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Reframing Traditional Biology Labs: a Lab-before-lecture Model to Prime Conceptual Understanding

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Abstract

Students in introductory undergraduate biology frequently struggle to translate static textbook representations of mitosis into dynamic cellular processes. To enhance conceptual understanding, we reversed the traditional lecture–laboratory sequence and incorporated a timed refresher activity. A quasi-experimental comparison was conducted between two Fall sections taught by the same instructor: a Fall 2024 section (n = 13) using a lecture-first approach and a Fall 2025 section (n = 12) implementing a "lab-leads-lecture" model in which students observed mitosis in onion root tip cells prior to formal instruction, followed by a retrieval-based refresher activity one week before the mitosis lecture. Performance on five identical multiple-choice exam items aligned to stage recognition and process sequencing increased from 66.1% to 81.7% following implementation. A post-lecture survey administered to the Fall 2025 section (N = 12; response rate 83.3%) indicated that 60–80% of students strongly agreed that the sequencing provided a useful visual foundation, reinforced stage identification, and made mitosis concepts more concrete. Together, these preliminary findings suggest that experiential priming combined with spaced retrieval practice may strengthen conceptual clarity, retention, and lecture readiness. This instructional sequencing model offers a practical and scalable framework for innovative pedagogy in STEM education and other laboratory-based disciplines.

Keywords: Experiential Learning; Innovative Pedagogy; Instructional Sequencing; Retrieval Practice; Stem Education