Implementation of Self-Reflective Practices for Chemistry Undergraduate Teaching Assistants

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Abstract

Self-assessment of teaching have been shown to improve student learning outcomes by allowing instructors to refine their educational practices and provide self-evaluation. Despite the benefits that reflective practices can produce, reflections lacking a critical element, such as not considering a learner's perspective, can instead be incorrectly used to justify improper practices. This study investigates undergraduate teaching assistants and combines two parts:

1) bibliometric analyses that provide an understanding of the intellectual architectures existing in published literature regarding current reflective practices in higher education

2) Reflective accounts from undergraduate teaching assistants that examine the emergent themes and attitudes surrounding their instructional practices using the Vitruvian Model of Reflective Practice (VMRP). Participants in the study completed reflective entries about their teaching using the VMRP. The themes identified provide us with an insight to current UTA teaching practices and areas to focus on during their professional development training.

Introduction

Undergraduate Teaching Assistants' (UTA) support science instruction by giving students more individualized support during chemistry courses. At UCF, Chemistry UTAs undergo training in pedagogy and instructional practice to help them fulfill their duties. While this training is helpful, effective instruction also requires reflection and self-regulation to support the development of UTA instructional practices. A self-regulated student understands their own knowledge, motivation, and cognition that can inform student progress and allow for adaptations to learning experiences.[1] The Vitruvian Model of Reflective Practice (VMRP) was developed so support instructor reflective practice over the entirety of their teaching in a balanced and meaningful way without the unwieldly completion and review of typical reflective diaries.[2] Informal programs where the practitioner can adopt non-prescriptive reflective protocols, and freely express their thoughts or emotions are shown to be both useful and effective outlets for critical self-reflection.[3] The VMRP asks practitioners to reflect on 4 domains 1) Cognition, 2) Affective, 3) Psychomotor and 4) Conative. These elements inform this research investigating the reflective practices of UTAs with the VMRP and make recommendations to future training programs.

Research Questions

1) What is the intellectual structure of the literature surrounding reflective practices in chemistry education?

2) How do undergraduate teaching assistants self-reflect on their teaching practices using the Vitruvian Model of Reflective Practice?

Frameworks

Grounded Theory: grounded theory "focuses on generating theory rather than a particular theoretical content" and uses a constant comparative method of induction and deduction. This constant comparative method is based in comparing research results and testing emergent concepts with additional fieldwork, with results having an empirical basis.[4] This leads to results that are positioned close to where data was collected and results that are useful in recommending changes or updates to sources of data collection for further testing and refinements.

Constructivism: A theory of learning that people incorporate new knowledge and experiences into preexisting knowledge and "actively construct" their knowledge base. Constructivism focuses on the personal meaning-making in each individual as new information is synthesized into older information.[5] This research study is interested in how learning assistants view and improve their instructional practices over time through their lived experiences.

Bibliometrics: Methods that deal with the analysis of scientific works and their relations. Bibliometrics can be used to understand the dynamics of a research area and is used in our research to find important, core literature and describe the intellectual architecture of published works in the field. We adopt the principles of network analysis and graph theory to analyze the emergent networks to describe the literature base.[6]

Methods

Bibliometrics Data Collection

- Systematic literature search using specific search parameters for reproducibility, such as using "chemistry" in the topic search field.
- Results from literature search refined using criteria such as: "education", "higher education, and English language.
- Collected database results exported into Biblioshiny to analyze their intellectual architecture and related networks constructed.[7]
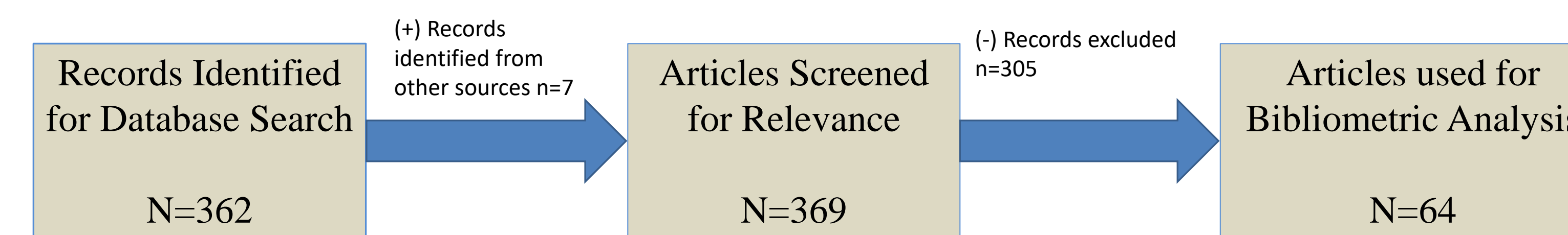
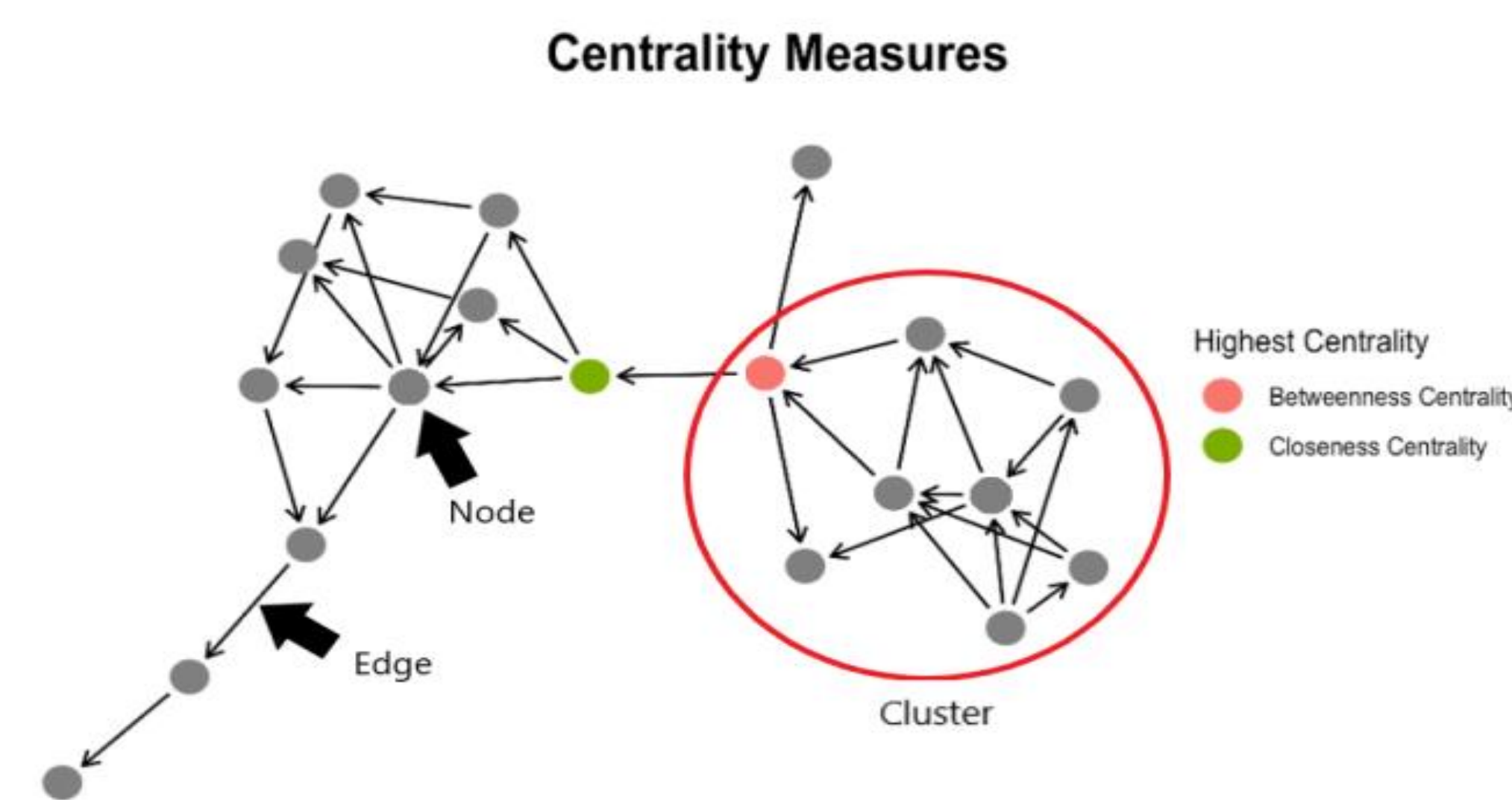**Figure 1.** PRISMA Diagram for refinement of dataset

Records Identified for Database Search N=362 → (+) Records identified from other sources n=7 → Articles Screened for Relevance N=369 → (-) Records excluded n=305 → Articles used for Bibliometric Analysis N=64

Figure 2. Examples of key features identifiable in Bibliometric Network Analysis[8]

Reflective Data Collection

- 14 Chemistry UTAs volunteered to complete reflective entries using the VMRP worksheet based on their weekly engagement with their students
- The worksheets were analyzed using emergent thematic analysis and descriptions and codes assigned to each emergent theme to create a codebook[9]
- Using the codebook, each worksheet was analyzed to identify relationships for each participant and the influence of temporal development on the 4 domains of the VMRP model.

Results

Bibliometric Analysis

The source data obtained from the systematic literature were analyzed using two different analyses:

- Co-citation analysis allows an examination of the works that are cited together in records from the dataset and can reveal works that make up the core of a research areas intellectual structure.
- Co-word analysis allows an examination of the thematic structure of records in the dataset.
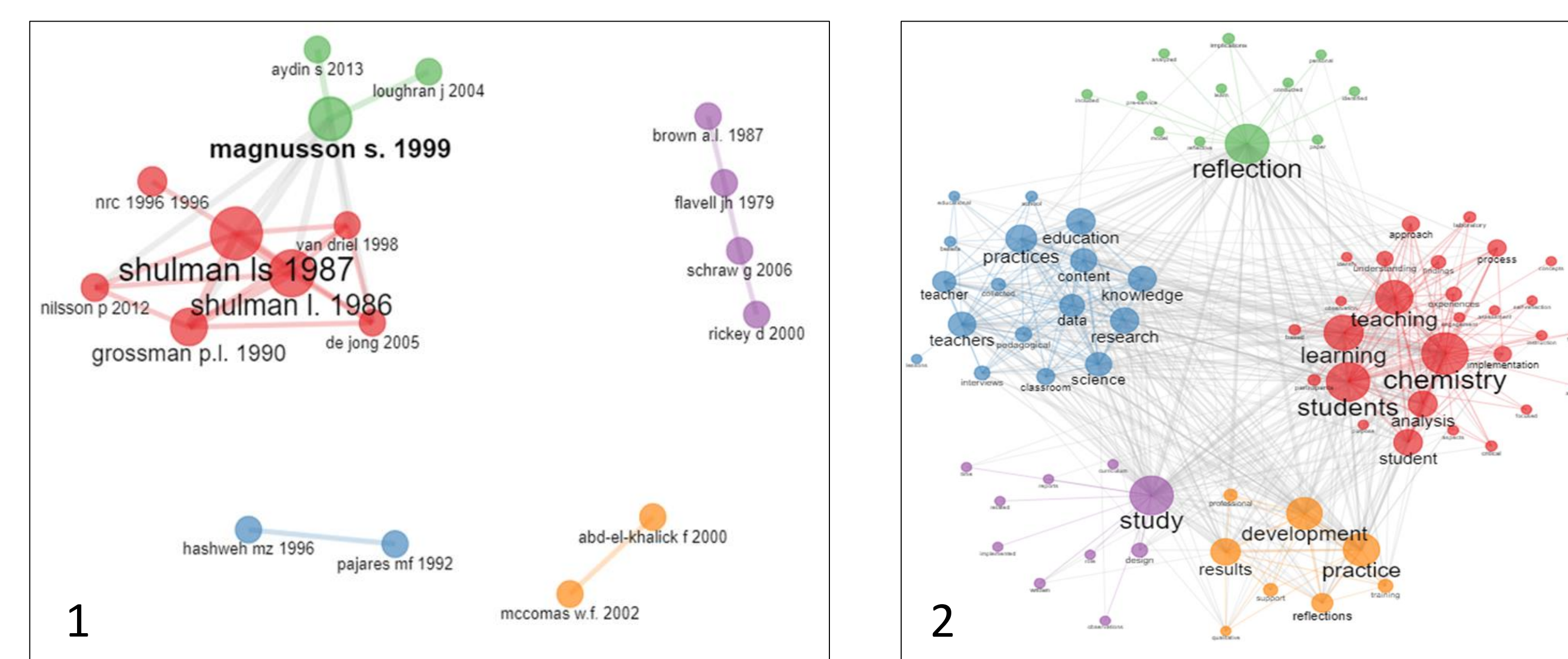
Figure 3. Co-Citation (1) and Abstract (2) Networks from Biblioshiny

UTA Reflection Data Analysis

The finalized codebook contained a total of 74 codes. Here we present a compressed set of themes that rose to prominence in participant worksheets.

Table 1. Ten Codes from Finalized Codebook with Examples from Reflective Entries

CODE	DEFINITION	EXAMPLE
Identifies a goal for developing ST relationships	Statements about ULAs setting relationship goals with the student population	"One thing I want to try, taking inspration from the physics L.A videos, is to try and put myself into students group conversation and just try to fit in with the students."
Transparency/Honesty	Statements about the expression of truths to students	"I was completely honest with her and I looked up an explanation with her to the point where we were both satisfied with the answer she got."
Identifies emotions from ULA-ST interactions	ULA recognizes personal emotions present in interactions with students	"It was a little scary being subject to information that I wasn't entirely familiar with"
Student to ULA talk	Statements about student directed communications with ULAs	"I've had students talk to me more about the strategies I did to pass the course."
Discusses relatability between ULA and ST	discusses the similarities between ULAs and students with regards to challenges and beliefs	"First exam is always a humbling experience for me, and I guess that was the case with the biochemistry 1 students too because they were actively trying to learn now."
Reasoning for body language	Reasons provided by ULA to justify the body language of students or ULAs	"sat down next to people who asked for help so I was not blocking the view of people behind me and still be able to help the student."
Linking resources that support ULA actions	Statements or reflections that connect the use of resources to supporting ULA actions in the learning environment	"Also, I think it will be beneficial to incorporate the whiteboard again since the math problems in these next sections are very complex and lengthy"
Links teaching style with student interactions	Statements that connect the style of teaching with the quantity/quality of student interactions	"I believe the structure of the class allowed the students to be more open to assistance"
Reflection on preparing to support students	Reflection on ULA preparation before classroom activities	"Before the class I had gone through the case study questions again, but I could not remember my answers. It required a lot of re-learning to understand it"
Reflections about ULA-ULA interactions	Reflection on interactions between different ULAs	"I have noticed that the closer I become with fellow LA's, the less stressful my experiences within the classroom have become."

Implications and Future Applications

Implications

- Undergraduate Teaching Assistants (UTA) focus on developing professional relationships with students, other learning assistants, and the instructors
- UTAs often are uncertain of their actions and are afraid to make mistakes or afraid their actions may cause harm
- UTAs preparations for supporting students are highly varied, depending on individual and course subject

Future Directions

- This research reveals the common considerations made by UTAs regarding their instructional experiences and can inform decisions about the training they receive from their program.
- Interviews with participants are planned to richer interpretations and contexts of UTA reflective entries.

Acknowledgements

References

1) Butler, D. L., & Winne, P. H. (1995). Feedback and Self-Regulated Learning – A Theoretical Synthesis. *REVIEW OF EDUCATIONAL RESEARCH, 65*(3), 245–281. https://doi.org/10.3102/00346543065003245

2) Blair, E. (2011). Balanced reflection as a means of practitioner development in the post-compulsory education and training sector. *RESEARCH IN POST-COMPULSORY EDUCATION, 16*(2, SI), 249–261. https://doi.org/10.1080/13596748.2011.576575

3) Shoffner, M. (2008). Informal reflection in pre-service teacher education. *Reflective Practice, 9*(2), 123–134. https://doi.org/10.1080/14623940802005392

4) Patton, M. Q. (2002). *Qualitative Research & Evaluation Methods*. SAGE Publications

5) Bodner, G. M., & Orgill, M. (2007). *Theoretical Frameworks for Research in Chemistry/Science Education*. Pearson/Prentice Hall.

6) Scott, J. (2000). *Social Network Analysis* (2nd ed.). SAGE Publications

7) Aria, M., & Cuccurullo, C. (2017). bibliometrix: An R-tool for comprehensive science mapping analysis. *JOURNAL OF INFORMETRICS, 11*(4), 959–975. https://doi.org/10.1016/j.joi.2017.08.007

8) Stellenbosch University. (n.d.). Variability of Centrality Measures. https://www.sun.ac.za/english/data-science-and-computational-thinking/winter-school/social-network-analysis-with-r.

9) Bryman, A (2001) Social Research Methods, Oxford: Oxford University Press