ePortfolio Reflection

By Austin Goodman

Prior to taking this course, Fluid Mechanics (MET330), I had heard from others that it would be incredibly challenging, if not the most challenging of all courses that I would take in the process of pursuing my degree. To the credit of those who warned me, this course proved to be right on par with their statements. I can say without any hesitation that this course has been one of the toughest that I've experienced. Now, this isn't just due to the material, which can be tough that in of itself, but also due the sheer amount of coursework required. Now add that to taking other classes in parallel, a full-time career, two kids, and to be blunt it just felt impossible at times. Like there just wasn't enough time in the day to get everything done. Nevertheless, I am pleased to say that I have persevered. And now that the course has come to an end, I have the opportunity to reflect on, and discuss, all the things that I have learned along the way. At first glance, the course objectives seemed overwhelming. But the work that I produced throughout the semester fully demonstrates my knowledge and understanding of each of the course learning objectives.

I began by learning the fundamentals such as the nature of fluids and various fluid properties, the relationships between said properties, and how to find them when required. I learned about Bernoulli's Equation and how it is instrumental in solving any problem related to fluid mechanics. Evidence of this can be seen in assignments HW-1.1 – HW-1.4 and Test 1, where I demonstrate how to solve problems related to manometers, venturi meters, hydraulic cylinders, and solving for properties of pumped systems. Each of these examples involve provided information like the specific weight of the fluid being moved, a flow rate or velocity of fluid, or a pressure at a given point in a system. With the given information, I would apply Bernoulli's equation to the system provided to solve for the unknowns which could be anything like determining the maximum deflection in a manometer, the pressures at various locations in a pumped system, the volume flow rate of the fluid in a system, and the list goes on. This portion of the course demonstrates my knowledge of the nature of fluids and different fluid properties, the principles of conservation of mass, and how to identify and solve for specific characteristics of fluid systems.

The next section pertained to applying previously learned principles to the concepts of open channel flow, reaction forces in tanks and in piping systems, buoyancy, drag and lift, flow measurement, water hammer and cavitation in a system, and energy losses in piping systems. Demonstration of my work towards these concepts can be seen partially in HW-2.2 – HW-3.1 and fully in Test 2. In Test 2, we were required to solve for things related to all concepts that I mentioned. I was successful in answering the majority of these problems correctly, however, I struggled with a few of them. I reached out to Dr. Ayala when necessary for guidance and was able to fully answer all problems. My work in this met the objectives of describing the nature of fluids and define different fluid properties, compute pressure and the forces (magnitude, location, and direction) associate with it in a stagnant fluid, discuss what buoyancy is and determine object stability while floating or submerged in a fluid, apply the principles of conservation of energy (Bernoulli's equation) and mass to fluid flow systems, compute friction losses in pipes for a series configuration, and identify and solve for different very specific industrial problems, such as, open channel flow, cavitation, water hammer, drag, lift, forces in pipes, and learn about different instruments to measure fluid flow quantities (such as, pressure, fluid velocity, flow velocity, etc.).

The last section of material that we covered was centered around series and parallel pipeline systems and pump selection. For problems related to series and pipeline systems, I had to get better accustomed to using excel to perform calculations for iterations. Evidence of my knowledge on this can be seen in HW-3.1 – HW-3.3 as well as in Test 3. For Test 3, I was given a problem related to a sprinkler system with two heads. Given the pressure in the system, I was asked to determine the flow rate at each sprinkler head including all minor energy losses. To do this I applied Bernoulli's Equation to the system twice, once for each sprinkler head, and solved for the unknown flow rates. I then plugged these equations into the conservation of mass equation and ended up with three equations, three unknowns. The only way to solve this correctly was to guess values for the friction factors and the total flow rate and run iterations in excel by comparing the percentage of error of each new iteration's calculated flow rates and friction factors to the previously calculated. This was a cumbersome process but yielded the correct answers for the exam. Pump selection can be seen not only in the homework mentioned, but also in the group project.

The group project was a semester-long assignment where me and 3 other classmates were tasked with designing systems for supply and return of coolant to machines in a processing plant. For this, there were around 23 tasks related to the project that required us to use the things learned in class and assignments to complete. Specifics of the project and the final project report can be found in the provided link. This project not only demonstrates my knowledge on all of the course learning objectives, but also demonstrates how I was able to work with others to develop detailed fluid mechanical systems that would be operational and feasible in a real-world scenario.

Answer the following questions, using links or excerpts (visual, audio, or written) from your ePortfolio to illustrate your answers:

1) Where is your learning demonstrated in the course?

   My learning course is demonstrated in my work that I completed throughout the semester. From homework assignments to tests to the group project, they all demonstrate my learning and knowledge I've gained from taking fluid mechanics and can be found on my website under the associated tabs.

2) What areas did you feel you were most successful, or improved the most?

   I felt that the areas that I improved the most were problem solving and use of excel. An example of an excel spreadsheet that I made for calculating flow rates through iterations can be found under Test 2 Calculations at this link. As for problem solving, I am now able to look at a problem and figure out a good starting point to build from and how to analyze what I know, don't know, and what to solve for. The types of problems in this course can be overwhelming but through practice, familiarizing myself with the material, and learning from mistakes I am much better at solving these types of problems. I may not get them correct all the time, but I am able to get farther than I ever would have at the beginning of the course.

3) How do you see this course's content intersecting with your field or career?

   Because I want to be a mechanical engineer, I can see the knowledge that this course provides being an integral part for being successful in my future career.

4) Have you been able to apply concepts you have learned in the course to what you do at work or in other courses?

Yes. I am currently an engineering technician that deals with fluid mechanical systems every day. For my position, I develop technical documents and system tag outs for work to be performed on reactor plant mechanical systems. I also test these systems after all work has been completed for certification before it is handed over to the customer. I honestly wish that I was able to take this class sooner because the things that I learn in here are 100% applicable to what I do. I have a better understanding of why systems are designed the way that they are and am better at troubleshooting unexpected system responses due to my better understanding of fluid mechanics in general.

4) How, when, where and why you might use this information or skill in the future?

If or when I become a practicing engineer, I would use this information for designing/evaluating system characteristics for customers or for my company. I would use the information from this course because if done carefully and correctly, it will produce accurate results and ensure the safe operation of fluid systems.

5) Do you think what you learn is important for your professional career?

Yes, I believe it is crucial that I learn these skills so that I am competent and don't make mistakes when designing or evaluating systems. If not able to be done correctly, this could result in damage to components resulting in high costs for repair and replacement or the endangerment of others.

6) Where do you think you will be using everything you learned?

I believe I will be using this information if I am in an engineering position where I am required to have knowledge of fluid mechanics. This course has taught me so many concepts and how to apply them that I am confident I will be able to use them in the future, given the opportunity.

8) If you were starting this class again, what advice would you give yourself to ensure that you had a successful semester?

The advice I would give myself would be to only take this class so I could dedicate all of my time to it. Like a previously stated, this course has so much work involved that, in order to fully understand it all and become proficient, you really need to dedicate the majority of your time to it. Also, practice, practice, practice the problems. This is one of the courses that unless you work the problems and become familiar with the processes (especially ones involving the use of excel), you will not be successful.

Also answer the following questions:

1) After taking this class, in what ways have you improved as an engineer? What brought about those improvements?

I have improved in the area of fluid system knowledge and critical thinking. I have learned how to evaluate fluid mechanical systems and how to select components based on desired outcomes. Due to the complexity of some of the problems I encountered, I would spend long hours thinking of ways to get to a solution and thinking critically to do so.

2) What was your biggest accomplishment in the course? Be specific with respect to your work and the topics you learned in the course.

I feel my biggest accomplishment in the course is that I have a full understanding of the concepts and learning objectives. Yes, the project and the tests were huge undertakings that I am proud to say I completed or took part in completing. But the fact that I am now able to go to my place of work and look at fluid systems in a totally different way is just awesome. I feel accomplished in knowing that I can solve for whatever characteristic of a system is needed on the job, which is something that many people I work with cannot do.

3) What skills did you master in this course? How are they reflected in the assignments (HW, tests, etc.) Be specific.

I feel I mastered the skills of solving complex fluid mechanics problems, the iteration process for solving problems with multiple unknowns, and time allocation for completing required work on time. These can be seen in my completed tests and in my group project. This course required a good amount of planning to complete the various assignments, and many times, we would be completing homework assignments, preparing for tests, and working on a group project all while taking other courses that were unrelated. Being able to balance so many

things is a great skill. I also now have a good understanding of how an engineering firm goes about designing systems for a customer based on their needs. This is something that I hadn't experienced previously.

4) What do you feel are your strengths and weaknesses? Explain while making specific references to your work.

My strengths include evaluating systems using Bernoulli's equation, solving for various characteristics of fluid systems, determining what components to use and how to design a system for a specific purpose, and how to use excel to make complex calculations easier. All of these things I've mentioned were weaknesses in the beginning of the course, so I can safely say that I don't feel I have any weaknesses worth noting pertaining to the information I've learned.

5) How did you think about this course before you took it and how you think about it now that it is over? How many of your assumptions of understandings changed? Why?

Before I took this course, I felt it was going to be interesting and useful for my career field of choice. I also figured that it wasn't going to be easy based on what others had said about it. I don't feel that my assumptions were incorrect or have changed. It was a challenging course, yes, but the material was very useful and interesting, and I will be able to use this information I've learned for years to come in my career field once I am an engineer.