

Instant Diagnostic Technology in Resource-Scarce Areas from the Perspective of Medical Education

Qianqian Zhang*

Graduate School of Education, Peking University, China

***Corresponding author:** Qianqian Zhang, Graduate School of Education, Peking University, Beijing 100871, China

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ABSTRACT

The application of prompt diagnosis technology (POC) in resource-poor areas faces the dual challenges of technology and human capital. From the perspective of economics of medical education, this paper analyzes the disconnection between industry and education in the promotion of POC technology and proposes that deepening the reform of medical-education synergy through school-enterprise co-establishment of industrial colleges and clinically oriented curriculum development can enhance the penetration rate of the technology. The practice of Chinese vocational colleges and universities shows that “dual-teacher” faculty construction, such as the rotation system of clinical teachers in Suihua University of Health Sciences, and job-embedded training, such as the “base teaching class” in Three Gorges Medical College, can effectively shorten the cycle of technology application.

Introduction

Global health inequality presents new features in the development of POC technology, and the gap between the rate of technological innovation and the ability of primary care personnel to apply the technology continues to widen. 2023 WHO reports that only 28% of

health stations in low-income areas are able to standardize the use of new diagnostic equipment, and that the core bottleneck is not only the shortage of hardware, but also stems from the lack of synergy between the medical education system and the industry’s technological iteration (Table 1).

Table 1: Pathways of support for POC technology implementation in China’s medical school industry-teaching integration model.

Model Type	Typical Case	POC Technology Adaptation Scenario	Effect on Human Capital Improvement
Integration of Affiliated Hospitals of Colleges	Suihua Health School Medical-Education Integration Center	Standardized training for equipment operation	The passing rate of students’ clinical operations increased by 40%
Co-construction of Industry Colleges	Yiyang Medical College Intelligent Pharmaceutical Consortium	Virtual training on drug testing equipment	Enterprise technical training costs reduced by 65%
Targeted Training for Rural Revitalization	Rural Doctor Program of Chongqing Three Gorges Medical College	Support for home follow-up with portable equipment	The passing rate of licensed assistant physicians increased by 10%
Overseas Technology Promotion	Shennong College of Weifang Nursing Vocational College	Cross-border adaptive transformation of TCM diagnostic equipment	500 person-times of technical certification in Central Asia

Integration of Technological Potential and Medical Education

The promotion of tools such as CRISPR-SHERLOCK at the grass-roots level is limited by the complexity of operation, whereas Suifang Nursing School, through the clinical apprenticeship point system and students’ 1-week affiliated hospital rotation per semester, enables imaging students to independently operate CT equipment prior to their internships, demonstrating that job-front training can break through the barriers of technological application. The cost of nanopore sequencing has been reduced to \$1,000 per sample, but the research of Weifang Nursing Vocational College shows that there is a positive correlation between the utilization rate of the equipment and the clinical experience of teachers. Through the integrated platform of “TCM department-hospital-research base”, the school has transformed the research results of the five movements and six qi into diagnostic

teaching modules, which has significantly increased the adoption rate of the technology.

Key Barriers in Education and Economic Dimension

The imbalance in the allocation of educational resources has exacerbated the technology gap. A survey of rural doctors in Chongqing shows that the idle rate of POC equipment reaches 57%, which is mainly due to the lack of continuing education. The university developed a “four-combination” model of government-university collaboration, online and offline, point-to-point coverage, and education and training articulation, and completed 12,000 trainings through catechism and resident mentorship, raising the utilization rate of the equipment to 89%. With regard to the integration of industry and education, although enterprise virtual situation training reduces training costs, fewer POC technology papers in the past five years have dealt with the evaluation of educational interventions (Table 2).

Table 2: Analysis of multidimensional barriers in the implementation of POC technology.

Barrier Dimension	Performance in Educational Economics	Typical Data
Human Capital	Lack of technical retraining system for primary medical staff	Only 32% of licensed physicians have received equipment training
Institutional Cost	The cycle for patent transformation in school-enterprise cooperation is as long as 18-24 months	Technology launch lags behind clinical needs by 2.3 years
Regional Differences	The ratio of vocational education resource input between eastern and western regions reaches 1:5.7	The equipment renewal rate of western colleges is 41% lower than that of eastern colleges

Medical Education Innovation Drives Technology Transformation

Promote dual-scenario immersion learning with VR simulation operation before class and guidance from enterprise mentors during class. The experience of the Three Gorges Medical College shows that this mode reduces the error rate of electrocardiograph operation by 65%. Developing technical gradient course packages, referring to the mind map of 234 courses of Suihua Health School, and designing POC training modules for nurses, village doctors and inspectors in a hierarchical manner to match the requirements for job skill certification. Establish cross-domain industry-teaching consortiums such as the Chengdu-Chongqing Medicine and Health Vocational Education Alliance and form a sustainable input mechanism through the sharing of equipment among institutions, enterprise donation quotas, and government subsidies to crack the resource fragmentation dilemma.

Conclusion

The realization of the universal value of POC technology needs to be premised on the reconstruction of the medical education ecosystem. The practice of Chinese vocational colleges and universities shows that the integration of the three chains of “education chain - technology chain - industry chain” can significantly reduce the cost of technology application through the model of “building production in the school and growing the school and production together” of Weifang Nursing Vocational College. Future research should focus on the quantitative relationship between vocational education investment and technology penetration rate and provide empirical support for resource optimization in economics.

Conflict of Interest Statement

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