment of cooperation between industries and education can be successfully implemented through enhancing the digital literacy of teachers.

5.4. Promoting the Application of Evaluation Results in Educational Reform

The main goal of assessment is not to assess the performance, but to create an atmosphere of continuous improvement and educational growth. Hence, the evaluation systems based on the artificial intelligence need to create a closed-loop process of:

data collection → intelligent analysis → evaluation feedback → improvement optimization

Based on the results of evaluation, colleges can determine areas of weakness in professional construction, curriculum development, practical teaching and enterprise partnership.

As an example, when assessment outcomes show that there is inadequate enterprise participation in developing the curriculum, universities may streamline collaboration systems and enhance involvement of enterprises. Talent cultivation programs may be altered in case students competencies do not entirely satisfy workplace demands.

The feedback system allows evaluation to be used as an impetus of ongoing improvements not just as an assessment instrument.

6. Conclusion

The use of artificial intelligence makes it possible to introduce new possibilities of technology in building a multi-dimensional assessment system in terms of the integration between industry and education in higher vocational education. The existing assessment processes are currently challenged by low involvement of assessment participants, lack of full indicator systems, and inadequate use of educational and industrial data.

The proposed research suggests an intelligent evaluation model which is based on multi-source data integration, multi-stakeholder collaboration, and intelligent feedback optimization. The suggested system will facilitate the change of evaluation as it is not a static assessment but a dynamic monitoring, as it is not an experience-based judgment but rather a data-driven decision-making, and as it is not a result-oriented evaluation but a process-oriented improvement.

The future of higher vocational colleges must be to enhance even more the integration of artificial intelligence technologies and industry-education cooperation evaluation, enhance data governance systems, and come up with more rigorous evaluation standards. With the help of continuous innovation in evaluation concepts and technologies, artificial intelligence can play a very effective role in supporting high-quality development of vocational education and improving the effectiveness of industry-education integration.

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