ASEE AMERICAN SOCIETY FOR ENGINEERING EDUCATION

Paper ID #35060

Professional Certification Exam: An Alternative Method for a Remote Additive Manufacturing Lab

Dr. Rustin Webster, Purdue University, New Albany

Dr. Rustin Webster is an assistant professor in the Purdue Polytechnic Institute at Purdue University and specializes in mechanical engineering and computer graphics technology. Dr. Webster's industry experience includes time as a contractor for the Department of Defense as an engineer, project manager, and researcher. He holds a B.S. in Engineering Graphics and Design and a M.S. in Management of Technology from Murray State University, and a Ph.D. in Interdisciplinary Engineering from the University of Alabama at Birmingham. Dr. Webster has received various professional certifications from the American Society of Mechanical Engineers, SOLIDWORKS, and the Project Management Institute. His research interests include engineering technology outreach and design education with focus areas in CAD and project-based learning.

Professional Certification Exam: An Alternative Method for a Remote Additive Manufacturing Lab

Rustin Webster*
Purdue University
rwebste@purdue.edu

ABSTRACT

A free professional certification exam was adopted as an ad hoc individual remote lab in an introductory course on the study of polymers and composites after the course was transitioned to remote education due to the COVID-19 virus pandemic in the spring of 2020. Attempting the Certified SOLIDWORKS Associates – Additive Manufacturing (CSWA-AM) exam and watching the prerequisite 10-part online video learning path helped to replace student learning that traditionally would have come from various other hands-on laboratory activities. Twenty-five engineering technology (ET) students attempted the exam and passed at a rate of 76.00% (n = 19), 31.35% higher than the global passing rate. The perceived positive student acceptance to and effectiveness of the remote lab activities to complement required course learning outcomes is encouraging the instructor to not only continue using the CSWA-AM in coming years, but to explore the use of additional professional certification exams in remote and in-person courses.

Key Words: Certification, Additive Manufacturing, COVID-19, SOLIDWORKS, Active learning

INTRODUCTION

Hands-on labs are commonly used to enforce and expand upon lessons learned from more passive-based instruction, such as lectures (Cook, 2020). When an introductory materials and processes course at Purdue Polytechnic New Albany (PUNA) was required to transition to remote learning due to COVID-19 in the spring of 2020, thus eliminating all remaining in-person labs, the instructor was faced with the challenge of replacing multiple team-based lab activities with individual remote learning experiences. Along with complementing required course

learning outcomes, the instructor was hopeful when developing the course completion plan to continue providing interesting, impactful, and innovative learning experiences.

From an ASEE Engineering Technology Division listserv email on March 14, 2020 and from external resources (Pearson, 2020, Rowe, Koban, Davidoff, & Thompson, 2018), the instructor generally saw five methods suggested for transitioning hands-on labs to remote learning. First, was to completely eliminate the planned labs and provide no alternative learning experience. Second, was for faculty and/or staff to film themselves completing the lab activities and provide the video footage to students. Third, was to identify previously created online multimedia (e.g. simulations, games, and videos). Forth, was to provide hands-on at home laboratory kits and/or ask students to use at home items. Fifth, was a combination of the previously mentioned methods.

Each method displayed positive and negative consequences for the instructor and students, and no method was viewed as a one size fits all solution. For example, completely eliminating a lab(s) would increase free time; however, learning would most likely decrease. Filming the labs would require a significant amount of effort from the instructor and/or staff and there was no evidence that learning would increase. Finally, identifying available online multimedia proved to be difficult for many of the remaining course topics, time-consuming, and costly for mass access; however, some forms of online multimedia promoted remote, individualized, and self-paced learning.

This paper discusses the challenge of creating an ad hoc individual remote lab experience to enforce and expand upon additive manufacturing knowledge gained from assigned readings and lectures in a course on the study of polymers and composites. Ultimately, the instructor explored an alternative method from the five previously stated methods with the use of a free professional certification exam and the prerequisite 10-part online video learning path. The Certified SOLIDWORKS Associates – Additive Manufacturing (CSWA-AM) exam (Dassault Systèmes, n.d.-b) includes topics on 3D printing materials, machine types, design considerations, and etc. The 60 minute CSWA-AM exam consisted of 50 multiple choice questions, scored out of 100 total points, and required 80 points or more to pass (i.e. become certified).

Similar professional certification exams from the SOLIDWORKS Certification Program have been used in post-secondary classrooms (Dassault Systèmes, n.d.-e). Webster, Dues, and Ottway (2018) presented a case study on the passing rates of engineering technology (ET)

students on the Certified SOLIDWORKS Associates-Mechanical Design (CSWA-MD) and the Certified SOLIDWORKS Professional – Mechanical Design (CSWP-MD) exams. In both cases the exams were administered at the end of the semester and students passed the CSWA-MD at a rate slightly below (i.e. 60.00%) the global average (i.e. 67.00%) on the first attempt and significantly above after one retake (86.67%). Students passed the CSWP-MD at a rate comparable (62.50%) to the global average (64.00%) on the first attempt. Related research by Webster and Ottway (2018) on certification value for students "concluded that it is beneficial to undergraduate engineering and ET students to become SOLIDWORKS certified and that the engineering community perceives this program as a valuable asset" (p. 30).

It is important to note that the term certification as used in this paper is not equal to a certificate, degree, or license. According to Workcred (n.d.), a certification is generally awarded by an industry/professional certification body, awarded for an independent competency assessment, and indicates skill mastery and/or knowledge gain. Training time, time to complete, and the required renewal period, if any, for certified individuals generally varies.

METHODS

MET14400, materials and processes II, is a lecture and lab course which is traditionally taken by second semester freshman. The course covers an overview of structures, properties, processing, and applications of polymers, composites, laminates, biomaterials, green materials, nanomaterials, and pharmaceuticals commonly used in industry. In general, the only significant changes to the course during the spring 2020 COVID-19 virus pandemic transition where the use of WebEx instead of in-person lectures and the elimination of the final two labs, as the use of the learning management system (LMS), assigning readings, and the use of pop quizzes and exams remained unchanged. The transition to remote learning occurred in week 11 of 16 and the original completion plan as presented to the students is summarized as follows.

1. Attend two 50 minute synchronous lectures weekly via WebEx®
2. Elimination of in-person and hands-on labs 6 and 7
3. Exams two and three taken via LMS and proctored via WebEx
4. Pop quizzes 7 to 10 taken via LMS and proctored via WebEx
5. Readings 17 to 22 completed asynchronous prior to their respective lectures

The original transition plan was slightly adjusted in week 12 when the instructor openly discussed the possibility of creating a remote additive manufacturing lab (ultimately becoming lab 6). Students had just completed multiple textbook readings on the subject and during a lecture the instructor mentioned that there was a professional certification exam available on the subject. Based on the initial interest on the topic and an impromptu discussion over WebEx, the instructor agreed to create the lab. In general, the lab consisted of the following procedures:

1. Create a SOLIDWORKS account at https://my.solidworks.com/
2. Complete the 10-part additive manufacturing training asynchronously at https://my.solidworks.com/training/path/81/additive-manufacturing
3. Complete the CSWA-AM exam asynchronously via the Tangix TesterPRO Client (Dassault Systèmes, n.d.-a)

Both the CSWA-AM exam and the online training were created and distributed by Dassault Systèmes® (the parent company of SOLIDWORKS), and there was no cost because PUNA was already a SOLIDWORKS academic certification provider (Dassault Systèmes, 2014). To become an provider, an individual must apply and if approved, over 15 different certification exams ranging from mechanical and electrical design to sustainability can be offered to students for free (Dassault Systèmes, n.d.-d).

RESULTS

Thirty-two ET students (one female) enrolled in the course and 75% (n = 24) were classified as freshman. The new additive manufacturing lab grade was scored out of 20 total points (16.66% of the final course grade) and was calculated from students' official CSWA-AM scores. In other words, if a student scored a 100 on the CSWA-AM, he or she received 20 points for the lab. Twenty-five students attempted the exam, became certified at a rate of 76.00% (n = 19), and the average class grade was 14.44/20 (72.88%). Four students did not complete the lab and received a grade of 0/20 and three students, who had previously taken the CSWA-AM, received a grade based on their original CSWA-AM score. From an email from Mike Puckett, Senior Manager World Wide Certification Program, on June 25, 2020, the first attempt global passing rate for individuals (e.g. students, professionals, etc.) on the CSWA-AM is 55.40%, significantly lower than the ET students from this study.

The instructor estimates the effort to create and distribute the lab was minimal (<five hours) and grading was automated by the testing software. The instructor also had the ability to assign trackable exam vouchers, which allowed for post-viewing of exam results via the 3DEXPERIENCE® Certification Center (Dassault Systèmes, n.d.-a). The instructor also believes that the lab was effective in enhancing and expanding upon the additive manufacturing assigned readings and lectures in an untraditional lab format (i.e. remote).

Observations of students' initial reactions to the lab were positive as many students expressed interest in having the possibility to add a professional certification to their resume. Jyotishi and Cardenas-Navia (2020) discuss that the integration of high-quality, industry-recognized certifications into college degree programs can provide significant value by allowing students to gain skills and/or competencies in specific areas/domains that employers in global and high-tech industries desire but college programs often fail to teach. Workcred, in partnership with the Association of Public and Land-grant Universities (APLU) and its permanent partner, the Coalition of Urban Serving Universities (USU), and the University Professional and Continuing Education Association (UPCEA), recently reported that there is a rise in four-year schools who are embedding professional certifications into their programs, partially from industry pressure for more workforce-ready graduates; however, success depends on getting support from top administrators, aligning curriculum with the certification exam content, and informing employers of the credentials (Jyotishi & Cardenas-Navia, 2020, Swift et al., 2020).

CONCLUSION

The ad hoc individual remote additive manufacturing-based lab as described in this paper provides a simple and free alternative method to traditional hands-on activities for teaching the basics of additive manufacturing, and certified students gained a credential which they can use to further market themselves for future employment (Dassault Systèmes, 2015). The instructor was satisfied with the students' passing rate (31.35% higher than the global passing rate) and will include the lab in future semesters while hoping to empirically study the labs perceived effectiveness to complement required course learning outcomes and students' satisfaction with. The instructor has also began to explore the possibility of utilizing additional professional certification exams in the course, such as the Certified SOLIDWORKS Associate Sustainability

(CSWA-Sustainability) exam (Dassault Systèmes, n.d.-c), which covers topics such as life cycle assessment, recycling, and green design.

REFERENCES

Cook, K. (2020). Development of Modular Fixturing Lab Kits to Enhance Design for Mnaufacturing Learning. *Journal of Engineering Technology 37*(1), 14-26. Retrieved from http://www.engtech.org/jet/

Dassault Systèmes (2014). *SOLIDWORKS Student and Educator Certifcation Program*. Retrieved from: http://files.solidworks.com/pdf/EDU_Certification_DataSheet_ENG.pdf

Dassault Systèmes (2015). *Academia: Value of Certifications*. Retrieved from: https://www.3ds.com/fileadmin/Training/PDF/3DS-2015-ACADEMIA_WHITEPAPER_VALUE_OF_CERTIFICATION.pdf

Dassault Systèmes (n.d.-a). *3DEXPERIENCE® Certification Center*. Retrieved from: https://3dexperience.virtualtester.com/#home

Dassault Systèmes (n.d.-b). *CSWA - Additive Manufacturing*. Retrieved from: https://www.solidworks.com/sw/support/54427_ENU_HTML.htm

Dassault Systèmes (n.d.-c). *CSWA - Sustainablity*. Retrieved from: https://www.solidworks.com/sw/support/14672_ENU_HTML.htm

Dassault Systèmes (n.d.-d). *SOLIDWORKS Certification*. Retrieved from: http://www.solidworks.com/sw/support/solidworks-certification.htm

Dassault Systèmes (n.d.-e). *SOLIDWORKS Certification Program*. Retrieved from: https://www.solidworks.com/solidworks-certification-program

Jyotishi, S. R., & Cardenas-Navia, I. (2020). *A New Approach to Filling High-Level Manufacturing Jobs*. Retrieved from: https://www.industryweek.com/talent/education-training/article/21123727/a-new-approach-to-filling-highlevel-manufacturing-jobs

Pearson (2020). *Moving Labs Out of the Laboratory*. Retrieved from: https://www.pearsoned.com/moving-labs-online/

Rowe, R. J., Koban, L., Davidoff, A. J., & Thompson, K. H. (2018). Efficacy of Online Laboratory Science Courses. *Journal of Formative Design in Learning 2*(1), 56-67. doi: 10.1007/s41686-017-0014-0

Swift, R., Elzey, K., Cardenas-Navia, I., Hansen, R., Uranis, J., Martin, S., . . . Rodriquez, A. (2020). *Embedding Certifications into Bachelor's Degrees: Certification Degree Pathways Project*. Retrieved from: https://workcred.org/Documents/Embedding-

Certifications-Into-Bachelors-Degrees-Certification-Degree-Pathways-Project-Framework-Report-November-2020.pdf

Webster, R., Dues, J., & Ottway, R. (2018). Industry Supplied CAD Curriculum: Case Study on Passing Certification Exams. *Engineering Design Graphics Journal 81*(2), 1-14. Retrieved from http://www.edgj.org/index.php/EDGJ/issue/archive

Webster, R., & Ottway, R. (2018). Computer-Aided Design (CAD) Certifications: Are They Valuable to Undergraduate Engineering and Engineering Technology Students? *Journal of Engineering Technology 35*(2), 22-32. Retrieved from http://www.engtech.org/jet/

Workcred (n.d.). *How Do Credentials Differ?* Retrieved from: https://www.workcred.org/Documents/How-Do-Credentials-Differ-image.pdf