

## Pedagogical Opportunities of Physics Education Technology Interactive Simulations for Secondary Science Education in Bangladesh

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**Abstract :** Science education in Bangladesh is losing its appeal at an alarming rate due to the lack of science laboratory equipment, excessive teacher-student ratio, and outdated teaching strategies. Research-based educational technologies aim to address some of the problems faced by teachers who have limited access to laboratory resources, like many Bangladeshi teachers. Physics Education Technology (PhET) research team has been developing science and mathematics interactive simulations to help students develop deeper conceptual understanding. Still, PhET simulations are rarely used in Bangladesh. The purpose of this study is to explore Bangladeshi teachers' challenges in learning to implement PhET-enhanced pedagogies and examine teachers' views on PhET's pedagogical opportunities in secondary science education. Since it is a new technology for Bangladesh, seven workshops on PhET were conducted in Dhaka city for 129 in-service and pre-service teachers in the winter of 2023 prior to data collection. This study followed an explanatory mixed method approach that included a pre-and post-workshop survey and five semi-structured interviews. Teachers participated in the workshops voluntarily and shared their experiences at the end. Teachers' challenges were also identified from workshop discussions and observations. The interviews took place three to four weeks after the workshop and shed light on teachers' experiences of using PhET in actual classroom settings. The results suggest that teachers had difficulty handling new technology; hence, they recommended preparing a booklet and Bengali YouTube videos on PhET to assist them in overcoming their struggles. Teachers also faced challenges in using any inquiry-based learning approach due to the content-loaded curriculum and exam-oriented education system, as well as limited experience with inquiry-based education. The short duration of classes makes it difficult for them to design PhET activities. Furthermore, considering limited access to computers and the internet in school, teachers think PhET simulations can bring positive changes if used in homework activities. Teachers also think they lack pedagogical skills and sound content knowledge to take full advantage of PhET. They highly appreciated the workshops and proposed that the government designs some teacher training modules on how to incorporate PhET simulations. Despite all the challenges, teachers believe PhET can enhance student learning, ensure student engagement and increase student interest in STEM Education. Considering the lack of science laboratory equipment, teachers recognized the potential of PhET as a supplement to hands-on activities for secondary science education in Bangladesh. They believed that if PhET develops more curriculum-relevant sims, it will bring revolutionary changes to how Bangladeshi students learn science. All the participating teachers in this study came from two organizations, and all the workshops took place in urban areas; therefore, the findings cannot be generalized to all secondary science teachers. A nationwide study is required to include teachers from diverse backgrounds. A further study can shed light on how building a professional learning community can lessen teachers' challenges in incorporating PhET-enhanced pedagogy in their teaching.

**Keywords :** educational technology, inquiry-based learning, PhET interactive simulations, PhET-enhanced pedagogies, science education, science laboratory equipment, teacher professional development

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