Evolution of Undergraduate Research Training Approaches in the Biomedical Sciences:

Moving from Apprenticeship-Type Training to include Group-Based Team Research

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May 2, 2024 – Queen’s CTL Showcase of Teaching and Learning
Who are we ...

Natalie Domingo  
BHSC ‘24

Nicolle Domnik  
DBMS; DOM

Jeanne Mulder  
DBMS

Natalie McGuire  
DBMS; OPDES
... and why are we here? Welcoming the Discovery Labs

"The future of discovery is collaboration"

- Dr. Lynne Postovit
A philosophical question meets a practical conundrum
Theoretical and Practical Benefits and Challenges


• Massification of education a challenge for apprenticeship models to research training (Fendos CBE Life Sci Educ 2022)

• Group-based research may additionally enhance collaborative skills, teamwork, conflict resolution, and project management (Wilson CBE Life Sci Educ 2018; Finelli CRLT 2011; Johnson JECT 2014; Lamm J Agric Ed 2012)

• 80% of graduates (i.e., employees) transition to team-based work environments (Attle Int J Teach Learn High Educ 2007)

• Is group-based research training the solution?

• Will people see it as the solution?
Study Objective(s)

1. **Students:** i) understand motivations for pursuing UR, ii) examine expectations, iii) monitor perceptions of chosen research stream.

2. **Educators:** i) explore experiences supervising students in UR, ii) challenges and factors influencing adoption of group-based research, iii) impressions of training levels attained by students in both streams.
Recruitment and Participants

Direct Email Invitation:
160 students + 126 faculty (Queen’s)  
+ ListServe Emails
Canadian universities 
+ Posters 
(community + social media)

16 Participants 
(14 women + 2 men) 

8 Students 
(7 women + 1 man)

8 Educators 
(7 women + 1 man)

- 5 Queen’s
- 1 Brock
- 1 McMaster
- 1 York

- 7 Queen’s
- 1 Laurier
Study Overview

5-30-minute surveys via Qualtrics

Queen’s participants received three surveys: Sept 2023, Dec 2023, Apr 2024
Non-Queen’s participants received one survey: Jan 2024

Surveys used multiple-choice, ranking, Likert scale, open response questions

Optional debrief interviews in Apr 2024

Participation was voluntary and anonymous

Qualitative data underwent inductive thematic analysis using Nvivo, and numeric results using descriptive statistics
Who is represented?

<table>
<thead>
<tr>
<th>Sociodemographic Characteristic</th>
<th>Students</th>
<th>Educators</th>
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</thead>
<tbody>
<tr>
<td>Program of Study/Supervision</td>
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<tr>
<td>Other / Late Career</td>
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</table>
What did we learn?
Initial Impressions: Group- vs Individual-Research

Group Research

communication  teamwork  inclusive  applicable
active-listening  organized  compromise
resolution  problem  conflict

collaboration

Individual Research

self-directed  independent

self-managed  problem-solving

time-management  dedication  accountable
responsible  resilient  hard-working

confident  prioritizing  alone

deadlines

Words used by students and educators to describe research approaches; word size reflects frequency of reporting.
“Overall contribution to scientific discovery depends on the novelty of the research findings” – Student 3
“Whether the research experience is "richer" will depend on supervisor engagement and student motivation” – Educator 2
Joint Themes

Benefits
- Collaboration
- Teamwork

Concerns
- Conflicts
- Unequal Workload

Recommendations
- Contracts
- Clear Guidelines
Take Home Messages

• Group-based team research offers significant potential, which is recognized by students and educators amidst some reservations
  - Specific conditions required for group-based team research to thrive
• Fostering greater interdisciplinarity could further enhance group efficacy: a call to other disciplines
• *Shameless plug for the Discovery Labs!*
Thank-you!

Feel free to reach out, if you’d like to connect about the Discovery Labs:

n.j.domnik@queensu.ca or discovery@queensu.ca

Heartiest thanks to Natalie Domingo, who really drove this work!

DISC599: Discovery Labs
Radical Collaboration through Team-Based Research

The Discovery Labs are your sandbox for experiential learning and essential, practical research skill development. By developing and executing your own unique research project you will learn about diverse research tools and approaches... and how to use them, positioning you for success as scientists.

Science increasingly involves multidisciplinary teams that leverage member skill diversity to achieve more than a single researcher in isolation. We are excited to deliver this approach via the Discovery Labs, training you – our next generation of scientists – to work collaboratively in teams of 5 to achieve research success.

DISC599 will provide you with training and experience-building in a rich breadth of topics relevant to science while completing your research project. You will be work as a team under the mentorship of disciplinary experts to develop and maintain the highest standards of professional academic performance.

Project support: DBMS Research Initiation Grant (NJD)
Recruitment: Students

1st Round of Recruitment (Queen’s University)

- PHGY 499, QOL LISC 596 and HSCI 59* students: (n = 160)
  - Excluded; did not consent: (n = 143)
  - Consented: (n = 17)
    - Excluded; did not complete Sept intake survey: (n = 12)
    - Participants completing Sept intake survey: (n = 5)
      - Participants completing Dec check-in survey: (n = 4)
      - Participants completing Mar closing survey: (n = 4)
        - Total participants including those lost: (n = 8)
          - Participants completing optional debrief interviews: (n = 3)

2nd Round of Recruitment (Canadian Universities)

- 43 emails to program assistants/course coordinators (Western, UofT, McMaster, Guelph, uOttawa, TMU, York, Laurier, Brock, Carleton, Waterloo, Trent, McGill, Dalhousie, UBC)
  - 39 negative responses
  - 4 positive responses confirming recruitment poster circulated among supervisors (Guelph, York, Laurier, Brock), 7 likes on online Instagram ad. Anticipate a reach of: (n = 607)
    - Excluded; did not consent: (n = 603)
    - Consented: (n = 4)
      - Participants completing Jan intake survey: (n = 3)
Recruitment: Educators

1st Round of Recruitment (Queen’s University)

- PHGY 499, QOL LISC 596 and HSCI 598 supervisors: (n = 83)
  - Excluded; did not consent: (n = 74)
  - Consented: (n = 9)
    - Excluded; did not complete Sept intake survey: (n = 3)
      - Participants completing Sept intake survey: (n = 6)
        - Participants completing Dec check-in survey: (n = 4)
          - Participants completing Mar closing survey: (n = 2)
            - Total participants including those lost: (n = 8)
              - Participants completing optional debrief interviews: (n = 1)

2nd Round of Recruitment (Canadian Universities)

- 43 emails to program assistants/course coordinators (Western, UofT, McMaster, Guelph, uOttawa, TMU, York, Laurier, Brock, Carleton, Waterloo, Trent, McGill, Dalhousie, UBC)
  - 39 negative responses
    - 4 positive responses confirming recruitment poster circulated among supervisors (Guelph, York, Laurier, Brock). Anticipate a reach of: (n = 200)
      - Consented: (n = 4)
        - Excluded; did not consent: (n = 196)
          - Excluded; did not complete Jan intake survey: (n = 2)
            - Participants completing Jan intake survey: (n = 2)
## Participants

<table>
<thead>
<tr>
<th>Sociodemographic Characteristic</th>
<th>Students</th>
<th>Educators</th>
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*sex and self-identified gender were documented and aligned for all n=16 participants
Student Perspectives

1. **Motivations for Pursuing Research**
   - Higher Education and Career Exploration
   - Skill Development
   - Scientific Discovery

2. **Expectations of Group vs Individual Work**
   - Collaboration and Support
   - Autonomy and Responsibility

3. **Overall Perceptions of Project Format**
   - Strengths and Weaknesses
   - Recommendations

- Understand interests in research, explore careers, gain practical experience
- Acquire/enhance skills applicable to academia and careers (e.g., communication, writing)
- Expected benefits re: groups (collaboration, support, real-world experience), with some concerns re: workload and communication
- Perceptions of autonomy and responsibility leading to ownership in individual projects
- Collective impact and working towards shared goal highlighted, versus individual pride
- Sense of personal accomplishment linked to novelty of work more than project type
Educator Perspectives

1. Experiences
   Supervising Group vs Individual Projects
   - Collaboration and Teamwork
   - Ownership and Responsibility

2. Factors Influencing
   Group Training Model Adoption
   - Research Experience Richness
   - Conflicts

3. Impressions of
   Student Skill Development
   - Skill Acquisition
   - Future Applications
   - Recommendations

- General preference for individual projects, but richness of research depends on factor including supervisor and student engagement
- Some group conflicts, with some mitigation strategies suggested
- Excited about skill-enhancement and authenticity – but concerns about freeloading – in group settings
- Individual projects have clear path of ownership while group work requires delineation of duties to avoid conflict
- Feeling that group projects might develop practical, academic and professional skills less (“divide and conquer”)
- Concerns about how others (e.g., interviewers) may perceive student skills or contributions in group settings in the future
Student Perspectives

1. Motivations for Pursuing Research
   - Higher Education and Career Exploration
   - Skill Development
   - Scientific Discovery

2. Expectations of Group vs Individual Work
   - Collaboration and Support
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3. Overall Perceptions of Project Format
   - Strengths and Weaknesses
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Theme 2: Experimental design

ST4 – Autonomy: Student perspectives on individual project work.
   - “I prefer to have deadlines and ensure all my work is done on time.” – Student 3

Theme 3: Perceptions on their projects’ impact on scientific discovery.

ST5 – Collaboration Contributions: Highlight group projects’ collective impact and equal contributions, fostering motivation and individual pride.
   - “A group project has ... [made] me feel like we have the capacity to make a more meaningful impact with more hands-on deck” – Student 1

ST6 – Individual Impact: Highlights greater personal accomplishment to scientific discovery, but more so depends on the novelty of the findings.
   - “Lead to greater discovery in a more focused area... any discovery found, will seem more impactful as it was done alone” – Student 7

ST7 – Overall Contributions: Emphasizes the role of individual contributions in scientific research.
   - “Overall contribution to scientific discovery depends on the novelty of the research findings” – Student 3
**Educator Perspectives**

1. **Experiences Supervising Group vs Individual Projects**
   - Collaboration and Teamwork
   - Ownership and Responsibility

2. **Factors Influencing Group Training Model Adoption**
   - Research Experience Richness
   - Conflicts

3. **Impressions of Student Skill Development**
   - Skill Acquisition
   - Future Applications
   - Recommendations

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**Theme 3: Impressions on students’ training and skill development.**

**ST5 – Skill Acquisition:** Both projects facilitate practical skill development for academic and professional advancement, but group projects to a lesser extent.

- “They can both offer skill development just with a different skill set” – Educator 1
- “[Group projects] will probably get a least holistic experience, as most groups "divide and conquer" - which means they may not get to engage in all steps of the research process” – Educator 3

**ST6 – Applications to Future Endeavours:** Expected benefits (advance knowledge, develop expertise, contribute to societal improvements) with each project type, but concerns about how others may perceive contributions in group settings are noted.

- “Advance knowledge in their field of interest to improve society locally, nationally, and/or globally” – Educator 4
- “[It] may be harder to position yourself in job interviews since it’s unclear on the interviewer’s end how much the student actually did themselves” – Educator 5