Science Utsav 2021

Proceedings of Online One Day Teachers' Conference on

Developing Online Interactive Environment for Science Teaching and Learning

Saturday 6th February, 2021

Online Zoom Meeting

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Augmenting Science Education Resources Of Vigyan Pratibha Through Videos

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Introduction

The Vigyan Pratibha program being conducted under the academic leadership of the Homi Bhabha Centre for Science Education (HBCSE) works at the school level to nurture the enquiry-based method of learning science in interested students. “Videos” discussed in this paper were thought to be an important addition to the existing educational resources of Vigyan Pratibha. This paper summarizes the pedagogical and practical considerations in the efforts to create videos as a supporting educational material. Though this effort assumes more importance in the light of the current Covid-19 pandemic-induced online learning, its scope and utility are much beyond it.

The Vigyan Pratibha program[1] aims to strengthen school science education in India. This is mainly achieved by designing and generating documents called ‘Learning Units’ based on topics related to school curriculum. The learning units present these topics in a different perspective, linking them with observations and phenomena in daily life. These are discussed in the form of multiple short sessions with school students and school teachers (separately), using a constructivist approach[2] - a lot of opportunities are provided for students/teachers to collect and analyse data meaningfully as opposed to the more common lecture format with limited such opportunities. To further strengthen the learning unit modules, creation of video resources was undertaken. These short videos, called ‘support videos’, were meant to be useful for both students and teachers. Making the science videos pedagogically sound, within a limited time frame (about five minutes) was found to be a challenging and non-trivial task. This is a work in progress - videos in various science topics are currently being worked upon, with some near the finishing stage, before being made public.

The making of a science video

There are many steps involved in the planning and creation of support videos. They are highlighted below.

1. Selection of topic: The topics which were based on actual experimentation were chosen as the initial candidates for video creation. Some examples are ‘Parallax’, ‘Pinhole camera’, ‘Components of wood ash’, ‘An experiment in measuring volumes’, ‘Bringing back shine to copper’.

2. Content planning: Plans of the videos were chalked out considering the content in the learning units. Additional dimensions were also planned, so that the learning unit and the video were not repetitions but could complement each other productively.

3. Video shooting of experimental sections: Much of science at school level is experimental in nature, requiring students to associate with the content by performing experiments. In many cases, visualisation of the actual experimental set up is key to complete understanding. Creating an analogous model of the experiment is also important, especially for topics in physics. Hence, detailed experimental demonstrations were an important part of support videos.

To cater to the online mode of teaching and learning, appropriate modifications were thought out in the experiments using materials available at home. Pilot experiments were performed to make sure the modifications were robust. It was hoped that teachers and students would find such 'adapted' experiments easy to perform by themselves even at home. Additionally, these modifications enriched the existing learning unit and would be worth retaining in future physical classroom/laboratory sessions of the learning units. Common problems and challenges encountered in creating the experimental set up were also included along with simple tricks to resolve them. The experimental details were video shot either at HBCSE laboratories or at homes of team members.

4. Script and visuals generation: A detailed written script for the support video was generated. The language was simple but scientific. Words were chosen carefully with minimum jargon, so as to match the learning stage of the students (for example: a video meant to be discussed with grade 8 students did not contain terms/concepts which are introduced to them only in grade 10). Relevant schematics were created to explain certain phenomena. Appropriate images and animations helped bring a good balance of visual and audio communication. The entire script went through multiple revisions to accommodate comments from team members.

5. Pedagogical aspects: One of the main distinguishing features of the support videos was that these were to be unlike most videos available online. Instead of being just information-rich, these were planned to be pedagogy-rich. Thus, especially the teachers could have meaningful take-aways from these videos. Daily-life examples or experiences were included so that the viewer could identify with the scientific phenomena being discussed. For example, scenes of wood ash accumulation as seen in village ''chulhas' (traditional cooking stoves), or images of tarnished copper vessels in kitchens were used for the support videos for 'Components of wood ash' and 'Bringing back shine to copper', respectively.

The videos contained some facts and demonstrations leading into each other by way of questions. The questions were not rote-learning based, but analytical. For example: questions commonly began with "Do you think that....?", "What may happen if ...?", "Have you observed ...?" Sometimes, the questions had more than one answer depending on the thought process chosen by the viewer, but they were never open-ended. This was especially true for some chemistry-based videos. Direct answers were not given at all, but appropriate cues and clues were provided at every stage so as to trigger the thinking process of the viewers. Even the experimental demonstrations were made such that the final result or effect was not shown, to ensure that the viewers would be

curious about the outcome and try the experiment themselves. The viewers were also encouraged to change certain variables in their experimental set up and observe the effects, especially in optics related topics in physics (e.g., 'Pinhole camera'). Thus, the entire effort was to make the videos an exercise in self-discovery, where the viewers would only get appropriate prompts and directions to 'discover' the concept by themselves.

The videos can also be looked upon as opportunities for teachers to create 'flipped classrooms'3, wherein the students by themselves, get acquainted with the topic at their homes, before it is discussed in class. The 'flipped' approach is relatively new and uncommon in India. The videos therefore, can encourage teachers to attempt it, at least occasionally.

6. Voice over and assembly: The voice over was done in English, ensuring clarity and correct tone. Appropriate pauses were included so as to give the viewers a real-like experience online. All the video and audio parts were assembled together in a systematic fashion using video editing software. The videos do not follow any set pattern, each has its own flavour and dimensions, depending on the topic.

7. Vetting: The ready videos are planned to be vetted by external experts before they are made available on the Vigyan Pratibha website.

Conclusion and Way Forward

The generation of support videos is an attempt to explore the audio-visual medium to nurture the critical thinking approach among school students and teachers. The videos help build interest in the topic, familiarise the viewers with the contents of the corresponding learning unit and also encourage them to read the detailed learning unit. It is hoped that the teachers will be able to give their students a complete 'experience' of the topic by making use of the support video, the learning unit and their own facilitation methods. This effort has been a learning experience for the Vigyan Pratibha team too and feedback from the end users will be important in shaping future videos.

The videos shall be made available in the very near future. Though currently in English, there is a potential for these to be dubbed in various regional languages for better reach throughout India.

Acknowledgements

The authors acknowledge Pankaj Tadakhe and AmisH Parmar for their contribution in the design and creation of many of the physics and chemistry videos and discussing the nitty- gritty of the video creation process throughout this work. Thanks to Ankush Gupta for relevant and timely feedback and suggestions. The entire Vigyan Pratibha team is thanked for their suggestions and contributions in shaping the support videos.

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