The Water Working Group at West Texas A&M University: A creative means for interdisciplinary research catalyzation and faculty development

Dr. Nathan Luke Howell, West Texas A&M University

I am an associate professor examining micropollutants in natural water systems: their origins, processes that control their distribution in the environment (air, sediment, soil, and water), and their fate-and-transport and risk to biota and humans. My research includes experimental studies, field measurements, and model development. I am also investigating large deep groundwater aquifer water quality data sets to determine what possible use such water could be to alleviate water stress.

Dr. Kenneth R. Leitch P.E., West Texas A&M University

Dr. Kenneth R. Leitch holds BS, MS, and Ph.D. degrees in Civil Engineering from New Mexico State University and an M.B.A. from Colorado Christian University. He is an Associate Professor of Civil Engineering in the College of Engineering at West Texas A&M University in Canyon, Texas and is a registered professional engineer by examination in Texas and Indiana. He is active in the structural, transportation, construction materials, and sustainability subjects of the civil engineering discipline and in engineering education.

Dr. Anirban Pal, West Texas A&M University

Dr. Anirban Pal received his B. Tech. from Indian Institute of Technology Kharagpur (2010) and his Ph. D. from Rensselaer Polytechnic Institute (2016), both in Mechanical Engineering. He worked as Post-Doctoral Research Associate for 1.5 years and as a Lecturer for 6 months at Rensselaer Polytechnic Institute prior to joining the College of Engineering at West Texas A&M in Fall 2019 as an Assistant Professor of Mechanical Engineering.

The famous American scientist Richard Feynman prophesied the huge potential for engineering at small scales (There's plenty of room at the bottom!). In this spirit, Dr. Pal is interested in the unique nano-mechanical behavior of materials at small scales, and how they can be harnessed to produce desired behavior at larger macroscopic scales.

His research interests include energetic molecular crystals, fiber networks, mechanical and thermal metamaterials. Using computational tools such as molecular dynamics, density functional theory, graph theory and finite elements, he has published work in Physical Review Letters, Scientific Reports, Physical Review E, and Modelling and Simulation in Materials Science and Engineering. A list of his publications can be found under ORC id 0000-0002-0466-0589.

The Water Working Group at West Texas A&M University: A creative means for interdisciplinary research catalyzation and faculty development

ABSTRACT

West Texas A&M University is a Primarily Undergraduate Institution (PUI). The university has historically been focused on pedagogy for K-12 educators and growing a more educated workforce across many disciplines, which is why we have been and still are a PUI with continued focus on undergraduate education. However, beginning in 2021, a group of 10-15 faculty who have grown know to each other in areas of agricultural science, natural science, computer science, engineering, and social science have found it advantageous to make common cause through a scarce natural resource that seems to come up often in education, rural life, business, and policy in our region--water. We have therefore been meeting as faculty researchers who want to grow in research success through something we call the Water Working Group (WWG).

The vision for the WWG is to see "water challenges relevant to the culture, people, and environment of the Texas Panhandle be solved in a way which is meaningful both to our current residents and in the long-term, 100-year time horizon." While this is the public face of WWG, for faculty, this group has served as a strong means of faculty development. This development includes activities such as connecting with area entrepreneurs who might benefit from research consultation and joint projects, sharing ideas about how to broaden education in water beyond our classroom so that the wider Panhandle culture changes their mindset about water, going on research-oriented group field trips, and preparing grant applications through formal concept papers. In this Work-In-Progress paper, we explain the study design for the near term that will examine how faculty have been impacted in their participation in the form of in-depth individual interviews and a survey. At the time of writing, no direct data has been collected as this data is forthcoming in summer and fall of 2024. Any faculty elsewhere who have struggles in areas of junior faculty mentoring, the balance between research and teaching, and growing interdisciplinary research at your institution may benefit from the lessons we are learning.

KEYWORDS

interdisciplinary; water research; faculty development; community connections; integrated research and education; entrepreneurship

BACKGROUND

Examining faculty development in practice, it is natural to look at it logically. Important questions related to the logic are why, how, and who. Why it is being conducted? What is the aim of the development activity? How is it being conducted? Do the means of faculty development suit the objective, and is there evidence that the means is effective? Who is doing the developing, and who is being developed? Is it being driven by faculty themselves, or by peers, older faculty, or administrators? Are the people engaged in faculty development even aware that this is what they or doing, or does it happen so naturally that they are unaware?

Engineering education literature on faculty development reveals that often its purpose is the adoption of pedagogical training material by faculty into their instructional practice (1). Examination of how such training is delivered is important. For example, there is a distinction in the nature of faculty development in the form of push-oriented trainings (where the push of scientific discovery by researchers and administrators drives innovation) as compared with pull-oriented trainings (the need expressed by faculty pulls innovations towards approach to practical problems and needs). With respect to instructional trainings, ASEE's NETI and ASCE's ExCEEd, Barner et al. have provided evidence that often push-orientated development work does not lead to actual adoption of material learned by faculty (2). A detailed examination into the history by Estes et al. of the ASCE ExCEEd Teaching Workshop illustrates the need to focus on pedagogy for engineering faculty. Most do not have pedagogical training though teaching is a sizeable portion of their

work expectations. ExCEEd is a mentor-based instructional tool, and, while focused on teaching, there are concomitant gains in the areas of service and scholarship (3). As an analog to teaching students, faculty development within the ExCEEd teaching model could similarly be based on Lowman's two dimensions of teaching effectiveness-(1) interpersonal rapport and (2) intellectual excitement (4, 5). In other words, for those who want to develop faculty, these two dimensions of the social and the intellectual could also be important.

Regarding the means of faculty development, mentorship both in specifically engineering contexts and sometimes in wider STEM contexts are relevant here. Mentorship can be specifically defined as the more experienced faculty investing in the lesser experienced faculty. Pair-based mentoring can be formally assigned by departmental or college leadership, or it can form naturally according to common interests and personalities. A recent study asking these and other questions to engineering deans across multiple types of institutions (R1, R1/R2, PUI) found that there is value in both types of arrangements. A department onboarding type of mentoring may be a good use of formal, assigned mentors whereas a bottom-up approach often works better for long-term and research-growth based mentoring (1). As one might expect, mentoring is used in other fields for faculty development including medicine and nursing where the goal may to grow faculty in clinical practice or promote the growth of faculty interested in emerging research areas requiring interdisciplinary Team Science (6, 7). If it is accepted that a common desire is that faculty desire to reach their full potential and become more competent, then research into the effectiveness of such development from other fields should inform engineering.

The Water Working Group (WWG)[a] is an interdisciplinary group of water-related researchers which meets at our university and focuses on water challenges which are unique to the region in which the university resides, an area of about 25 counties in Texas. While there is certainly natural mentoring that occurs, we see that this group may be more accurately seen as a form of a Community of Practice (CoP) which has at least been as seen as valuable in adoption of technology-enhanced instruction (8). The WWG mission as stated on the group's website is

> **To see water challenges relevant to the culture, people, and environment of Texas Panhandle be solved in a way which is meaningful both to our current residents and in the long-term, 100-year time horizon.**

Like other institutions, our university has developed silos related to differences in interest, social cliques, and academic units. We originally established a group to break down some of these barriers for the express purpose of encouraging multidisciplinary research. However, we discovered after six months of meeting that having a group be this broad, while beneficial for many who are highly interested in interdisciplinary research, was ***not*** for everyone. Having a group whose purpose was to conduct research projects specifically for purposes of integrating disciplines was too vague. Water is a critical issue front of mind for most Texans. It is also a theme that connects many different types of expertise including biology, engineering, technology, data science, agriculture, environmental science, chemistry, policy, economics, communications, education, marketing, and ethics. We converted the group from a theme of "multidisciplinary" to "water", which still allowed it to be interdisciplinary. During this process we discovered three truths that we did not set out to determine from the beginning.

(1) We did not know how to define and therefore how to promote multidisciplinary or interdisciplinary thinking.[b] Due to this, these words, while they helped to gather people together no matter their discipline, became tiring to everyone due to their "buzzword" nature. We therefore stress their technical meaning. Interdisciplinary connotes the idea of ***integration*** of content from multiple

[a] https://www.wtamu.edu/academics/college-engineering/water-working-group

[b] The distinction between multidisciplinary and interdisciplinary is important. As informed by Klein and Schneider, ***multidisciplinary*** indicates the juxtaposition of disciplinary perspectives, adding breadth and available knowledge, information and methods. Separate voices in "encyclopedic alignment". In some contrast, ***interdisciplinary*** means the integration of content, data, methods, tools, concepts, and theories from two or more disciplines or bodies of specialized knowledge in order to (a) advance fundamental understanding, (b) answer complex questions, and/or (c) solve problems that are too broad or complex for a single approach.

disciplines, and integration is what we determined that we wanted. In a group dynamic, this requires a high degree of communication, understanding, and trust between all of the participants (9).

(2) We did not anticipate the prospect of such a group not only achieving "results" in the form of more scholarly productivity and externally funded research but serving as vehicle for encouragement, growth, accountability, and collegiality between faculty from disparate fields. In a word, we did not set out to use WWG for faculty development. Yet, we believe that it is occurring.

(3) We thought we knew what issues were important to our region for water. In some ways, we did. Yet we found that, when you want to conduct research or education projects that not only generate peer-reviewed publications but need to show tangible benefit to local people, you must spend time speaking with the local community to be sure that you know their felt needs and perspectives.

The working hypothesis for this research is that facilitating a means for faculty to work together frequently, in relationship, for the purposes of intellectual development is an underserved area of faculty development that needs to be conscientiously addressed. Even though engineering faculty, in theory, know how to conduct research as part of their training to receive a terminal degree, the research enterprise itself, especially at universities which are not R1, is often difficult. Ambitious and capable faculty, therefore could grow professionally in ways that will increase scholarly productivity, teaching confidence, and collaborative capacity through groups devoted to interdisciplinary research and education. The questions which we will be investigating are:

(1) What types of faculty development opportunities are seen in a group of researchers, which gather on their own, and are united through a common thematic interest?

(2) What kind of increased interdisciplinary vision and action do those from diverse fields experience when they meet together with the express aim of becoming more interdisciplinary in order to solve difficult problems?

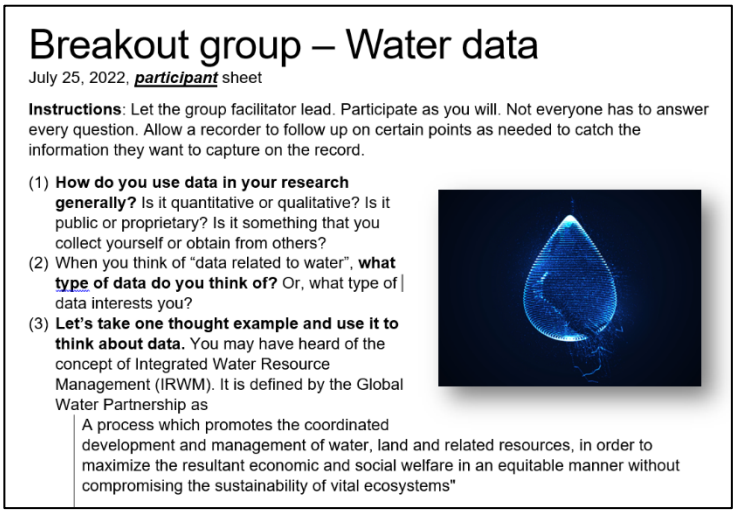
Table 1. Sample of interview questions to be used to evaluate faculty impacts in Water Working Group.

Category	Question
Identifying information	**Regional background** – How would you characterize your experience and/or interest in the Texas Panhanlde, the place where the WWG is focused in terms of its impacts?
Experiences in Water Working Group	**Definitions** – In your own words, what do you think the Water Working Group is? What do you think is its purpose?
	Value and benefit to you – What kind of benefits does WWG provide to you? When you attend, why do you attend? What do you hope to gain? How do you hope to contribute?
Mission & impact	**Achieving vision** – In your honest opinion, do you think the current state of WWG trends towards its vision? Why or why not?
	Interdisciplinarity - How well do you think that WWG embodies this concept of interdisciplinary research or education?
	Improvements or changes – What would you change (if anything) to improve WWG in ways which may benefit you in your professional capacity, the Texas Panhandle, or both?

METHODS & STUDY DESIGN

The Water Working Group has met monthly since June 2022, and there have been 10-15 faculty from several fields, many of which have come to 6+ meetings during that time. There are few who come to every meeting. We are doing an inductive study to examine the potential impact which faculty in attendance at some of these meetings can perceive through the continued participation. Specifically, we will be using an interview protocol which will used (30-60 min) on with 4-5 individuals with questions as provided in **Table 1**. We have designed shorter survey of multiple choice/multiple select questions concerning faculty origin (are they from the region or not?), length of time since PhD graduation, and familiarity with water research and education.

The questions in both interview and survey are designed to understand faculty background in water related research and their overall experience. We expect that some faculty will find that there is benefit from connecting their field, which they may see as more as "tool-based" (such as computer science or machine-learning), to something that they feel is more concrete or connects directly to the benefit of others. Other faculty may come to Water Working Group because their confidence in writing grants or starting a new area of research for them is a challenge. For these faculty, being around others who want to branch out into new areas of research or take a risk on a large team grant will be of interest. We note that data collection is on-going and will not be available in any meaningful sense until the end of summer 2024 at the earliest.



Breakout group – Water data

July 25, 2022, ***participant*** sheet

Instructions: Let the group facilitator lead. Participate as you will. Not everyone has to answer every question. Allow a recorder to follow up on certain points as needed to catch the information they want to capture on the record.

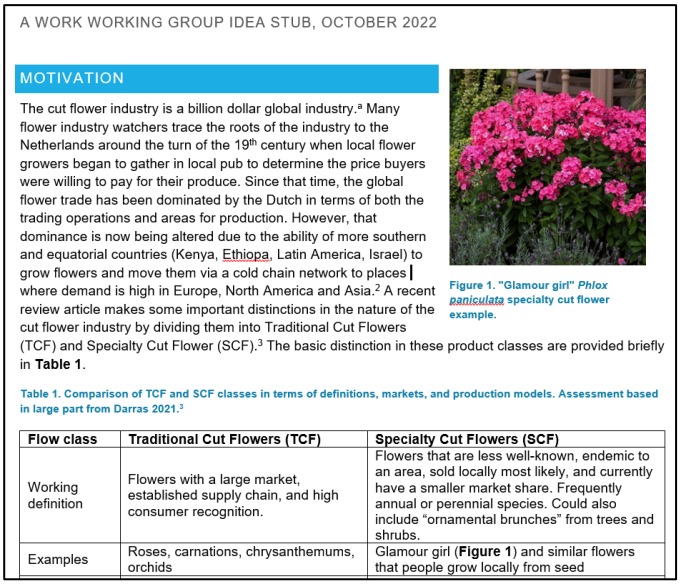
(1) **How do you use data in your research generally?** Is it quantitative or qualitative? Is it public or proprietary? Is it something that you collect yourself or obtain from others?
(2) When you think of "data related to water", **what type of data do you think of?** Or, what type of data interests you?
(3) **Let's take one thought example and use it to think about data.** You may have heard of the concept of Integrated Water Resource Management (IRWM). It is defined by the Global Water Partnership as

> A process which promotes the coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems"

Figure 1. Excerpt from a breakout discussion used to promote group cohesion around a topic common to many in research, the nature of data.

ACTIVITIES IN THE WATER WORKING GROUP

The particulars of what individuals have experienced in the WWG are important points of context for understanding their experiences. The group is at its core about addressing regional water challenges. We have provided here some examples of what this has looked like in practice in time of the group's existence. **Figure 1** shows an early activity which occurred in WWG where we encouraged faculty to talk about something which is common to most everyone in research—data. People come to these meetings presumably wanted to talk about water projects, but what they did think a "water project" was? Talking about the types of data which they have, might find in public form, or might want to collect as part of a water project helped people to build a relationship and have an interlanguage for how to speak to one another about something common—water—when they might come from very different fields that otherwise seem like they have little relation one to another. Another example is the concept of an "idea stub" (**Figure 2**). Faculty in the Water Working Group have a high demand of time on things which are not related to developing research projects. They do not often feel like they have the time to develop a proposal, a paper idea, or a new line of research. The WWG has been using writing of idea stubs and concept papers to write short things. Faculty get their thoughts down on paper, and they get feedback on the writing and also how to pursue the idea. There is therefore in this an opportunity to grow through mutual support and encouragement. Unlike a formal research proposal to a federal agency, the feedback they get is from someone they know and does not require many, many hours to write the proposal. In other words, the process of writing and feedback can be more regular as has been found to be important especially in early career faculty (1). There are more repetitions, opportunities for improvement, and faculty can improve on how to work out their ideas and make them clear in written form sooner than if they wrote just a few long proposals a year. This lower rate of scholarly production is common at many



A WORK WORKING GROUP IDEA STUB, OCTOBER 2022

MOTIVATION

The cut flower industry is a billion dollar global industry.[a] Many flower industry watchers trace the roots of the industry to the Netherlands around the turn of the 19th century when local flower growers began to gather in local pub to determine the price buyers were willing to pay for their produce. Since that time, the global flower trade has been dominated by the Dutch in terms of both the trading operations and areas for production. However, that dominance is now being altered due to the ability of more southern and equatorial countries (Kenya, Ethiopa, Latin America, Israel) to grow flowers and move them via a cold chain network to places where demand is high in Europe, North America and Asia.[2] A recent review article makes some important distinctions in the nature of the cut flower industry by dividing them into Traditional Cut Flowers (TCF) and Specialty Cut Flower (SCF).[3] The basic distinction in these product classes are provided briefly in **Table 1**.

Figure 1. "Glamour girl" *Phlox paniculata* specialty cut flower example.

Table 1. Comparison of TCF and SCF classes in terms of definitions, markets, and production models. Assessment based in large part from Darras 2021.[3]

Flow class	Traditional Cut Flowers (TCF)	Specialty Cut Flowers (SCF)
Working definition	Flowers with a large market, established supply chain, and high consumer recognition.	Flowers that are less well-known, endemic to an area, sold locally most likely, and currently have a smaller market share. Frequently annual or perennial species. Could also include "ornamental brunches" from trees and shrubs.
Examples	Roses, carnations, chrysanthemums, orchids	Glamour girl (**Figure 1**) and similar flowers that people grow locally from seed

Figure 2. Example of an "idea stub", little writing assignments that encourage people to generate ideas, put them on a page, and receive feedback from others.

smaller institutions like the one in this project, and faculty that have ambition simply need more opportunities to grow their nascent skills through practice.

SUMMARY AND ON-GOING WORK

The stated aim of the Water Working Group has been in large part to encourage interdisciplinary research and scholarship in an important uniting theme area for our institution—water resources. Though the group was not formed with the specific intent of faculty development we nonetheless observe that development is likely happening in the group which serves in effect as Community of Practice in research idea formulation, development, grant applications, scholarship, and regional impacts. The study is on-going through interviews and surveys of participants. The effort to examine faculty development gains and potential is exploratory. We hope that we will be able to assess these impacts of the group in formative way that allows us to increase research productivity in a place where teaching is historically predominant. What we find may be directly applicable to engineering colleges and departments in similar situations where faculty may feel underserved and under supported in their research ambitions.

REFERENCES

(1) Huerta, M.; London, J.; McKenna, A. Engineering deans' perspectives on the current state of faculty development programs in engineering education. *International Journal of Engineering Education* **2022**, *38* (4), 1073-1091.

(2) Barner, M. S.; Brown, S. A.; Lutz, B.; Montfort, D. How engineering faculty interpret pull-oriented innovation development and why context matters. *International Journal of Engineering Education* **2018**, *34* (5), 1644-1657.

(3) Estes, A. C.; Ressler, S. J.; Saviz, C. M.; Barry, B. E.; Considine, C. L.; Dennis, N. D.; Hamilton, S. R.; Hurwitz, D. S.; Kunberger, T.; Lenox, T. A.; et al. The asce exceed teaching workshop: Assessing 20 years of instructional development. *International Journal of Engineering Education* **2019**, *35* (6), 1758-1786.

(4) Estes, A.; Welch, R.; Ressler, S. The exceed teaching model. *Journal of Professional Issues in Engineering Education and Practice - J PROF ISSUE ENG EDUC PRACT* **2005**, *131*. DOI: 10.1061/(ASCE)1052-3928(2005)131:4(218).

(5) Lowman, J. *Mastering the techniques of teaching*; Jossey-Bass, 1995.

(6) Turnbull, B. Scholarship and mentoring: An essential partnership? *International Journal of Nursing Practice* **2010**, *16* (6), 573-578. DOI: https://doi.org/10.1111/j.1440-172X.2010.01883.x.

(7) Coleman, D. L.; Tannock, L. R.; Pignone, M.; Amin, A. N.; Finn, P. W. Developing faculty in emerging areas of interdisciplinary research. *American Journal of Medicine* **2018**, *131* (10), 1257-1262. DOI: 10.1016/j.amjmed.2018.06.009.

(8) Kandakatla, R.; Palla, A. Faculty development and community of practices: Exploring their interplay to facilitate change in pedagogical practices at hei's. *Saiee Africa Research Journal* **2021**, *112* (4), 207-215.

(9) Klein, J. T.; Schneider, C. G. *Creating interdisciplinary campus cultures: A model for strength and sustainability*; Jossey-Bass, 2010.