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Original Article

Innovative Design and Practical Reflections on Teaching Ideological and Political Aspects of 'Pharmacoeconomics' in the Digital Era

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ABSTRACT

Objective: This study examines the innovative design and practical application of ideological and political (IP) teaching in the Pharmaceutical Economics course in a digitally evolving educational landscape. It seeks to effectively integrate IP education into the curriculum, enhance the synergy between disciplinary and IP education, and foster students' holistic skills and social responsibility.

Material and Methods: The research began with a literature review to identify the unique characteristics of the "Pharmaceutical Economics" course and the theoretical underpinnings of IP teaching in a digital context. It then employed empirical analysis, using specific teaching cases to compare the outcomes and challenges of innovative versus traditional teaching methods. Finally, feedback from students and teachers was gathered through interviews and surveys to provide deep insights into the practical implementation of these methods.

Results: Findings indicated that leveraging online platforms and digital resources enhances the diversity and engagement of "Pharmaceutical Economics" teaching. Integrating IP education into professional instruction not only helps students link theory with practice, enhancing their overall qualities and skills, but also improves the relevance and effectiveness of IP education. Nonetheless, challenges persist; including the selection and use of digital resources, the impact of blended learning, and the fairness and accuracy of evaluations.

Conclusion: Digital teaching opens new avenues for incorporating IP education in "Pharmaceutical Economics". Careful strategic and methodological choices are required to ensure the pedagogical rigor and effectiveness of IP education. Future research may explore the transformation of teacher roles in digital environments, the empowerment of student agencies, and the seamless integration of online and offline teaching modalities.

Keywords: blended learning; digital education; ideological and political teaching; pharmaceutical economics; teaching innovation

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INTRODUCTION

1. Background

The 21st-century digital transformation has reshaped societal operations and revolutionized higher education's pedagogy and research landscape[1]. This swift technological evolution offers higher education both novel avenues and challenges. Digital pedagogy, utilizing online platforms and multimedia, provides a dynamic environment for educators and learners alike[2].

"Pharmacoeconomics" unveils the complex interplay between drug economics, pharmaceutical policies, drug markets, and societal health[3]. Based on the course content, its political-ideological education component illuminates the subject's crucial role in the healthcare system, fostering students' values, societal responsibility, and policy analysis skills. However, seamlessly integrating this education into specialized courses to maintain synergy between discipline teaching and ideological instruction is challenging.

In the digital age, conveying political-ideological aspects in "Pharmacoeconomics" requires adept utilization of digital tools to enhance educational outcomes. Digital tools can enrich education, allowing political-ideological teachings to reach specialized classrooms with diverse methods[4]. Leveraging online resources can innovate teaching methods, piquing students' interest while instilling political-ideological knowledge. The challenge for pharmaceutical educators is integrating this education and emphasizing its significance in pharmaceutical courses[5].

This study seeks to innovate the design of political-ideological education in the "Pharmacoeconomics" course in the digital era. We aim to suggest an effective model for integration, discussing challenges and improvements based on practical experiences. Through analysis and validation, we aim to guide the teaching of "Pharmacoeconomics" and related courses, highlighting strategies for content and methodology. Our objective is to deepen political-ideological education while retaining the course's uniqueness, providing insights for future pedagogical strategies.

2. Theoretical framework

2.1 Ideological education in specialized courses

Political-ideological education in this context refers to the incorporation of values, ethics, and societal roles into the technical and theoretical instruction of a subject. It aims to bridge the gap between theoretical knowledge and societal applications, thereby enhancing the synergy between discipline-specific teachings and broader ethical considerations. "Pharmacoeconomics" is not only tasked with imparting subject knowledge but also with conveying the importance of values in shaping economic decisions that affect healthcare outcomes. Thus, fostering a sense of societal responsibility and a strong professional ethos among students[6].

2.2 Digital pedagogy in ideological education

These digital strategies employ a variety of interactive and flexible teaching methods aimed at enhancing both theoretical understanding and practical application.

Flipped classrooms

The flipped classroom model is a central approach within digital pedagogy for pharmacoeconomics. Here, students are expected to first access lecture content online at their own pace. This initial online engagement is crucial as it prepares students for subsequent in-class discussions. By handling the theoretical content before class, students can engage more deeply during face-to-face sessions, thus ensuring a more comprehensive comprehension of the material.

Blended learning

Blended learning strategies further support this educational approach by merging online educational resources with traditional classroom methods. This integration creates a dynamic learning environment that can adapt to different learning styles, thereby enhancing student engagement. The use of multimedia resources, interactive simulations, and real-time feedback are hallmark features of blended learning environments that make them particularly effective for teaching complex subjects like pharmacoeconomics.

Project-based learning

Project-based learning (PBL) is another significant strategy employed in the digital pedagogy of pharmacoeconomics. In PBL settings, students undertake real-world projects that require the application of pharmacoeconomics concepts. For example, students might be tasked with performing cost-effectiveness analyses for the introduction of new drugs. This method not only helps in solidifying theoretical knowledge but also in developing practical skills critical for professional success.

Integration of online-offline methods

A detailed examination of how online resources are synchronized with offline activities highlights the seamless learning experience provided by digital pedagogy. This integration emphasizes the real-world significance of pharmacoeconomics and enhances the learning process. The use of digital tools to simulate pharmaceutical market scenarios allows for interactive learning and a deeper understanding of both economic and political-ideological aspects of pharmacology[7].

MATERIAL AND METHODS

1. "Pharmacoeconomics": characteristics and pedagogical insights

1.1 Course essence and features

"Pharmacoeconomics," an essential sub-discipline in pharmacy, evaluates the economic aspects of drugs within the broader socio-economic landscape. This course extends beyond simple cost-value analysis to explore comprehensive economic implications of drug policies, market behaviors, and pricing mechanisms. To better elucidate the integration of political-ideological education. Table 1 lists the key political-ideological topics covered; including healthcare equity, economic sustainability and ethical pricing. These topics aim to enhance students' understanding of the societal implications of pharmacoeconomic decisions. The course requires foundational knowledge in both pharmacy and economics, actively bridging theoretical concepts with practical, real-world challenges; to sharpen analytical skills and foster a robust professional ethos[8].

Table 1 Topics in political-ideological education within the pharmacoeconomics course

Topic	Description
Ethical drug pricing	Explores ethical considerations in drug pricing, focusing on fair pricing strategies that balance profitability with patient access. Case studies highlight impacts on public health outcomes.
Health policy and public health	Discusses the role of pharmaceutical companies and governmental policies in public health, examining conflicts between profit motives and public responsibilities, and ethical guidelines that should govern decisions.
Global pharmaceutical policies	Analyzes the effects of international health policies and trade agreements on drug prices and access to medicine, with a focus on how entities like the WHO and WTO influence global and national health outcomes.
Pharmaceutical regulation and compliance	Analyzes regulatory roles in ensuring drug safety and efficacy, discussing ethical responsibilities and compliance with these regulations.
Economic inequality and access to medicine	Investigates how economic disparities affect access to medications and strategies to improve equity in pharmaceutical services. Includes analysis of socioeconomic factors influencing drug accessibility.
Corporate responsibility in pharma	Explores ethical obligations of pharmaceutical companies towards patients and society, focusing on sustainability, transparency, and the broader impact on societal health.
Pricing strategies and market dynamics	Reviews pharmaceutical pricing strategies and market dynamics, discussing socio-economic implications and the ethical dilemmas involved, such as balancing healthcare resource prioritization and cost containment.
Ethics in pharmaceutical marketing	Investigates ethical issues in pharmaceutical marketing, including the impact of direct-to-consumer advertising on drug utilization and public perception. Regulatory frameworks are discussed to protect consumer interests.
Role of pharmacoeconomics in healthcare	Covers the influence of pharmacoeconomics on healthcare policy and drug development, exploring how economic decisions affect healthcare costs, access to treatments, and promoting health equity through pharmacoeconomic evaluations.
Sustainable pharmaceutical practices	Discusses the importance of sustainable practices in the pharmaceutical industry, focusing on environmental, economic, and social sustainability to improve global health outcomes.

1.2 Pedagogical Challenges in Ideological Integration

The integration of political-ideological content within "Pharmacoeconomics" presents distinct pedagogical challenges. To address the need for a balanced transmission of core values and specialized knowledge, we elaborate on innovative digital teaching strategies, such as virtual reality simulations, interactive case studies, and online discussion forums. These methods are designed to enhance engagement and understanding of political-ideological elements alongside pharmacoeconomic concepts. They facilitate a more cohesive educational experience by linking theory with the practical application of teaching, thus addressing previous instructional gaps[9].

2. Innovative political-ideological instruction in "Pharmacoeconomics" in a digital context

2.1 Digital tool-driven content innovation

Integrating theory and practice with digital resources

To enrich the integration of political-ideological content in education, digital resources are extensively employed to vividly convey theoretical knowledge and bridge these theories with practical real-world applications. This approach not only increases the practicality and ideological relevance of the course but also allows educators to effectively illustrate complex topics; like rare disease medication coverage. By using online platforms, educators can demonstrate global policy implementations and trends, enabling students to critically analyze the economic and societal implications of these policies. This process is further enhanced by interactive class discussions and online seminars that tackle complex issues; such as balancing patient rights with cost containment and emphasizing societal equity. Additional digital teaching strategies include; Virtual Reality (VR) simulations, which offer students immersive experiences of drug market dynamics from a pharmaceutical company's perspective, and interactive polls and quizzes during live-streamed lectures to gauge understanding and foster engagement with political-ideological topics (Table 2)[10].

Digital teaching and interactive innovations

Digital platforms are integral in the enhancement of educational strategies; particularly in illustrating and analyzing negotiation data and strategies related to national medical insurance drug negotiations. These platforms facilitate immersive simulation exercises that allow students to engage in realistic negotiation scenarios, thus improving their practical skills and deepening their understanding of the political-ideological dimensions involved. Additionally, the

Table 2 Examples of digital teaching strategies

Topic	Description
Virtual reality simulations	To enhance understanding of drug market dynamics, virtual reality setups allow students to experience the market from a pharmaceutical company's perspective.
Interactive polls and quizzes	During live-streamed lectures, interactive polls and quizzes are integrated to gauge understanding and encourage engagement with the material on political-ideological topics.
Augmented Reality (AR) Scenarios	AR technology is used to project complex data and real-world scenarios, such as health policy impacts, directly into the classroom setting.
Case study simulations	Online simulations that replicate real-life pharmacoeconomic challenges, allowing students to apply theoretical knowledge to solve practical problems.
Digital debates	Structured debates held via video conferencing tools, where students argue different aspects of pharmacoeconomics policies and their societal implications.
Collaborative research projects	Students work in groups using digital tools to research and develop solutions for current pharmacoeconomic issues, encouraging collaborative skills.
Interactive infographics	Use of dynamic and interactive infographics to visually represent pharmacoeconomic data, enhancing comprehension and retention of complex information.

use of online debates helps students critically evaluate and discuss the impacts of national drug bulk purchasing policies from multiple perspectives. Further enriching the learning experience, online case studies of national drug policies provide a basis for group activities, wherein students can propose and debate strategies using interactive tools that simulate real-life outcomes. Web-based discussion forums extend these discussions beyond classroom boundaries, promoting continuous engagement and fostering a deeper understanding of the course material[11].

2.2 Integrated online-offline instructional innovations

In the "Pharmacoeconomics" course, we utilize a blended learning approach that maximizes the benefits of both digital and traditional face-to-face instruction, thereby creating a dynamic and complementary teaching environment. Foundational theories are delivered through comprehensive online resources; including detailed lectures and essential readings, facilitating broad accessibility and self-paced learning. Subsequent in-person sessions are dedicated to deep-dive discussions and hands-on case studies, essential for translating theoretical knowledge into practical, ideologically relevant scenarios. This integrated approach ensures a balanced educational experience, enhancing interactive learning and the application of concepts in real-world contexts[12].

2.3 Innovative assessment: shifting from knowledge to skill development

In "Pharmacoeconomics," the assessment strategies have evolved to emphasize skill development, particularly in analytical depth, ethical reasoning, and effective teamwork, reflecting the educational shift towards more practical skills in the digital era. These multifaceted evaluations focus on both participation and the quality of interactions across online and offline platforms, offering a comprehensive perspective on students' abilities to integrate political-ideological content. Enhanced assessment techniques include: peer review mechanisms, which encourage collaborative learning by allowing students to assess each other's understanding and contributions. Additionally, portfolio assessments require students to compile and present coursework and projects that demonstrate their depth of understanding and the practical application of political-ideological principles in pharmacoeconomics[13].

RESULTS AND DISCUSSION

1. Reflective practices

1.1 Practical case overview

Course design and implementation

Deep exploration was undertaken in designing and implementing political-ideological instruction for "Pharmacoeconomics" in a digital context. Digital tools were integrated into the course, enriching student experiences and practical relevance. For instance, using a myriad of online pharmacoeconomics cases to meld theory with real-world challenges, boosting student engagement via blended instructional strategies.

Analysis of instructional outcomes

The data for this study were derived from the teaching practices associated with the "Pharmacoeconomics" course, which is part of the curricula in the School of Pharmacy, School of Basic Medicine, School of Nursing; and School of Public Health at a medical university. The sample included 50 students who participated throughout the course, capturing their academic performance and satisfaction surveys both before and after the implementation of the digital teaching strategies. All data were collected and analyzed anonymously, ensuring student privacy and upholding the ethical integrity and compliance of the research. Rigorous statistical methods were employed during data analysis to empirically investigate the actual impact of digital teaching strategies on enhancing student performance and satisfaction. To ensure the effectiveness of the comparative analysis, the same assessment tools were used before and after the implementation of the

teaching strategies. If different tests were administered at different times, scores were standardized to enable comparison between the periods before and after the implementation of the teaching method. This standardization involved converting scores to Z-scores to eliminate potential biases between different tests, ensuring consistency and accuracy in the assessment outcomes.

Digital Implementation in "Pharmacoeconomics": Enhanced Student Performance and Analysis

A rigorous analysis delineated in Figure 1 encapsulates the transformation in student proficiency across four educational dimensions: theoretical knowledge, practical skills, critical thinking, and teamwork. Preceding the implementation of a bespoke educational strategy, the mean score registered at 78.92 (S.D.=11.83), with the median at 75.5, encapsulating a general but constrained performance. Subsequent to the intervention, a slight elevation in mean scores to 79.84 (S.D.=11.23) was observed, coupled with a median advancement to 79.0 (Table 3). Despite these improvements, a t-test revealed that the increase in scores did not reach statistical significance (p-value=0.6732), suggesting the necessity for a deeper exploration of the strategy's educational impact. The violin plot's expansion in the upper quartile post-intervention indicates an enriched performance among a subset of students; particularly those surpassing the 75% benchmark, which shifted from 89.75 to 87.75. This bifurcation of outcomes points to a differentiated absorption of the pedagogical methods introduced, emphasizing the value of personalized and adaptable educational frameworks to achieve widespread and significant academic enhancement.

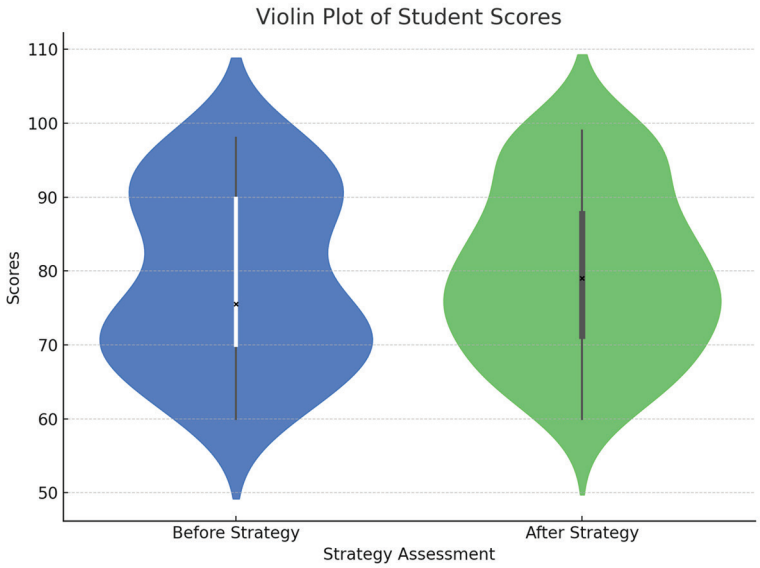

Figure 1 Violin plot depicting the distribution of student scores pre- and post-intervention

Table 3 Statistical analysis of scores before and after educational intervention

Intervention	Mean score	Standard deviation	t-statistic	p-value
Before strategy	78.92	11.83		
After strategy	79.84	11.23	-0.424	0.6732

Changes in student satisfaction in "Pharmacoeconomics" under a digital context: notable improvements and in-depth analysis

Under the digital backdrop, changes in student satisfaction in the "Pharmacoeconomics" course post-political-ideological teaching strategy implementation were investigated using Line Figure 2. Preliminary data indicated an average satisfaction score of 3.62 (S.D.: 0.07) pre-implementation. Post-intervention, this surged to 4.54 (S.D.: 0.09), denoting increased satisfaction with slightly elevated variability. The chart underscores marked satisfaction enhancements across "Theoretical Learning," "Practical Operations," and "Class Discussions," particularly the latter. This implies the strategy's efficacy in boosting student engagement and experience, especially in interactive segments. However, the augmented satisfaction variability post-strategy suggests varied student receptions. While some experienced profound improvements, others felt lesser impacts. These observations offer insights into strategy outcomes to guide future pedagogical refinements. Future endeavors will discern which strategies excel and which necessitate enhancements.

Analysis: Correlation of Student Scores and Satisfaction Pre- and Post-Digital Strategy in "Pharmacoeconomics"

Figure 3 portrays a scatter plot contrasting student performance scores against satisfaction levels before and after educational intervention. Initial data, represented by blue circles, displayed a negligible trend, indicating a feeble correlation between scores and satisfaction. Conversely, post-intervention observations, illustrated by green squares, delineated a steeper positive trend, implying a fortified link between scoring and satisfaction increments. Figure 4's regression analyses further elucidated this shift; pre-intervention data yield a near-zero coefficient (β=0.000169) with a baseline intercept of 3.972, reflective of only a slight satisfaction uptick as scores increased. Post-intervention delivered a significant coefficient surge to 0.0243 with a lowered intercept at 2.088, confirming the intervention's effectiveness in amplifying the correlation between academic achievements and satisfaction levels. This also highlights the benefits of integrating ideological and political elements into the course structure. This accentuates the capacity of thoughtful educational strategies to enhance

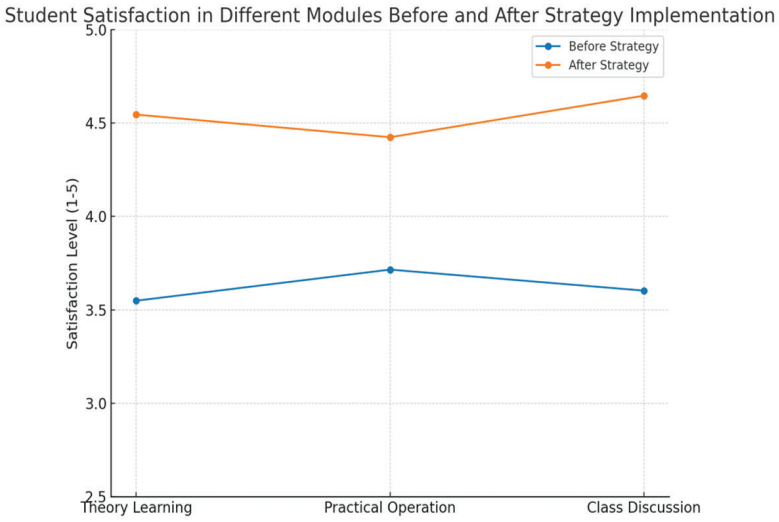

Figure 2 Score distribution before and after educational intervention

student outcomes by weaving substantial ideological content into the fabric of technical disciplines, with the observed satisfaction surge alongside improved scores underscoring the value of encompassing both intellectual and ideological educational facets.

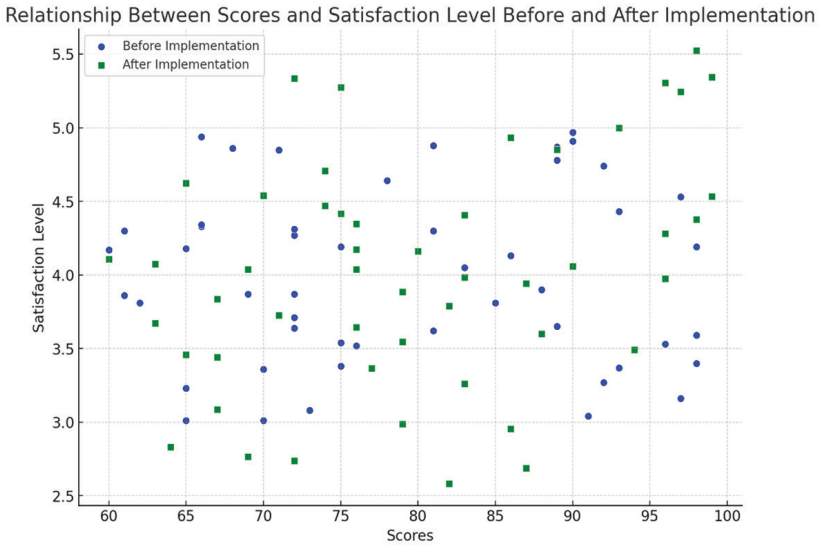

Figure 3 Relationship between scores and satisfaction levels before and after educational intervention

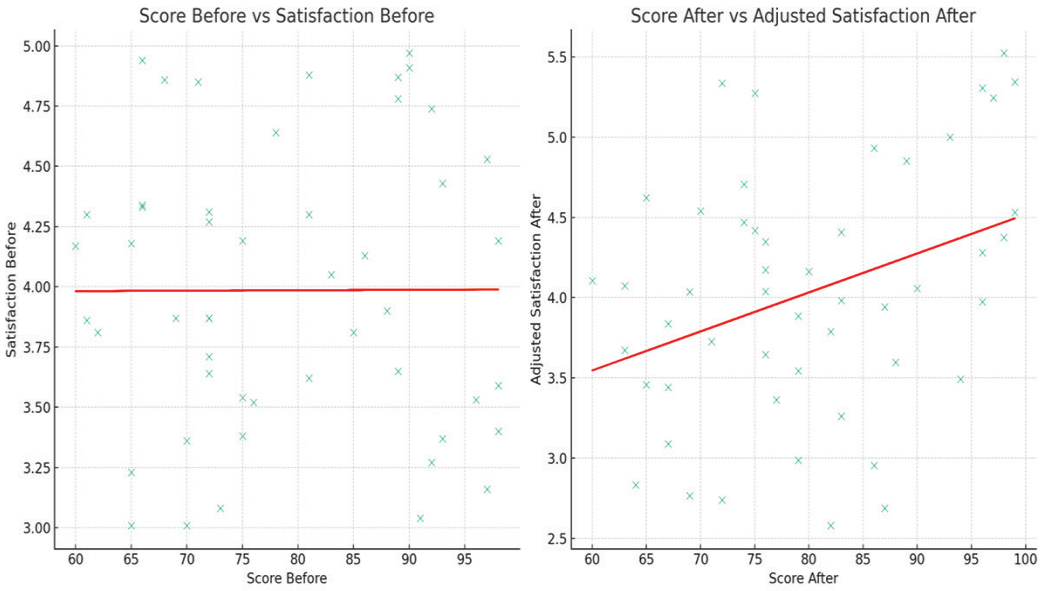

Figure 4 Regression analysis of scores and satisfaction levels before and after educational intervention

Student self-assessment: evaluating skill enhancements in "Pharmacoeconomics" post digital-pedagogical strategy implementation

This study incorporated a self-assessment survey for students, evaluating their skills in both pre and post digital teaching strategy's implementation. Figure 5 illustrates their self-rated improvements across various criteria: theoretical knowledge grasp, practical operational skills, critical thinking, and team collaboration. Post-strategy, theoretical scores rose from 3.49 to 4.09, suggesting enhanced conceptual understanding. Practical skills saw a notable rise from 3.45 to 4.08, possibly reflecting the enriched hands-on and case study components. Critical thinking exhibited a modest increase from 3.53 to 4.09, indicating some progression. Teamwork ratings jumped from 3.47 to 3.91, possibly due to added team-based projects. Moreover, trend lines are incorporated to demonstrate the upward trajectory in each skill category following the course intervention. Statistical analysis confirms that the observed improvements are significant, underscoring the efficacy of the educational program in fostering essential academic and practical skills (Table 4).

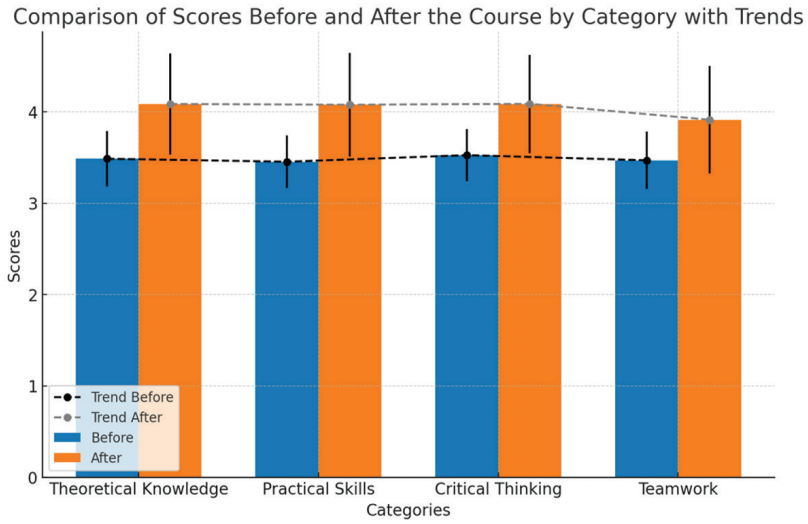

Figure 5 Comparison of student scores in theoretical knowledge, practical skills, critical thinking, and teamwork before and after participation in the educational course

Table 4 Statistical analysis of pre- and post-educational program performance across different skills

Category	Mean before	Mean after	Change	t-statistic	p-value
Theoretical Knowledge	3.49	4.09	+0.60	−6.53	<0.001
Practical Skills	3.45	4.08	+0.62	−6.30	<0.001
Critical Thinking	3.53	4.09	+0.56	−6.42	<0.001
Teamwork	3.47	3.91	+0.44	−4.56	<0.001

1.2 Challenges in implementation

Despite observed improvements, several challenges emerged during the implementation of the new educational strategy in our "Pharmacoeconomics" course. A significant hurdle was balancing theoretical knowledge with practical application to ensure organic integration without sacrificing depth. Maintaining student engagement in blended learning environments and preventing drop-offs in online participation proved challenging. Additionally, accurately assessing learning outcomes, especially in online formats, required careful reconsideration and adaptation of our assessment methods[14].

1.3 Improvement strategies and recommendations

To address these implementation challenges, we recommend refining our curriculum design to strengthen the connection between theory and practice, possibly by incorporating more real-world case studies into the coursework. Enhancing management and guidance within online teaching environments through proactive online discussions, assignments, and tests can improve student engagement. Utilizing digital tools; like online quizzes and automated feedback systems, can help increase the accuracy and efficiency of assessments. Furthermore, recognizing the diversity of student needs, differentiated guidance and support should be provided to facilitate the effective implementation of these strategies; thus, promoting holistic student development. These strategies and recommendations are based on our reflections on observed outcomes and challenges in teaching "Pharmacoeconomics" in a digital era. Going forward, we will continue to refine and iterate these methods to achieve superior instruction that integrates political-ideological components effectively[15,16].

CONCLUSION

Key findings

This study assessed the innovative instructional design and post-implementation reflections of the "Pharmacoeconomics" course within a digital framework. Through comprehensive evaluations of students' performance, satisfaction, and self-assessments; both before and after the implementation of the new teaching strategy, several key findings were identified. Notably, there was a significant increase in students' academic performance and satisfaction following the strategy's implementation. A pronounced positive correlation was also observed between students' grades and their satisfaction post-implementation. Furthermore, improvements were particularly evident in self-assessments of "practical operational ability," among other dimensions[17].

Limitations

While the findings are promising, they come with certain limitations. The reliance on self-reported data from students might introduce subjective biases into the results. Additionally, the study's intervention-based approach, lacking a randomized control group, requires further empirical validation to conclusively attribute improvements to the new strategy alone. The representativeness of the sample and the sample size itself also warrant further consideration.

Recommendations for future research and practice

Future research should seek to validate these findings across various academic disciplines, educational levels, and types of institutions. On a practical level, educators are encouraged to utilize digital tools and blended learning approaches that emphasize the development of students' practical and critical thinking skills. Despite the positive outcomes observed, challenges; such as student adaptability and varying quality of online resources, were encountered. Educators should, therefore, be prepared to address potential issues when developing and implementing innovative instructional strategies to ensure their effective execution[18].

Ethics statement

This study was conducted in accordance with the ethical standards set forth by the Kunming Medical University Institutional Review Board (IRB) and the 1964

Helsinki Declaration. All participants provided informed consent, and their data confidentiality was strictly maintained.

Author contributions

Zaixian Yang and Ruo Lin spearheaded the initial drafting and theoretical framework, while Jia Li and Siqi Yin were pivotal in the analysis and interpretation of the empirical data. Ji Li, Jian Yang, provided critical oversight in manuscript review and project supervision, ensuring the study adhered to high academic standards. All authors have thoroughly reviewed and approved the final manuscript for publication.

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CONFLICT OF INTEREST

The authors declare that they have no potential conflicts of interest relevant to this study.

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