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Educational Strategies in Curriculum Development: The Spices Model

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ABSTRACT

Background: Developing effective medical education curricula requires well-structured and evidence-based strategies to ensure learners gain the necessary competencies. The SPICES model (Student-centered, Problem-based, Integrated, Community-based, Electives, Systematic) has been recognized as a robust framework for curriculum development in medical and health professions education. This study aims to evaluate the application of the SPICES model in the curriculum development process and its impact on student learning outcomes.

Methodology: A cross-sectional descriptive study was conducted at Khyber Medical University Peshawar, employing the SPICES model in curriculum design. A sample size of 300 students and 50 faculty members was selected through purposive sampling. Data was collected through structured questionnaires and interviews to assess perceptions of the SPICES model's effectiveness. Statistical analyses, including chi-square and t-tests, were used to compare outcomes and perceptions between traditional and SPICES-based curricula.

Results: The results demonstrated a significant improvement in student-centered learning, problem-solving abilities, and community-based experiences in institutions adopting the SPICES model. Integration of subjects and elective options was also positively received. The statistical analysis revealed a marked difference in student satisfaction and learning outcomes between SPICES-based curricula and traditional models ($p < 0.05$).

Conclusion: The SPICES model presents a comprehensive and effective approach to curriculum development, fostering improved student engagement, critical thinking, and integration of community-based experiences. Further studies could explore longitudinal outcomes and adaptations across different educational settings.

Keywords: medical education, curriculum development, medical and health professions education.

Introduction

Curriculum development in medical education is a dynamic process that seeks to adapt to the evolving demands of healthcare delivery¹. As healthcare systems become more complex, there is an increasing need for educational frameworks that promote comprehensive learning while emphasizing student engagement and real-world application^{2 3}. The SPICES model, first proposed by Harden et al. in 1984, has gained attention as a student-centered and flexible approach to curriculum development⁴. The model stands on six pillars: Student-centered learning, Problem-based learning, Integrated teaching, Community-based education, Electives, and Systematic approach⁵.

In contrast to traditional curricula, which are often teacher-centered and subject-based, the SPICES model offers an innovative approach that shifts the focus towards active learning and real-world application⁶. The model encourages institutions to adopt a holistic educational

strategy that integrates theoretical knowledge with practical skills, fosters collaborative learning, and addresses the needs of diverse student populations^{7,8}.

Internationally, implementing the SPICES model has enhanced learner motivation, improved problem-solving abilities, and fostered a deeper understanding of medical sciences⁹. Studies from various regions, including the United States, Europe, and Asia, have shown that institutions adopting the SPICES model have experienced increased student satisfaction and improved learning outcomes^{10,11}. Furthermore, the integration of community-based education has been particularly beneficial in preparing students for the complexities of real-world healthcare¹².

In recent years, educational institutions in Pakistan have also begun to explore the application of the SPICES model in curriculum development¹³. The need for reform in medical education has been driven by changing healthcare demands, with an emphasis on producing graduates who are not only clinically competent but also socially accountable and equipped to address community health needs¹⁴.

This study aims to evaluate the application of the SPICES model in medical education curricula across various institutions in Pakistan. By examining the perceptions of students and faculty members, this research seeks to determine whether the SPICES model contributes to better learning outcomes, improved student engagement, and a greater focus on community-based education. The results of this study may provide insights into the effectiveness of the SPICES model and offer guidance for institutions looking to adopt similar educational strategies.

Methodology

This was a cross-sectional descriptive study conducted to assess the effectiveness of the SPICES model in curriculum development. The study was conducted at Khyber Medical University Peshawar, that has integrated the SPICES model into its curriculum framework. The study employed a mixed-methods approach, combining quantitative surveys and qualitative interviews. Structured questionnaires were distributed to both students and faculty to evaluate their perceptions of the SPICES model. In-depth interviews were conducted with faculty members to gain insights into the challenges and successes of its implementation.

Inclusion Criteria: Medical students enrolled in institution that have implemented the SPICES model and faculty members involved in curriculum development. **Exclusion Criteria:** Students and faculty members from institutions using traditional curriculum models.

A sample size of 350 participants (300 students and 50 faculty members) was determined using a confidence level of 95% and a margin of error of 5%. Purposive sampling was employed to select participants from institutions that have fully adopted the SPICES model in their curricula.

Data was collected using structured questionnaires focusing on key components of the SPICES model: student-centered learning, problem-based learning, subject integration, community-based education, electives, and systematic teaching. Additional data was gathered through interviews with faculty members involved in curriculum planning. The quantitative data was collected over a period of 3 months, while interviews were conducted using a semi-structured format to allow for in-depth exploration of key themes.

Quantitative data was analyzed using SPSS version 25.0. Descriptive statistics were calculated, and chi-square tests were used to assess associations between curriculum type (SPICES vs. traditional) and student satisfaction. Independent t-tests were conducted to compare student performance outcomes between the two models. A p-value of less than 0.05 was considered statistically significant.

Result

The demographic characteristics of the participants show that both the SPICES-based and traditional curriculum groups had similar age distributions, with no statistically significant difference ($p = 0.12$). Additionally, the gender distribution between the two groups was comparable ($p = 0.23$). This indicates that the demographic variables were well-matched, reducing potential bias related to age or gender in the outcome measures. The similarity in demographics ensures that differences in outcomes are more likely attributed to the curriculum model rather than to participant characteristics.

Table 1: Demographic Characteristics of Participants

Characteristics	SPICES Model (%)	Traditional Model (%)	P-value
Age (mean)	22.4 ± 1.8	21.9 ± 1.7	0.12
Gender (Male/Female)	45/55	40/60	0.23

Table 2 The results demonstrate that students in the SPICES-based curriculum reported significantly higher satisfaction scores across various dimensions of the curriculum. For example, student-centered learning had a mean score of 4.5 in the SPICES group, compared to 3.2 in the traditional curriculum group ($p = 0.001$), indicating a significant improvement in student engagement and autonomy.

Additionally, problem-solving skills showed a notable increase in the SPICES model (mean = 4.7) compared to the traditional model (mean = 3.5), with a p -value of 0.003. This suggests that the problem-based approach embedded within the SPICES framework fosters better critical thinking and problem-solving abilities. Integration of subjects was also rated significantly higher in the SPICES model ($p = 0.004$), reflecting how the integrated nature of this curriculum helps students connect theoretical knowledge with clinical practice.

Table 2: Comparison of Student Satisfaction Scores

Curriculum Aspect	SPICES Model (Mean)	Traditional Model (Mean)	P-value
Student-centered learning	4.5 ± 0.3	3.2 ± 0.4	0.001
Problem-solving skills	4.7 ± 0.2	3.5 ± 0.3	0.003
Integration of subjects	4.6 ± 0.4	3.3 ± 0.5	0.004

Table 3 Performance outcomes between the SPICES and traditional curriculum groups further support the effectiveness of the SPICES model. In the problem-solving test, students in the SPICES curriculum scored an average of 85.3, compared to 78.6 in the traditional curriculum, with a statistically significant difference ($p = 0.002$). This reinforces the notion that the problem-based component of the SPICES model improves students' ability to analyze and solve complex issues.

Similarly, performance in clinical skills assessments was significantly higher in the SPICES group (mean = 88.4) compared to the traditional group (mean = 81.2), with a p -value of 0.005. The enhanced performance in clinical skills is likely due to the hands-on, community-based, and integrated teaching approach within the SPICES model, which exposes students to real-world scenarios earlier and more frequently in their education.

These findings suggest that the SPICES model is not only beneficial for theoretical knowledge but also equips students with practical, clinical skills, making them more prepared for real-world medical practice.

Table 3: Student Performance Outcomes (Test Scores)

Assessment Type	SPICES Model (Mean)	Traditional Model (Mean)	P-value
Problem-solving test	85.3 ± 5.2	78.6 ± 6.4	0.002
Clinical skills assessment	88.4 ± 4.3	81.2 ± 5.1	0.005

Table 4 Faculty members rated the integration of theory and practice higher in the SPICES model (mean = 4.8) compared to the traditional curriculum (mean = 3.6), with a p-value of 0.001, demonstrating a significant difference in favor of the SPICES model. Faculty also believed that the engagement with community health was significantly better in the SPICES curriculum (mean = 4.7), compared to the traditional approach (mean = 3.5), with a p-value of 0.002.

These ratings indicate that faculty members perceive the SPICES model as more effective in bridging the gap between theoretical knowledge and clinical application, as well as enhancing students' involvement in community-based healthcare experiences.

Table 4: Faculty Perception of Curriculum Effectiveness

Curriculum Aspect	SPICES Model (Mean)	Traditional Model (Mean)	P-value
Integration of theory and practice	4.8 ± 0.3	3.6 ± 0.4	0.001
Engagement with community health	4.7 ± 0.2	3.5 ± 0.3	0.002

The results consistently show that the SPICES model outperforms traditional curricula across key educational parameters. Students expressed greater satisfaction with the SPICES curriculum, particularly regarding student-centered learning, problem-solving skills, and integrated teaching. These improvements were reflected in their performance, with SPICES students scoring significantly higher in problem-solving tests and clinical assessments.

Faculty members also viewed the SPICES model favorably, highlighting its effectiveness in integrating theory and practice and preparing students for real-world healthcare through community-based education. These results validate the effectiveness of the SPICES model as an educational strategy for enhancing both student learning experiences and outcomes.

The statistical significance ($p < 0.05$) across multiple measures—student satisfaction, problem-solving skills, and performance outcomes—suggests that the SPICES model has a meaningful and positive impact on medical education.

Discussion

The results of this study demonstrate that the SPICES model significantly enhances student engagement, problem-solving skills, and integration of community-based education compared to traditional curricula. These findings align with prior research, such as a study conducted by Razak et al 2022, which reported improved critical thinking and problem-solving abilities among students exposed to problem-based learning (PBL) environments¹⁵.

In agreement with our study, Stafford et al. in 2023 also emphasized that student-centered approaches foster deeper learning and increased motivation¹⁶. The integration of electives in the

SPICES model allows students to pursue individualized learning paths, contributing to greater satisfaction. This was corroborated by a similar study conducted in Canada, where the implementation of electives was associated with higher levels of student autonomy and engagement¹⁷.

However, some challenges were noted in the implementation of the SPICES model, particularly regarding the integration of community-based learning in resource-limited settings. A study conducted in low-resource countries indicated logistical challenges in ensuring effective community-based education, which may limit its overall impact¹⁸. Despite these challenges, our study found that students valued community-based experiences and believed it prepared them for real-world healthcare delivery.

Contrary to the overwhelmingly positive feedback regarding the SPICES model, some studies have raised concerns about the feasibility of problem-based learning in larger class sizes¹⁹. Research from Australia, for example, noted that scaling PBL to larger cohorts may dilute the effectiveness of the model, requiring additional faculty training and resources²⁰. Despite these concerns, the faculty in our study expressed strong support for the systematic and integrated approach of the SPICES model.

Conclusion

The SPICES model offers a robust framework for curriculum development, emphasizing student-centered learning, problem-based approaches, and community integration. The findings of this study suggest that the SPICES model leads to improved student satisfaction and learning outcomes. Despite some challenges in implementation, particularly in resource-limited settings, the model remains a valuable tool for medical education reform. Further research is needed to explore the long-term impact of the SPICES model and its adaptability across various educational contexts.

References

1. Vreuls J, Koeslag-Kreunen M, van der Klink M, et al. Responsive curriculum development for professional education: Different teams, different tales. *The Curriculum Journal* 2022;33(4):636-59.
2. Wang Y, Ji Y. How do they learn: types and characteristics of medical and healthcare student engagement in a simulation-based learning environment. *BMC medical education* 2021;21:1-13.
3. Gonzalo JD, Davis C, Thompson BM, et al. Unpacking medical students' mixed engagement in health systems science education. *Teaching and Learning in Medicine* 2020;32(3):250-58.
4. Rizk MH, Nasser AA, Ra'oof RA, et al. Implementation and evaluation of a faculty development program; an essential step for curricular change. *Journal of Ecophysiology and Occupational Health* 2022;22(2):22-28.
5. Park DE. *Learning Beyond the Classroom: Community Partnerships for Project-based Learning*: University of California, Los Angeles 2023.
6. Sigdel B. ENGLISH TEACHERS' PERCEPTIONS OF AND EXPERIENCES IN INTEGRATED CURRICULUM: AN INTERPRETATIVE PHENOMENOLOGICAL ANALYSIS, 2023.
7. Wright C, Ritter LJ, Wisse Gonzales C. Cultivating a collaborative culture for ensuring sustainable development goals in higher education: An integrative case study. *Sustainability* 2022;14(3):1273.
8. Scharoun L, Meth D, Crowther P, et al. *Contemporary Design Education in Australia: Creating Transdisciplinary Futures*: Intellect Books 2023.

9. Tienthavorn T. An Exploration of Simulation Based Medical Education (SBME) Innovation Through the COVID-19 Pandemic: A Comparative Case Study of Two Medical Schools (Scotland and Thailand). University of Dundee, 2023.
10. Gulati C, Thakur A, Sancheti S. A STUDENT'S PERSPECTIVE ON BLENDED LEARNING: TOWARDS A RESILIENT EDUCATION. *Fostering Resilient Business Ecosystems and Economic Growth: Towards the Next Normal* 2022:546.
11. Lonergan R. Problem-Based Learning: Does it have a place in diverse middle-school science classrooms? UNSW Sydney, 2018.
12. Haruta J, Yamamoto Y. Realist approach to evaluating an interprofessional education program for medical students in clinical practice at a community hospital. *Medical teacher* 2020;42(1):101-10.
13. Bakhshi SK, Afzal N, Merchant AAH, et al. Undergraduate Medical Education Curriculum reforms in Pakistan: a mixed methods study of Academic Leadership perspectives. *Academic Medicine* 2023;10.1097.
14. Kaufman A, Scott M, Andazola J, et al. Social accountability and graduate medical education. *Family Medicine* 2021;53(7):632-37.
15. Razak AA, Ramdan MR, Mahjom N, et al. Improving critical thinking skills in teaching through problem-based learning for students: A scoping review. *International Journal of Learning, Teaching and Educational Research* 2022;21(2):342-62.
16. Stafford DC. Teacher Perspectives and Experiences Implementing Student-Centered Learning. Southern New Hampshire University, 2023.
17. Arora R, Kazemi G, Hsu T, et al. Implementing changes to a residency program curriculum before competency-based medical education: a survey of Canadian medical oncology program directors. *Current Oncology* 2020;27(6):614-20.
18. Ezeonwu M. Community-based education in global low-resource settings: A unique interprofessional collaborative experience in primary care delivery. *Pedagogy in Health Promotion* 2020;6(1):56-62.
19. Bijsmans P, Versluis E. Problem-based learning and the relevance of teaching and learning European Studies in times of crises. *European Political Science* 2020;19:668-86.
20. Deehan J. Online education practices and teaching team compositions in Australian preservice primary science education. *Australian Journal of Teacher Education (Online)* 2021;46(6):78-97.