

Course Development for “The Robot World”: Cultivating Ethical Values within Technical Education

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Abstract

With the rapid advancement of artificial intelligence (AI) and robotics, robotics literacy has emerged as a critical component of comprehensive competence for citizens in modern society. Rooted in the requirements for interdisciplinary talent cultivation under China’s national “Double First-Class” Initiative and aligned with the “Five-in-One” educational philosophy, this paper explores the development pathway of the general education course “The Robot World”. Taking “from technical cognition to value shaping” as its central theme, the course features interdisciplinary teaching content that encompasses multiple dimensions: fundamental robotics, ethics, law, social impact, and cutting-edge applications. It adopts a blended online-offline teaching model, incorporating experiential and project-based learning methods to foster students’ innovative thinking, critical awareness, and social responsibility. Furthermore, the paper advocates leveraging “Curriculum Ideology and Politics” as a guiding principle for the course, with a focus on deepening education in professional ideals and ethics. The ultimate goal is to cultivate versatile talents possessing technological literacy, humanistic care, and a forward-looking perspective—thus offering practical insights for the reform of general education in universities.

Keywords

Robotic Literacy, General Education Course, Interdisciplinary Integration, Curriculum Ideology and Politics

1. Introduction

In 2022, the Ministry of Education, the Ministry of Finance, and the National Development and Reform Commission jointly issued the “Guidelines on Deepening

the Development of World-Class Universities and Disciplines.” The document emphasizes that the effectiveness of fostering virtue and nurturing talents should be regarded as the fundamental criterion for evaluating all university activities. It calls for the establishment of an educational system that promotes well-rounded development in moral, intellectual, physical, aesthetic, and labor education. Additionally, it highlights the need to strengthen interdisciplinary talent cultivation in key fields such as integrated circuits, artificial intelligence, energy storage technology, and the digital economy. Knowledge related to robotics falls within the scope of these emphasized areas.

With the rapid advancement of artificial intelligence and robotics technology, their applications have permeated various sectors of social life. From industrial production to medical services, from smart homes to scientific exploration, robotics is reshaping how societies operate. In this context, higher education, serving as the core stage for cultivating future leaders and well-rounded talents, bears the responsibility of helping students understand and adapt to this wave of technological transformation. (Gao et al., 2023; Fang & Wang, 2023)

General robotics education is not merely about the dissemination of technical knowledge, but also about the cultivation of interdisciplinary thinking and comprehensive competence. It integrates knowledge from multiple fields such as engineering, computer science, ethics, sociology, and even artistic design, which can stimulate students’ innovative awareness, systematic thinking, and ability to solve complex problems. Furthermore, issues related to robotics, such as ethical guidelines, social implications, and human-machine interactions, prompt students to reflect on the relationship between technology and the future of humanity, thereby fostering their social responsibility and critical thinking skills (Yang, 2022).

2. Basic Principles for Curriculum Development

The curriculum development aligns with the “high-level, innovative, and challenging” standards of first-class undergraduate programs, with a focus on enhancing its interdisciplinary liberal arts core. The curriculum embodies the holistic educational philosophy integrating value shaping, knowledge exploration, potential development, international perspective, and all-round development. It is essential to further clarify the course objectives and positioning, aiming to establish a general education elective course characterized by advanced liberal arts concepts, well-structured content, effective teaching outcomes, and regional distinctiveness.

The development entails creating high-quality courses that span fields in both humanities and social sciences and natural sciences, breaking down disciplinary barriers. Emphasis will be placed on practicality, innovation, and internationalization to meet the needs of modern society for talents with broad knowledge, strong adaptability, as well as critical thinking and innovative capabilities (Wang et al., 2021).

Guided by the aforementioned fundamental principles, the development of

“The Robot World” course places particular emphasis on the deep integration of interdisciplinary liberal arts connotation with the “Five-in-One” educational philosophy. The course not only focuses on imparting knowledge of robotics technology itself but also emphasizes situating it within broad scientific, humanistic, and social contexts. This approach guides students to contemplate the ethical logic, social impact, and philosophical thinking behind technological development, thereby addressing the requirements for “value shaping” and “knowledge exploration.” Simultaneously, by introducing cutting-edge cases and setting open-ended projects, the course aims to stimulate students’ innovative potential and critical thinking, enhancing its “challenge level” and “innovativeness,” and thus serving “potential development” and “all-round development.” At the level of “international perspective,” the course content and case selection emphasize the combination of a global background and regional characteristics, analyzing both the latest trends in international robotics technology and the opportunities and challenges in its localized application, ensuring the course is both contemporary and regionally relevant. This series of specific practices that integrate the principles has established a solid framework and clear direction for the design of the course’s teaching content (Lin, 2020; Su & Li, 2018).

3. Instructional Content Design

In the teaching of “The Robot World” the course team faces multifaceted challenges. First, in terms of content integration, due to the diverse academic backgrounds of enrolled students (covering humanities, social sciences, science, and engineering), balancing technical depth with general breadth and organically integrating soft topics such as robot ethics and social impact with hardcore technical knowledge has become a key difficulty in instructional design. Second, in terms of teaching methods and student engagement, students without a technical background often experience apprehension due to a lack of mathematical foundations or difficulties in understanding technical terminology. Maintaining their learning interest requires extensive case-based and experiential teaching (such as hands-on operations and scenario simulations), which places high demands on teaching resources and classroom organization. Third, in terms of course coordination and logistical support, the sharing of experimental equipment and the allocation of resources for blended online and offline teaching involve communication across multiple departments. In practice, issues such as disjointed management and delays in resource support are prone to arise.

Robotics liberal arts education helps break down disciplinary barriers, promotes interdisciplinary integration, and meets the future job market’s demand for interdisciplinary talent. Students enrolled in this course come from various majors such as English, Philosophy, Law, Chemical Engineering, Transportation, and Literature. Regardless of whether students come from humanities, social sciences, or natural sciences fields, possessing fundamental robotic literacy will enhance their future competitiveness and adaptability. Under the aforementioned frame-

work, the design of the course teaching content closely revolves around the core objectives of “building an interdisciplinary knowledge system and strengthening critical thinking and practical skills,” and has been developed as shown in **Figure 1**.

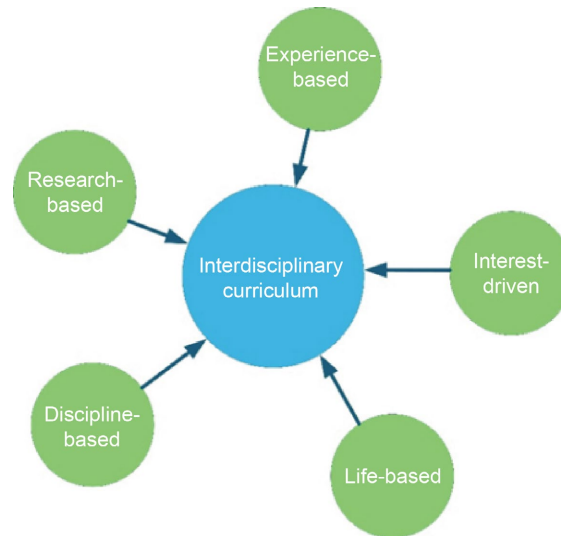


Figure 1. Instructional design.

- **Leveraging Student Interests**

The module begins by showcasing iconic robots from films and animations such as Transformers, Westworld, and Big Hero 6. This leads into a discussion on the question, “What does your ideal robot look like?” Student answers often align with these popular media portrayals. Seizing this opportunity, the instructor introduces broad and narrow definitions of robots, supported by explanations and video clips of various robots in action, thereby segueing into an overview of core robotics technologies.

- **Connecting to Everyday Life**

An activity titled “Spot the Robot in Your Life” is initiated, where students document robot applications they encounter over a week by taking photos or notes, followed by a sharing session in class. This activity aims to dismantle the stereotype that robots must be humanoid, helping students recognize the pervasive nature of robotics technology. Examples shared by students—such as robotic vacuum cleaners, window-cleaning robots, and smart voice-interactive devices—serve as a springboard to introduce core technologies like SLAM (Simultaneous Localization and Mapping) and sensor technology. Analysis then extends to logistics and service robots (e.g., food delivery robots in restaurants/hotels, delivery drones), exploring how they are transforming business models and employment structures. Finally, robots contributing to smart cities, such as autonomous vehicles, pipeline inspection robots, and security patrol robots, are discussed to examine their impact on evolving lifestyles.

- **Integrating Disciplinary Expertise**

Students are guided to explore the integration of robotics technology within their own fields of study, facilitating knowledge transfer and innovation. For instance, when covering “Robot Evolution and Classification,” ethical and sociological perspectives are incorporated, prompting discussions on societal issues like “The Rights Boundary of Artificial Intelligence” and “The Trolley Problem in Autonomous Driving.” When introducing “Application Fields of Robotics,” students majoring in economics or management are guided through case analyses, such as developing a market launch strategy for a new cleaning robot, considering target customers, pricing strategies, and supply chain management.

- **Emphasizing Hands-on Experience**

The curriculum design is deeply informed by the understanding that abstract theories and formulas pose significant barriers for students from non-engineering backgrounds. Consequently, we strongly emphasize a “Learning by Doing” philosophy, shaping the course into an open “Robotics Experience Workshop.” This approach allows students to naturally spark interest, grasp fundamental principles, and connect knowledge to their own disciplines through an immersive environment involving tactile interaction, direct operation, and firsthand experience with robots.

- **Incorporating Research Projects**

Graduate students and professors from the university’s robotics laboratories or partner institutions are invited to give guest lectures. Potential topics include “Soft Robotics,” “Brain-Computer Interface for Robot Control,” and “Swarm Robot Cooperation.” Guest speakers are requested to explain their research using accessible, non-technical language.

4. Reform in Teaching Methods

This course adopts a blended teaching model that integrates online and offline components, as illustrated in **Figure 2**. It is designed to optimize instructional efficacy through a clear and scientific division of tasks. The systematic delivery of foundational knowledge is assigned to online modules, where students independently study core concepts, thereby preparing thoroughly for the in-person sessions. This design liberates valuable classroom time, allowing a dedicated focus on cultivating higher-order thinking skills.

During offline teaching, the instructor’s role transforms from a knowledge transmitter to a learning facilitator and guide. The focus of the classroom shifts towards guiding students in deep reflection, organizing thematic discussions, and encouraging them to express personal insights related to disciplinary characteristics.

This instructional design embodies advanced educational concepts such as the “student-centered approach” and the “flipped classroom.” By front-loading knowledge transfer to the online phase, it ensures that the physical classroom becomes a dynamic space for intellectual exchange and skill enhancement. Under the professional guidance of the instructor, students become the true protagonists

of the class. Through articulation, debate, and comprehensive exchange of viewpoints, they not only deepen their understanding of the subject matter but, more crucially, develop critical thinking, communication skills, and the ability to construct and apply knowledge in authentic contexts, thus achieving comprehensive development of their competencies.

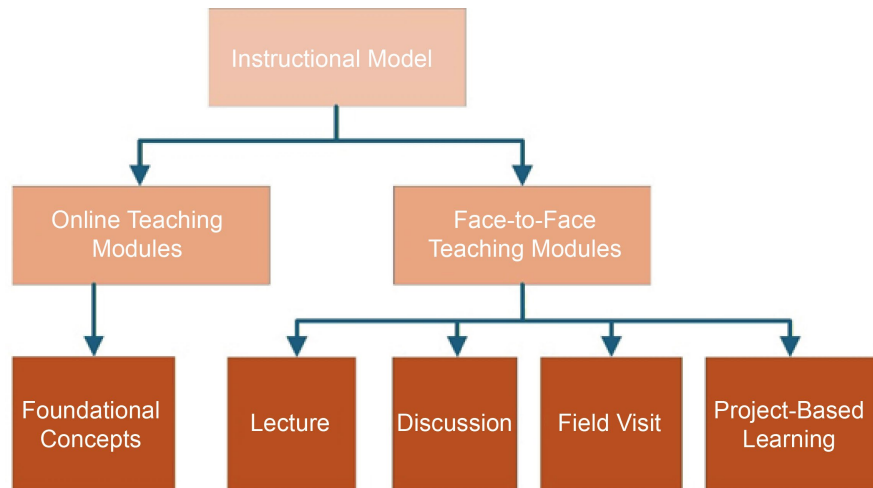


Figure 2. Teaching methods.

In the specific implementation of teaching, to effectively achieve the core objective of “building an interdisciplinary knowledge system and strengthening critical thinking and practical skills,” the course specifically incorporates a thematic discussion segment. This segment is carefully designed around nine interdisciplinary discussion topics, such as “Robot Ethics and Legal Boundaries,” “The Aesthetic Controversies of AI in Literary and Artistic Creation,” “How Robotic Technology Empowers the Sustainable Development Goals,” and “The Potential Challenges of Brain-Computer Interfaces to Social Equity.” These topics are intended to require students to step beyond the knowledge framework of their own majors and utilize critical thinking to conduct comprehensive analysis and judgment on robotic technology and its social impact from multiple perspectives including technology, ethics, society, law, and humanities. This not only directly addresses the course’s requirements for “interdisciplinary liberal arts connotation” and “challenge level” but also serves as deep cultivation of students’ “potential development” and “value shaping.”

Through this series of meticulously designed discussions, the course successfully translates abstract educational concepts into concrete scenarios where students can participate and engage in critical thinking. In the clash of perspectives among students from diverse disciplinary backgrounds, they not only deepen their understanding of robotic technology but, more importantly, learn how to examine complex technological issues from multiple viewpoints. Their ability to integrate knowledge and their literacy in interdisciplinary communication are significantly enhanced. This instructional design ensures that the “Five-in-One” ed-

educational philosophy and the “innovativeness and challenge level” course standards take root in interactive classroom practice. It provides a vivid vehicle for comprehensively assessing student learning outcomes and offers a practical basis for the continuous optimization of subsequent teaching content.

5. Integrating Ideological and Political Education into the Curriculum

In developing the ideological and political dimensions of this course, we deeply recognize that igniting students’ intrinsic motivation for learning and a sense of noble mission is crucial to achieving educational effectiveness (Zhang, 2019). Consequently, the course establishes “Cultivating Professional Ambition, Serving National Strategies” as the central theme of its ideological and political education. It is dedicated to aligning students’ personal career aspirations with the overarching national goals of building a technological powerhouse and achieving national rejuvenation.

Aligned with the content of the “The Robot World” course, we emphasize the principle of “embracing innovation and exploration while steadfastly upholding ethical boundaries.” Our approach is twofold: What We Encourage: We foster bold imagination and cross-boundary innovation, cultivating a scientific spirit that dares to experiment and explore. In course projects, we support any robotics application concept aimed at enhancing productivity, improving human life, and promoting social progress. What We Prohibit: We strictly forbid crossing the bottom line of technological ethics. We explicitly instruct students that technological development and application must adhere to the principle of “Doing Good.” The design of any robotic system intended to harm humans, infringe on privacy, create injustice, or damage the ecosystem is strictly prohibited. Through case study discussions, we lead students to a profound understanding that technology devoid of ethical constraints is not only unreliable but also dangerous.

The ultimate objective of our robotics general education course extends beyond merely teaching students what a robot is. It aims to guide them in contemplating a more profound question: What kind of robotic era do we want to create? By exploring the significance of responsibly leveraging and responding to technological advancements, our goal is not to cultivate passive recipients of technology, but rather proactive citizens and builders capable of critical thinking and responsible stewardship of our future technological society. This represents education’s essential response and its noble mission in the age of intelligence.

6. Conclusions

In summary, the development of the general education course “The Robot World” represents a systematic teaching reform practice guided by the “Five-in-One” education philosophy and aligned with the gold standard of “Two Qualities and One Degree” for first-class courses. By constructing a tripartite teaching content framework of “foundational knowledge-cutting-edge interdisciplinary topics-so-

cietal impact,” employing student-centered diversified teaching methods (such as case-based teaching, thematic seminars, and project-based learning), and organically integrating ideological and political elements into the entire process of knowledge impartation and ability cultivation, the course has successfully transformed robotics—a highly specialized field—into an inspiring and challenging interdisciplinary liberal arts platform accessible to all students.

Student feedback indicates that the course is highly effective in stimulating learning interest and tapping into the potential of students with diverse academic backgrounds. It has not only broadened their knowledge horizons but also achieved remarkable teaching outcomes in enhancing critical thinking, interdisciplinary communication skills, and sensitivity to technological ethical issues. This fully validates the foresight of the course construction principles and the feasibility of the teaching design.

Looking ahead, the course team will continue to track the latest developments in robotics technology and societal trends, dynamically update teaching cases and seminar topics, and further enrich and refine the course resource library. Meanwhile, plans are underway to introduce more flexible graded challenging tasks to meet the personalized development needs of students with varying foundational knowledge. Additionally, collaboration with off-campus enterprises and research institutions will be actively explored to provide students with practical opportunities to engage with cutting-edge developments and real-world applications. Through these efforts, the “The Robot World” course will be developed into a high-quality general education brand with greater influence and exemplary value, contributing robustly to the cultivation of interdisciplinary innovative talents in the new era.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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