

Molecular storytelling builds knowledge, experience and confidence for teaching about biomolecules

Caleb M. Trujillo (University of Washington Bothell) Shuchismita Dutta (Rutgers University)

INTRO

Molecular CaseNet project

- **Who?** Collaborative network of biology and chemistry educators
- **What?** Develop, publish, and use molecular case studies to inspire molecular storytelling
- **How?** Integrate open access biological data resources: Protein Data Bank, UniProt, PubMed, and DrugBank

How does participation develop knowledge for teaching with molecular storytelling?

METHODS

- **Theory:** Technological, pedagogical, and content knowledge (TPCK)
- **Context:** One-week workshop for writing Molecular Case Studies
- **Data:** Pre-post survey where each TPC component measured in a 24x3 Likert-scale survey (n = 17)

RESULTS

- Increased technology integration across confidence, knowledge, and experience: T, TPC, PC and TC
- Most participants gained across measures but some decreased

Technological, Pedagogical, and Content (TPC) increased across measures

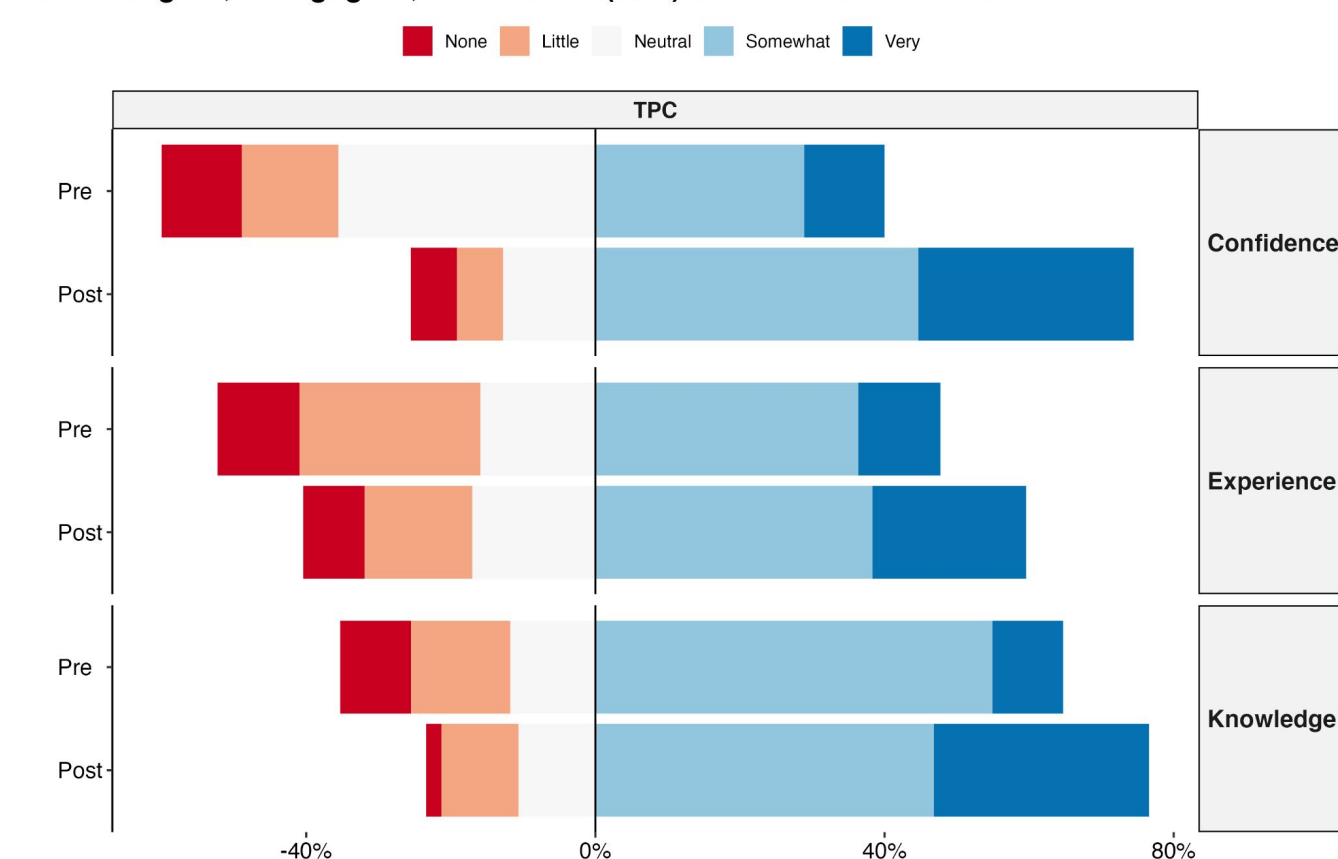


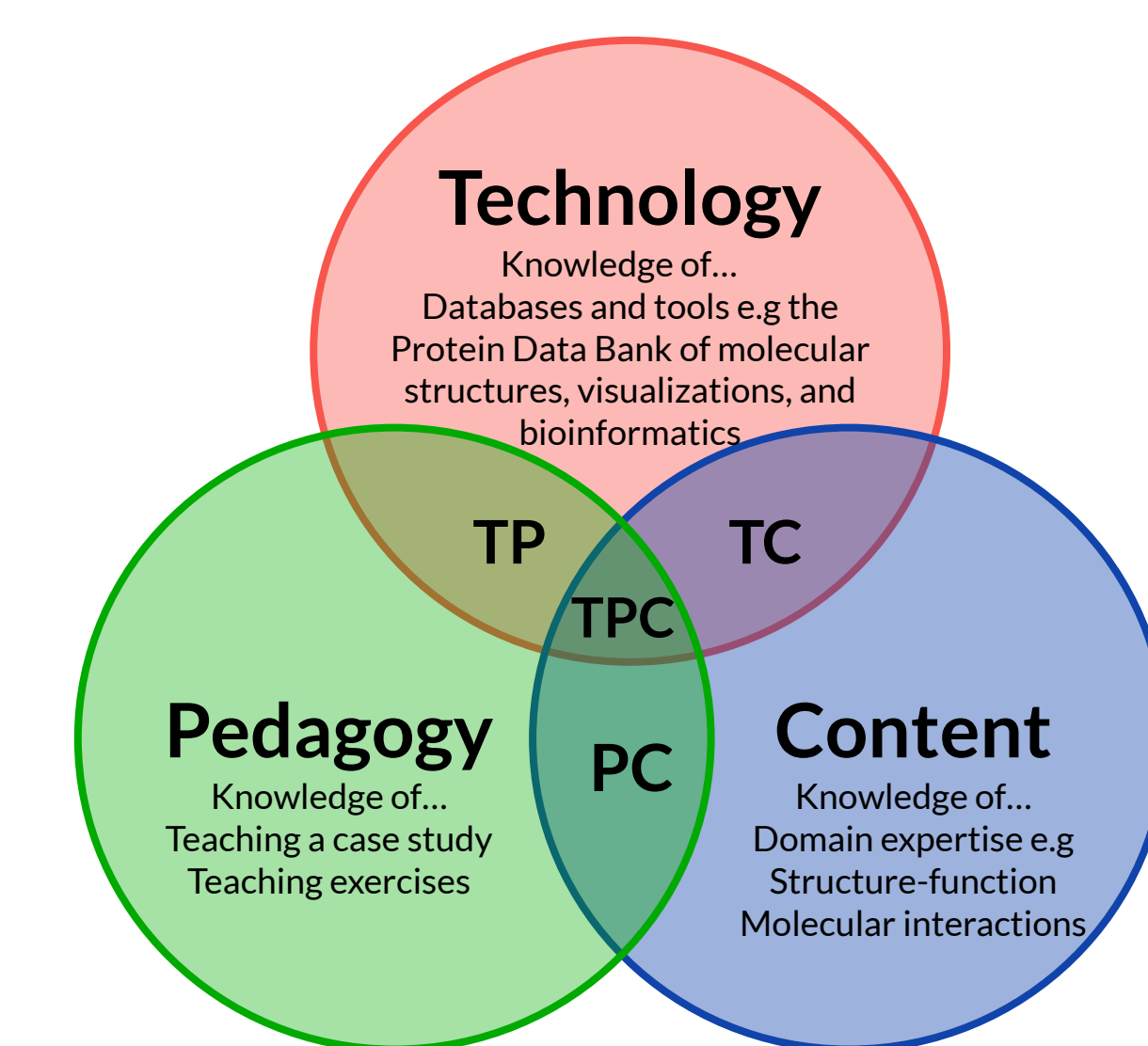
Figure: TPC-only, Likert plot of self-ratings of knowledge, confidence, and experience from Molecular CaseNet participants (n = 17) pre to post. Data represent the distribution across three questions for each measure.

DISCUSSION

- Collaborations support engagement with new tech across disciplines
- Decreases in TPCK for some members will be investigated



Developing Molecular Stories integrates faculty knowledge for teaching molecular structure and function

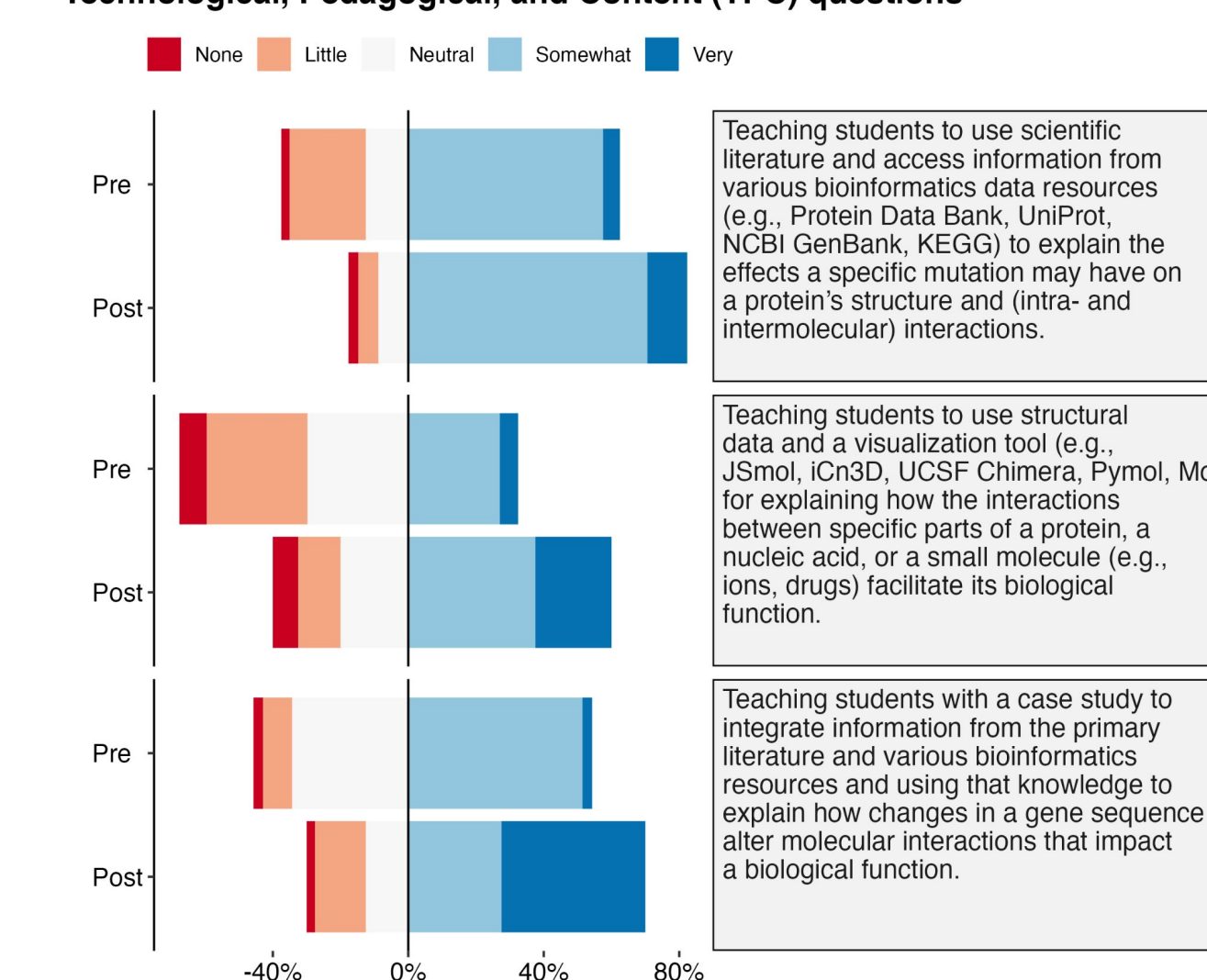


Figures: (Top) The Technology, Pedagogical Content, Knowledge (TPCK) model with overlapping areas as a combination. (Below) A Likert plot of participants' ratings for the TPC-specific questions (n = 17).

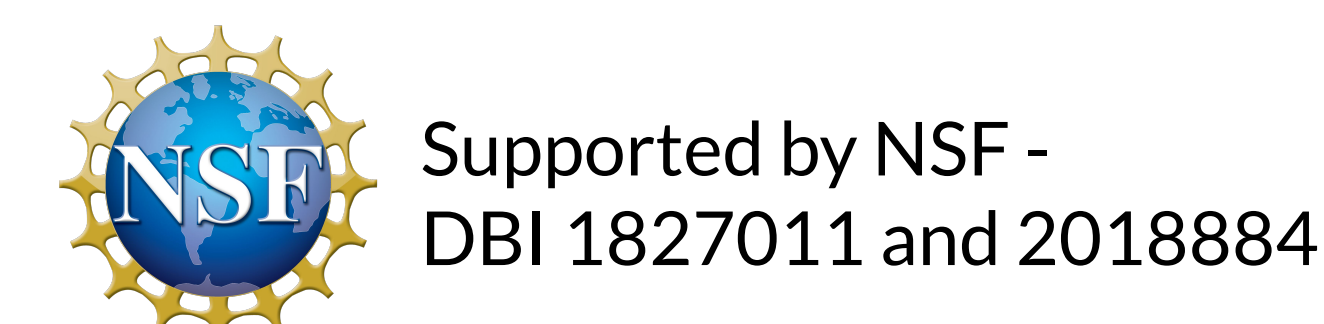
Tables: (Top) Performance measures of the assessment. (Bottom) Means and Wilcoxon paired test.

Validity measures	Values
Split-half reliability (R)	0.80–0.87
Internal consistency (R^2)	0.71–0.75
Item analysis (α)	0.98

Technological, Pedagogical, and Content (TPC) questions



	Pre	Post	p	p adj.	
C	4.2	4.4	0.07	0.19	ns
P	4.2	4.4	0.06	0.19	ns
PC	3.7	4.1	0.003	0.02	**
T	3.5	3.9	0.006	0.03	**
TC	3.6	4.0	0.03	0.1	*
TP	3.7	3.8	0.17	0.19	ns
TPC	3.2	3.7	0.006	0.03	**



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References:
 Clase, K.L., Gundlach, E. & Pelaez, N.J. (2010). Calibrated peer review for computer-assisted learning of biological research competencies. *Biochem. Mol. Biol. Educ.*, 38: 290-295. doi:10.1002/bmb.20415
 Goodsell, D. S., Dutta, S., Voigt, M., & Zardecki, C. (2021). Molecular storytelling for online structural biology outreach and education. *Structural dynamics (Melville, N.Y.)*, 8(2), 020401. doi: 10.1063/4.0000077
 Koehler, M. J., & Mishra, P. (2009). What is technological pedagogical content knowledge? *Contemporary Issues in Technology and Teacher Education*, 9(1), 60-70.
 Riley, K.J., Vardar-Ulu, D., Pollock, E., Dutta, S. (2021) Students authoring molecular case studies as a partial course-based undergraduate research experience (CURE) for lab instruction, *BAMBE* 49: 853-855, doi: 10.1002/bmb.21578

Participants Integrated their Technological, Pedagogical, and Content Knowledge

Average self-ratings of knowledge, confidence and experience from the start of the workshop to the end

