

## Intermural Online Research Group Meetings As Professional Development Tools for Undergraduate, Graduate, and Postdoctoral Trainees

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### Abstract

In academic research laboratories, well-organized group meetings are common training tools that can benefit individuals and the group as a whole. Owing to the COVID-19 pandemic, virtual meetings have become an increasingly important format for research group meetings. Virtual meeting formats also offer an important and underappreciated advantage: ease of collaboration with researchers at other (potentially distant) institutions. Herein, we describe the strategies we employed to facilitate engaging and productive online meetings and academic exchanges between environmental chemistry/engineering laboratories at a primarily undergraduate program and a doctoral research intensive institution. Over a period of 12 months, six intermural group meetings were held through videoconference. All meetings consisted of two segments: (1) a literature or research discussion and (2) a professional development session that emphasized topics such as navigating life after completing a bachelor's degree, advice on securing graduate school admission and funding, and characteristics of effective instructors (from the undergraduate perspective). Student-led discussion of scientific literature and research is valuable in enhancing trainees' communication skills, interdisciplinary perspectives, and critical reading of the literature. Professional development sessions facilitate unique opportunities for professional mentorship. Given the substantial pedagogical and other professional benefits of intermural group meetings, we recommend this meeting format as a useful training tool for research trainees even after the current pandemic wanes.

**Keywords:** higher education; interdisciplinary training; collaborative learning; professional development

### Introduction and Motivation

GROUP MEETINGS ARE a regular occurrence in most workplaces, including academic research laboratories. Research shows that groups that have successful meetings produce better outcomes (Allen *et al.*, 2016). A high-quality group meeting occurs when group members have a meaningful impact on each other, increasing competency and confidence of the participants for future opportunities (e.g., undertaking complicated research projects and participating in team-based research projects) (Burt, 2017; Burt *et al.*, 2017; Keller and Kendall, 2017). Factors contributing to a productive meeting include stable membership (Walker

*et al.*, 2017), clear communication of participant responsibilities (Agricola *et al.*, 2019; Leupen *et al.*, 2020), and timely distribution of information (e.g., reading assignments) to maximize participation in meeting discussions (Leupen *et al.*, 2020).

Recently, COVID-19 has increased the use of online formats for meetings and conferences (Milić *et al.*, 2020). Online formats have several benefits, including social distancing in a pandemic, reduced travel and space needs (resulting in decreased costs and environmental impacts), and the ability to reach a wider audience. However, possible drawbacks to online meetings for academic purposes include fewer interactions between members and less effective guidance compared with in-person meetings (El-Magboub *et al.*, 2016; Könings *et al.*, 2016; Gillingham *et al.*, 2020).

In higher education, research group meetings are common and are occurring increasingly online. One approach to enriching online group meetings is by forming partnerships between groups spanning multiple institutions. Such intermural online group meetings can promote exchanges of research experiences among students (and faculty), thereby

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providing opportunities to enhance communication skills, practice self-assessment, and increase motivation. In addition, connections between research groups can provide opportunities to gain practical advice regarding experimental design and information from unpublished articles.

Among possible partnerships between academic institutions, collaborative exchanges between predominantly undergraduate institutions (PUIs) and doctoral-granting universities with very high research activity (i.e., research intensive [R1] institutions) can improve research productivity and educational quality (Carnegie classification of institutions of higher education, 2018; Rovnyak and Shields, 2018; Freeman *et al.*, 2020; Shields and Feller, 2020). Exposure to an R1 institution can benefit students from a PUI through increased confidence in their competencies, insights toward choosing a graduate school (Kreitzer and Malchow, 2013), information on research trends, and opportunities for direct research participation at the R1 (Lopatto, 2007; Pufall and Wilson, 2020). Reciprocally, through online intermural meetings, we anticipate that graduate students and postdocs at R1 institutions can develop mentorship and teaching skills, align their research goals with broader perspectives, and discover what a career at a PUI entails (Dolan and Johnson, 2009).

In this article, we share implementation strategies and didactic benefits associated with intermural group meetings between a predominantly undergraduate research group in the department of chemistry at Towson University and a research group of primarily doctoral students in the department of civil and environmental engineering at the University of Southern California (an R1 institution). From the summer of 2020 through the summer of 2021, six joint group meetings were convened between members and principal investigators (PIs) of both groups. The purposes of the intermural meetings were to broaden perspectives of research trainees by facilitating interdisciplinary dialogues, sharing unpublished research to strengthen it through informal peer review, and gaining experience mentoring across academic institutions and levels.

## Implementation Strategies

### Identifying prospective collaborators

Developing partnerships between research groups is a crucial step in organizing intermural group meetings. In Table 1, we suggest opportunities to make connections between different institutions. Previous experience working together on projects or in the same group can be a useful source for organizing intermural group meetings. Also, a list of researchers affiliated with the same professional organizations or societies can be a source of research groups and institutions for potential partnerships. Conference rosters or funding agency public award information can directly show their research interests and provide information on potential collaborators. Finally, authors of articles on similar research topics could be contacted to inquire about forming a potential partnership. The partnership described herein was established based on the pre-existing relationship between the PIs.

### Organizing intermural group meetings

Intermural group meetings (Table 2) occurred through Zoom and consisted of two 60-min segments, with the first

TABLE 1. OPPORTUNITIES TO BUILD INTERMURAL PARTNERSHIPS BETWEEN RESEARCH GROUPS

- Pre-existing relationships from graduate school and postdoctoral work
- Connections through professional organizations or societies
- Networking at professional conferences<sup>a</sup>
- Funding agency databases to discover who is working on funded projects that are in areas of inquiry similar to your group
- Reaching out to authors of articles in your area of expertise

<sup>a</sup>Examples include American Chemical Society meetings, Gordon Research Conferences addressing topics such as environmental science and water disinfection, Society of Environmental Toxicology and Chemistry meetings, American Water Works Association conferences.

segment being either a literature discussion or a conference-style research presentation. Literature discussions were co-facilitated by one or more students from each institution. Student cofacilitators assisted in selecting peer-reviewed articles to discuss, which included a mix of highly cited seminal articles and hot-off-the-presses reports. The cofacilitators were responsible for dividing labor among themselves, and they interfaced with one another through videoconference to plan their approach and to create presentation slides to guide the discussion. For research presentation segments, one member from each group was invited to present their research for 20 min. These presentations were followed by question-and-answer sessions, wherein members of both groups posed questions to each presenter and were selected by the presenter on a first-come-first-served basis.

The second segment of each meeting consisted of a professional development presentation panel discussion or facilitated social interactions (e.g., online ice-breaker activities and team-based games). Each professional development session was led by several trainees. At some meetings, graduate students and postdocs shared knowledge relevant to the goals of undergraduates (e.g., success after college, deciding whether to pursue graduate education, preparing graduate school applications, selecting a graduate program/advisor). At other meetings, undergraduates shared insights based on their experiences interacting with more senior scientists (e.g., effective teaching/mentoring strategies from students' perspective).

Notably, every participant had a role at the meetings. Trainees tasked with leading a literature discussion or giving a research talk were responsible for preparing slides, presenting at the meeting, answering questions, and guiding the discussion by posing prepared questions to the group. For a literature discussion, student facilitators typically distributed discussion questions to the other group members to view in advance of meetings. Trainees not presenting or leading a discussion prepared for the meeting by reading assigned articles and reviewing discussion questions beforehand. These group members were expected to participate in the literature discussion and pose questions to presenters after their research talks.

The role of PIs was to guide student presenters and facilitators in their preparation for meetings, act as moderators (and, occasionally, interjectors) during discussions, and

TABLE 2. INTERMURAL GROUP MEETING DATES AND TOPICS FROM JUNE 2020 THROUGH JUNE 2021

Meeting date	First segment	Second segment
June 26, 2020	Literature discussion	Not applicable
July 30, 2020	Research presentations	Education and career tracks (e.g., engineering vs. chemistry), external funding sources for graduate school
September 11, 2020	Research presentations	Graduate school fellowship and scholarship applications/essays
October 30, 2020	Literature discussion	Effective instruction in the classroom from an undergraduate perspective
January 22, 2021	Literature discussion	Group interview among trainees on the effectiveness of intermural group meetings (with PIs in a breakout room)
June 4, 2021	Research presentations	Social hour that included an online ice-breaker activity and a team-based online game

PIs, principal investigators.

contribute insights on discussion topics when appropriate. For certain topics (e.g., selecting a graduate program/advisor, effective teaching/mentoring strategies), it was beneficial for PIs to minimize their participation (and in some cases move to a breakout room), providing space for trainees to drive the discussion and speak freely about their experiences.

### Pedagogical Advantages and Ancillary Benefits

Environmental engineering and science (EES) is inherently interdisciplinary, with researchers often submitting collaborative proposals, coauthoring articles, etc., across department and university lines. Our article highlights that research groups do not need to wait until a collaborative research project is funded to initiate an exchange of ideas and perspectives across the boundaries the EES field transcends. We contend that connecting researchers across subdisciplines within EES (e.g., aquatic chemistry and physical/chemical process engineering) can enhance the training experiences of EES students by diversifying their viewpoints and experiences. During the intermural meetings, undergraduate and graduate trainees exchange ideas and discuss questions embedded in the presentation. The literature discussions improve their ability to critically assess scientific writing. The challenge of discussing scientific topics (including their own research) with members of a different group is also valuable for building communication skills. When selecting research articles to discuss, we found it beneficial to rotate between highly cited pioneering articles and newer articles whose impact on the field is not yet known. The professional development sessions, and the meetings in general, provide an environment for frank discussions spanning different institutions, disciplines, and academic generations. In addition, the exchange of ideas between the two groups presents a unique opportunity for mentorship especially for those considering a career in academia, for whom it is beneficial to see the type of research students at a PUI are capable of doing.

### Conclusions

Overall, online research group meetings can be an effective tool for professional development of undergraduate, graduate, and postdoctoral trainees. Each component of the meeting affords advantages that can be amplified by communicating across academic disciplines and institutional types. Through literature discussions, trainees improve their

critical review skills and learn from the exchange of ideas. Sharing unpublished work provides relatively low-stress practice conveying research to different audiences, and experimental methods can be improved through the input of others. Lastly, professional development sessions foster new mentoring relationships and experiences that could be rare within each separate institution.

### Authors' Contributions

E.K. and O.M.D. wrote the article. D.L.M. and J.D.S. originated the ideas underpinning this study, supervised the project, and contributed to the writing of the article.

### Disclaimer

Any opinions, findings, and conclusions or recommendations expressed herein are those of the authors and do not necessarily reflect the views of the National Science Foundation.

### Author Disclosure Statement

No competing financial interests exist.

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