Journal of Human Resource Development (2024)
Clausius Scientific Press, Canada

DOI: 10.23977/jhrd.2024.060212
ISSN 2616-3357 Vol. 6 Num. 2

Industry Leading and Agile Training: Exploring and Practicing the Path of Applied Talent Cultivation in Modern Industry College

Wenlong Su[a,*], Tingting Li[b], Suping Liu[c]

Department of Computing, Guangdong University of Science and Technology, Dongyuan Avenue, Songshan Lake High-tech Industrial Development Zone, Dongguan, China
[a]su.wenlong@outlook.com, [b]2720433265@qq.com, [c]457789090@qq.com
[*]Corresponding author

Keywords: Agile Training, Industry College, Industry-Education Integration, Applied Undergraduate

Abstract: Currently, a new wave of technological and industrial transformation is underway, imposing new demands on talent cultivation due to the challenging industrial landscape. Exploring talent cultivation models within modern industry academies is a crucial pathway for enhancing applied undergraduate education. This paper, based on the foundation of industry academies and drawing from the "Agile Development Model" in the field of software engineering, analyses industry characteristics and talent cultivation needs. Combining personal teaching experience in both industry and academia, we propose an innovative "Agile" applied talent development model (AATDM). In this model, the organization of engineering practice teaching within the college involves "agile teams" consisting of 5-7 students and one enterprise mentor or "dual-qualified" teacher. Students undergo "multi-iteration" training within these teams, producing talent "products" that meet the development and needs of the computer industry. This model, validated through four years of daily teaching practice in a modern industry college, significantly improves students' engineering application abilities compared to traditional cultivation models. The talents produced are better adapted to the rapid technological changes in the industry and have a stronger job-matching ability. Case studies and employment data analysis indicate the effectiveness and superiority of this cultivation model. It is a result of applied undergraduate institutions' exploration into modern industry academies and industry-education integration collaborative education mechanisms. This model is of great significance for further promoting the deep integration of industry, academia, and research, achieving multi-faceted win-win outcomes in industry-education integration, and cultivating high-quality talents who can adapt to and lead industrial development.

1. Introduction

Your paper will be part of the journals therefore we ask that authors follow the guidelines explained in this example, in order to achieve the highest quality possible.

In the era of "software defines everything," the role of software is crucial. New-generation information technologies such as big data, cloud computing, Internet+, and artificial intelligence have become indispensable infrastructures for social production and life. Compared to other technological fields, China's information technology industry has developed rapidly, especially the software industry, which shows a trend of sustained high-speed growth. However, there is a phenomenon where the industry is large but not strong, with many enterprises that are numerous but not excellent.[1]

According to data released by the China Ministry of Industry and Information Technology (MIIT) from 2018 to 2023, the software and new-generation information technology industries have consistently maintained high growth, with their proportion in the electronic information industry continuously rising. Internationally, 19 countries have software expenditures exceeding 0.5% of their GDP, with the United States exceeding 1%. This industry's scale has been growing continuously. In terms of workforce, the global ICT industry employed about 40 million technology workers in 2022, with around 21 million being professional software developers. Data from MIIT shows that the number of software practitioners in China has been increasing annually, reaching 5.76 million in 2016.

From the perspective of open-source communities, the software Q&A platform Stack Overflow has 32 million registered users, with over 25 million being frequent visitors. Correspondingly, China's technical Q&A platform CSDN has 30 million registered users, with over 10 million active online users, indicating a large workforce engaged in software-related fields. Despite the industry's booming development and growing scale, we find that current talent cultivation models in universities have shown little innovative development, making it difficult to meet the industry's rapid growth demands for talent, leading to significant conflicts.

It is well known that cultivating applied innovative talents is a crucial part of modern industrial and social development. Facing the "14th Five-Year Plan" period, to increase the reserve of high-quality applied professionals in the software information technology and service industries and meet the trend of rapid industry development and iterative changes, educators must actively reform and innovate in university curricula and talent cultivation systems. The "14th Five-Year Plan for National Economic and Social Development and the Long-Range Objectives Through the Year 2035" clearly emphasizes the importance and necessity of cultivating applied talents in universities. The report of the 20th National Congress of the Communist Party of China also explicitly calls for "enhancing the deep integration of industry, academia, and research led by enterprises." On July 30, 2020, the Ministry of Education and the Ministry of Industry and Information Technology jointly issued the "Guidelines for the Construction of Modern Industry Colleges (Trial)" (No. 16 [2020] of the General Office of the Ministry of Education), highlighting the innovation of talent cultivation models and improvement of talent cultivation quality, providing new ideas for local applied undergraduate institutions.[2]

This paper explores the new agile talent cultivation model of modern industry academies, constructing a new teaching paradigm for university industry academies to cultivate competitive high-level applied talents with forward-looking industrial knowledge. This is not only necessary for the development of applied undergraduate institutions' industry-education integration but also essential for the development of China's information technology industry in the new era.

2. Definition of the Model

The "agile" in the Agile Talent Cultivation Model originates from a software development model in software engineering known as Agile Development. This model, characterized by its responsiveness and speed, is a new approach and philosophy in the field of software engineering. Its

main feature is its ability to effectively handle rapidly changing requirements during the software development process. This development model encourages close collaboration between engineering teams and industry business experts, advocates for short and efficient face-to-face communications through "stand-up meetings," and promotes the rapid delivery of new software versions by forming small, streamlined teams.[3]

The Agile Development Model is result-oriented, team-supported, and addresses various issues encountered during work through reasonable division of labor and iterative processes. This creates a compact, self-organizing project team that can complete tasks quickly and with high quality. Another key feature of this model is its emphasis on speed and iteration, often described in internet enterprises as "small steps, quick runs." This method embraces change and efficiently addresses risks, making it well-suited to adapt to changing external industry demands. It highlights the importance of people over tools in the software development process. This development model is currently the most popular among internet companies. The flowchart of this model is as follows:

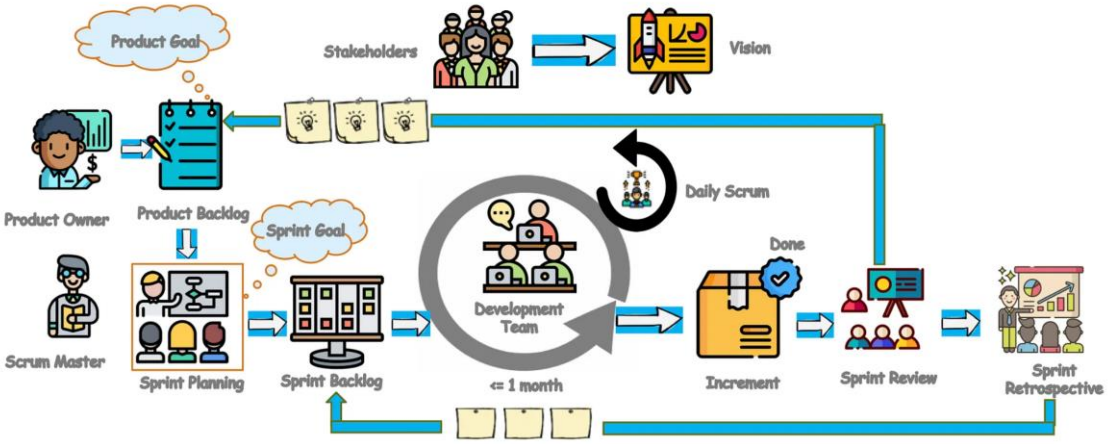

Figure 1: Internet Enterprise Agile Development Model Flowchart

This paper explores the introduction of agile development concepts, ideas, and organizational forms into the talent cultivation model in universities. It aims to build an agile teaching team that proactively explores new technologies in the software industry and continuously iterates to optimize talent cultivation methods. Driven by industry-university collaborative projects, the model establishes and selects student agile teams, guided by agile development principles, to complete projects while maximizing the synergistic effects of agile teams. This approach not only strengthens faculty development but also cultivates agile software development talents that meet enterprise needs. In Figure 1, the guiding teacher acts as the product owner, while students take on roles such as developers, project managers, product managers, test engineers, and operations engineers.

Specifically, the Agile Talent Cultivation Model involves dividing industry classes into "agile teams" of students and teachers. Each team, consisting of 5-7 members, is managed in detail and paired with one dual-mentor or "dual-qualified" teacher, forming an "agile team." These teams employ the Agile Development Model to conduct project-based teaching and competition activities, significantly enhancing the efficiency of both teachers and students in project development and competitions. Using case-based teaching and collaborative guidance based on industry projects or research projects, students participate in various engineering projects and receive "multi-iteration" training from their mentors, achieving "small steps, quick runs." This method embodies a student-centered teaching philosophy, fully leveraging students' initiative and creativity.

In the current wave of constructing applied undergraduate programs and cultivating innovative talents, the innovation of talent cultivation models using modern industry academies as platforms is a core driving force for universities transitioning to industry-education integration. The ability to

quickly cultivate "innovative talents" that adapt to industry development on the fertile ground of applied undergraduate education will, to some extent, depend on the reform and innovation efforts of modern industry academies in talent cultivation.[4]

3. The Main Tasks of the Mode

With the development of new-generation information technologies such as artificial intelligence, the pace of change in the market's demand for talents is constantly accelerating. Consequently, the sustainable competitiveness of applied talents is undergoing new changes. In this context, new requirements are being proposed for the agile talent cultivation model. Its main tasks for talent cultivation include the following.

3.1. Gap the Demands between the College and Industry

The business requirements and technological advancements of enterprises evolve rapidly, yet the talent cultivation and teaching systems in universities often lag behind. Traditional educational cases are outdated, practical examples are criticized for being obsolete, and graduates often face the challenge of being deemed "capable on paper but ineffective in practice," leading to high rates of unemployment upon graduation. Even in courses that include some practical components, the materials are often several years out of date and fail to align with industry standards.

In industrial colleges, such as those offering software engineering majors, the focus is on nurturing engineers with the capability to design and develop large-scale software systems. Practical engineering skills and corresponding job-specific abilities are crucial characteristics of applied talents and are key requirements in today's industries. This is particularly evident in the ability to design solutions to industry problems and to identify and resolve engineering issues. By utilizing agile teams in the field of software engineering, students' practical engineering training can be significantly enhanced. This organizational approach not only strengthens students' practical training but also hones their actual engineering skills.[5]

3.2. Solving the Difficulty of Students in Acquiring Real-World Job Skills

Currently, some universities lag behind industry developments in terms of experimental environments, practical facilities, and faculty teams. To ensure that talents cultivated by universities possess the skills required by enterprises and industries, it is necessary to provide corresponding real-world environments. However, universities often struggle to create authentic enterprise production environments because such environments are constantly changing, while traditional talent cultivation models change infrequently and have long cycles.

Therefore, adopting the agile cultivation model allows students to choose positions based on their interests within agile teams. Each position corresponds to a job in an enterprise. Students can familiarize themselves with job responsibilities and the latest knowledge in the field before entering the workforce, thus bridging the gap between the skills taught in school and those required by employers. While in school. Currently, some universities lag behind industry developments in terms of experimental environments, practical facilities, and faculty teams. To ensure that talents cultivated by universities possess the skills required by enterprises and industries, it is necessary to provide corresponding real-world environments. However, universities often struggle to create authentic enterprise production environments because such environments are constantly changing, while traditional talent cultivation models change infrequently and have long cycles.

3.3. Cultivating Students with Excellent Collaboration and Communication Skills

Addressing the issue of students' lack of excellent collaboration and communication skills. Applied engineering talents not only require outstanding individual technical performance but also, more importantly, comprehensive abilities and collaboration skills within a team, which are emphasized even more in agile development. As the forefront observation post of the industry, the Industrial College fully mobilizes the innovation capabilities within the team. Team members are required to continuously and creatively solve engineering problems, especially in the era of "Internet Plus" and "AI Plus," where innovative software products are in high demand. Meanwhile, the rapid innovation in AI technology necessitates that students being trained must possess the ability to quickly learn new technologies and innovate. Members are required to present abstract and complex program codes in a clear and understandable manner to clients or team members through visual aids such as diagrams, facilitating easier feedback and suggestions from superiors or clients. Under the agile talent cultivation model, on-campus agile teams particularly focus on nurturing students' teamwork and communication skills.[6]

3.4. Solving the Difficulty of Lack of Teaching Staff with Industry Experience

Addressing the shortage of applied teaching staff and the low ratio of dual-qualified teachers. Cultivating innovative and applied talents requires applied teaching staff. The faculty in industrial colleges are the core for connecting with industry applications, and teachers need to have rich industry or corporate experience, especially in internet enterprises. However, most universities have not incorporated dual-qualified teachers into their title evaluation and annual assessment criteria, resulting in teachers focusing more on research and teaching development, rather than on improving practical skills and fostering professional qualities. Teachers need to continuously align themselves with the industry, engage with new technologies, concepts, and knowledge in the industry, and refine this industry knowledge into courses, textbooks, methods, techniques, and services for daily teaching and work, thereby cultivating talents that meet industry needs and requirements.

4. Characteristics of Agile Talent Cultivation Model

4.1. Iterative Teaching and Training

Currently, although application-oriented institutions have teaching methods such as project training, skills practice, and corporate internships, they primarily focus on knowledge-based teaching, organizing and dividing courses based on knowledge modules. This teaching system has a significant drawback, namely the serious separation between theoretical and practical teaching, which is not conducive to cultivating application-oriented talents with a focus on engineering practical abilities. However, the Agile Talent Cultivation Model adjusts and integrates existing professional courses by targeting internship industrial projects, thereby compensating for this deficiency in the current talent cultivation model.

The important feature of the Agile Software Development Model is iteration, colloquially referred to in internet enterprises as "sprinting." This method embraces change well and responds to risks quickly and efficiently. In the Agile Talent Cultivation Model, project-driven teaching based on the Agile Software Development Model is adopted to cultivate students through "multiple iterations." This iterative teaching method embodies the "student-centered" teaching philosophy and can be widely promoted and applied in application-oriented higher education institutions, especially in industrial colleges. Students actively learn and explore the knowledge and skills required by completing meaningful engineering practice tasks within agile teams, thereby fully demonstrating

students' initiative and innovative spirit. By developing and negotiating enterprise horizontal topics as the source of student practice in agile teams, colleges and industrial colleges base their agile team organization on real industrial projects, constructing an agile cultivation system for application-oriented undergraduate talents.[7]

4.2. Enterprise Project-driven Teaching

The projects required for school teaching come from horizontal topics, or real enterprise-level projects are extracted from school-enterprise cooperation horizontal topics. As the forefront of industry-education integration, industrial colleges have abundant industrial projects and horizontal topics. Students must participate in all activities under the Agile development model led by teachers, including regular Agile stand-up meetings, project review meetings, document writing, software risk and progress assessment, and other Agile process activities. In addition, taking the software engineering major as an example, according to the software engineering project development process, it also includes activities such as project requirements analysis, user interaction design, system design, algorithm design, coding, testing, and online operation. By using real projects and real team collaboration, students truly grasp the real working mode, working skills, and working intensity in the industry, thus cultivating high-quality talents that meet industry requirements.

4.3. Industry Position Orientation Teaching

In the Agile cultivation model, students select positions based on their strengths and interests within the team, corresponding to a real position in the industry. This allows students to familiarize themselves with the responsibilities of the position and the latest knowledge in the field before entering the industry, effectively addressing the gap between talent cultivated by the school and the needs of enterprises. Members of agile teams collaborate with each other for the common project goal, each taking on the responsibilities assigned by their respective positions, thereby fully enhancing the knowledge and skills of each member in the team. Ultimately, they work together to complete project tasks, solve practical engineering problems, and achieve the goal of matching talents with positions.

From the perspective of talent cultivation, the Agile cultivation model cultivates students' mastery of "position skills." During the iterative cultivation cycle, students' skill cultivation is coordinated with project-based software product development. The teaching team of teachers is seen as a team of software development engineers composed of teachers and students, and the demand of the industry and enterprises for talents is likened to the demand of customers for software products. By setting 2 to 5 large project iteration cycles with several small cultivation cycles within each large cycle, the direction of talent cultivation and skill upgrading courses is dynamically revised regularly based on market changes. Eventually, high-quality application-oriented talents that meet the latest industry needs and developments are cultivated. This model adopts a position-oriented approach and establishes a dynamic talent cultivation course system, which can accurately cultivate application-oriented talents according to changes in industry demands, meeting the strong practical requirements of application-oriented undergraduate talent cultivation.

4.4. Transparent Training Process Data

Traditional training models lack corresponding training data for decision support. However, in the Agile training model, all roles played by student members participate in the entire project development process. During project iteration and talent cultivation iteration, students first learn to

use various development tools under the Agile model, including project process management tools, code unified hosting platforms, integrated development environments, and pipeline DevOps automatic construction tools. These tools can effectively record data during the training and practice process. This facilitates the accumulation of data in the student training process, making it convenient to quantitatively assess the quality of student training. Subsequently, students also need to learn industry coding specifications and strictly follow these specifications in engineering practice activities. Finally, according to the actual requirements of the industry, students develop engineering skills based on coverage-based unit testing, Git-based code hosting delivery, and Kanban management based on project progress. All links in the entire engineering practice and training process have statistical data and trace records that can be queried.

4.5. Team Building and Collaboration

Currently, agile development in the software and internet industries is no longer the "individual hero all-around" development model; instead, it emphasizes the process of team collaboration. It is crucial for industrial colleges to consciously cultivate students' ability to participate in team organization and collaboration based on different positions and roles. In agile development teams, each student plays multiple roles corresponding to positions in the enterprise, such as Developer, Tester, Product Manager, UI Designer, etc., with each position bearing corresponding role responsibilities. Between development teams, communication is facilitated using advanced management tools in the industry, such as GitLab for code hosting, wikis, Kanban boards, etc., to achieve rapid communication of progress and risk points through brief stand-up meetings. Additionally, team members need to communicate with customers or other department personnel and collaborate and exchange information with other teams through means like "technical wikis" to facilitate team collaboration and communication.

5. The Significance of Establishing AATDM

5.1. Reducing the Gap between Talent Cultivation and Industry Demands

The rapid pace of change in business requirements and technology in the industry contrasts with the relatively static nature of talent cultivation and teaching systems in higher education. This misalignment poses significant challenges to the higher education sector. Higher education should lead industry trends and stay at the forefront of industrial developments. However, many new technologies and concepts originate from enterprises, particularly those adopting agile thinking in internet companies, highlighting the lag in higher education. The agile talent cultivation model proposed in this paper addresses this issue by focusing on project-driven agile teams to solve actual enterprise problems. Each member's role in the agile team corresponds to positions demanded by the industry, ensuring that talents cultivated by universities meet industrial needs.

5.2. Strengthening Collaboration between Universities and Enterprises

The agile talent cultivation scheme aims to train students to quickly adapt to the constantly changing demands of new industries, requiring the involvement of various sizes of technology enterprises. As modern industrial colleges, they serve as the forefront of cooperation between applied undergraduate colleges and various technology companies. By completing the tasks of integrating industry and education, transforming scientific research results, and empowering social services, industrial colleges provide advanced industrial resources and high-quality practical teaching resources for the agile talent cultivation model. Furthermore, enterprises can offer efficient

and beneficial suggestions from an industrial perspective. The management of industrial colleges can use these suggestions to periodically reconstruct the traditional curriculum system to ensure that talent cultivated can adapt to future industrial development. Meanwhile, industrial colleges can learn and draw on advanced technologies from enterprises to keep their teaching content aligned with future industrial development.

5.3. Providing Enterprises Research Projects in Universities

Horizontal Enterprises research projects in universities are the most effective and direct way to serve the transfer and transformation of scientific and technological achievements for enterprises. Exploring project-driven agile team talent cultivation models can enhance the transformation capability and efficiency of horizontal research projects in universities. Project leaders act as Scrum Masters in agile teams, with other teachers and some students participating as team members in various roles such as developer, tester, manager, etc. Members of agile teams grow rapidly with the project through rapid iterations, mutual dependence, and shared responsibility for specific project goals, ultimately completing horizontal research projects together.

6. Reflections on the Agile Talent Cultivation Model

While the implementation and development of the agile talent model have many advantages, it also presents certain requirements for universities, industrial colleges, and their teachers. Several reflections on this cultivation model are as follows.

6.1. Policies Should be Focused on the Enterprise Experienced Faculty

How to solve the problem of "dual-teacher" faculty? "Dual-teacher" faculty are the key of the agile talent cultivation model, it means the teacher with both enterprise experience and college teaching experience. Constructing them is a long-term and complex systematic project. On the one hand, teachers need to have rich enterprise, especially internet company work experience. On the other hand, they also need some teaching experience. However, most universities have not included "dual-teacher" faculty in their title evaluation and annual assessment indicators, leading to teachers' focus remaining on scientific research, teaching construction, etc., with little emphasis on improving practical skills and professional ethics.

6.2. Great Effect on Students' Competitions.

Students participating in agile project teams benefit greatly from competitions. Students who have participated in agile top project groups have received numerous awards, with their average monthly salaries after graduation significantly higher than the average level of the same graduating class. They are highly recognized by employers for their professional capabilities, and most of them have become important members of enterprises or project teams. Additionally, students have achieved significant breakthroughs in intellectual property applications. With the guidance of agile mentors, students can participate in software copyright applications, appearance patents, thesis writing, etc.

6.3. The Educational Information Infrastructure Needs to Upgrading

The agile talent cultivation scheme requires continuous iteration and adjustment, with data serving as an important basis for adjustment. Universities need to strengthen the construction of

information infrastructure to make the data transparent and accessible for the cultivation process, providing data support and decision-making basis for continuous iteration of talent cultivation. Additionally, universities, especially industrial colleges, need to grasp the trend and dynamics of changes in industrial positions, which cannot be achieved without information-based data platforms.

7. Conclusion

In conclusion, based on the current industrial development and the contradiction between the supply and demand of applied talents in universities, this paper explores talent cultivation models inspired by agile development thinking in the modern industrial college's software engineering major. It innovatively proposes an "agile cultivation" model, which has two layers of meaning: first, likening the talent cultivation process to software development, and second, setting up real projects for practical training segments. This model not only promotes rapid iteration and improvement of teaching teams' practical skills but also addresses the problem of the misalignment between talent cultivation goals and rapid changes in the industry. This has important reference significance for universities to implement deep integration of industry and education, strengthen the construction of industrial colleges, and form coordinated cooperation among governments, universities, industries, enterprises, and industrial parks.

Acknowledgements

We gratefully acknowledge the financial support from the two projects, the first one is Higher Education Teaching Reform Project of Guangdong University of Science and Technology, titled "Exploration and Practice of Tencent Cloud Industrial College's Characteristic Construction Path" (Project No.: GKZLGC2022017). Another one is the Teaching and Research Integration Project of Guangdong University of Science and Technology, titled "Tencent Cloud Industrial College Industry-Education-Research Technological Innovation Team" (Project No.: GKJXXZ2023038).

References

[1] Kharchenko K, Beznosyk O, Bulakh B, et al. The development of the method of optimizing costs for software testing in the Agile model[J].Technology audit and production reserves, 2023, 6(2):10-14.

[2] Sara S, Yves W, Stephan P, et al.An empirical evaluation of scrum training's suitability for the model-driven development of knowledge-intensive software systems[J].Data Knowledge Engineering, 2023, 146

[3] Zhang H, Zheng M. Research on the Driving Force and Path Innovation of the Construction of Shandong Modern Service Industry College[J].Advances in Vocational and Technical Education, 2024, 6(1)

[4] Liu B, Jiang L. The Analysis of Relationship between Modern Service Industry and College Students' Employment [C] // Advanced Science and Technology Research Center. Proceedings of the 2nd International Conference on Social Science and Environmental Protection (SSEP2013).Shenyang University;, 2013:5.

[5] Yue X, Wang H, Zhang W. Practical research on the construction of modern industry college in application-oriented universities[C]//2023 2nd International Conference on Sport Science, Education and Social Development (SSESD 2023), 2023: 214-220.

[6] Wang J, Zhao H, Han B. The Problems and Countermeasures in the Cultivation of Chinese International Education Talents in Applied Colleges and Universities[C].//Proceedings of the 4th International Conference on Education: Current Issues and Digital Technologies (ICECIDT 2024).Changchun Humanities and Sciences College; 2024:6. DOI:10.26914/c.cnkihy.2024.002085.

[7] Li K. Research on Optimization of English Teaching in Universities under the Guidance of Applied Talent Training [J]. Adult and Higher Education, 2024, 6(2)