Research on the Quality Assurance and Evaluation System for Talent Cultivation in Secondary and Higher Vocational Education Articulation Programs at Vocational Colleges Based on the Sydney Accord Paradigm

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Abstract: *As the main source of technical and skilled talents for vocational colleges, there are problems with poor coordination among all links in the integrated cultivation system of secondary and higher vocational education, unclear progression of competencies, and fragmented evaluation standards in the systematic construction of the quality assurance and evaluation system. The Sydney Accord has provided a good theoretical support for quality governance in integrated cultivation and put forward the ideas of results orientation, competency foundation and continuous improvement. According to the size of core competencies in the Sydney Accord model, a quality assurance factor identification model and an outcome-oriented closed-loop mechanism for the integrated cultivation of secondary and vocational education at the tertiary level are built in this paper. There will be all kinds of quality assessments in the form of formative and summative evaluations, and a collaborative feedback network will be established among all relevant parties. A competency map will be built in this paper, teaching-observation nodes will be set up, and according to the results of the evaluation, the cultivation plan will be adjusted dynamically to form a three-level integration mechanism. The operation technical path to achieve the goals of goal setting, process supervision and plan adjustment in integrated cultivation will be introduced in this paper, and an orderly solution for the internal quality governance of integrated cultivation at vocational colleges will also be proposed.*

Keywords: *Sydney Accord Model, Integration of Secondary and Higher Vocational Education, Quality Assurance, Evaluation System, Competency Mapping, Continuous Improvement*

Introduction

Joint cultivation of secondary and higher vocational education is an essential link in the talent cultivation system of vocational colleges, and its aim is to develop students' technical and practical abilities in all areas of the integrated structure of various stages of study. However, there are many problems in the actual operation of integrated cultivation, such as redundant course content, unclear competency standards and isolated evaluation information; as a result, there are serious fluctuations in the quality of cultivation. As the benchmark framework for international accreditation of engineering and technology education, the Sydney Accord paradigm has the logic of outcome orientation and competency foundation; it is in line with the general requirements for the integrated cultivation of secondary and higher vocational education and provides a theoretical basis for building quality assurance and evaluation systems in this field. The purpose of this paper is to translate the general characteristics of the competency factors in the Sydney Accord into specific applications for integrated education and thus provide a quantitative basis for the inheritance of students' abilities at all times during their school years. The purpose of this paper is to solve the problem that the quality assurance for integrated cultivation has always been based on experience, and there is no systematic supervision and adjustment according to competency maps; thus, continuous optimisation of cultivation plans has not been achieved. Therefore, this paper will investigate the technical path for the local application of the Sydney Accord paradigm in the integrated cultivation of secondary and higher vocational education at the three levels of construction of the theoretical framework, establishment of evaluation indicators and design of the integration mechanism.

1. Theoretical Framework of the Quality Assurance System for Talent Cultivation in the Integration of Secondary and Higher Vocational Education under the Sydney Accord Paradigm

1.1 Deconstruction and Transfer of the Core Competency Dimensions of the Sydney Accord Paradigm

The first few parts of the core competencies in the Sydney Accord model are the application of technical knowledge, analysis of engineering problems, development of design solutions, communication and collaboration, lifelong learning, and professional ethics. Given that the joint cultivation environment for secondary and higher vocational education at vocational colleges is being established, this paper will divide the two parts hierarchically to distinguish between the goals of competence achievement at the secondary vocational level and those at the higher vocational level. The first goal of the second stage of secondary school is to cultivate basic life skills and good habits, and at the same time, the aim of the higher vocational stage is to develop complex problem-solving and system optimisation abilities. According to the theory of competency gradation, the deconstruction process should map the original dimensions to the curriculum modules and practical training links at all levels of education to ensure continuity and measurability in the development of competencies.

The expansion of the scope of core competencies from secondary vocational school to higher vocational school is not only an inheritance but also an adaptation and reconstruction in light of the characteristics of integrated cultivation at the higher education level. A division of the set of competency goals and an exact match for articulation points are used in this kind of migration. The competency output of the secondary vocational stage is the competency input for the higher vocational stage, and it needs to be quantified with threshold standards in the competency map. Some higher-order dimensions of the original paradigm, such as the evaluation of complex systems, need to be reduced in terms of dimensions for operable sub-competencies at the secondary vocational level, and their full forms should be kept for the higher vocational level. Asymmetric migration can avoid the problem of a shortage of talent or many rounds of training and create an uninterrupted chain of learning[1].

1.2 Identification Model of Quality Assurance Factors for the Integration of Secondary and Higher Vocational Education

The Logic of the Quality Assurance Factor Identification Model is that of system input, process and output. The input-end factors are the knowledge base of enrolled students, the double-qualified teacher system, standardised training equipment and the curriculum coordination plan. Process-level factors refer to the progress of teaching content during the implementation of instruction in a course, the uniformity of assessment methods, and the extent of sharing of teaching resources between secondary schools and higher vocational education. Output-level factors refer to the professional quality of the graduates, the time it takes for them to find a job, and how many times they have been rejected by universities. All the above reasons are connected in a chain to form the static structure diagram of quality assurance for integrated cultivation.

A Multi-Criteria Decision Analysis method is employed in the identification model to assign weights to all the reasons and determine their correlations. The first goal of the guarantee at the secondary vocational level is to provide a common foundation for all students, and more varied sets of guarantees for all-round application ability have been added at the higher vocational level. Based on the concept of the threshold effect, some main reasons for the non-linear change in integration quality have been identified by the model, such as the extent of overlap and the degree of gaps in course content. If the overlap rate is too high, people will lose the will to learn; if it is too low, there will be a gap in their knowledge foundation. All the factors in the model have reasonable ranges, and there will be quantitative support for the monitoring and intervention in the following.

1.3 Result-Oriented Closed-Loop Quality Assurance Mechanism for Integrated Cultivation

The concept of results-oriented education is to promote all-round development of students at secondary and vocational colleges by setting clear, observable and comparable learning goals. The four links of the closed-loop mechanism are the goal-setting layer, the implementation monitoring layer, the evaluation feedback layer and the improvement execution layer. Set the goals for the period in accordance with the competency standards of the Sydney Accord system at different times. The Collection of Formative Data is to gather information on the results of classes, practical training activities and other regular observations of teaching. Based on the above data, compare it with the set

indicators in the evaluation feedback layer and issue corresponding corrective measures for deficiencies. The implementation and operation department will take the above suggestions into account and take corresponding measures, such as revising the curriculum and improving teaching methods.

Gradual Adjustments will be made to the Operation of the closed-loop device. According to the evaluation results of each round, the goals for the next round will be adjusted; thus, there will be an ongoing cycle of setting goals, achieving results, verifying results, and improving based on the results. Mechanism Design is a kind of feedback-delay control that can avoid noise in the data caused by an overly short evaluation period or a long improvement lag. A characteristic of cross-stage feedback in integrated cultivation is that evaluation information from the lower vocational level should be conveyed to the higher vocational level for modification of teaching content and progress plans at the latter stage. At the same time, follow-up data of the graduates of higher vocational education will also be used to inform the cultivation plan at the secondary vocational level and achieve full-chain outcome-based closed-loop management[2].

2. Construction of Indicator Systems for the Quality Evaluation System of Talent Cultivation in the Integration of Secondary and Higher Vocational Education

2.1 Set some evaluation standards for the learning goals

At all levels, there are many criteria to judge whether the learning objectives have been achieved in light of the dimensions of the Sydney Accord. The first level is the basic skill achievement standards for secondary vocational education; it includes standardisation of tool operation, accuracy in process execution and the ability to find simple faults. The second level will lay the foundation for good grades at the higher vocational college and cover debugging and parameter optimisation of the system, cross-module coordination skills, etc. The third is the general result norm for integrated cultivation; it refers to how far the compound work task has been accomplished, the quality of technical documentation writing, and the efficiency of team collaboration. All the standards at all levels are connected by competency thresholds, and the minimum achievement value of the secondary vocational stage standards provides the foundation for the higher vocational stage standards.

The Quantification of the evaluation standards is based on anchoring, and the external reference is the general vocational competency level of the industry. At each level, there are three grades of evaluation: the passing line, the good line and the excellent line, which correspond to the three competency states in the Sydney Accord model: basic mastery, proficient application and innovative transfer. The index of achievement is expressed in terms of fuzzy comprehensiveness evaluation to quantify the qualitative description of operating results. The evaluation at the secondary vocational level is the accumulation of process indicators, and the evaluation at the higher vocational level is based on the combined results of outcome indicators. The newness of the construction for multiple levels of standards is that they can be vertically aligned in a single measurement system to accumulate and compare the learning results of different stages of study.

2.2 Integration Path of Formative and Summative Evaluation under the Orientation of Continuous Improvement

The integration of formative assessment and summative assessment in the all-round cultivation system of secondary and higher vocational education is based on the dual integration of the dimension of time and the dimension of function. Formative assessments will be conducted all the time during the period of secondary vocational school and higher vocational college, and at various times, data will be collected from unit tests, training reports, periodic project reports, classroom participation, etc. Summative assessments will be conducted at the end of each stage in the study and at the end of high school, such as the secondary vocational college entrance examination and the general college entrance examination. The main direction of integration is that the results of the formative assessment provide a foundation for prediction in the summative assessment, and the results of the summative assessment are used to adjust the weights and collection frequencies of the indicators in the formative assessment.

A series of Designs will be employed to achieve the integration path in this way. The proportion of formative assessment in each teaching unit is 60 per cent, and that of summative assessment is 40 per cent. At the joint point of the academic stages, the cumulative average score of the formative assessment will be used as the foundation for the summative test. Longitudinal tracking of the evaluation data is carried out in the form of individual student growth portfolios to record changes in

the scores of all formative assessments and the achievement status of summative assessments. The direction of continuous improvement is shown by the threshold mechanism for adjusting teaching according to evaluation results: if the pass rate of the formative assessment in the same class drops below the set limit twice in a row, then modifications will be made to the teaching content or supplementary training links will be added automatically. The integrated path above does not have the problem of a fragmented evaluation function, so the improvement actions will no longer be limited to end-of-semester summary feedback but will be included in the micro-cycle of daily teaching activities[3].

2.3 Evaluation Information Feedback Network with Collaborative Participation of Stakeholders

The five types of stakeholders are professional teachers, curriculum developers, teaching managers, students and employers. Good teachers should be able to provide timely behavioural feedback on students in class, such as their participation in group activities and the quality of homework, etc. Curriculum developers need to provide a framework for the evaluation data of the achievement of curriculum goals, determine whether there is a suitable alignment in module difficulty, make reasonable connections among content, differentiate assessment items, etc. Teaching managers communicates the company's plan for using resources and how it will be implemented. Students' feelings about their studies are shown in the form of self-assessment and peer assessment. Representatives of the employers will give feedback on the intern's work during the internship and at the start of employment.

The construction of the feedback network will be based on the two ideas mentioned above. Horizontal feedback takes place at the same level; for example, good teachers talk about the general development of a class with each other and adjust their teaching speed accordingly. Vertical feedback is carried out among the different levels of education; teachers at the secondary vocational school provide information on the competency traits of students to the receiving teachers in the higher vocational school, and the job performance of graduates is reported back to the curriculum development team at the secondary vocational school. A single code is used to normalise the processing of feedback information, and thus labels for qualitative descriptions from all sources can be collected. The effect of joint participation is to increase the speed of the information feedback loop; thus, the employer's feedback cycle will be shortened from once a year to once every three months, and the frequency of student self-assessment will be increased from the end of the semester to after each project. Another attribute of this network is that there is no closed-loop problem for the evaluation information of any single subject; rather, a three-dimensional feedback structure has been built to support cross-validation and collaborative interpretation of multi-source data.

3. Integration Mechanism of the Sydney Accord Paradigm and the Quality Assurance and Evaluation System for Integrated Cultivation

3.1 Competency Mapping Method in the Vertical Articulation of the Curriculum System

Competency mapping is based on the competency dimensions of the Sydney Accord paradigm as the starting point, and these are mapped to the curriculum modules of both the secondary vocational level and the higher vocational level as the carriers of the map. First, to build the competency map, competency labels are obtained from the course content at the secondary vocational level, and then each professional course is divided into several operable competency units. The sub-competencies of the Circuit Analysis course should include circuit identification, use of measuring instruments and fault location, etc. The courses in higher vocational education have several competency modules, such as the automatic control system course, and the sub-competencies of this course are system modelling, parameter tuning and stability analysis. The mapping process will construct a two-way correlation matrix of the dimensions of course content and competency, and quantify the coverage intensity and occurrence frequency of each competency unit in the courses at different levels of education. A matrix can be constructed to show the redundancy and deficiency of competencies, and thus provide objective information on the coherence of the curriculum.

The two logics of hierarchy and breadth are employed to divide the vertical division of the competency map. Hierarchical progression is to present the same competency dimension in the form of a basic operation at the secondary vocational level and then expand it into a comprehensive analytical form at the higher vocational level; for example, the competency of "wiring according to diagrams" at the secondary vocational stage can be extended to "circuit topology optimisation" at the higher

vocational stage. Horizontal expansion is the addition of nodes in the competency dimension over time in the joint training period to increase the density of the competency network. A mapping method is employed to find the shortest path of a minimal curriculum sequence from the secondary vocational competency node to the higher vocational competency node and thus optimise the order of course delivery. A force-directed layout is used to display the competency map; nodes have different colours according to the stage of study, and the thickness of the lines indicates the degree of competency dependence. First, we can use the general competency framework in the Sydney Accord paradigm as an effective technical way to build the curriculum without omitting or repeating any parts of competency education[4].

3.2 Design of Quality Monitoring Nodes in the Teaching Implementation Process

Quality supervision nodes will be distributed and designed in line with the schedule for the joint cultivation of secondary and vocational education and the law on competency development. There are three kinds of the monitoring nodes. The two times for the entry nodes are set as the beginning of secondary vocational education and the beginning of higher vocational education, and they will collect data on students' existing knowledge reserves and skill starting points. The process nodes are distributed evenly in the semesters, and three fixed monitoring points have been set in each semester to cover the start, middle and end of the semester. The two exit nodes are set at the time of secondary vocational school graduation and the time of higher vocational school graduation, and the terminal competency data will be collected after the entire cultivation cycle. All the data from the monitoring nodes correspond to the dimensions of competency in the Sydney Accord; that is to say, the entry nodes focus on basic knowledge and fundamental skills, the process nodes focus on continuous improvement of regular competencies, and the exit nodes cover all aspects of application and problem-solving. In accordance with the law of non-uniform development of ability, the density of nodes will gradually increase in the joint period of the two schools.

The two kinds of operational indicators for the monitoring nodes are quantitative indicators and structured observation indicators. First, there will be automatic collection of data on how quickly a person can pass unit tests, how long it takes to finish practical training tasks, and how often their operating steps are correct. The structured observation indicators are teachers' ratings of students' cooperation ability, problem presentation ability and new application of tools. The Design of the node is a redundant monitoring method; that is to say, for each dimension of the key competencies, two backup indicators have been set, and if one indicator cannot be obtained due to a problem with the measuring tool, the backup indicator can be used instead. According to the weight of the decay memory, set the monitoring frequency for a node; that is, newer monitoring data will be given a higher weight in the calculation of the competency status. The quality monitoring nodes fall under the formative evaluation mentioned in the previous chapter; that is to say, the monitoring nodes provide the basic data for the evaluation system, and the results of the evaluation will be used to adjust the indicators of the next monitoring nodes.

3.3 Dynamic Optimisation Strategy of the Cultivation Plan Based on Evaluation Results

Based on the results of the above evaluation, the dynamic optimisation strategy will work in a closed-loop manner as shown in Chapter 1, and the evaluation index system introduced in Chapter 2 will be used as its input. The first principle of the optimisation method is to directly map the results of the difference analysis for the evaluation output to the modifiable parameters of the cultivation plan. The adjustable items are the allocation of course credits, prerequisites for courses, the proportion of practical training hours in total class hours, weight settings of different types of assessment, and thresholds for achieving competency. If the evaluation data show that the achievement of a certain competency dimension is lower than the preset threshold, the system will automatically identify the set of courses corresponding to that dimension, calculate the contribution coefficient of each course to the achievement of that dimension, and then adjust the weight of the course or reallocate class hours accordingly. To obtain the contribution coefficients and avoid the problem of multicollinearity among the courses, regression analysis is used[5].

The two kinds of triggers for dynamic optimisation are rolling updates and fixed times. Rolling revisions will be carried out every semester, and based on the accumulated data from formative assessments, some minor adjustments will be made to the teaching plan for the following semester; however, these modifications will not exceed 10 per cent of the total class hours. Point-based corrections will be made at the connection points of the academic stages or at the graduation node, and

a full review of the cultivation plan will be carried out based on summative evaluation and graduate follow-up data; the adjustment range may be more than 20%. Based on the above plan, we will build a version control system to record all changes made to different editions of the cultivation plan and keep track of the reasons for these modifications. Verification of the optimisation effect is to compare the difference in the achievement of the same competency dimension between the two cohorts of students before and after the revision, and the significance test for the difference is an independent samples t-test. The newness of this way is that we no longer need to rely on experience to adjust the cultivation plan; instead, we have built a calculable map to link the results of evaluation with changes in the plan.

Conclusion

In line with the model of the Sydney Accord, this paper has established a quality assurance and evaluation system for talent cultivation in the integrated secondary and higher vocational education system and set up a three-level structure of theoretical basis, assessment indicators and integration mechanism. The three stages of the quality assurance are to present the staged deconstruction method for competency dimensions, the factor identification model and the closed-loop operation logic. There will be several grades of achievement in the level of the evaluation system, and all kinds of assessments will be combined with a multi-party feedback structure. At the level of the integration mechanism, some applications of competency mapping, monitoring of node layout and dynamic plan optimisation have been introduced in this paper. The three parts are arranged reasonably and form a closed loop; the competency map provides a basis for setting evaluation standards, the results of the evaluation are fed back to the monitoring node, and based on this, plans are continuously optimised, and so on, and all links are connected. In the future, we will carry out empirical calibration of the competency mapping algorithm and explore all kinds of laws for threshold setting in different professional areas; further modelling of the conflict resolution mechanism for multi-source data in the evaluation information feedback network needs to be done, and machine learning techniques will be used to dynamically adjust the calculation method of contribution coefficients in a dynamic optimisation strategy to improve the accuracy and responsiveness of cultivation plan revision.

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