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# Demonstration kits for locating an image formed by a concave mirror

To improve student understanding about an image formed by a concave mirror, 2 demonstration kits were developed. One kit is used to view images formed, and show how to locate and find the image distances and sizes. The other uses a laser beam to show the incident and reflected light rays and relate to the ray diagram normally used to find the image location. The demonstration kits were applied to 58 year-11 Thai high-school students and the teaching process was designed to be usable for both online (N = 34) and on-site (N = 24) classes. The 4 diagnostic questions were used in the investigation of student understanding both before and after instruction. The questions cover the image visualization, the mirror equation, and the ray diagrams of a concave mirror. The overall mean scores (N = 58) of the pre- and post-test are 1.3 and 5.3 out of 13, respectively, and the normalized gain is 0.34, which is at the medium level. Interestingly, the normalized gains of the two classes are not significantly different indicating that the demonstration kits can be applied to either an online or on-site class. The best improvement was found in the first question (post mean score = 55%) which is about the image visualization. Seeing an image by themselves using the demonstration kit, accompanied with the teaching process, helps students to have a better understanding of visualization. On the other hand, the lowest improvement was shown in the second question (post mean score = 19%) which indicates that the students are still unable to apply the mirror equation. This might be because that the teaching process does not encourage them to do calculations. Apart from these results, the demonstration kits make the physics content enjoyable. The students found it exciting and fun while much is being learned.

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