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Using Hands-On Activities to Engage Students in Engineering Mechanics

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Active learning principles recognise that when students are actively engaged with their learning, they are much more likely to understand the concepts. The more involved and engaged the student is with the program, the greater his or her level of knowledge acquisition and general cognitive development [1]. Another important finding that is emerging from current engineering education literature is the value of successful group collaboration project work for students' personal and academic development. Such activities tend to maximise all the group members' learning outcomes and have been shown to promote higher individual achievement than competitive or individualistic approaches [1].

This paper describes an initiative that was undertaken to promote student engagement and improve learning outcomes in two new core undergraduate engineering mechanics courses at the University of the Sunshine Coast (USC). A set of low cost, hands-on, interactive models were developed for students to use in small groups that demonstrated the underlying theory and helped them to better understand the basic engineering mechanics principles.

Engineering Statics and Mechanics of Materials are foundation engineering courses that are traditionally regarded by many students as conceptually difficult and overly theoretical. Engineering students often experience substantial difficulties with foundation mechanics courses and it is widely noted in the literature that pass rates in typical foundation mechanics courses tend to be unacceptably low [8,9,10]. It has been shown that poor performance in these early engineering courses causes many students to lose confidence in their abilities and to consequently drop out of engineering programs.

A literature review was undertaken to identify successful teaching approaches that have been used to improving student learning outcomes in foundation engineering courses. The review findings suggested that a more effective teaching strategy would be to move away from the typically over-complicated text book approach to introducing relevant theory, and to simplify the concepts by using real-world examples that students can relate to. The use of simple, hands-on interactive models and activities to demonstrate real-world concepts makes learning interesting and enjoyable for the students.

The practical hands-on, interactive models were designed as real-world, authentic examples to demonstrate the underlying theory and principles in a way that students can relate to, and is easy for them to understand. Students were observed to fully engage with the new practicals and they found them interesting and enjoyable.

A range of evaluation methods were used to gauge the effectiveness of the new practicals in achieving increased student engagement, including classroom observation, standard course evaluation instruments, student surveys and analysis of assessment results. Although the new practicals were clearly successful in improving the level of student engagement, teamwork and understanding, it is difficult to make any substantial claims on the pedagogical benefits of using the hands-on, interactive models due to a lack of reliable evidence. However, the final grades for students in both courses were substantially better than typical results presented in the literature for similar foundation mechanics courses.

A comparison of student pass rates for the two new USC courses demonstrated that the pass rates were higher than those achieved in similar international foundation engineering courses. Although these results are very encouraging, there is as yet, still insufficient evidence available to make any substantial claims on the pedagogical benefits of using the hands-on, interactive models. However, the degree of student engagement and involvement while undertaking the practicals was clearly evident. This paper illustrates that with a few materials and a little imagination, engineering practicals can be designed to promote more engaging and rewarding student learning experiences. ■

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1. Mechanical Engineering for Makers: A Hands-on Guide to Designing and Making Physical Things. This book is specifically written for people who don't have an engineering degree. It gives mechanical engineering information in a simple and practical way, without being totally boring. It allows you to do your projects with materials that you can easily get. Source: Brian Bunnell, Samer Najia/Amazon. 2. An Introduction to Mechanical Engineering.Â It is a handbook for mechanical engineering students and brings a modern perspective on design and new applications. Source: Richard Budynas, Keith Nisbett/Amazon. 13. Fundamentals of Thermodynamics. Thermodynamics is one of the basic branches of engineering. Mechanical Engineering Student Resources. Resources are provided to help students stay on course to graduation. Information regarding course scheduling, advising requirements, faculty advisors, the competency exam, and when courses are taught are provided below. Student Laptop Requirements. Students are expected to have their own laptops for use in several courses. The following page describes the hardware requirements students should consider when purchasing a laptop for an engineering education. Student Laptops. Academic Catalog. Requirements for graduation with a B.S. degree in mechanical e... Get hands-on engineering experience immediately. All first year Clark School students participate in Keystone classes to begin their engineering experience. Class activities include building your own hovercraft and testing it on a 60 foot course. Working in teams to complete a hands-on engineering project in year one builds fundamental skills and knowledge you'll use throughout your engineering journey. Learn More. Conduct research.Â Students in mechanical engineering have access to a wide range of laboratories and research facilities to help them engage in research-related activities that cultivate experience for future opportunities. Learn More. Participate in highly engaged student organizations.

1. Develop hands-on and visualization tools to aid students in problem formulation and enhance. learning opportunities. 2. Integrate software simulation and hands-on experiences into lectures. 3. Ensure that the equipment that is developed has an impact on core courses in Statics and Solid. Mechanics as well as advanced courses in the Mechanical and Civil Engineering programs and the interdisciplinary design clinic sequence. 4. Improve the critical thinking and problem solving skills of students by engaging them in the learning process, allowing individual experimentation and providing for int For pre-school students, Iâ€™ve been using Marco Polo Learning lately and paired with Epic books, makes a powerful combination for students to be empowered in their own learning. See also Virtual Teaching Tips For Beginners. 14. Think Before, During, And After Learning. And in pursuit of empowering students, encourage students to â€˜ownâ€™ their learning and self-direct it. A strategy here is BDA: Before, During, And After.Â You might be surprised. And donâ€™t make this complicatedâ€“use an app on your phone to time individual activities or the running time on Zoom, Skype, Google Hangouts, etc. 25. Consider digital grouping strategies. Iâ€™ll write more about this soon. - Popularising it among mechanical engineering students is a BETTER one! * Beginning a blog is an ...Â Drive the content, Put up videos , videos of cars, maybe tutorials on commonly used software like CATIA , SolidEdge etc , and then maybe ask experts to upload more. 355 views Â·. View 1 Upvoter.Â Asking mechanical engineers, tips to engage students is again a NICE idea! - Similarly, asking them to contribute to make this a success is a NICER one! Thanks for the A2A.