

GIFTS - A Hands-on Activity for Improving the Students' Understanding of Centroids in a Freshmen Engineering Mechanics Course.

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Engineering mechanics is a freshmen course that poses significant challenges for instructors in ensuring students accurately grasp the fundamental concepts [1]. The visualization skills of freshmen students are still developing, making it difficult for them to understand many vital concepts in engineering mechanics [2]. Active learning strategies like hands-on activities introduced in engineering mechanics education have demonstrated higher levels of conceptual understanding and problem-solving skills among students [3-4]. Many studies have shown that students can better understand and retain information when they interact with the material [5] and when learning is reinforced [6].

In this work, a hands-on activity was developed integrating active learning and reinforcement approaches to teach centroids, with the learning objectives of applying theoretical knowledge, and enhancing problem-solving skills. Unlike traditional methods, where students calculate the centroids of shapes presented on a screen or paper, this approach involves students handling physical models of rigid bodies and identifying their centroids through various methods. At the beginning of the class, the theory of centroids and applications in engineering systems were explained. Then a class of 40 students was divided into 10 groups. Each group was provided with different shapes cut out of form boards, a weight tied to a string, push pins, and a handout that guided them through the entire activity. As a first step, each group guessed the location of the centroid. In the second step, students used the weight attached to the string as a plumb line to locate the centroid experimentally. In the third step, students calculated the centroid using the summation method. As a final step, they compared the different results, including their initial guesses, and summarized their inferences (Figure 1).

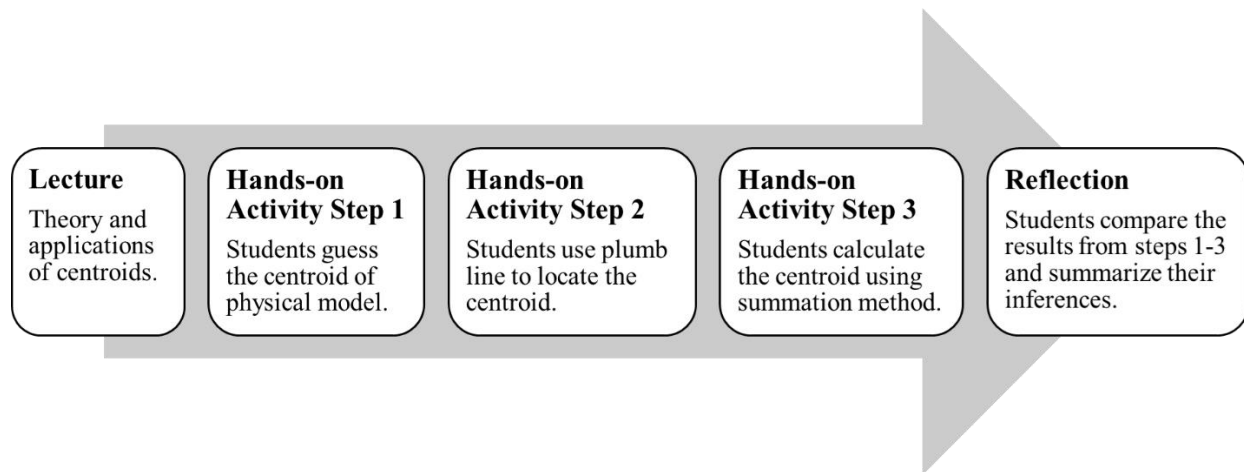


Figure 1. Steps involved in the hands-on activity to improve students' understanding of centroids in a freshmen engineering mechanics course.

This activity was implemented in the Freshmen Engineering Mechanics (Statics) course in Spring 2024 and informal in-class feedback from students indicated that the activity improved their theoretical knowledge and problem-solving skills. Mechanisms to assess the effectiveness of this hands-on activity in improving student outcomes will be implemented in future semesters.

References

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