

# An Attempt to Integrate Excellent Traditional Chinese Culture into Advanced Mathematics Teaching: A Case Study of Curriculum Ideology and Politics in Integration by Parts

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## Abstract

China's five-thousand-year traditional culture constitutes the foundation for national and ethnic inheritance and development. Promoting China's excellent traditional culture helps enhance the cultural confidence of contemporary university students. How to organically integrate China's splendid traditional culture into the dry study of Advanced Mathematics, how to enhance contemporary university students' interest in this course, and how to establish their cultural confidence—all these issues are worthy of our exploration at present. Based on this starting point, this paper takes an important knowledge point—the ideological and political teaching of integration by parts—as an example, and presents an application of several typical images from Chinese traditional culture in the Advanced Mathematics course. Additionally, it can be observed that the author's ideological and political teaching has effectively improved students' learning interest and learning outcomes in this course.

## Full Text

### A Practice of Integrating Excellent Traditional Chinese Culture into “Advanced Mathematics” Teaching: A Case Study of Ideological and Political Education in Integration by Parts

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**Abstract:** Five thousand years of Chinese traditional culture form the foundation for national inheritance and development. Promoting our excellent tra-

ditional culture helps enhance contemporary university students' cultural confidence. How to organically integrate our splendid traditional culture into the often dry study of "Advanced Mathematics," how to improve students' interest in this course, and how to establish their cultural confidence are all questions worth exploring at present. Based on this starting point, and taking an important knowledge point—ideological and political education in integration by parts—as an example, we present an application of several typical images from Chinese traditional culture within the "Advanced Mathematics" curriculum. Additionally, it can be observed that the author's ideological and political teaching approach effectively improves students' learning interest and outcomes for this course.

**Keywords:** traditional culture; integration by parts; advanced mathematics; course-based ideological and political education

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"The fundamental mission of universities lies in cultivating virtue and nurturing talent. We must steadfastly take fostering virtue and nurturing talent as the central task, and run ideological and political work through the entire process of education and teaching to achieve all-round and whole-process education." In recent years, the central government and the Zhejiang Provincial Committee have issued numerous opinions on strengthening ideological and political work in universities in the new era, requiring the construction of a comprehensive education framework involving all personnel throughout the entire process. Course-based ideological and political education organically integrates political identification, national consciousness, cultural confidence, and character development with the original knowledge and skills of various courses, combining explicit and implicit education to cultivate students' correct worldview, outlook on life, and values, thereby fully realizing the educational function of university teaching. As a public foundational course commonly offered to first-year students in numerous science and engineering universities, "Advanced Mathematics" has a large student audience and long instruction hours, exerting significant influence on the formation of students' correct "three views." The course itself possesses a rich knowledge system with strong logical and abstract qualities, playing an important auxiliary role in cultivating rigorous scientific attitudes, innovative consciousness, and forming correct worldviews. In practical teaching, the organic integration of ideological and political elements into "Advanced Mathematics" classroom instruction can better achieve the dual-dimensional teaching practice of knowledge transmission and value guidance. General Secretary Xi Jinping pointed out that "to firm up confidence in the path, theory, and system of socialism with Chinese characteristics, we must ultimately firm up cultural

confidence.” How to integrate our rich and excellent cultural traditions into the “Advanced Mathematics” curriculum is precisely the theme explored below.

## 2. Teaching Design for Ideological and Political Education in Integration by Parts

We begin with the popular game *League of Legends*, introducing a basic skill in the game called “Flash” and playing the most popular game video at point B. While capturing students’ interest, we introduce a fundamental method for finding indefinite integrals—integration by parts—and analogize it to the “Flash” skill. This leads to the basic formula of integration by parts and its proof, namely  $\int u dv = uv - \int v du$ . Next, we explain the meaning of integration by parts, guiding students to discover that when calculating certain indefinite integrals, we can proceed stepwise by first solving the easier part before addressing the remaining portion of the indefinite integral—this is the starting point of integration by parts. Naturally, the choice of functions is also crucial and requires regular practice and pattern mastery.

Here, we can guide students that in life, when encountering seemingly insurmountable challenges or difficulties, they should not get stuck in a dead end. Instead, they should face difficulties bravely, actively seek help, start with the easier parts, and wait for opportunities to change. We emphasize that “as heaven maintains vigor, so should a gentleman constantly strive for self-improvement,” and that heaven helps those who help themselves.

For convenience of explanation, we write it in the following easy-to-operate form. Borrowing mainstream gaming terminology, we point out that in this operation, both  $u(x)$  and  $v(x)$  essentially “flash” :  $u(x)$  flashes from the left side of the differential operator  $d$  to the right side, while  $v(x)$  simultaneously flashes from the right side of  $d$  to the left. Similar to the gaming principle of “no kill after flash,” once the opponent flashes, the danger is eliminated—in other words, the difficulty of the subsequent indefinite integral is substantially reduced. To strengthen impression, reduce mathematical abstraction, and help students overcome their fear of difficulty, we now borrow from China’s rich ancient cultural elements, allowing students to master this formula unconsciously during a pleasant cultural journey.

### (1) The Cowherd and Weaver Girl—A Famous Ancient Chinese Folk Love Story

Legend has it that the granddaughter of the celestial emperor, the Weaver Girl, was skilled at weaving and wove colorful clouds for the sky every day. She grew tired of this monotonous life and secretly descended to the mortal world, marrying the Cowherd from the western river and living a life of farming and weaving. This infuriated the celestial emperor, who captured the Weaver Girl and ordered their separation, allowing them to meet only once a year on the Magpie Bridge during the Qixi Festival. Their steadfast love moved the magpies,

and countless magpies flew in to form a magpie bridge across the Milky Way, enabling the Cowherd and Weaver Girl to reunite. The Northern Song Dynasty lyric poet Qin Guan wrote in *The Immortal at the Magpie Bridge*: “Delicate clouds play with skillful craft, shooting stars convey bitter grief, across the vast, vast Milky Way they secretly cross. When golden wind meets jade dew, their rendezvous outshines countless earthly unions. Tender affection flows like water, their sweet date seems but a dream, how can they bear to look back at the magpie bridge homeward! If love between two hearts lasts long, why need they stay together morning and night?”

Here we substitute the Cowherd and Weaver Girl into the integration by parts formula, obtaining . We point out that when the Weaver Girl and Cowherd meet, their reunion outshines countless earthly unions, and the difficulties after their meeting, equivalent to the Cowherd Weaver Girl portion, become insignificant to them.

## (2) The Story of Lu You and Tang Wan

Lu You, from Shanyin, Yuezhou (present-day Shaoxing, Zhejiang), was a renowned literary figure, historian, and patriotic poet of the Southern Song Dynasty. His poem *Visiting Shanxi Village* features bright colors and embeds philosophical truths in its scenery description, with the line “mountains multiply and waters double, suspecting no path; willows darken and flowers brighten, revealing another village” becoming a widely circulated famous phrase. According to research, at age twenty, Lu You married his cousin Tang Wan, and after marriage, they were “perfectly matched.” However, Lu’s mother disliked her daughter-in-law, eventually forcing the couple to divorce. Tang remarried, and Lu married another. When Lu You was thirty-one, he accidentally encountered Tang Wan and her husband at Shen Garden. Lu remained melancholy for a long time, composing the poem *Phoenix Hairpin* on the garden wall. Over the subsequent fifty-plus years, Lu You wrote many elegiac poems, with *Two Poems of Shen Garden* being the most popular.

Substituting Lu You and Tang Wan into the formula, we obtain . We point out that the encounter between Lu You and Tang Wan is analogous to choosing inappropriate functions when performing integration by parts, leading to formidable difficulties in solving the remaining indefinite integral -  $\int \frac{1}{x} dx$  Tang Wan and Lu You. Lu You’s *Phoenix Hairpin · Red Crispy Hands* has been called “without such heartbreaking events, there would be no such heartbreaking poetry. Speaking in terms of a hundred years, who would wish for such events? Speaking in terms of a thousand years, such poetry must exist.” Tang Wan later saw Lu You’s inscription at Shen Garden and was filled with emotion, composing a matching *Phoenix Hairpiece · Worldly Ways Are Thin*. In the autumn of the same year, she died of depression. This regret continues to resonate deeply with people even after hundreds of years.

After these two examples, students’ fear of difficulty in learning mathematics

during their cultural journey has been alleviated, and their learning interest and efficiency have improved.

We then proceed to the consolidation and application phase of the knowledge point, implementing examples of common basic elementary functions multiplied together one by one. This allows students to apply the formula in a relaxed and pleasant mood and master the empirical mnemonic “反对幂三指” (inverse trigonometric, logarithmic, power, trigonometric, exponential functions). Additionally, when explaining integration by parts involving basic trigonometric and exponential functions, we use the following indefinite integral calculation as an example:  $\int x e^x dx$ . We point out that although  $\sin x e^x$  appears repeatedly—“mountains multiply and waters double, suspecting no path”—at this moment we can use the algebraic thinking of solving equations to directly obtain its value as follows:  $\int x e^x dx = x e^x - \int e^x dx = x e^x - e^x + C$ . Truly, this represents “willows darken and flowers brighten, revealing another village.” Naturally, we can also adapt the Southern Song lyricist Xin Qiji’s line from *Green Jade Case • Yuanxi*: “Searching for him among the crowd a thousand times, suddenly turning back, that person is there where the lantern light dims,” to express the joy after our efforts, which is also the best reward for those among us who constantly strive for self-improvement.

Some teachers and scholars have already explored the application of Chinese traditional culture in ideological and political education within “Advanced Mathematics” classrooms [1-4], but to the author’s knowledge, such efforts have not been fully developed. This paper’s exploration enriches the teaching manifestations of excellent Chinese traditional culture in the “main channel” of ideological and political classroom construction for “Advanced Mathematics.” Additionally, this paper only presents two allusions—the Cowherd and Weaver Girl, and Lu You and Tang Wan—while Chinese traditional culture contains many similar ideological and political elements, such as King Fuchai of Wu and the beauty Xi Shi, the calligrapher Wang Xizhi and geese, Shu Han’s Liu Bei and Zhuge Liang, etc. Due to space limitations, these are not presented here. This exploration aims to serve as a modest spur to induce more valuable contributions, hoping that more teachers and experts will uncover more relationships between specific knowledge points in “Advanced Mathematics” and concrete elements of Chinese traditional culture, forming a synergistic effect between course-based ideological and political education and ideological and political courses, constructing a comprehensive education framework, and jointly writing a new chapter in ideological and political teaching.

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*Note: Figure translations are in progress. See original paper for figures.*

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