

Cross-cultural Mentoring Relationship in International Chemistry and Biology Undergraduate Research Experiences

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Outline

Background and Research Questions

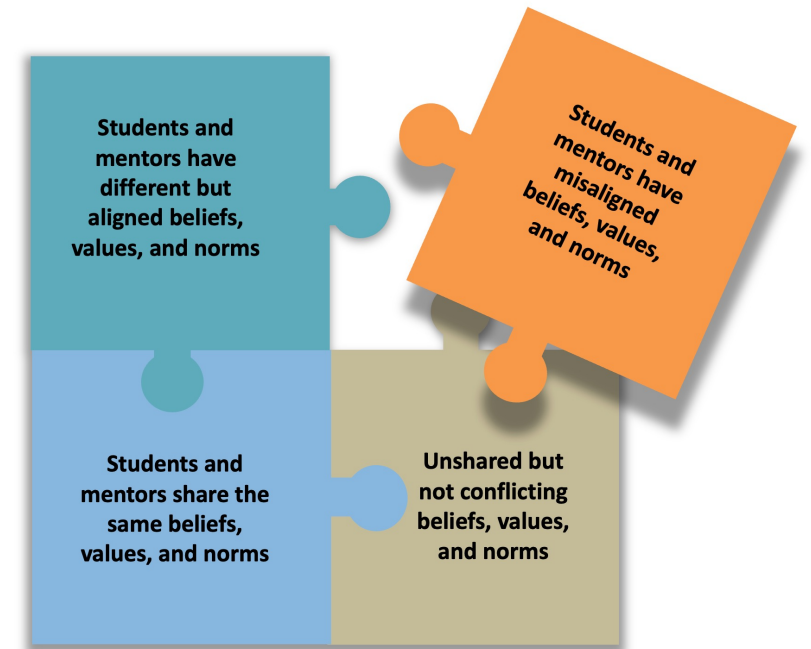
Research Design

RQ1: characteristics of mentoring relationship

RQ2: Setting structures behind the mentoring relationship

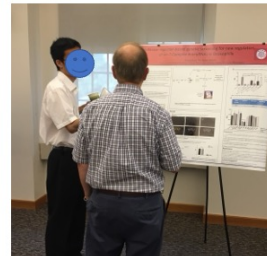
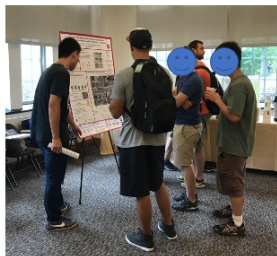
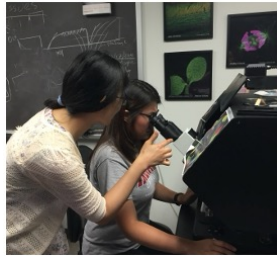
Conclusion

Implications



Background, Motivation and Research Questions

- Background: Undergraduate research is an authentic inquiry practices conducted by **undergraduate students** under the **guidance of research mentors**.
- Students experience in UR programs is related to mentoring relations, which is defined as a **mentor/student tutorial** in a laboratory setting conducting authentic research.
- International Summer Undergraduate Research Program (ISURP) (2016)



- Research question:
 - How do students, mentors, and supervisors describe their mentoring relationships?
 - How does an Asian student co-create the mentoring relationship with his/her mentor(s)?

Research Design

- **Critical Qualitative Methodology influenced by Habermas's communicative action theory.**
- **In a relationship, participants co-create a set of normative infrastructures (i.e., setting structures) that implicitly coordinate their activities**
- **Every member of a communication contributes to the creation of their setting structure, but the one with more power influences more on the setting structure**

Participants in the ISURP (2016): Eight undergraduate students were nested in five research groups

Data source:

The transcripts of students and their mentors pre- and post interview

Each interview contains ~15 open-ended questions in a semi-structured format.

The interview ranges from 12 to 48 minutes with an average of 25 minutes.

Data analysis:

identify interview questions that motivate participants to talk about their mentoring relationship

include analytical memos and reflections on the transcripts around the research questions

Research question 1

Characteristics of mentoring relationship

Mentoring relationships are presented in terms of participants' actions that reflect mentor/student tutorials about conducting scientific research .

- Propose research question or project idea
- Gather and analyze data
- Propose possible explanations
- The use previous research and literature

Research question 1: characteristics of mentoring relationship

- Characteristics of mentoring relationship
 - Propose research question or project idea:
 - Pre-determined projects.
 - Authenticity ranges from **free exploration to manipulated authentic research.**
 - Students were assigned with a task to replicate a reaction based on a published paper but with modified substrate.
 - Students explored a new technique developed in this group.
 - Mentor designed a project based on his ongoing research for Student
 - Student worked on part of Mentor's dissertation project that involves testing several hypotheses through a series of experiments.
 - Students are less independent and contribute in terms of labor when they worked on part of their mentors' projects
 - **Time constraint** was a major consideration of mentors' choice of projects

Research question 1: characteristics of mentoring relationship

- Gather and analyze data
 - Mentors pre-prepared materials for summer researchers
 - For example, Xin (Mentor) indicated they pre-prepared the plants for Kaimeng (student) otherwise minimum achievement could be made during short time period.
 - Students mastered basic laboratory skills in a short period, regardless of their prior experience. When come to higher level of methods, they watched their mentors operating (e.g., SEM).
 - Mentors played a dominating role on data analysis, variable adjustment, or decision for the next step (for seven students).
 - For example, Yeona and Haoran (students) perform parallel experiments with different experimental variables. The decision of which variable to change was Kevin's (mentor) decision.
 - One exception: Prof. NS claimed that Teng (student) often proposed new ideas to pursue the project.
 - Seven out of eight students are more involved in the doing aspects of research and made less intellectual contributions.

Research question 1: characteristics of mentoring relationship

Research question 1: characteristics of mentoring relationship

- **Propose possible explanations**
 - In most cases, mentors and students discuss about the result together, and then students summarize the the explanations.
 - Linna (mentor) explained to Jiyeon regarding specific parts to write. Jiyeon wrote the abstract herself, and Linna helped her to reshape the abstract.
 - In one case, the mentor played a dominating role on proposing explanations.
 - Shaojie (mentor) prepared 90% of the materials needed for Ying's (student) presentation, including figures, captions, abstract, and presentation scripts. Ying gave her presentation by memorizing the scripts prepared by Shaojie.
- **The use previous research and literature**
 - Literature seemed to be detached from undergraduate research
 - Mentors offer students with several representative papers, but did not require them to read through
 - Students were not required to search for additional literature
 - Two students took the initiative to dive into literature
 - Jiyeon contacted Prof. CW via email to ask for literatures before she arrived. Linna said "When we first met, she (Jiyeon) came to me with a binder full of research papers from our group."
 - Teng searched for additional literature based on the paper provided by prof. NS.

Research question 2

Setting structures
behind the
mentoring
relationship

Settings refer to the normative infrastructures that implicitly coordinate participants actions in the mentoring relationships.

- How participants understand the nature of scientific research
- The meaning of undergraduate research to students
- Their beliefs about how each participant should be engaged
- Undergraduate researchers' knowledge and skill
- Their expectation towards this relationship.

Student

- Research lab has a hierarchical structure
- Laboratory environment is different in the US
- Gain a sense of achievement
- English proficiency is a necessity
- Experience a new culture and communicate with local students
- Mentors take the initiative to check the progress

Common place

- Learn basic concepts and skill in a specific field
- Mentor approach students as apprentice/students see themselves as apprentice
- Reading extensive literatures is not a necessity for experiments
- Experience life in graduate school
- Help make decision on career choice
- Explore potential research fields to find interest

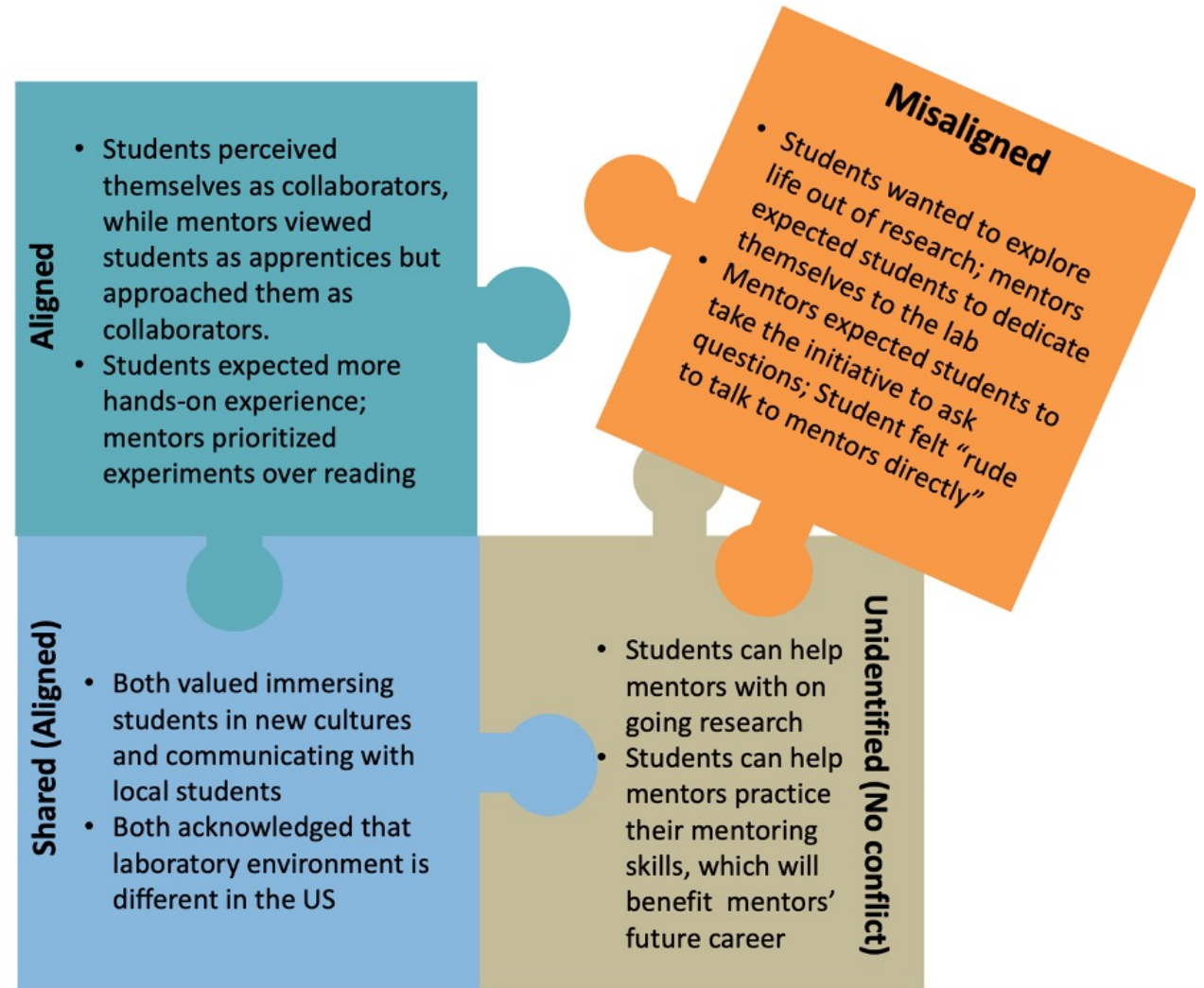
Mentor

- Mentor approach students as collaborators
- Students take the initiative to ask questions
- Time constraint shapes the mentoring relationship
- Help mentor with ongoing research
- Provide students with authentic experience
- Pre-request skills needed

Research question 2: Setting structures behind the mentoring relationship



Research question 2: Setting structures behind the mentoring relationship



Conclusion

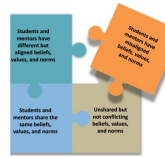
- This study provides a glimpse into what cross mentoring relationship look like in an international undergraduate summer research program.
- Most mentors engage students in the doing aspects of research with minimum intellectual input from students.
- Students' prior laboratory skills were not crucial for the summer research program as mentors could prepare students with basic laboratory skills in a short period of time.
- Students and mentors walked into the mentoring relationship with a set of normative infrastructure, which is less likely to change during eight weeks.
- The mentoring relationships were shaped by the common place of participants' settings. When differences were presented, it was dominated by the one with more power.

Implications

I hope to help IU recruit the best students.

Unfortunately, my success has been in placing the students in really good labs in other graduate programs. I feel sad, but I know it's going to happen.

I was pretty negative about it before I got started, and it's basically my PI told me to take her, and I did. But then, by working with her, it's really like quite rewarding to see how fast she learned like grow. She helps moving the project faster than I thought it was.



Supervisors

Discuss expectations explicitly

Set up achievable goals

Assess students' achievement



Mentors

Balance between self-care and student's needs



Students

Communicate your own expectations

Actively seeking for feedback

Reflect on the setting

They are open to questions. If you have question, ask them, do not hesitate

Settings: Beliefs, Values, and Norms



Thank you

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Undergraduate scientific research

- Undergraduate scientific research is:
 - conducted by undergraduate students.
 - a practice in which students experience authentic scientific inquiry
 - a pedagogical tool for promoting students' personal and professional development
- Benefit of undergraduate scientific research:
 - Career aspiration: develop understandings of graduate school and science career (Balster, et al., 2010; Jones, et al, 2010; Shortlidge, et al., 2016).
 - Gain in Content knowledge: develop deeper understanding of concepts and research skills (Maltese & Harsh, 2015; Russell, et al., 2007; Shortlidge, Banger & Brownell, 2016)
 - Develop higher level thinking and better understand the nature of science (Sadler & McKinney, 2010)
 - Increased graduation rate and retention rate (Jones, et al., 2010; Lopatto, 2007)
- Effective mentoring relationship maximizes the benefits (Thiry and Laursen, 2011; Aikens *et al.*, 2017, 2016; Hernandez *et al.*, 2017)

Mentoring relationship in Undergraduate scientific research

- Mentoring relationship is defined as *a mentor/student tutorial in which a mentor guides a student through authentic scientific research practices.*
- A mentor work closely with students to share experience and knowledge, help skills training, and provide all kinds of supports (Bozeman & Feeney, 2007).
- Primary mentoring and Secondary mentoring (Whitely, Dougherty, and Dreher, 1991)
- Mentors' and students' attitudes, values, and beliefs influences their reported experience (Eby, McManus, Simon, and Russel, 2000)
- Mentoring literatures highlight the importance of communication between mentors and students (Dolan & Johnson, 2009)

Context, Data Collection and Analysis

- Participants in the ISURP (2016)

Student	Gender	Home Country and City of Institution	Placement	Mentor	Research Area
Ying	Female	Hefei, China	SS group	Shaojie	Chemistry, nanomaterials
Haoran	Male	Hefei, China		Kevin	Chemistry, nanomaterials
Yeona	Female	Soul, South Korea	CW group	Linna	Biology, cell biology
Jiyeon	Female	Soul, South Korea			
Changyuan	Male	Beijing, China	SC group	Peter	Chemistry, organic synthesis
Minjun	Male	Soul, South Korea			
Kaimeng	Male	Beijing, China	SM group	Xin	Biology, plant
Teng	Male	Beijing, China	NS group	Prof. NS	Biology, neurobiology (fly)

- Eight undergraduate students were nested in five research groups
 - Four undergraduate—graduate/postdoc/professor dyads
 - Two undergraduate—undergraduate—graduate/postdoc triads
- Data source:
 - The transcripts of students and their mentors pre- and post interview
 - Each interview contains ~15 open-ended questions in a semi-structured format.
 - The interview ranges from 12 to 48 minutes with an average of 25 minutes.
- Data analysis:
 - identify interview questions that motivate participants to talk about their mentoring relationship
 - include analytical memos and reflections on the transcripts around the research questions

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