

FUTURE OF PHYSICS TEACHING PRACTICES: HOW NEW AND EMERGING EDUCATIONAL TECHNOLOGIES MEDIATE TEACHING AND LEARNING

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The fundamental elements of teaching include students, content, and medium. In addition to blackboard and chalk, lecture demonstrations of physical phenomena have long been the medium of teaching physics. Videos of physics demonstrations by the Physical Science Study Committee (PSSC) in the USA in the 50s were early adoption of contemporary technologies for physics instruction. While the medium of recordings of physics demonstrations has changed from magnetic tapes to CDs and DVDs and to virtual space online, its purposes are the same: making physics principles observable, engaging students, and providing evidence for knowledge claims (Berg, 2012; Káčovský & Snětinová, 2021). On the other side, for a century, laboratory activities have been a fixed feature of science education where students directly interact with physical phenomena. Given these two unique features, i.e., demonstrations and laboratories, recent digital technology seems to call for a paradigm shift. Lecture demonstrations, whether in magnetic tapes or digitalised mediums, are under the control of teachers in terms of what and when to show. Similarly, laboratory activities are predetermined for students to experience hands-on. Recent technologies allow more interactions between students and the medium of teaching and learning. Demonstrations of physical phenomena are freely available online, and students can watch what they want to, when they want to. Interactive simulations and physical computing have been utilised for quite a while where students perform laboratories different from each other, to answer their own questions in lieu of the traditional labs. Furthermore, interactive virtual reality, mixed reality, and metaverse are emerging mediums in trial and under research (Sonntag & Bodensiek, 2022). Underpinning the increase in interactions between students and mediums is the constructivist view of learning and the recent emphasis on student agency in learning. From such theories of learning, both demonstrations where students passively watch and listen, and cookbook-style laboratories, are ineffective and fail to help students be active problem solvers as required by the 21st century. Thus, recent technologies are very useful for changing the traditional approaches to teaching to make students active learners. This change is not only by the demand of the era but also by the demand of the students. Not only the medium, but also the students drastically changed. Dubbed Generation Z, the current students in schools and campuses are digital natives who are born into modern technology and familiar with global access to knowledge and tools to reproduce knowledge. Generation Z is used to spontaneously searching for information to make sense of things and create their own content to share with each other. Thus, teaching needs to be reconceptualised to ensure epistemic agency in helping students to be lifelong learners. In this talk, I will illustrate the changing scenes of science teaching and discuss the notion of epistemic agency and how it relates to teaching approaches.

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