**UF Faculty First and Last Name:** Matthew J. Traum & Michael G. Fitzgerald

**UF Course Name and Number** EGN3353C - Fluid Mechanics (With Laboratory)

**UF Department:** Mechanical & Aerospace Engineering

**UF College:** Engineering

**Partner’s Name and Last Name(s):** Walid A. Aissa

**Partner’s Course Name:** Fluid Mechanics, Thermodynamics, Gas Dynamics, Renewable Energy, Advanced Fluid Mechanics

**Partner’s Department:** Mechanical Power Department

**Partner’s College:** Faculty of Energy Engineering

**Partner’s Institution:** Aswan University

**Additional Partner Information**

**2nd Partner’s Name and Last Name(s):** Ahmed M. Reda

**2nd Partner’s Course Name:** Heat and Mass Transfer, Refrigeration and Air Conditioning

**VE Project Title/Topic:**

Energy Engineering Virtual Exchange Using Educational Laboratory Kits

**Sequence and Description of Activities:**

Before students from the two schools begin working together on the higher-stakes kit-based fluids experiments, the instructors will conduct an asynchronous icebreaker, a synchronous icebreaker, and an engagement activity.

**Asynchronous Icebreaker Activity:** Video Self-Introduction

Tool: Flipgrid & Canvas

Individual/Group: Individual

Duration: 60-second videos

Activity: Each student will produce a 60-second self-introduction video in Flipgrid where they will give their name, institution, year in school, and a statement of what they hope to gain from the course and the virtual exchange. These videos will be shared with the class via Canvas discussion allowing everyone to “meet” their peers.

**Synchronous Icebreaker Activity:** Informal Discussion of Fluids in Daily Egyptian and US Life

Tool: Zoom

Individual/Group: Individual

Duration: 1 hour Synchronous Discussion followed by 1 hour of in-class Informal presentations in groups

Activity: This discussion will be seeded by asking students to describe and discuss fluid mechanics applications that they encounter daily and to illuminate underpinning fluids principles that make these technologies work. For example, a water drinking fountain works by Bernoulli's principle of trading kinetic energy for potential energy -- If water doesn't flow fast enough from the fountain jet it doesn't get high enough for someone to take a drink. Do Egyptian students and American students experience the same types of common Fluids applications in their daily lives?

The goal of this activity is to put the lab kits the students will use in context. Often in instructional labs, simple phenomena are masked by the complexity of the apparatus. So, the purpose of this discussion is to prepare the students to realize that many phenomena underpinning functions of fluids systems they encounter daily and in the lab kits are, in fact, usually pretty simple to understand in a theoretical context.

Students will be asked to prepare ideas on their own, asynchronously in advance of the discussion. We’ll put them in groups during class using Breakout Rooms with each group made of some Egyptians and some Americans. After giving them a class period to discuss, we will reconvene the full class and let a representative from each group share with the class what their Breakout Room group talked about. Presentations will take another class period.

**Engagement Activity:** Padlet Exploration of the World’s Hydroelectric Dams

Tool: Zoom

Individual/Group: Individual

Duration: 1 hour Synchronous Discussion followed by 1 hour of in-class Informal presentations in groups

Activity: The proximity of Aswan University to the Aswan High Dam and the importance of this major piece of Egyptian infrastructure to the overall joint fluids course is a central element of the Virtual Exchange. The Aswan High Dam is an Egyptian cultural product that provides a comparison point to US-based hydroelectric dams, especially the Hoover Dam. This activity will be conducted synchronously by groups of students who will eventually work together on the fluids lab kit experiments. Student teams will use Padlet to post information they gather about major hydroelectric dams around the world. Each team will be assigned a dam to research, and they will post key quantities underpinning these structures in Padlet; for example, 1) Geographic and country location, 2) River system dammed, 3) Year of construction, 4) special techniques used, 5) water volume flow rates, 6) nominal and maximum power production capacity, and 7) hydrostatic pressure profile from the dam bases to their reservoir lake surfaces.

Once research is complete and a Padlet with basic information is posted, each group of students will produce videos presenting highlights of the dams they researched, and these videos will also be linked to Padlet. The technical introductions to dams around the world available in Paglet will then be used to underpin a cultural and socioeconomic discussion of how hydroelectric power infrastructure projects are used by nations to drive growth. For example, Hoover Dam was an American 'New Deal' infrastructure project in the Great Depression built to bring electric power, flood control, and jobs to the American Southwest in the 1930's. Similarly, the Aswan High Dam was the centerpiece of 1970's economic growth in Southern Egypt, and it created a regional boom in energy-related jobs and ability to control Nile flooding far upriver from population centers to the north.

**Hands-On Lab Experiments: Studying Fluid Mechanics Phenomena**

Tool: Zoom

Individual/Group: Group

Duration: Minimum 3 hours per week

Activity: Students from Egypt and the US will collaborate on physical fluids experiments using identical lab kits located at both institutions.

**Final Group Project: Collaborating On New Laboratory Experiment Creation**

Tool: Zoom

Duration: 3 weeks of design/build/test followed by 1 hour of formal in-class group presentations

Activity: Once students from Egypt and the US have collaborated together to work through experiments embodied in the shared fluids laboratory kits, the culminating activity of the joint course will be student-led development of new experiments using elements and parts from the kit to elucidate different fluids phenomena. In the past, US-based students working with the kit have developed manometers, contact angle goniometers, and multi-physics phase change demonstrations using kit elements. The best of these ideas become new future lab kit experiments! Teams made up of students from both countries will work together to develop these new experiments with deliverables including 1) a list of needed parts for the new experiment, 2) a written lab manual to carry out the experiment, 3) a video showing how the experiment is carried out, and 4) representative experimental data and analysis showing how well the newly designed kit experiments matched the theoretical phenomena it is meant to demonstrate.