

Creating concept vignettes as a module supplement for active and authentic learning

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Teaching Quantum Mechanics can be a daunting task for instructors. Typical classroom lectures may not be sufficient at times for proper understanding of the fundamental concepts. Hence there is a need to incorporate an effective scheme in the present teaching curriculum to further the learning experience of the students thereby enhancing their understanding of complex and abstract concepts. As such developing short educational and instructional videos known as Concept Vignettes on selected topics can help to supplement the existing lesson materials in quantum mechanics (Garik et al, 2005; Kohnle et al, 2010). Concept Vignette videos have been created on various topics previously by MIT's Teaching and Learning Laboratory and are specially designed to enable students to learn a key concept in Science or Engineering (McKagan et al, 2008; Muller R et al, 2002) . My study will involve developing similar videos (in collaboration with MIT lecturers) with focus on the fundamentals of Quantum Mechanics.

Keywords: Concept vignettes, curriculum, active and interactive learning

Project objectives and deliverables

The main aim for this research is to provide the students with an online platform to overcome their conceptual difficulties related to the lectures in Quantum Mechanics. My research will be focused on devising an effective way by means of which students will be able to revisit certain core concepts post regular lectures. This pedagogical strategy will also ensure that students are able to gauge their understanding of the lesson materials by answering some fundamental questions that will be integrated in this user-friendly online platform.

Methodology

My research will involve developing Concept Vignettes on topics mentioned earlier. Designing of Concept Vignettes comprises of the following steps:

- a) Creating short videos whereby difficult concepts will be revisited using commercially available software
- b) Embedding these videos in Microsoft PowerPoint to create an interactive platform
- c) Online quiz will be developed to test students' understanding. After introducing a concept, a student needs to answer some questions related to the topic before moving on to a new one.
- d) An online student survey would be conducted in order to gauge how much it has benefitted them and should such strategies be adopted in the future. The survey would be mostly online supplemented by some student interviews.

Significance and impact of study

This is a pilot project that would help students enrolled in General Chemistry course. It is meant to address the key areas of student difficulty and is expected to remove some of their common misconceptions. The core and the fundamental concepts will be presented through a user-friendly video to reinforce the confidence of the students. Students are expected to watch the video prior to answering the embedded quiz. This pedagogical strategy will not only benefit the students, but will also facilitate the instructors to attain the pre-identified learning objectives of the module and therefore, enhance student learning outcomes. Such videos can be used by educators, students or anyone with an interest in Science.

Creating Concept Vignettes as a supplement to teach Quantum Mechanics

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Motivation

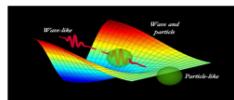
- Quantum mechanics is one of the topics that students have difficulty in understanding.
- Students find the concepts very abstract since most of the phenomena that is studied cannot be observed directly, as reflected in the following feedback received during ILP2 Chemistry 2015.

"Suggest to give more explanation to the experiments related to physics knowledge"- Student

- Classroom lectures may not be sufficient for proper understanding of the fundamental concepts as reflected in the following comment:
"If possible, the team could provide more addition study resources to help us actively do some extra learning"

- Developing short videos known as **Concept Vignettes** on selected topics can help to supplement the existing lesson materials on Quantum Mechanics

<http://makersade.com/2/7/forums-cartoon-thinking-face/>
<https://www.cartoonists.com/galleries/physics>

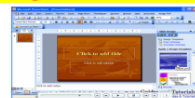


Using Technology as a tool to supplement Classroom Instructions

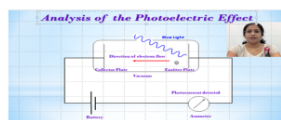
Record short videos using iPad



Integrate with PowerPoint



Create an interactive platform and upload the video on a portal accessible by students



References:
B. Muller and H. Wiesner, "Teaching quantum mechanics on an introductory level," *American Journal of Physics*, 70, 200, (2002).
A. Kohnle et al., "Developing and evaluating animations for teaching quantum mechanics concepts," *Eur. J. Phys.* 31, 1441, (2010).

- The core and the fundamental concepts will be presented through a user-friendly video to reinforce the confidence of the students.
- Students' will also get the opportunity to test their understanding of concepts on their own by answering a series of questions that would follow after watching the video.



References

- Garik P et al. (2005). Modernizing General Chemistry for the Year 2050: Why Are General Chemistry Instructors Hesitant to Teach Quantum Concepts?, *Presented at NARST, Dallas, TX*.
- Kohnle A. et al. (2010). Developing and evaluating animations for teaching quantum mechanics concepts, *Eur. J. Phys.* 31, 1441. <https://doi.org/10.1088/0143-0807/31/6/010>
- McKagan SB et al. (2008). Developing and Researching PhET simulations for Teaching Quantum Mechanics, *Am J of Phys*, 76, 408.
- Muller R & Wiesner H. (2002). Teaching quantum mechanics on an introductory level, *American Journal of Physics*, 70, 200, (2002). <https://doi.org/10.1119/1.1435346>

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<https://doi.org/10.14742/apubs.2015.1010>

Note: All published papers are refereed, having undergone a double-blind peer-review process.



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