

# Research on Interdisciplinary and Integrated Talent Cultivation in Higher Education

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**Abstract:** Amid technological and industrial transformation, higher education faces rigid disciplinary boundaries and insufficient student innovation. Following a “current situation analysis—model construction—practical verification—policy recommendations” logic, this paper constructs a “Three Integrations (knowledge, methodology, platform) – Three Crossings (discipline, major, department) – Four Stages (general education, project practice, incubation, output)” talent cultivation model. A four-year comparative experiment (90 experimental vs. 90 control students) shows the model significantly improves interdisciplinary innovation competence, raising the comprehensive index from 52.0 to 87.2. Suggestions on organization, curriculum, faculty, platforms, and evaluation are provided.

**Keywords:** Interdisciplinary Studies; Integrated Talent Cultivation; Higher Education; Interdisciplinary Competence; Talent Development

## 1. Introduction

Amid technological revolution and industrial transformation, real-world problems increasingly transcend single disciplines, yet higher education still suffers from rigid disciplinary boundaries, fragmented curricula, isolated departments, and weak practice-evaluation mechanisms. Following the logic of “current situation analysis—model construction—practical verification—policy recommendations,” this paper explores the mechanisms of interdisciplinary and integrated talent cultivation, constructs an operable “Three Integrations—Three Crossings—Four Stages” model, and tests its effects through comparative practice. The findings aim to provide theoretical and practical references for universities promoting interdisciplinary talent cultivation.

## 2. Theoretical Foundations and Practical Analysis Defining Interdisciplinary Integration

### 2.1 Defining Interdisciplinary Integration

Interdisciplinary studies integrate concepts, theories, or methods from multiple disciplines to generate new knowledge and solutions. Integrated talent cultivation coordinates curricula, faculty, platforms, and evaluation to build interdisciplinary knowledge structures and innovation abilities. Its value lies not in simply adding courses or merging disciplines, but in reconstructing content, organization, and evaluation around complex problems—shifting from discipline-based instruction to integrated development, from knowledge-centered to competence-centered education, and from individual to collective cultivation.

### 2.2 Practical Challenges in Interdisciplinary and Integrated Talent Cultivation in Universities

Based on the investigation, the main challenges of interdisciplinary and integrated talent cultivation can be summarized in four dimensions: curriculum, organization, faculty and platforms, and practice evaluation, as shown in Table 1. These problems cannot be solved by simply adding courses or forming temporary teams; instead, a systematic reconstruction of the cultivation model is needed.

## 3. Construction of an Interdisciplinary and Integrated Talent Cultivation Model

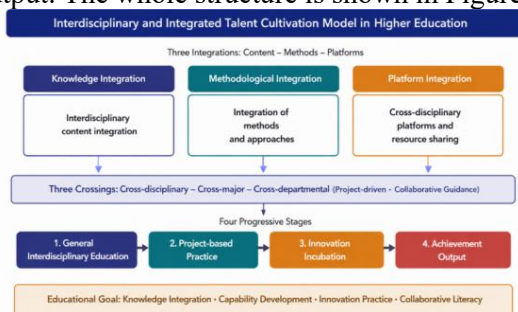
### 3.1 Design Concepts and Principles

The model is constructed according to the following four principles. First, it is oriented to the development of the interdisciplinary innovation competence. Second, it is oriented to being problem oriented, i.e. with a complex real-world problem to favor knowledge integration.

Third, it is oriented to the continuity, i.e. the support of an ability development with a four stage progressive process. Last, it is oriented to the collaboration and scalability, i.e. the model should be able to be gradually implemented under the existing conditions of the university.

### 3.2 The “Three Integrations-Three Crossings-Four Stages” Model of Interdisciplinary and Integrated Talent Cultivation

Based on the above mechanisms and principles, in this paper, with the support of three integrations, the so-called the integration of knowledge, the integration of methodological and the integration of platform, it constructs an interdisciplinary and integrated talent cultivation model, which is advanced by three crossings, the so-called the crossing of disciplinarity, the crossing of major and the crossing of department; and it organizes along four progressive stages, the so-called the general interdisciplinary education, the project based practice, the innovation incubation and the achievement output. The whole structure is shown in Figure 1.



**Figure 1. Framework of the “Three Integrations–Three Crossings–Four Stages” Model for Interdisciplinary and Integrated Talent Cultivation**

Three integrations restructure cross-curricular content (knowledge), reshape problem-solving (methodology), and ensure platform support and resource sharing. Three crossings—across disciplines, majors, and departments—break organizational barriers via collaborative mentoring. Four stages (general education → project practice → innovation incubation → achievement output) design progressive competency goals. Their coordinated interaction systematically enhances interdisciplinary talent cultivation quality.

### 3.3 Key Support Mechanisms and the Evaluation Model for Talent Cultivation Effectiveness

In this paper, we set up a quantitative evaluation

model of the effect of the cultivation of the interdisciplinary and integrated talent to evaluate the effect of cultivation quantitatively. Let the comprehensive effectiveness index  $F$  be given by the weighed combination of knowledge integration ( $K$ ), thinking transfer ( $T$ ), innovation practice ( $I$ ), and collaborative literacy ( $C$ ), as follows:

$$F=w^1 \cdot K+w^2 \cdot T+w^3 \cdot I+w^4 \cdot C \quad (1)$$

Where  $w^1 \sim w^4$  are weighting coefficients satisfying  $w^1+w^2+w^3+w^4=1$ , Based on expert consultation and the analytic hierarchy process, this study sets  $w^1=0.25$ 、 $w^2=0.25$ 、 $w^3=0.30$ 、 $w^4=0.20$ , All sub-indicators are normalized to a scale of 0~100. Furthermore, the growth of students' interdisciplinary competence across cultivation stage  $s$  can be described by the following learning curve:

$$F(s)=F_{max} \cdot (1-e^{(-\eta s)}) \quad (2)$$

Where  $F_{max}$  represents the upper limit of cultivation effectiveness, and  $\eta$  which serves as the core indicator for evaluating the effectiveness of interdisciplinary and integrated talent cultivation.  $\Delta F=F_{post}-F_{pre}$ , which serves as the core indicator for evaluating the effectiveness of interdisciplinary and integrated talent cultivation.

## 4. Teaching Practice and Effectiveness Analysis

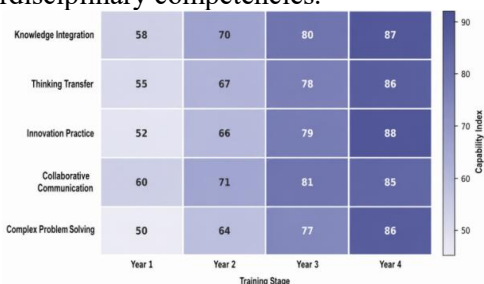
### 4.1 Practice Design and Sample

We carried out a comparative practice in four years in a multidisciplinary training track at the university. We selected 90 students in the experimental group and 90 in the control group, and no significant difference in the quality of admission. In the experimental group the students have adopted the model of the “Three Integrations-Three Crossings-Four Stages” and in the control group the students have adopted the traditional discipline based training system. The two groups are in general balanced in the teaching staff, credits and in the cultivation objectives, but only in the cultivation model. The data have been collected from the tests of the competencies, from the results of the projects, in the innovation list, and from the teacher-student interviews.

### 4.2 Analysis of Talent Cultivation Effectiveness

Figure 2 shows the improvement in the

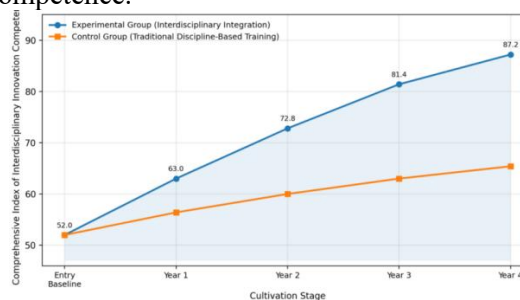
interdisciplinary competence dimensions of the experimental group across the stages after the completion of the cultivation process. All the five dimensions, i.e., knowledge integration, thinking transfer, innovation practice, collaborative communication and complex problem solving, improved steadily as the cultivation stages went on. And they are generally above 85 by the fourth academic year. It should be point out that the interdisciplinary and integrated talent cultivation can promote systematically the development of students' core interdisciplinary competencies.



**Figure 2. Heat Map of Improvements in Interdisciplinary Competence Dimensions of the Experimental Group Across Cultivation Stages**

From a comparative perspective, the changes of the comprehensive index of interdisciplinary innovation competence for the two groups across the cultivation stages are given in Figure 3. The comprehensive index of the experimental group increased from 52.0 to 87.2 of an entry baseline by the fourth academic year, while that of the

control group increased from 52.0 to 65.4 in the same period. We can see that the gap of the two groups for the comprehensive index of the experimental group is continuing to expand as the cultivation stages go on. That is to say, the interdisciplinary and integrated talent cultivation has a great and lasting positive effect on the development of the interdisciplinary innovation competence.



**Figure 3. Evolution Curve of the Comprehensive Index of Interdisciplinary Innovation Competence Across Cultivation Stages**

A comparison of key comprehensive indicators is presented in Table 1. The experimental group significantly outperformed the control group in terms of overall talent cultivation effectiveness, innovation practice, collaborative literacy, and the proportion of high-quality outcomes. The differences were statistically significant according to an independent-samples t-test ( $p < 0.01$ ), thereby verifying the effectiveness of the proposed talent cultivation model.

**Table 1. Comparison of Key Indicators Between the Experimental Group and the Control Group**

Evaluation Indicator	Control Group	Experimental Group	Improvement
Interdisciplinary Innovation Competence Index	65.4	87.2	+21.8
Comprehensive Talent Cultivation Effectiveness F	63.5	86.1	+22.6
Innovation Practice Score	62.0	87.5	+25.5
Collaborative Literacy Score	66.0	85.0	+19.0
Proportion of High-Quality Outcomes / %	9.4	27.8	+18.4

### 4.3 Teacher–Student Feedback and Qualitative Analysis

Interview and questionnaire results showed that students regarded the interdisciplinary courses as practical and helpful for broadening problem-solving perspectives. Teachers also reported that cross-departmental collaboration and project-based learning enhanced course integration and students' innovation ability, while further support is still needed in faculty development and coordination mechanisms.

## 5. Recommendations

To advance interdisciplinary and integrated talent cultivation, universities should establish cross-departmental mechanisms (e.g., interdisciplinary centers, virtual teaching offices, resource-sharing rules); build a problem-oriented curriculum with progressive modules (general education, project practice, innovation incubation); strengthen interdisciplinary faculty and platforms via teaching teams, collaborative mentoring, training, and innovation platforms; and adopt a competency-oriented evaluation system that emphasizes project outcomes, innovation practice, and collaborative literacy over isolated knowledge. Institutions should

follow a “pilot implementation—iterative optimization—phased promotion” process based on their own disciplinary strengths and conditions.

## 6. Conclusion

There are three conclusions in this paper. First, the mechanisms of integration, collaboration, and generation of the proposed interdisciplinary integration can handle the problems of the disciplinary fragmentation, departmental separation, and lacking of the sufficient integration. Second, the proposed "Three Integrations-Two Crossings-Four Stages" can make the way of cultivating the interdisciplinary innovation competence clear and practical. Third, the comparative practice shows that the model significantly improves students' interdisciplinary innovation competence and related ability dimensions, with stable and sustainable effects. Future research will further expand samples and integrate digital technologies to improve the generalizability and evaluation accuracy of the model.

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## References

- [1] Academic Degrees Committee of the State Council, Ministry of Education. Notice on Establishing the Category of “Interdisciplinary Studies” and the First-Level Disciplines of “Integrated Circuit Science and Engineering” and “National Security Studies”: Degree (2020) No. 30[Z]. 2020-12-30.
- [2] Academic Degrees Committee of the State Council. Measures for the Establishment and Management of Interdisciplinary Disciplines Trial Implementation: Degree (2021) No. 21[Z]. 2021-11-17.
- [3] Ministry of Education. Opinions of the Ministry of Education on Accelerating the Construction of High-Level Undergraduate Education and Comprehensively Improving Talent Cultivation Capacity: Higher Education (2018) No. 2[Z]. 2018-09-17.
- [4] Cui Yubao, Li Jinlong, Zhang Shulin. Interdisciplinary Discipline Construction: Connotation Analysis, Implementation Dilemmas, and Promotion Strategies[J]. China Higher Education Research, 2022, 38(04): 16-22.
- [5] Zhu Huawei. Research on the Current Situation of Interdisciplinary Discipline Construction and Development in High-Level Universities in China: Based on a Survey of 46 Graduate Schools[J]. China Higher Education Research, 2022, 38(03): 15-23.
- [6] Wang Zhanjun, Chang Lang. Discipline and Transcendence: Institutional Dilemmas and Breakthroughs in Interdisciplinary Discipline Construction[J]. Higher Education Research, 2022, 43(05): 26-34