International Journal of Social Sciences and Public Administration
ISSN: 3005-9836 (Print), ISSN: 3005-9585 (Online) | Volume 9, Number 1, Year 2025
DOI: https://doi.org/10.62051/ijsspa.v9n1.25
Journal homepage: https://ijsspa.org

Research on the Construction and Practice of a Novel Teaching Organization for Software-related Maker Training

Huawei Mei, Mingquan Zhang, Junxian Zhao

North China Electric Power University, Baoding, China

ABSTRACT

To address issues such as the rigidity of traditional teaching organizations, strict disciplinary barriers, and limited teacher-student interaction, this study, based on the needs of software-related maker training, constructs a novel learning organization termed the "Innovation and Entrepreneurship Club" and the teaching organization termed the "Interdisciplinary Mentor Team." Through designs featuring a self-management framework, knowledge-sharing mechanisms, and three-dimensional mentor collaboration, the model breaks down boundaries between academic majors and between teachers and students, fostering a student-centered active learning ecosystem. Empirical findings indicate that this organizational model significantly enhances students' self-management and interdisciplinary collaboration skills. Notably, 92% of members believe that organizational learning has elevated their value hierarchy, and over 90% of employers expressed recognition of the students' technical adaptability and professional competence. This study provides a practical reference for software-related maker camps in higher education institutions.

KEYWORDS

Software-related Maker Training; Novel Teaching Organization; Innovation and Entrepreneurship Club; Interdisciplinary Mentor Team.

1. INTRODUCTION

1.1. Background and Needs

The "New Engineering Education" initiative requires higher education institutions to break away from the constraints of traditional teaching structures and develop talent equipped with interdisciplinary collaboration skills and self-directed development capabilities. In the digital economy era, software-related projects frequently involve composite requirements integrating "software, hardware, and services." Traditional teaching models organized around discrete academic majors and classes struggle to meet students' needs for cross-disciplinary learning and collaboration[1]. Furthermore, the predominantly one-way "teach-listen" mode of interaction between teachers and students tends to constrain the development of learners' self-management abilities and innovative awareness, highlighting an urgent need to establish flexible and open new types of teaching organizations.

1.2. Current Situation and Problems in Teaching Organizations for Software-related Majors

Current teaching organizations for software-related majors in universities face three major pain points:

Organizational Rigidity: Using academic majors and classes as the basic units, students in software specialties lack opportunities for collaboration with students from electronics, design, management, and other disciplines, failing to meet the demands of composite projects[2, 3].

Singular Guidance: Reliance primarily on internal faculty for teaching, with insufficient participation from external resources such as industry professionals and alumni, leads to a disconnect between guidance content and actual industry practices.

Cultural Deficiency: A lack of a learning atmosphere that embraces "tolerance for trial and error, and collaborative win-win" results in student participation in innovation and entrepreneurship activities being largely driven by external policies rather than intrinsic motivation for self-development[4].

2. CONSTRUCTION OF THE NOVEL TEACHING ORGANIZATION

The novel teaching organization, centered on "student autonomy, interdisciplinary collaboration, and diversified guidance," consists of the "Innovation and Entrepreneurship Club" (learning organization) and the "Interdisciplinary Mentor Team" (teaching organization). These two components operate synergistically, forming an educational closed loop of "student autonomous practice – diversified mentor guidance – organizational culture empowerment."

2.1. Innovation and Entrepreneurship Club: Practical Design of the Novel Learning Organization

Grounded in the philosophy of "interest-driven + self-management," the Innovation and Entrepreneurship Club breaks down traditional class boundaries to create an open and collaborative learning ecosystem. Specific implementations span three dimensions: organizational structure, knowledge sharing, and cultural cultivation:

2.1.1. Autonomous Organizational Structure: Ensuring Efficient Operation

The club established six technical groups, including Algorithm, Mobile Development, Big Data, and Product groups. Group leaders are elected democratically or through self-nomination by members for one-year terms, responsible for project planning and member management within their groups. Concurrently, a "Club Management Committee" was formed, comprising leaders from each group and two supervising teachers, tasked with major decision-making (e.g., resource allocation, competition recommendations) and cross-group coordination.

To standardize operations, the club formulated a "Charter" and "Project Management Measures": project proposals require submitting a feasibility report and must pass a defense session with at least five group members before initiation; project progress follows a "weekly report + monthly report" system, with leaders summarizing weekly progress and reporting to the committee monthly; resource requests adopt a "demand-based application + open review" model. For instance, applying for lab equipment requires stating the purpose and duration of use, evaluated by the committee before allocation. Over the past three years, the club has initiated over 20 projects, with an on-time completion rate of 90%. The self-management mechanism has effectively enhanced students' decision-making and execution capabilities.

2.1.2. Diversified Knowledge Sharing: Promoting Experience Transfer

Two main sharing platforms were established: a "Technical Blog Platform" and an "Open Source Code Repository."

- Technical Blog Platform: Updated weekly with original articles covering topics like "Python Performance Optimization Techniques," "Microservices Architecture Practice," and "Product Requirement Analysis Methods." Authors include senior students, mentors, and industry engineers. The platform features a "comment interaction zone" for Q&A. It produces an average of over 30 high-quality articles annually, with cumulative reads exceeding 2,000.

- Open Source Code Repository: Hosts source code from club projects, annotated with technical documentation, test reports, and instructions. Members can freely reuse and optimize the code. For example, after the source code for the "Campus Second-hand Trading Platform" was opened, 15 teams developed derivative projects like "Campus Rental" and "Textbook Sharing" based on it, achieving a code reuse rate exceeding 60%.
- Additionally, the club irregularly holds "Maker Salons," inviting industry experts and entrepreneurial alumni to share experiences. For instance, a technical director from an internet company was invited to explain innovation methods, and an alumni entrepreneur shared startup experiences, covering over 500 participant instances and effectively broadening students' technical horizons and industry understanding.

2.1.3. Value-oriented Culture Cultivation: Stimulating Intrinsic Motivation

Centered on "tolerance for trial and error, collaborative win-win, and value-driven action," the club conducts cultural activities:

- Hackathons: Require teams to complete project development within 24 hours, encouraging bold attempts at innovative solutions. Even failed attempts must submit retrospective reports. For example, one team's project, while not achieving the intended functionality, identified issues like "insufficiently detailed requirement decomposition" and "overly aggressive technology selection" through the post-project review, accumulating experience for subsequent projects.
- Team Building Month: Held every October, featuring activities like outdoor team-building and project review meetings. For instance, organizing a "Code Relay Race" where teams of four alternately complete module development to foster collaboration togetherness; holding "Failed Project Sharing Sessions" where members share lessons learned, creating an atmosphere of "no fear of failure, willingness to reflect."
- National Service-themed Sharing Sessions: Invite successful entrepreneurial alumni to discuss cases where technology serves society, such as teams aiding rural revitalization, sharing how to align project design with national needs. Surveys show that 92% of members believe such activities elevate their outlook on life and values, enhancing their sense of mission to "create value with technology."

2.2. Interdisciplinary Mentor Team: Practical Design of the Novel Teaching Organization

A three-dimensional mentor team comprising "internal faculty + industry executives/alumni mentors" was formed, breaking the traditional single-mentor model to provide students with comprehensive, multi-level guidance:

2.2.1. Roles and Collaboration of the Three-dimensional Mentors

(1) Internal Faculty: Focusing on Theoretical and Research Leadership

Primarily composed of key faculty from the Computer Science Department, they are responsible for helping students build systematic knowledge frameworks and guiding the technical direction of research projects and competitions. For example, in the "Intelligent Orthopedic Rehabilitation Medical System" project, computer science faculty guided the path planning algorithm design to ensure technical feasibility; in research projects, internal mentors guide students in literature review and experimental design, helping transform technical problems into research outcomes.

(2) Industry Executives/Engineers: Bridging Practice and Industry Needs

Technical executives and senior engineers from internet and software companies are invited to join the team. They conduct "Industry Frontier Lectures" each semester on hot topics like "Data Security Compliance Design." Simultaneously, they provide guidance on engineering challenges within student projects. For instance, addressing latency issues under concurrent requests in one project, an industry engineer proposed a solution involving "message queues + distributed caching," improving project performance by 40%. Furthermore, industry mentors offer internship opportunities and technical resources, with some students receiving job offers through these internships.

(3) Alumni Mentors: Supporting Entrepreneurship and Career Development

Primarily consisting of successful entrepreneurs and mid-level managers, alumni mentors focus on cultivating business thinking and resource connectivity: in entrepreneurial projects, they guide students in developing business models and writing business plans, expanding from "pure technical service" to "technology + content operation"; in career development, they provide resume critiques, interview coaching, and share industry promotion paths, assisting many students in entering leading companies.

2.2.2. Dual-Mentor Project Management: Ensuring Guidance Depth

Each competition or entrepreneurial project is assigned one internal mentor and one industry/alumni mentor, forming a "technical + practical/commercial" dual-guidance model. Mentors hold monthly online seminars to address project issues and propose solutions. For example, in an e-commerce project, the internal mentor guided database optimization, while the alumni mentor advised on user growth strategies and profit model design. Quarterly on-site guidance sessions are conducted to review progress and adjust plans. To avoid guidance conflicts, the team formulated a "Dual-Mentor Collaboration Manual," clarifying roles: internal mentors lead on technical direction, industry/alumni mentors lead on practical or commercial aspects, with major decisions requiring mutual agreement.

2.2.3. Faculty Capacity Building Plan: Ensuring Mentor Quality

To enhance the industrial practice capabilities of internal mentors, the following measures were implemented:

- Entrepreneurship Training: Organizing teacher participation in "Innovation and Entrepreneurship Mentor" training to learn business analysis, project incubation, etc.
- University-Industry Collaborative Research: Supporting faculty in conducting collaborative research projects with enterprises. Several collaborative projects are undertaken annually with companies, transforming industry needs into teaching cases to enhance the relevance of guidance.

3. IMPLEMENTATION EFFECTIVENESS

3.1. Significant Improvement in Student Abilities

- Self-Management Skills: 90% of club members can independently formulate project plans and coordinate resources; in project management, students autonomously resolve issues like schedule delays and member conflicts 78% of the time.
- Interdisciplinary Collaboration Skills: 75% of award-winning competition projects were completed by interdisciplinary teams. Students learned to listen to opinions from different specialties (e.g., hardware performance suggestions from electronics majors, user experience requirements from design majors) in various scenarios, significantly improving collaboration efficiency.
- Career Adaptability: Employer feedback indicates that students trained within this organization can quickly master cutting-edge technologies like Docker containerization deployment and cloud-native architecture. Their adaptation period to new technologies, teamwork awareness, and resilience are noticeably better than other new hires of the same cohort.

3.2. Typical Case: Interdisciplinary Team Develops "Building Urban Dreams"

- Organizational Support: The project team consisted of students from Computer Science (3), Electronic Information (2), and Economics & Management (2). After joining the Innovation and Entrepreneurship Club, they were assigned an internal mentor (Computer Science faculty) and an industry mentor (an engineer from a technology company).
- Guidance Process: The internal mentor guided the system algorithm design; Electronic Information students handled hardware deployment; Economics & Management students were responsible for project planning and promotion; the industry mentor recommended adding data visualization and anomaly alert functions.
- Outcomes: The project won a provincial bronze award in the "Internet Plus" Competition in Hebei Province, demonstrating the synergistic value of the interdisciplinary organization and dual-mentor guidance.

4. CHALLENGES AND IMPROVEMENT DIRECTIONS

4.1. Existing Problems

- Low Organizational Operational Efficiency: In the club's self-management, some groups experience lengthy decision-making (e.g., resource application reviews taking over two weeks) and poor cross-group collaboration. The Interdisciplinary Mentor Team faces high communication costs, and inconsistent opinions among mentors can easily delay project progress.
- Insufficient Mentor Incentives: Interdisciplinary guidance consumes significant time and effort but is not included in faculty performance evaluations. Industry and alumni mentors also lack long-term incentive mechanisms, affecting participation stability.
- Uneven Member Participation: Core club members (approx. 30%) undertake the main tasks, while peripheral members have fewer participation opportunities, limiting their skill development.

4.2. Improvement Directions

- Optimize Operational Mechanisms: Introduce "Agile Management" concepts to the club, establishing a "Rapid Decision-Making Group" to streamline resource application processes. Develop a "Communication and Coordination Manual" for the mentor team, clarifying dispute resolution procedures, using "project objective alignment" as the decision criterion when opinions differ.
- Improve Incentive Systems: Establish faculty guidance workload subsidies and "Outstanding Innovation & Entrepreneurship Mentor" awards. Provide incentives for industry and alumni mentors, such as "priority talent recommendation rights" and "corporate promotion opportunities," to enhance engagement loyalty.
- Promote Universal Participation: Implement a "Project Rotation System," requiring core members to involve two peripheral members in core project tasks each semester. Establish "Newcomer Special Projects" to offer peripheral members opportunities to independently manage small projects, boosting their sense of involvement.

5. CONCLUSION

The novel teaching organization of "Innovation and Entrepreneurship Club + Interdisciplinary Mentor Team," through its autonomous architecture, diversified guidance, and value-oriented culture, effectively addresses issues like the rigidity, singular guidance, and cultural deficiency of traditional teaching organizations, constructing a student-centered active learning ecosystem. Future efforts should further optimize operational mechanisms and incentive systems to promote the sustainable development of the organization and cultivate more innovative talents with self-management and interdisciplinary collaboration capabilities for software-related majors.

ACKNOWLEDGEMENTS

This article was supported by the 2023 Hebei Province Teaching Reform Research and Practice Project on Innovation and Entrepreneurship Education (Project No.: 2023cxcy211) and the Innovation and Entrepreneurship Curriculum Project.

REFERENCES

[1] Chen Qiuwei. Research on the Design and Application of Maker Education Curriculum Based on Design Thinking [D]. Central China Normal University, 2022.

[2] Wang Wei, Qin Sisi, Li Shijie. Exploration and Practice of the "Self-incubation - Dual Circulation" Cultivation Mechanism for College Student Makers in University Maker Spaces [J]. Innovation and Entrepreneurship Theory Research and Practice, 2025, 8(13): 188-192.

[3] Hong Lixin, Song Chuangjun, Wu Fengwei. Construction Strategy of the "One Core, Two Wings, Six Steps" Model for Internet+ Maker Education [J]. China Education Info, 2021, (16): 37-39.

[4] Li Zhonghua, Xia Minghua, Li Xiaodong, et al. Research on Innovation and Entrepreneurship Talent Cultivation Driven by Discipline Competitions – Taking the IT Application System Development Competition as an Example [J]. Computer Education, 2017, (12): 36-38+42.