

# Engaged Affectively, Supported Cognitively and Learning Actively

- Adopting modified team-based learning (TBL) in guantitative chemical analysis

## Kui Chen



## UNIVERSITY OF WVOMING

# Department of Chemistry, University of Wyoming Supporting students cognitively

o This class requires a solid foundation knowledge of many topics in general chemistry.

o Meet the students where they are.

(8 review lecture videos)

✓ 6 TBL iRAT / tRAT worksheets

✓ 5 experiential learning activities

o Accommodate students with different

✓ 15 active learning activities (2 in lab)

learning styles.

✓ Homework

✓ 16 traditional lectures

✓ 9 problem-based worksheets

✓ Post review videos as pre-party assignments

✓ Review foundation knowledge in class.



o Room for improvements for more challenging topics (right side of the plots). More granular analysis needed to determine correlation with active learning.

#### Student feedbacks

- . more engaging ... allow me to practice with my peers."
- group work reduces the initial amount of time spent confused."
- "I found myself understanding the content in a much deeper way
- with the components of active learning."
- ...getting the opportunity to struggle a bit, then having guidance when required is very valuable."
- ... not very beneficial ... when we start working on a worksheet without going over dome examples first."
- "...should be one day of a normal lecture class and one active learning class." "active learning is helpful, ... sometimes a little stressful how quickly we work through them."

Over the course of the semester, A. Strongly agree 3. Agree C. Neither agree nor disagre E. Strongly disagre Over the course of the semester, el like I have been learning active A. Strongly agree B Acres C. Neither agree nor disagree

D. Disagree

E. Strongly disa

"I like being able to work in groups. However, things often feel chaotic and inconsistent when it comes to the actual learning itself."

"At first, I was skeptical of the active learning style. However, I have

changed my perspective ... and come to enjoy active learning activities."

"As a more introverted individual, I was hesitant to have to do so much

#### Lessons learned

- o Despite some initial trepidation, students generally respond favorably to active learning.
- o Preliminary data supports correlation between active learning and improved learning outcome.
- Active learning takes a lot of time / effort to incorporate. Don't try to do too much too guickly.
- Keep on keeping on: execute-reflect-adjust, repeat.

#### Fractals

- o Use the pre- and post-knowledge survey results to identify and address "challenging" topics.
- o How to better support the students cognitively (balancing scaffolding and learning by doing)
- o Provide more pre-party activities to prepare students for in-class activities.
- o Foster growth mindset and an more encouraging environment for students to ask questions.

#### References

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#### Course and students

- o CHEM 2230: Quantitative chemical analysis, o Class size: 33 (Spring 2024) a sophomore-level analytical chemistry class. o Mostly juniors / seniors, few sophomores
- Topics: equilibrium, acids and bases, titrations, 
  ~ 50:50 split between chemistry and nonelectrochemistry, statistics, spectroscopy, and chromatography

o Pre-requisite: general chemistry II.

Solid math skill (algebra) required

- chemistry majors. Diverse student population from 11 different majors More quantitative than many chemistry classes
   Most non-majors take it to fulfill
  - requirement for minor in chemistry.

#### Learning space



Active learning classroom with 10 work stations for groups of 3 ~ 4 students sitting around the table. A TV screen at each work station where instructor's laptop / document camera can be projected. White board all around the room where students can get up and collaborate. Plenty of space for instructor / LA to move around easily and check in with different groups.

#### Engaging students affectively

- o Share my pedagogy with the students during first day of class. Explain why I want to adopt team-based learning.
- Students participated in an affective-domain exercise.
- ✓ First, students are asked to sign with their dominant hand. ✓ Then, they reflect on how they feel until they can describe it.
- ✓ Switch to the non-dominant hand and repeat the process

# Domains of learning

### To engage their affective domain during active learning: ✓ Students are asked to rate their preparedness before

working on the IRAT worksheet individually. Students are asked to rate their confidence after completing the tRAT worksheet in groups.



o Most topics in equilibrium, Pt2 are new which are covered with a combination of active learning activities and traditional lectures. Results are mixed.

- o Most students in the class took general chemistry more than 2 years ago.

  - ✓ Gallery walk

o More formative assessment / less summative assessment to promote confidence and growth

- ✓ Pre- and post-knowledge surveys ✓ Metacognitive reflections
  - ✓ Exams

#### Students learning actively





o Many topics in equilibrium, Pt1 are from general chemistry, reviewed with TBL / worksheets. The pre- and post-surveys show growth and increase in proficiency.



 Adopt different active learning modalities: ✓ Team-based learning (TBL) ✓ Experiential learning

✓ snowballing / muddiest point ✓ Low-stake guizzes











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