

Defense to Degree: Accelerating Engineering Degree Completion for Military Veterans

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Abstract

This paper will focus on the accelerated track for military veterans into bachelor's degrees in engineering. It is important to have contact with the military veteran prior to their arriving on campus to begin their schooling. Current policies give little credit for military experience or training. The development of on-line pre- and post- assessments and subject-based tutorials are being used to accelerate veterans' entry into the electrical engineering circuit theory sequence and the traditional mathematics sequence. Veterans may have a base of technical knowledge acquired through the technical nature of their service posts. Assigning them to introductory level courses with traditional freshman and sophomore students does not respect their technical expertise nor challenge their capabilities and accustomed pace.

Keywords: Veterans and engineering education; accelerated programs; electric energy systems; on-line tutorials

This paper addresses curricular issues involved in integrating post-9/11 veterans into the engineering workforce. A 2009 National Science Foundation Workshop on Enhancing the Post-9/11 Veterans Educational Benefit indicates that new, more generous veterans' educational benefits create an opportunity to expand the technical workforce while benefitting those who have served our country. The workshop further indicates that the veterans include a diverse and qualified pool of future talent for the nation's engineering and science employers.

Energy has been identified as a critical area where there is a large projected shortage of trained technical personnel. A 2008 NSF Workshop on the Future Power Engineering Workforce indicated "a serious need is emerging for more power and energy engineers. The IEEE Power and Energy Society in 2009 also indicated that "Immediate action must be taken to avoid letting a growing shortage of well-qualified electric power engineers slow progress in meeting critical national objectives."

Accelerated Bachelor's Degree

This paper will focus on the online materials developed to review the educational backgrounds of military veterans prior to their freshman semester to assist them accelerate process towards gaining a bachelor's degree in engineering. It is well documented how important it is to have contact with the military veteran and provide them with useful preparatory materials prior to their arriving on campus. By giving veterans access and the ability to review and self-assess their knowledge against learning outcomes identified by their future faculty, we are giving them the confidence needed to succeed once enrolled in courses on campus.

This NSF-funded project has focused on developing online, web-based review questions on topics in mathematics and basic circuits. Each on-line review question is then self-scored by the veteran, and help tutorials are automatically released to guide learning and understanding of the veteran in areas of deficiency.

Mathematics Review Modules

Undergraduate student helpers with graduate student oversight have been developing online mathematics review modules relevant to college algebra and trigonometry. These reviews are intended to help students refresh their memory on course material they may have already had in the past, which is a typical scenario with many of our incoming veterans.

With a proper login and password, a student planning to enroll in the electrical engineering program may be able to access these reviews and practice their skills remotely. Before starting the review modules, students are encouraged to take a mathematics pre-assessment exam (online) to better understand where their skills lie; based on their performance, they may pick and choose the review modules they need to work on. With guided practice and review, our goal is to help students get back into "mathematics-mode" by achieving fluency on material they have seen before. Ultimately, we would like our veterans to be placed into the appropriate math course via the math placement test (administered before reaching campus).

Written in PHP, the math modules created thus far include the topics of rational expressions, composition of functions, order of operations, triangle trigonometry, and complex numbers. Future review modules are geared towards the topics of graphing and exponential functions. On these review assignments, a student typically has a first chance to submit their answers, after which the student gets immediate feedback on which answers are correct and incorrect; they may correct their answers and

submit for final grading on the second round. If the student is still not satisfied with their score, they may log in for another fresh problem set.

Circuit Theory Review Modules

In the field of electrical engineering, the introductory circuit theory course presents basic concepts in electrical theory, engineering applications and an introduction to the circuits laboratory. As in mathematics, veterans would complete an on-line pre-test with auto-generated subject based tutorials in areas of deficiency, prior to enrolling in the freshman level courses. A veteran with high pre-assessment scores or a veteran who takes the opportunity to review would have the option of completing a one-time proctored post-test for course credit upon arrival to the university. Scores of C or better would be considered acceptable pre-cursory knowledge of the subject and allow the veteran to enroll in the follow-on courses within the program. This approach leverages the veterans' existing technical knowledge acquired through the nature of their service posts and accelerates their entry into courses that will be challenging and motivating.

This online approach puts Veterans in the driver's seat with early access and the ability to review their knowledge, the choice to study the tutorials and again choose to sit for the proctored exam. The exam is not a required final step, and many veterans may choose to utilize the pre-assessment and tutorials as preparation tools prior to enrolling in the introductory circuits course.

Kansas State University and the Military Environment

Kansas State University is near a major U.S. military installation, Fort Riley, and has more than 60 years of experience providing educational opportunities to military personnel and their families. The university provides academics, activities, services and support for military families. Kansas State University has been ranked among the most military-friendly universities in the country by *Military Advanced Education* magazine and by *G.I. Jobs* magazine.

While the tutorials are not yet finished we have tested the process using tutorial sessions one-on-one with a faculty member. The student was able to place in Calculus instead of College Algebra and successfully completed a quiz-out for the beginning circuit theory class. The major activity will be the continuation of tutorial development and development of recruiting material. The creation of accelerated courses specifically for veterans enrolled in the program will be another aspect used to accelerate degree completion.

References

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Currently serving as department head and associate professor, Don Gruenbacher joined the K-State Department of Electrical and Computer Engineering in 1997. Promoted to associate professor in 2002, Don has served as the graduate program coordinator of electrical and computer engineering since 2004. Don has been recognized as an outstanding faculty member by both Eta Kappa Nu and Mortar Board. His research activities focus in the areas of computer networks, communications, and digital design.

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Motivation

- Expand opportunities for military veterans to complete engineering degrees
- Increase the technical workforce while benefitting those who have served our country
- Provide pathways for veterans to complete degrees in a timely manner and within the timeframe of their GI Bill benefits

Accelerated Bachelor's Degree

- Early contact with military veteran is very important
- Can begin the analysis of proper credit for military classwork
- Have the veteran start reviewing material on mathematics and circuit theory (for electrical and computer engineering majors)

Mathematics Review Modules

- Have developed on-line mathematics review modules focused on college algebra and trigonometry
- Prepares the student to take the mathematics placement exam
- Helps the veteran get into a “mathematics mode” of thinking

Circuit Theory Review Modules

- For electrical and computer engineers circuit theory forms the basis for most upper level classes.
- Review modules being developed that can help veterans adapt their electrical and electronics experiences to university nomenclature
- Should help some quiz out of introductory circuits class

Transfer Credit

- Many engineering programs give little or no transfer credit for military courses or experience
- Some courses evaluated by ACE have been used for transfer credit
- Many engineering programs give little or no transfer credit for military courses or experience

Conclusion

- We (universities) need to continue to find ways to accelerate degree completion for military veterans
- Kansas State University is located near Fort Riley and has many programs to facilitate active duty military and veterans
- We plan to add Civil Engineering classes in the near future