

Using Khan Academy as an Open Educational Resource and Online Homework Tool for Introduction to Engineering (RESUBMISSION)

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GIFT: Using Khan Academy as an Open Educational Resource and Online Homework Tool for Introduction to Engineering

Introduction

Open educational resources (OERs) are increasingly important due to a variety of factors such as affordability and accessibility. U.S. Bureau of Labor and Statistics data show a rise of 88% in the cost of textbooks from 2006-2016, compared to a rise of 63% in college tuition and fees [1]. One impact of this is that students simply do not buy the textbook, thus missing out on a significant component of their coursework. OERs provide a free and electronically available option in which instructors can customize the content to tune it to their course. This paper describes integration of Khan Academy [2] (Khan) into an Introduction to Engineering course as an OER.

Using Khan Academy as an OER

The content of a first-year engineering (intro) course varies widely. Thus finding a textbook with the exact desired sequence of topics, OER or not, is challenging. The intro class at this institution covers not only introduction to the engineering disciplines, design and ethics, but also a range of foundational topics from mathematics (e.g. trig, exponentials, logarithms, vectors, matrices) and physics (e.g. mechanics, energy, DC circuits), as well as Excel as an analysis tools.

Khan offers a breadth of instructional videos, articles and exercises. These are used as a supplement to the material developed by the instructor. The exercises allow the students to practice their problem solving. Most problems are selected from question banks and/or include randomized numbers so each student gets a fairly unique problem set. The students get instant feedback on correctness, as well as hints as to how to solve the problem. The instructor collects handwritten solutions to the exercises to reinforce proper problem solving documentation.

Khan allows the instructor to set up a course, add students and create assignments, all free of charge. The reporting within Khan also makes assessment easy so the instructor can identify areas that need more reinforcement.

Khan also contains advanced modules over topics such as multivariable calculus, differential equations and Laplace transforms. The author also uses it in advanced courses as a “prerequisite” module to review fundamental prerequisite content for courses such as Signals and Systems. This can easily be extended to other engineering courses.

Conclusion

This initiative greatly enhances course delivery and assessment by providing additional instructional resources as well as an online homework system that includes varying the problem assignment per student. The author is planning a formal study on the impact. However anecdotal feedback from students is very positive and the ease of use makes this tool an excellent resource for a variety of early engineering coursework. Students report that they continue to use Khan outside of this course, as a resource for Calculus and Physics.

References

- [1] College tuition and fees increase 63 percent since January 2006, <https://www.bls.gov/opub/ted/2016/college-tuition-and-fees-increase-63-percent-since-january-2006.htm> (accessed 05/20/2021).
- [2] Khan Academy, <https://www.khanacademy.org/> (accessed 05/20/2021).