## Active drawing of genetics mechanisms as an undergraduate learning tool

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Many students navigate undergraduate biology courses through passive learning, relying on memorization techniques to study content. This may not be the most effective strategy for meaningful comprehension of multipart and unfamiliar or new concepts. Can instruction by engaging students in active drawing and diagramming be an effective learning strategy? This workshop on pedagogical design focuses on creating a learning environment for visual modelbased reasoning. Our strategy maximizes active drawing of the mechanisms of genetics and molecular biology during lecture and instructor-led collaborative drawing sessions. The goal is to increase student learning and success in undergraduate genetics coursework based on the fundamental concepts recommended by the Genetics Society of America. Topics are covered in three main sections - nature of genetic material and gene expression, transmission and genetic variation, and patterns of inheritance integrated with evolution and population genetics. Students are assigned pre-lecture concept questions with reading assignments and illustrative videos. In lecture, students are led in active stepwise drawing and discussion of concepts and misconceptions. Strategies include the reductionist point of view from theoretical and macroscopic down to molecular mechanisms. Concepts are related to modern research and human health and disease. Student learning is reinforced through weekly drawing and recitation group sessions led by lecture coordinators. Meaningful learning and level of comprehension is measured through concept inventory assessments and student feedback. Genetics concept-based hand drawings will serve as a learning tool for the genetics and molecular biology community after peer review and preparation for publishing. In this workshop, we share the semester week-by-week schedule with daily activities, concept questions and student-drawn as well as video illustrations. Importantly, workshop attendees are encouraged to participate in an active drawing session to demonstrate genetics concepts teaching strategy. We will share a questionnaire to get feedback on teaching strategy from attendees.

Keywords: drawing, diagrams, genetics

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