

Ideological and Political Teaching Practice in the Course of “Digital Signal Processing”

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Abstract:

Ideological and political education in professional courses is a challenge that every instructor must seriously consider and actively address. It is a mission entrusted by the times to “guard a section of the canal and cultivate the responsible field.” This paper discusses the integration of ideological and political education into the course “Digital Signal Processing” by introducing the ideas and teaching methods employed in the teaching process. By incorporating examples from familiar people and situations, academic analysis, engineering cases, and informal discussions on signal processing, ideological and political elements are woven into the course “like salt in water,” yielding positive teaching outcomes.

Keywords:

Digital signal processing
Ideological and political education in professional courses
Integrated cases
Casual talks on signals

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1. Introduction

Curriculum ideology and politics represent a broad perspective on education that aims to cultivate morality through various courses^[1]. Starting from the essence of “cultivating people with morality,” this approach leverages the moral education function in professional courses, practical courses, and other curricula to build a comprehensive ideological and political education system across all courses. This shift moves from a singular focus on ideological and political courses to a multi-dimensional moral education model, guiding students to translate theory into practice and become comprehensive

talents who contribute to the construction of the motherland with development in morality, intelligence, sports, aesthetics, and labor. The highest art of ideological and political education is to influence imperceptibly, like salt dissolving in water^[2,3]. As professional course instructors, it is essential to thoroughly comb through the ideological and political elements in the curriculum and integrate them into course instruction, subtly inspiring students’ growth and reflection on attitudes, emotions, and values. Moral education should be infused into the carrier of course knowledge and naturally conveyed to students.

2. Areas for improvement in ideological and political education in professional courses

The importance of implementing ideological and political education in professional courses is evident, and it has been vigorously carried out in various universities and courses. However, there are still some issues and areas for improvement in practice.

2.1. Forced ideological and political education

There are difficulties in integrating curriculum ideology and politics into course instruction, such as explicitness, formalization, and utilitarianism. For instance, bluntly instilling ideological and political elements in students can affect the integrity and coherence of the course itself, as well as students' interest in receiving the information. Packaging a course as an excellent ideological and political education course with elaborate designs but devoid of substance deviates from the original educational intent.

2.2. Misunderstandings about curriculum ideology and politics

There is a misconception that curriculum ideology and politics equate to "course + ideology and politics." For example, presenting universal truths divorced from the context of professional courses can make the content seem impersonal, lacking warmth, and uninteresting to students. Elevating the discussion to a philosophical level and only telling stories unrelated to the course can sound unfamiliar and inauthentic. Not incorporating the characteristics of the course and simply regurgitating information leads to rigidity.

2.3. Limiting curriculum ideology and politics to the classroom

Teachers fail to recognize that curriculum ideology and politics should be integrated into every aspect of teaching and practice, rather than confined to specific classroom sessions. For instance, inserting ideological and political elements into every lesson can be overkill. Professional courses should primarily focus on imparting professional knowledge, while ideological and political education serves as a seasoning, added only when necessary. If the content of a particular class session focuses on

deriving and proving formulas, it may not be suitable for incorporating ideological and political elements. A lack of holistic curriculum design for ideological and political resources, coupled with simplistic imitation of similar courses, prevents students from fully benefiting from the experience.

3. Teaching practice of integrating ideological and political education into the course of "Digital Signal Processing"

Recognizing some issues in integrating ideological and political education into coursework, the author closely aligns with the characteristics of the "Digital Signal Processing" course and adopts specific implementation methods, striving to achieve an organic combination of explicit professional education and implicit ideological and political education.

3.1. People and stories around us

Adhering to the ideological and political concept of telling "people and stories around us" in the context of professional courses, the author focuses on military struggles and equipment transformation, telling stories behind independent innovations in national defense science and technology. This subtle approach cultivates students' feelings of serving the country through science and technology, strengthening their ideals and beliefs in dedicating themselves to strengthening the military and national defense^[4,5].

Professor Zhongkang Sun, with his legendary stories, is one of the pioneers in the field of signal processing in China and a trailblazer in passive location and early warning detection. In the 1950s, Professor Sun served as the leader of the overall design team for the first domestically designed and developed high-speed fighter aircraft-mounted tracking and guidance radar. In the 1960s, he was responsible for developing the first digital transistor target simulator for precision tracking radars in shooting ranges and independently designing and developing continuous wave speed measurement radars for the first time in China. Every time these stories are told, students are filled with awe and respect, enhancing their consciousness and sense of responsibility to learn digital signal processing well.

In another example, Professor Huangfu Kan, the founder of the “Digital Signal Processing” course, is an outstanding teacher in the military and a model of tight integration between scientific research and teaching. Since 1977, the National University of Defense Technology has taken the lead in conducting teaching and scientific research in “Digital Signal Processing.” The course team has organized “Digital Signal Processing” training courses in more than ten universities and research institutes across the country, exerting broad influence in the field of digital signal processing in China. When it comes to Professor Huangfu, many people know that he is a golden signboard of the National University of Defense Technology^[6]. With his skill of “a piece of paper and a chalk” in class, he has created a phenomenon where professional courses on campus are “hard to get a seat.” Every time students hear stories about Professor Huangfu, they are deeply touched, realizing that the “Digital Signal Processing” course has such a glorious history, and their interest in learning becomes even stronger.

To illustrate further, the young people in the “Beidou Navigation System.” In the mid-1990s, three doctoral students from the School of Electronic Science at the National University of Defense Technology used digital signal processing methods to overcome the technical challenge of “fast acquisition and precise tracking” in the Beidou navigation system, laying the technical foundation for China’s Beidou system from scratch^[7]. Their spirit of “daring to be the first and brave in innovation” sets an example for young students.

These vivid stories of people and events around us greatly touch and inspire students’ interest and confidence in learning professional courses. By deeply exploring their own historical accumulation and cultural heritage, and organizing unique “people and stories around us” as ideological and political materials, telling their own stories leaves a deep impression on students, engaging their minds, and achieving subtle educational effects.

3.2. Analysis of academic situation

Based on the student’s professional characteristics and prerequisite courses, teachers conduct targeted education on the importance of their profession, sense of honor, and sense of mission, striving to make students become young people with aspirations, ambition, and responsibility.

For example, when teaching students majoring in microelectronics about the finite word-length effect, the topic naturally leads to research projects on the development of smart devices. Teachers from the School of Electronic Science have persisted in exploratory research for more than ten years, making the research team one of the top tiers in this field in China and achieving an internationally advanced research level^[8,9]. After learning about this research project, students become more interested in their major, feeling that they can make significant contributions in their professional field and wanting to contribute their strengths. For students majoring in simulation engineering, when introducing system modeling, Professor Zhongkang Sun’s derivation of the computational model for single-station passive location in his late 70s is mentioned. This provides valuable technical resources for future generations, and his students have expanded upon this through simulation, opening up new research areas. This helps students understand the importance of their major in practice and enhances their sense of honor in their chosen field.

3.3. High value-added cases

The term “high value-added cases” refers to cases that encompass not only engineering education values but also other values such as practical education values and ideological and political education values. By utilizing the method of integrating scientific research achievements into the classroom, we construct high value-added cases. The integrated comprehensive case design is illustrated in **Figure 1**. We extract and condense scientific research achievements from multiple fields into teaching cases, fully tapping into the practical, ideological and political, and engineering values inherent in these cases. Through a top-down, integrated design approach, we create comprehensive cases and then break them down step by step, building a series of high value-added signal processing cases that maximize the practical, ideological and political, and engineering education functions of the cases.

Taking the large-point Fast Fourier Transform (FFT)

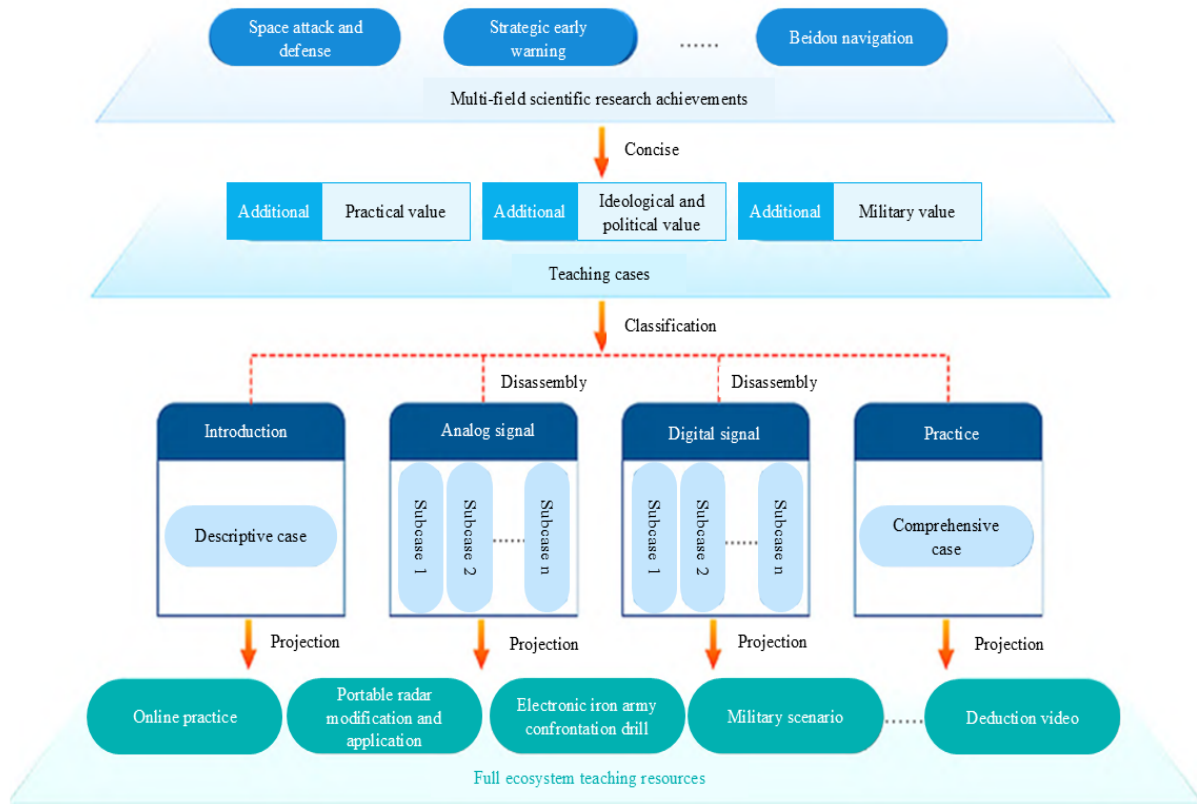


Figure 1. Integrated comprehensive case design

engineering case as an example, this case originated around 2000, when Professor Huangfu Kan, who was already in his 60s, led a group of young people to develop a multi-frequency continuous wave ranging radar for a shooting range. According to the design requirements, the measurement distance needed to reach over 150 km, but the signal-to-noise ratio of the received data was very low. To improve the detection capability of the target, large-point FFT calculations were needed to accumulate energy. Based on theoretical calculations and engineering experience, this “large point” was determined to be 128K. However, over 20 years ago, the maximum cache of Texas Instruments (TI) series Digital Signal Processor (DSP) chips only supported 16K data points. How to use a 16K DSP to achieve 128K FFT calculations became an engineering challenge for this project. After exploration and practice, Professor Huangfu Kan and his team finally achieved 128K FFT calculations using a 16K DSP chip.

This is a real engineering case and also an example of a great craftsman from a “nearby” big country. From an engineering application perspective, it corresponds

to the idea of “decimation in time” or “combination number” in digital signal processing. With this engineering background as a foundation, analyzing the specific situation of $N = 128K$ makes it easy for students to understand the origin, development, and usage of this knowledge point^[10-12]. This “signal processing case” carrying multiple values is generally used at the end of the FFT chapter, summarizing the chapter’s knowledge while also providing ideological and political education to students.

3.4. Casual talks on signal processing

“Casual Talks on Signal Processing” is the final chapter of the self-compiled textbook “Digital Signal Processing” by the author’s team. In this chapter, nine casual talks are presented in a lively and interesting way, effectively addressing the challenge of integrating ideological and political education into professional courses, making it both memorable and impactful^[13]. Student feedback indicates that while many of the specifics of the “Digital Signal Processing” course may be forgotten, these “Casual

Talks on Signal Processing” leave a lasting impression. The author has summarized the ideological and political design in the “Digital Signal Processing” course, as shown in **Table 1**.

4. Conclusion

Ideological and political education in courses is a long-term and arduous task. It is an educational concept for the new era, highly challenging, and a sacred mission entrusted to teachers by the times. In teaching practice, it is important to keep the goal of fostering virtue and talent firmly in mind, never forget the original intention,

strengthen the integration of ideological and political elements into teaching content, grasp the invisible aspects of teaching methods, steadily advance the implementation process, and constantly enrich and improve it. To cultivate builders and successors of socialist society, there is an urgent need for teachers to not only be proficient in professional knowledge and serve as “masters of classics” but also to cultivate their moral character and become “masters of humanity”, striving to be unified as both “masters of classics” and “masters of humanity” who are skilled in “teaching, imparting knowledge, and resolving doubts.”

Table 1. Ideological and political teaching design in the course of “Digital Signal Processing”

Ideological and political genre	Ideological and political element
Stories of people around us	Attract students’ attention, stimulate their interest in learning the course, and imperceptibly cultivate students’ native land emotions, ideals, and beliefs.
Academic analysis	According to students’ professional characteristics, targeted education on professional importance, honor, and mission is provided to students.
Case design	Introduce engineering application cases into the classroom: the application of “time-decimation” FFT segmented convolution in continuous wave-ranging radar projects, to establish students’ self-reliance and self-improvement character.
Introduction of ideological and political content in textbooks	The self-compiled textbook “Digital Signal Processing” tells nine anecdotes and interesting stories, attracting students’ reading interest in a lively and interesting way, making the ideological and political education of professional courses “enter the brain and heart, like salt in water,” stimulating students’ interest in learning, and gaining a sense of identity.

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Disclosure statement

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