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Paper ID #36652

Use of Industry Standard Certification as an Early Indicator of Retention within an Engineering Program

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Abstract

Retention of students within an engineering program can be a challenge. Many factors, such as self-efficacy, standardized test scores and performance in lower-level courses, have been studied in relation to student persistence within a program. Many innovative solutions have been implemented to increase retention rates. Mississippi State University (MSU) implemented the Certified SolidWorks Associate Exam – Academic Exam (CSWA), an industry-standard certification for a computer-aided design (CAD) 3D modeling software, into the curriculum of a sophomore-level engineering class. Passing the CSWA exam provides an official means for students to present skills learned in the classroom to potential employers. This quantitative study explored the correlation between passing or failing the CSWA and retention in an engineering program. The results did not show a direct correlation between passing/failing the CSWA and graduating/not graduating. However, student performance and the retention rates were constant across multiple semesters, providing other useful information about the role the CSWA and the course play in student education.

Keywords
Certification, Retention, CAD, SolidWorks

Introduction

Retention of students within an engineering program can be a challenge. Many factors, such as self-efficacy, standardized test scores, and performance in lower-level courses, have been studied in relation to student persistence within a program. In efforts to increase retention rates, the implementation of the Certified SolidWorks Associate (CSWA) – Academic Exam, an industry-standard certification for the computer aided design (CAD) 3D modeling software SolidWorks, was adopted into a sophomore level class curriculum at Mississippi State University (MSU). This course includes an introduction to manufacturing methods, 3D modeling software, and hands-on experience with machining. To further enhance the professional opportunities offered by the course, students are provided two opportunities to secure an industry certification in SolidWorks. The intention for implementing the CSWA is to not only to provide the students with the benefit of having industry certification, which allows them to be more marketable to a potential employer, but also to increase the student's self-efficacy. This study compared the pass/fail data of the CSWA and the correlation as an early indication of whether or not a student graduates the program.

Industry certifications are assessments conducted by companies or professional entities that use predetermined standards for knowledge, competencies, and skills. These certifications often expand opportunities for postsecondary degrees with the result of a credential that is nationally

recognized. Many industry engineers and employers express the benefits of acquiring industry certifications. Ricci believes "engineering certifications are a way for professionals to distinguish themselves and to validate their experience, skill, and knowledge in a specific field" [1]. By incorporating industry certifications into the undergraduate curriculum, Mata proposes that these certifications will enhance students' educational experience and increase the value of the curriculum [2]. Archer implies that a SolidWorks verification adds value to your resume, improves your confidence level on the job and increases your career opportunities [3]. Dassault Systemes claims the SolidWorks Certification Program gives your students a proven edge in today's competitive job market [4]. Ottway and Webster conducted a study to determine a better understanding of whether or not the SolidWorks certification program has value and benefits. The results of this study indicated that the certification is valuable for undergraduate engineering students, provides validation of skills, a competitive advantage in the job field, and demonstrates personal interest in development [5].

Many CAD software industries, including Autodesk, Dassault Systemes, PTC, and Simens AG, have introduced certifications that can be achieved by successfully passing an exam. These exams require requisite knowledge of the software and may test the ability to model and modify 3D parts and assemblies, create and manipulate 2D drawings, and execute specific commands [5]. The Dassault Systemes SolidWorks certification program categorizes the CSWA – Academic Exam as a beginner or entry-level certification. Students who pass the exam receive an electronic certificate listing their certification ID [4].

Because industry certifications have been shown to improve student education and hiring potential, it was hypothesized that there was a correlation between passing/failing the CSWA and graduating/not graduating from the degree program. Of the students who pass, a high percentage also graduated. Of those who failed, a high percentage left the program prior to graduation. Therefore, by preparing for the CSWA, students build skills that help them throughout the mechanical engineering degree program.

Methods

The early sophomore/late junior-level mechanical engineering students in the Modeling & Manufacturing class have two attempts to take and pass the CSWA exam. To prepare the students for the exam, a series of practice exercises are assigned for the students to complete. Each week throughout the course, the practice exercises involve incrementally advancing 3D modeling techniques. The use of SolidProfessor, a self-paced online learning platform, as the primary method for student learning of SolidWorks for MSU students was implemented in the Fall of 2018. A study by Spayde comparing the pass rate of the CSWA taken by MSU students shows that before the implementation of SolidProfessor, the pass rate was 59% and after the implementation of SolidProfessor, the pass rate increased to 73% [6]. The first attempt at the exam is ten weeks into the 16-week semester curriculum, and if the student does not successfully pass, a second attempt is offered during the 16th week of class. The complete CSWA exam is three hours, and the minimum passing grade is 70%. The exam covers the SolidWorks software methodologies and simulation principles, specifically how to create, model, and modify different parts, assemblies, and drawings in SolidWorks.

CSWA pass/fail data was collected starting in the Fall 2015 semester. Data was included from the two course sections on the main campus in Starkville, MS and the one section on the satellite MSU engineering campus in Gautier, MS. Data was not available from the Fall 2018 and Spring 2019 Semesters. A request was made for this data and will be included in future studies if available. Multiple instructors conducted the course during the time of analysis, but the curriculum and teaching methods were consistent between semesters and instructors. Additionally, semesters after Fall 2019 were not included in this study due to the number of continuing students and pandemic anomalies. Students were mapped using a unique student identifier to the list of degrees awarded in the Mechanical Engineering Department to date. A student lands in one of four possible outcomes listed below based on the two variables in question, CSWA result and graduation with a degree in Mechanical Engineering from MSU. Microsoft excel was used to compare the CSWA pass/fail result with if a degree had been awarded using logic formulas. Each outcome was tallied and converted to a percentage for comparison between semesters. The four outcomes were:

- Outcome 1: Pass, Finished Program
- Outcome 2: Pass, Departed Program
- Outcome 3: Fail, Finished Program
- Outcome 4: Fail, Departed Program

Results and Discussion

Figure 1 compares the percentage of each of the four potential outcomes by semester. This data indicates that the initial hypothesis that the CSWA can be used as an indicator of retention within the program is incorrect. Students who pass the CSWA are more likely to finish the program rather than depart. However, despite failing the CSWA, the student is more likely to continue within the program rather than departing. This result suggests that there are alternative factors to

be considered when investigating retention of sophomore and junior students.

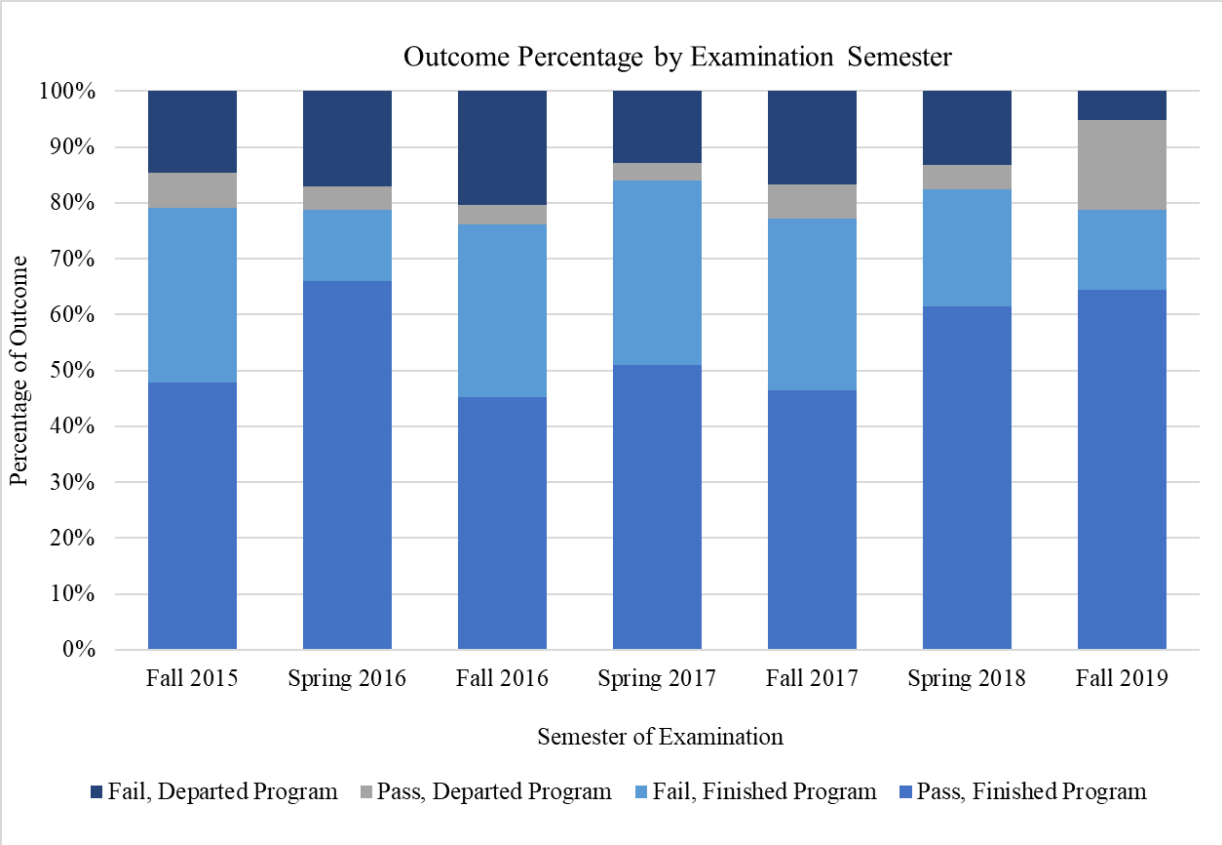

Figure 1: Outcome Percentage by Examination Semester

The percentages for both failure outcomes are points of interest. The higher percentage of failure and still completing the program instead of departing logically supports the idea that mechanical engineering is a broad field. While students may not be successful in one area, they can find success in another. In fact, across most of the semesters, students are more likely to fail and finish the program than depart the program (pass and fail combined). The data suggests that the CSWA could be used as one portion of a multi-faceted approach to predicting student retention. A combination of the CSWA and an industry certification exam that covers a different area of mechanical engineering may be a better predictor.

The data shows relative consistency in the percentages of each category per semester. The department saw an increase in enrollment over the course of semesters presented, so consistent outcome percentages demonstrate semester to semester consistency. The consistency also indicates that factors such as instructor or teaching assistant do not impact the outcome.

Table 1 displays the CSWA pass/fail percentage by semester the CSWA was taken alongside the percentage of students that completed the program or departed the program. From semester to semester, the data is consistent. The increase in pass percentage in the Fall 2019 semester can be attributed to the implementation of SolidProfessor.

Table 1: CSWA Pass/Fail Percentage and Program Completion Status

Semester	Pass	Fail	Finished Program	Departed Program
Fall 2015	54.17%	45.83%	79.17%	20.83%
Spring 2016	70.21%	29.79%	78.72%	21.28%
Fall 2016	48.67%	51.33%	76.11%	23.89%
Spring 2017	54.26%	45.74%	84.04%	15.96%
Fall 2017	53.19%	46.81%	77.19%	22.81%
Spring 2018	65.93%	34.07%	82.42%	17.58%
Fall 2019	80.51%	19.49%	78.81%*	21.19%

***Includes students that have been awarded degrees and students currently enrolled in the program but have not graduated.**

As with percentage breakdown by outcome, the consistency across semesters seen in Table 1 is evidence for semester-to-semester consistency. Even in the Fall 2019 semester, when the pass rate was higher than previous semesters, the finished program/departed program percentages are consistent with previous semesters.

Since the pass/fail rate of the CSWA is not directly correlated to the retention of students, the curriculum of the course can be objectively evaluated. Encouraging students to pass the CSWA exam for professional development reasons will remain a priority. However, additional emphasis can be given to other topics that tend to be neglected when the curriculum is tailored to ensure a high pass rate.

Conclusions

This study was conducted to see if there was a correlation between a student passing the CSWA and the retention of students in the engineering program. Industry standard certifications have shown to have a positive impact on the student's education and hiring potential. Because of this positive correlation of industry certifications, the intention of the implementation of the CSWA into the already existing curriculum would be to have a positive effect on the retention rate of students who have taken and passed the exam. The hypothesis was that the pass/fail rate of the CSWA could be used as an early indicator of the retention of students. However, it was concluded that the data does not show a direct correlation between the CSWA and retention rates. The results show that although a student might fail the CSWA, they are still more likely to complete the program rather than departing. Similarly, as expected, students who pass the CSWA are more likely to compete the program rather than departing. These results suggest there must

be other factors not related to the CSWA that might make a student depart the program. Although this is the case, the interest of student professional development will continue to be encouraged.

Future Work

The results of this study led to a series of additional questions that need further investigation. The first area to be further explored is the reasoning for the approximate 20% of students who did not complete the program. This topic will first be approached by determining if the student decided to continue in a different program or left the university entirely. Then it will be determined how far into the program they made it before departing. Second, the inclusion of SolidProfessor into the course's curriculum has increased the pass rate; however, the unintended consequences of a training aid should be investigated. While the teaching tool aids in learning the skills needed for the certification exam, skills such as troubleshooting and self-learning are exercised less. Additionally, throughout the curriculum, students are developing professional skills such as teamwork, communication, problem-solving, and troubleshooting. Identifying any professional skills that are developed as students are learning basic CAD skills can contribute to self-efficacy and retention within the program. This metric could be further analyzed by relating the pass/fail rate of the CSWA to metrics such as salary after graduation, completion of internship, or amount of time between graduation and job acceptance. The last area that could be investigated is the student self-efficacy before and after the industry certification exam. A failure on this exam could result in a negative effect on self-efficacy, but the same negative result could become a motivating factor. A survey of students could be beneficial to aid in understanding the effect on self-efficacy.

References

1 T. Ricci. Are Certifications Worth the Effort? Accessed on: November 13, 2022. [Online]. Available: https://www.asme.org/career-education/articles/certification/are-certificationsworth-the-effort

2 L. A. Mata and D. D. Carpenter, "Innovative incorporation of industry certifications to enhance recruiting and retention in civil engineering," 2014 IEEE Frontiers in Education Conference (FIE) Proceedings, 2014, pp. 1-4.

3 C. Archer. Why SOLIDWORKS Certification for Students is Important. Accessed on: November 13, 2022. [Online]. Available: http://www.amtekcompany.com/why-solidworkscertification-for-students-is-important/

4 Dassault Systèmes. Certification. Accessed on: November 14, 2022. [Online]. Available: https://www.solidworks.com/certifications/mechanical-design-cswa-mechanical-design-academic-version

5 Ottway, Rudy & Webster, Rustin. (2019). An Investigation into the Value and Benefits of the SOLIDWORKS Certification Program. Accessed on: November 11, 2022 [Online]. Available: https://www.researchgate.net/publication/337444681_An_Investigation_into_the_Value_and_Benefits_of_the_SOLIDWORKS_Certification_Program_an_Investigation_into_the_Value_and_Benefits_of_the_SOLIDWORKS_Certification_Program#:~:text=Results%20show%20respondents%20generally%20perceive,when%20applying%20for%20a%20job.

6 Spayde, Emily, Shane Brauer, and Dustin Spayde, "Improving Pass Rates for SOLIDWORKS CSWA Exam," 2020 ASEE Southeastern Section Conference, 2022. Accessed on: November 14, 2022. [Online]. Available: https://sites.asee.org/se/wp-content/uploads/sites/56/2021/01/2020ASEESE70.pdf

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