



Embracing Research Mindset Among BSc Soil Science Students Through Research-Teaching Nexus

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Pedagogical experts in higher education emphasize towards strengthening research-teaching symbiosis with the goal of preparation students to the challenges of professional life. Soil students are in an inordinate and vigorous position to play a significant role towards understanding and dealing with the multifaceted/complex processes in soil as a critical zone, in a complex interaction with other Earth's systems. Hence, soil graduates should have generic and versatile research skills/technical abilities for coping with the increasingly broad holistic role of soils related to the function and sustainability of the Earth.

We present, a research-based pedagogy of a course, Soil & Water Tour, for final year undergraduates in Soil Sciences, at Sultan Qaboos University (SQU). The course pedagogy is designed to stimulate the undergraduates towards effective research attributes by conducting their own experiments and by providing opportunities for students to discover and to use the fundamental laws/principles of soil sciences to solve real-world problems. Students are expected to develop research metacognitive skills enabling them to work collaboratively across disciplines.

The course consists of 5-days of fieldwork, during a winter break, followed by designing and execution sets of soil column/pot experiments and laboratory analyses, using SQU facilities during the Spring semester.

Students are required to submit a final report and orally defend the results of their research work by the end of this semester.

About 25-30 students register for the course and 5-6 students' groups (3-5 students/group with one student assigned as a leader) are formulated. Each group is exposed to a well-demarcated research question or case study formulated by the instructors who later mentor specific groups. The research assignments are multidisciplinary and vary from finding a specific well-protocolled solution to a concrete problem to a "wicked" type of case study, with no a priori clue of methodology and expected results.

The topics of the research experiments are connected to concepts/topics discussed during the fieldwork.

Groups meet at the beginning of the Spring semester and submit a proposal on the assigned research task with the followings: research question(s), objectives, experimental design, analyses and resources needed, and project timeline.

Students' outcomes performance within the desired research attributes is assessed through:

- Regular meetings with the faculty mentoring the group;
- Progress report and assessment by the group leader;
- Skills gained from the field and experiments; and
- Students' final report and presentation

Teaching evaluations in 2009-2016 showed the course to earn an average rating of 3.5/4.0 while the College average for all other courses (about 150/semester) during the same period was 3.2. Majority of students highly evaluate the course. For instance, a student wrote: "I am considering this course as a quantum leap based on the quality and nature of the assigned projects, the cooperative spirit between the students and faculty, and the type of support/encouragement that the students receive".

We discuss the challenges in implementing the objectives of this course. The presented pedagogy can be extended to other geosciences courses with fieldwork-laboratory integration.