

Designing the LMS Environment to Improve Solidworks Certification Exam Scores

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Abstract

Fear of the unknown, test anxiety and being unfamiliar with the test environment can result in poor test results. Test anxiety is a well-documented form of distress that may lead to poor performance no matter the ability of the student. A short learning curve during a timed exam can lead to poor exam results. The Certified SolidWorks Associate (CSWA) exam has been administered at our university since 2011. The scores averaged around 38% for the first few semesters and were considerably below the assessment goal of a 60% pass rate. After redesigning the test environment in the Canvas Learning Management System (LMS) to mimic that of the actual certification exam, scores dramatically increased. This paper will outline the process of restructuring Canvas quizzes to help prepare students for SolidWorks certification exams. The results of this study were primarily based upon subjective experiences rather than a structured research study.

Introduction

Industry-recognized certifications are finding their way into Engineering Technology curriculums at a significant rate. These exams are designed by companies that produce CAD software, and generally test the user's design knowledge, and the use of the software. Depending on the type of certification, the exam may test a user's ability to model and modify 3D parts and assemblies, create and manipulate 2D drawings, and/or execute specific commands within the CAD software environment (Webster and Ottway, 2019).

It is a well-documented fact that test anxiety may cause even the most gifted students to underperform, and in turn give a false indication of their knowledge or abilities. Reasons for test anxiety vary among students and may include the following (University, 2021):

- Expectations from others
- Fear of Failing
- Fear of the unknown
- Lack of preparation

Fear of the unknown and lack of preparation are two areas where the instructor can structure the test environment help minimize test anxiety. A brief from Education Dive states that "familiarizing students with their testing environment, can help them visualize the setting ahead of time, making it more familiar and comfortable" (Harper, 2019). The context of "environment" in the above statement may have been based on the classroom setting, however the meaning could easily lend itself to the digital testing environment. This paper will focus on the theory that familiarization with the testing environment will assist in increasing test scores, and will show how to structure the Canvas LMS quiz environment to match that of the SolidWorks VirtualTester environment.

Background

In 2009 the Pittsburg State University Engineering Technology department utilized Pro-E, SolidWorks, Inventor, Catia, and some faculty were still using Rhino. To lower operating costs, and to streamline the use of one software throughout the curriculum a survey was developed to see what software was being most widely used in industry. The result showed that SolidWorks was most widely used and was gaining popularity in the markets of our constituents. The decision was quickly made to utilize SolidWorks throughout the curriculum for design and analysis. This change prompted the university to purchase a larger license agreement which also allowed unlimited certification exam vouchers for students and faculty.

In 2011, after becoming more confident in the ability of the students' use of SolidWorks, the first certification exams were given. The Certified SolidWorks Associate exam was given as the final exam in the second semester CAD course. It was decided that this level of student understanding of the software, most appropriately matched the recommendation of 40 hours of training by SolidWorks. Students must receive a score 70% on the 3-hour exam in order to attain certification. The results of the first few exam sessions fell well below the assessment goal of 60% (Figure 1).

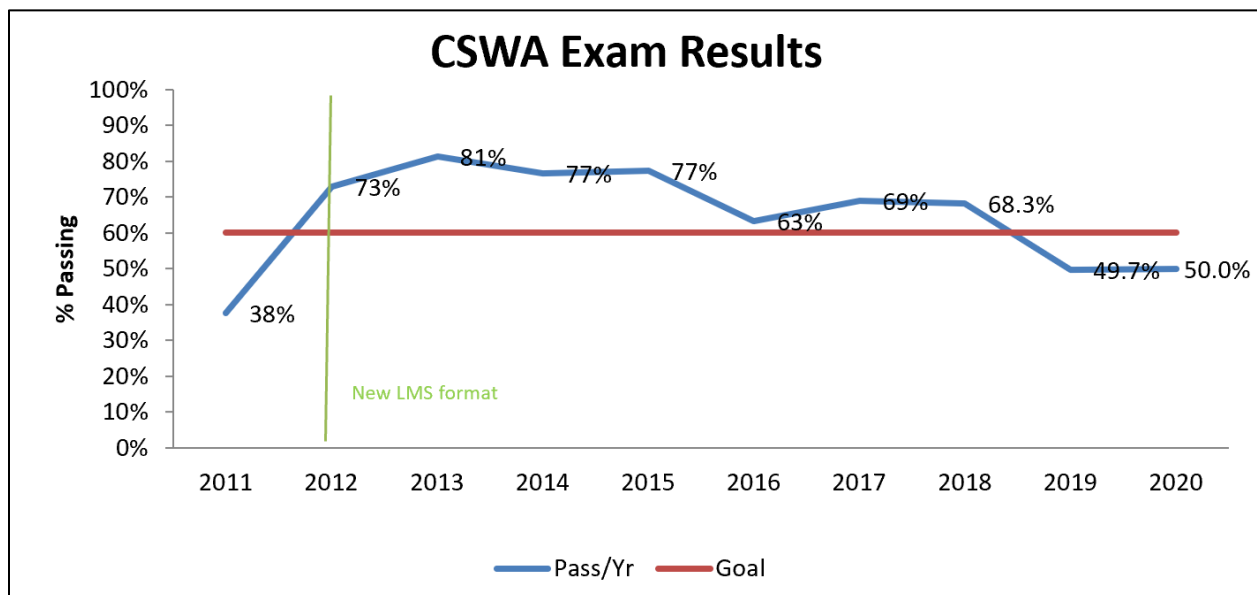


Figure 1. CSWA Exam Results

Students were doing well with assignments and seemed to be grasping the thought process behind the software, however even the brightest students were having trouble with the exam. Conversations with a few of the students revealed that they were unsure how to maneuver the exam, had trouble finding information in the provided views, and other issues which caused additional stress and then emotional shutdown. Discussions with fellow faculty members also revealed a reduction in efficiency due to unfamiliarity with the virtual testing environment. Armed with this knowledge it was evident that changes in the preparation of this exam needed to extend beyond just teaching the proper use of the design software.

Assessment Methods

Initially the assessments in the course involved giving a student a dimensioned 3D model or 2D drawing and then asking them to create the model using SolidWorks. At times they would be asked to provide the mass of the part which was usually in the form of a multiple-choice question. Students were also asked to provide their sldprt file. At the time it seemed that was enough information to determine if the student was knowledgeable on the subject. In some cases assessments were timed, but for the most part students were given a week to complete their work.

VirtualTester

VirtualTester is a third-party software that proctors certification exams for SolidWorks. The VirtualTester environment incorporates a bank of parts and questions so that not every student receives the same problem during the exam. Once the student fills out their personal information and applies a voucher code the test begins. The student is given a part to create based upon several 3D views with dimensions. The student can click on a view and it will maximize for ease of viewing. Once the student completes the geometry and applies a material the mass of the part can be determined. The first question for every individual part is “what is the mass?” and is presented in a multiple-choice format (Figure 2).

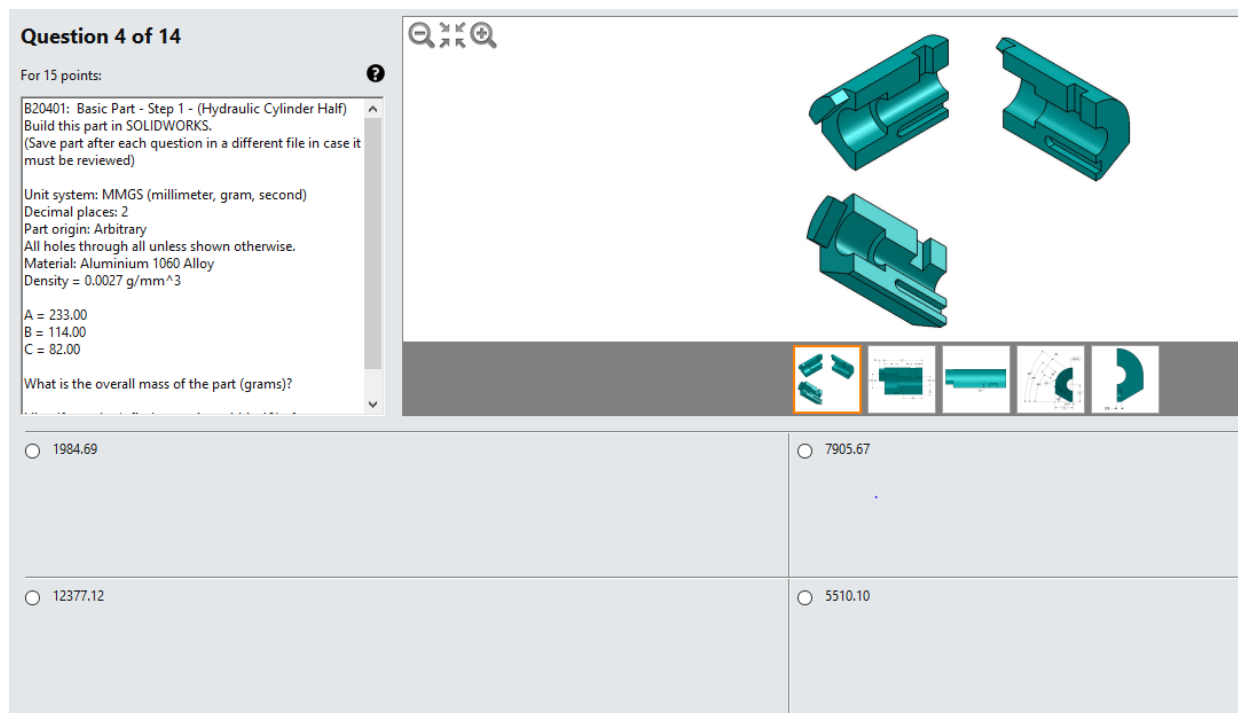


Figure 2. Screenshot of CSWA multiple-choice format. (VirtualTester :: Home, 2021)

The next question asks the student to make changes to the geometry and again asks for the mass of the part. This time, however, the student is asked to type in the mass (Figure 3). If the answer is within 1% of the actual mass the answer will be correct. The student will have a basic, intermediate and advanced part, including design modifications for each part during the exam.

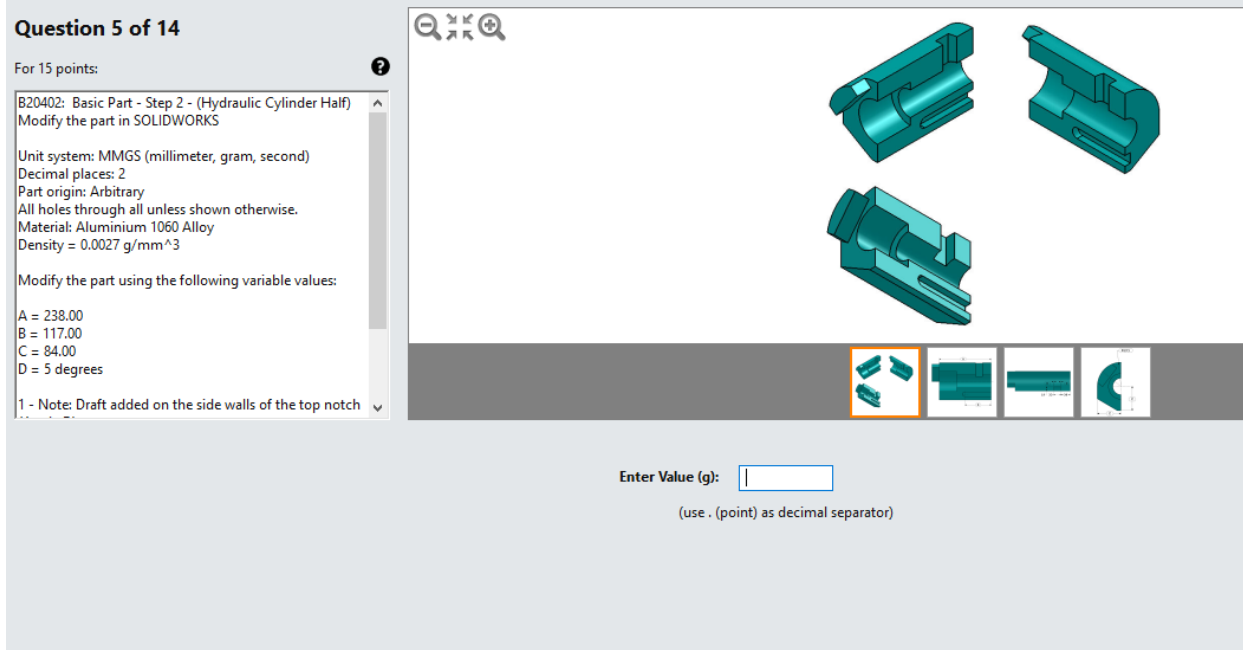


Figure 3. Screenshot of CSWA modification question. (VirtualTester :: Home, 2021)

The student will also be given two assemblies to create and will then be asked to create a coordinate system. At this point they will be asked to confirm the X,Y,Z coordinates from the center of mass. Again the initial question is asked in multiple-choice format followed by a modification and then type-written answers.

Students are allowed three hours to complete the exam and must receive a score of 70% (165/240 points) to receive certification. Due to final exam schedules only allowing two hours for exams scheduling time for the 3-hour exam became problematic. In the fall semester of 2018 the decision was made to eliminate this time conflict by moving to the 2-part academic version of the CSWA. This allowed the students to take the first half of the exam during Dead Week and the last half of the exam during their regularly schedule Final Exam time. However, now the students must pass both parts of the exam with a 70% in order to become certified. Although the student must still pass 70% of the exam, they could possibly come up short on one part and excel on the other part and still not receive the certification. This explains the dip in the Figure 1 chart in 2018.

The grading of each individual question of the certification exam is not disseminated to the student or instructor. There is, however, a line chart that provides information on how each individual student did in certain competencies. This information can be consolidated and used by instructors to determine which topics need to be reinforced within the curriculum.

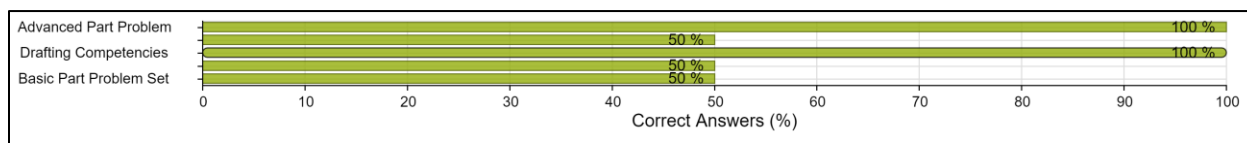


Figure 4. Individual student CSWA exam competency scores. (VirtualTester :: Home, 2021)

Canvas LMS

Pittsburg State University has been using the Canvas LMS system for course management since 2009. Since its implementation there have been major improvements to the format design functionality of the software. The instructor has much more control over the HTML coding which in this case allows for quiz and assignment designs that more closely mimic the VirtualTester platform. This allows more visual information to be provided to the student during the quiz. Multiple 2D or 3D views can be made available just as in the VirtualTester environment (Figure 5). By choosing the Multiple-choice question and Numerical Answer formats within Canvas (Figure 6) the instructor can provide an authentic testing environment that is comparable to the certification exam.

Time management is also a very important variable as it pertains to test anxiety. When breaking down all the models and assemblies that must be completed within the three-hour exam time, it has been determined that no more than 40 minutes should be spent on a particular part. Canvas includes functionality that allows the quizzes to be timed much like the VirtualTester environment. This is a very important tool that allows instructors to “train” students to be more aware of time management. Earlier in the semester quizzes can be timed more liberally, and as the semester progresses times can be progressively reduced until the goal of 40 minutes is reached.

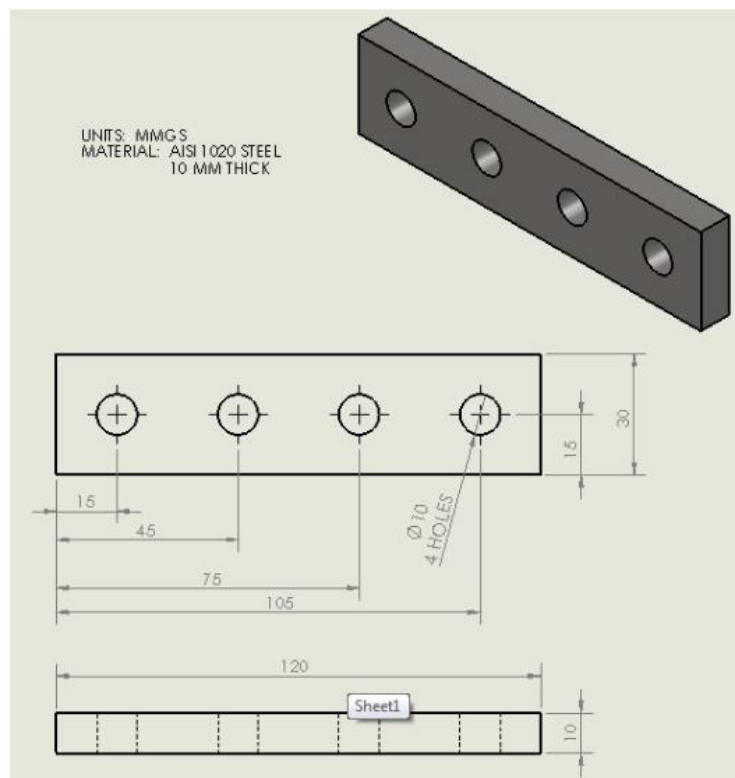


Figure 5. Canvas quiz screenshot showing model details.


Question 1	Question 2
<p>5 pts</p> <p>Use the drawing below to create your part. What is the mass of your part in grams?</p> <p>Fixture 1-1.PDF </p> <hr/> <p><input type="radio"/> 298.75 grams</p> <hr/> <p><input type="radio"/> 188.86 grams</p> <hr/> <p><input type="radio"/> 496.52 grams</p> <hr/> <p><input type="radio"/> 509.92 grams</p>	<p>5 pts</p> <p>Make the following changes to your model and then record your new mass in grams below. Round your answer to 2 decimal places and do not include anything else in the answer box.</p> <p>Material: Plain Carbon Steel</p> <p>Dimension A: 10 mm</p> <p>Dimension B: 15 mm</p> <p>Save this file as a sldprt file and submit in the Quiz 3 files assignment to receive credit for this quiz. Failure to do so will result in a zero for the quiz.</p> <div style="border: 1px solid #ccc; width: 100px; height: 20px; margin-top: 10px;"></div>

Figure 6. Sample Canvas quiz questions.

The Canvas system has recently integrated HTML coding functionality which allows instructors to create more realistic certification exam environments. This prepares students by allowing them to better understand the format, process and flow of the exam.

Conclusion

Creating a testing environment in Canvas that parallels that of the SolidWorks CSWA has drastically improved exam scores. Since implementing quiz formatting changes in the Spring 2012 semester passing rates have more than doubled and, in some semesters, realized a 71% increase. It is important to note two negative trends in Figure 1. The first occurred in the fall of 2016 when the instructor became Department Chair and briefly lost focus on the course due to increased administrative duties. The second dip in the chart occurred in the fall of 2018 when transitioning to the 2-part certification exam, which actually requires the student to pass each Part with a 70% rather than an overall score of 70%. A student could pass Part 1 and fail Part 2 and still accumulate the required 165 points, but not become certified. A different instructor taught the course in the spring of 2019, and did not utilize the Canvas environment as a teaching tool.

Although it could be argued that the primary instructor could have become better at teaching the course content, or introduced additional teaching aids, the test environment has been the major change associated with offering the CSWA exam in the course. Therefore, it is safe to theorize that the improvement in test scores can be attributed to familiarity with the test environment.

It could also be argued that pass rates increased due to the instructor “teaching to the test”. This was not the case. Course topics and content did not change. Students were still learning advanced modeling techniques, assemblies and drawing standards. The only major change was the quiz environment.

Future Work

Since the inception of the current Canvas LMS quiz structure, test scores have not been near the initial low test scores. During that time there has been primarily one instructor that has used this method to prepare students for the SolidWorks certification exams. As we move to incorporate

additional levels of these exams throughout the curriculum, it will be beneficial to take extra care in the design of the LMS environment to closely mimic that of the certification exam. This will also involve branching out to additional courses, so it will be important to disseminate this information to other faculty who may be teaching these types of CAD courses. It will also be important to continuously monitor the certification exams to ensure that changes in the exams are reflected in the LMS quizzes. There are more opportunities to enhance other Canvas quiz environments to match those of other SolidWorks certification exams.

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