Transformation of Digital Technology in Teaching and Learning

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Australia Awards

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Dr Lam Pham

- B. Pharm.
- PhD Pharm.
- PhD Edu.

Teaching and research interests: Pharmacy, Medical Education, Chemistry and Science Education

Transformation of technology in teaching and learning

- The United Nations' sustainable development 2030 agenda emphasises quality education.
- Aim to ensure inclusive and equitable quality education.
- Digital technologies / Information and Communication Technology (ICT) have emerged as an essential tool to achieve this goal (Haleema et al., 2022)
- "ICT can impact student learning when teachers are digitally literate and understand how to integrate it into curriculum" (UNESCO, 2023)

Digital transformation in this presentation: The incorporation of ICT into classroom and curriculum design to improve students' learning outcomes.

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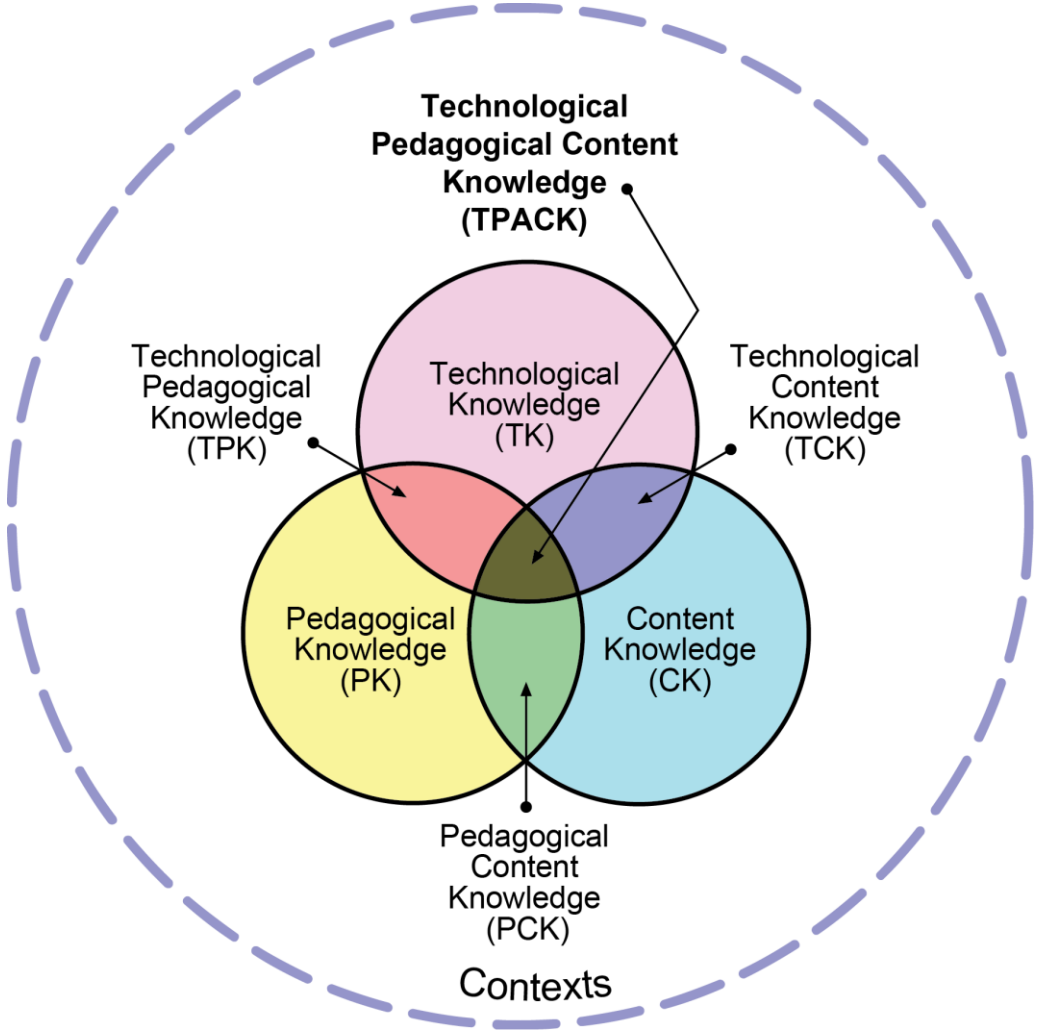
TPACK

- **Technological Knowledge**
- **Content Knowledge**
- **Pedagogical Knowledge**



Components of the TPACK framework (Mishra & Koehler, 2006)

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Technology Integration Matrix

Levels of Technology Integration into the Curriculum

Characteristics of the Learning Environment	Entry	Adoption	Adaptation	Infusion	Transformation
Active	Information passively received	Conventional, procedural use of tools	Conventional independent use of tools; some student choice and exploration	Choice of tools and regular, self-directed use	Extensive and unconventional use of tools
Collaborative	Individual student use of tools	Collaborative use of tools in conventional ways	Collaborative use of tools; some student choice and exploration	Choice of tools and regular use for collaboration	Collaboration with peers and outside resources in ways not possible without technology
Constructive	Information delivered to students	Guided, conventional use for building knowledge	Independent use for building knowledge; some student choice and exploration	Choice and regular use for building knowledge	Extensive and unconventional use of technology tools to build knowledge
Authentic	Use unrelated to the world outside of the instructional setting	Guided use in activities with some meaningful context	Independent use in activities connected to students' lives; some student choice and exploration	Choice of tools and regular use in meaningful activities	Innovative use for higher order learning activities in a local or global context
Goal-Directed	Directions given, step-by-step task monitoring	Conventional and procedural use of tools to plan or monitor	Purposeful use of tools to plan and monitor; some student choice and exploration	Flexible and seamless use of tools to plan and monitor	Extensive and higher order use of tools to plan and monitor

Technology Integration matrix, Adopted from (Poyo, 2016)

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High levels of personalization supported by artificial intelligence and virtual reality possibly change education delivery

The balance between the on-campus and at-home learning and teaching

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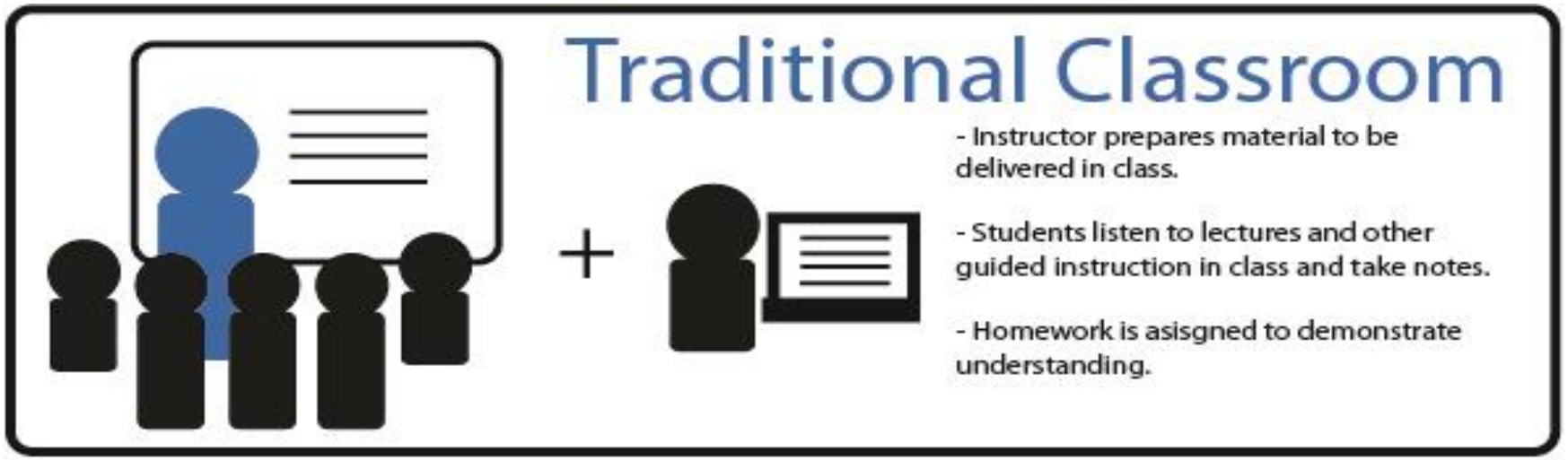
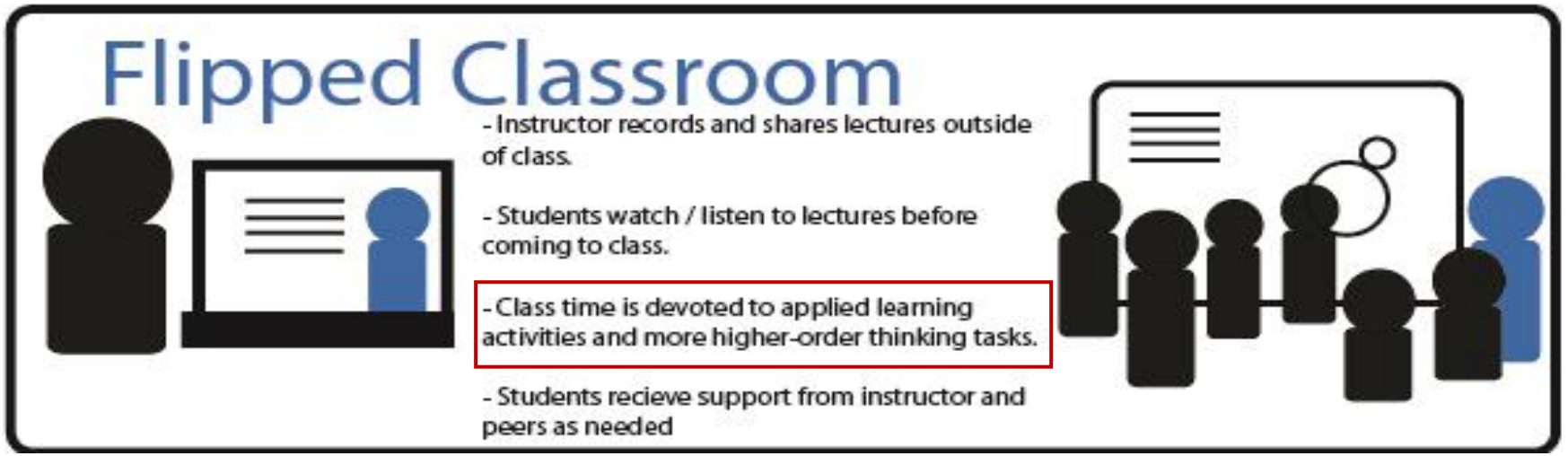
Flipped classroom





Source: https://www.slu.edu

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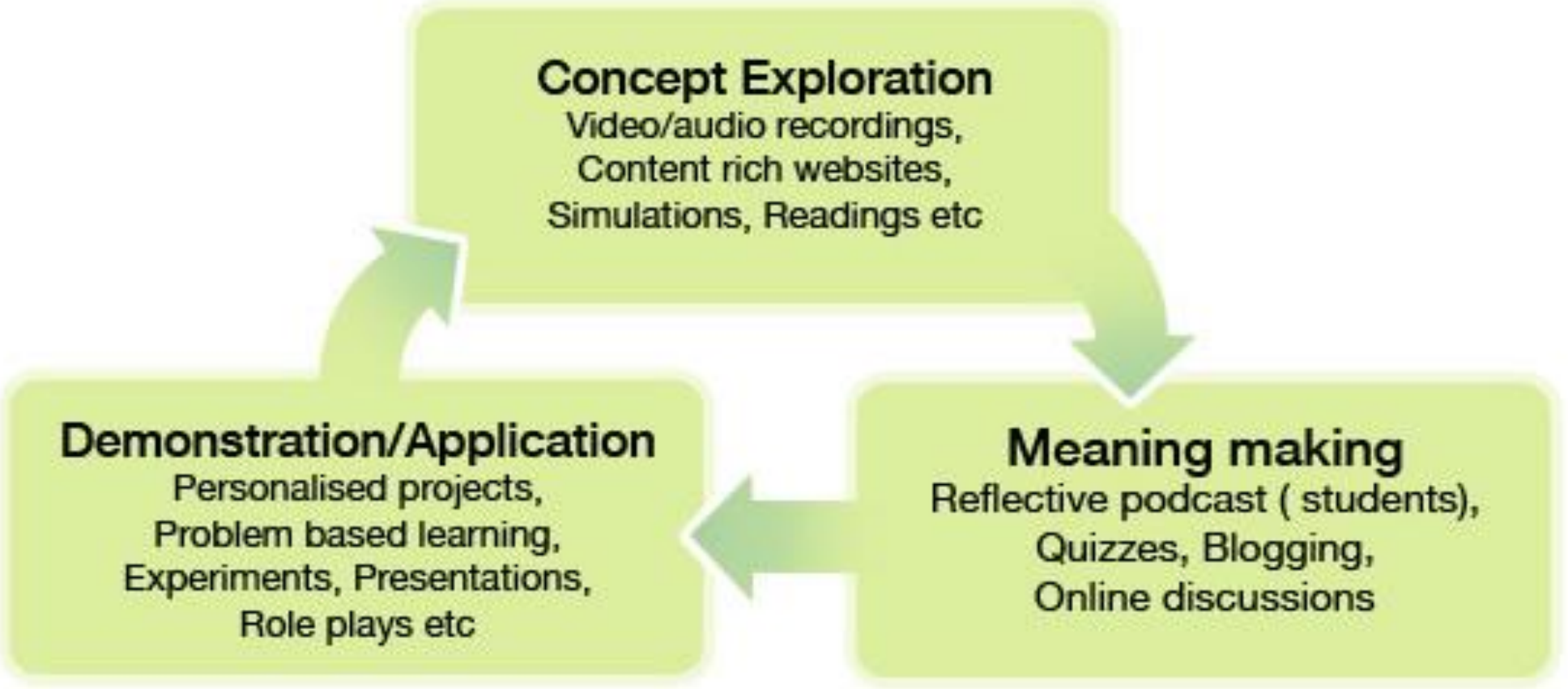
Flipped classroom

Learning opportunities



Source: https://ivypanda.com/essays/flipped-classrooms-advantages-and-disadvantages/

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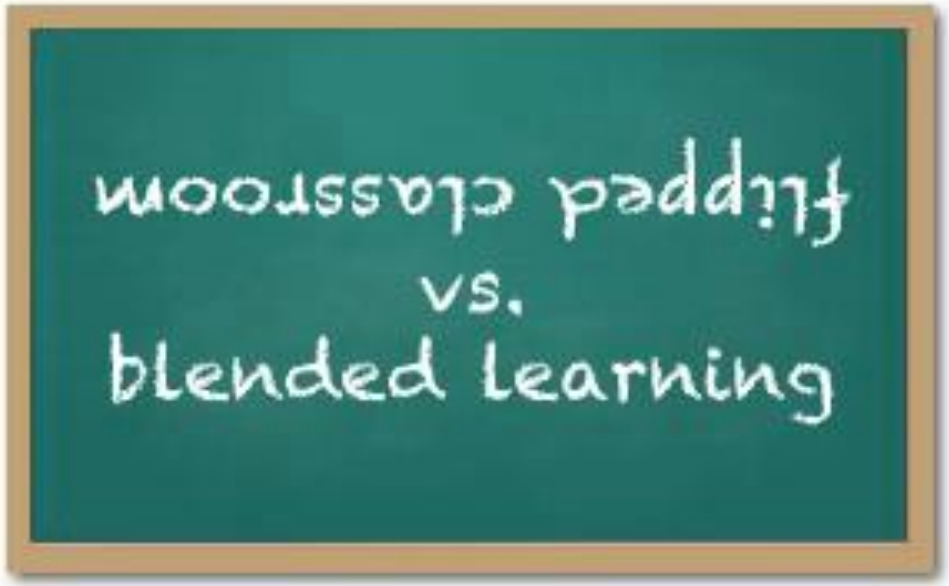
Blended classroom

- Enables teaches to use online tools to facilitate learning outside of the classroom
- Online materials do not take the place of face-to-face instruction/tutorials
- Tutorials are used to instruct / compliment / consolidate student learning in the classroom



Picture from: https://teachwithict.weebly.com/flipped-classroom-vs-blended-classroom.html

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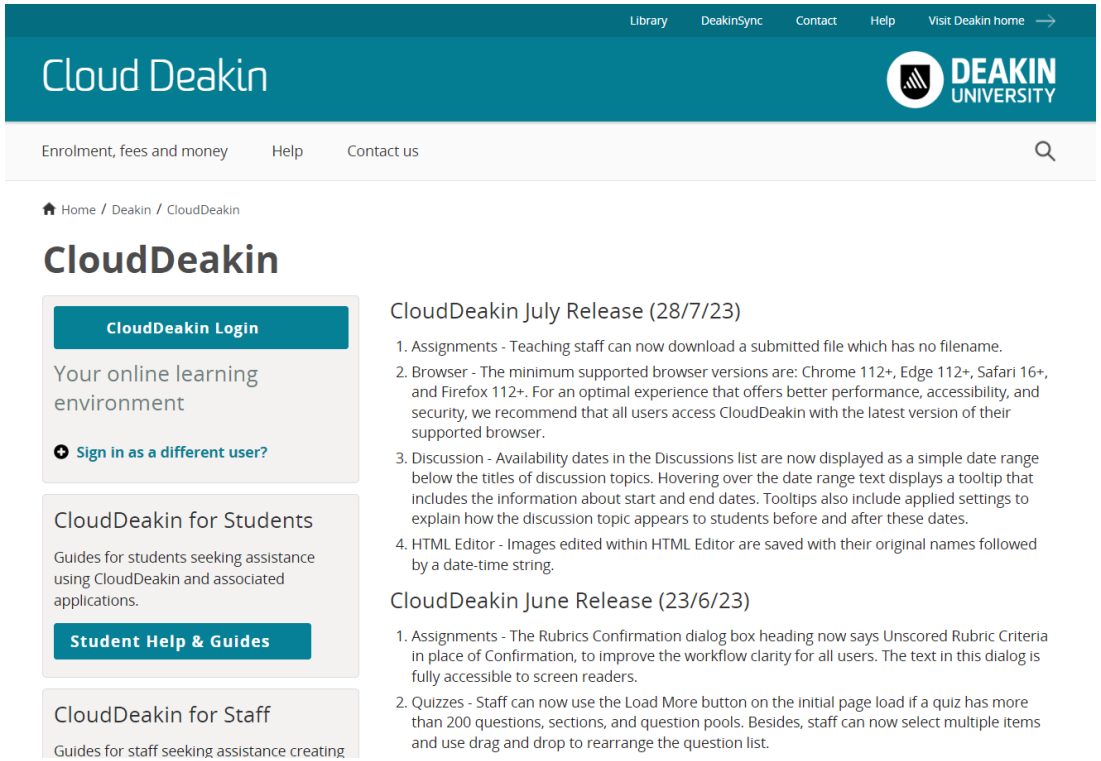
Learning management system (LMS) at Deakin University

Clouded Base e-Learning platform : CloudDeakin



Cloudeakin site demonstration

Source: https://www.deakin.edu.au/clouddeakin

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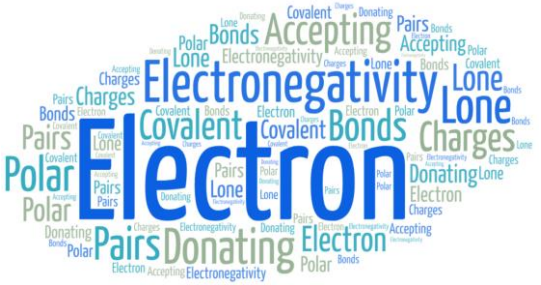
Teaching and Learning Science

- **Diagnostic assessments**
  - Concept maps, mind maps (create and share on Google share)
  - Kahoot
  - Quizlet live
  - Mentimeter
  - Poll Everywhere
  - Wordart



How do I implement ICT into diagnostic assessments?

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Teaching and Learning Science

How do I implement ICT into these assessments?

- **Formative assessments**
  - Predict, observer and explain (POE)
  - Think pair share (TPS)
  - Interview about instance (IAI)
  - Peer review
  - Virtual experiment
  - PhET simulation:

    Concentration https://phet.colorado.edu/sims/html/concentration/latest/concentration_all.html

    Electrolysis simulation: https://sepuplhs.org/high/hydrogen/electrolysis_sim5.html

- **Summative assessments**
  - Create videos, posters
  - Online or face to face presentations
  - Online MCQs
  - Written essays

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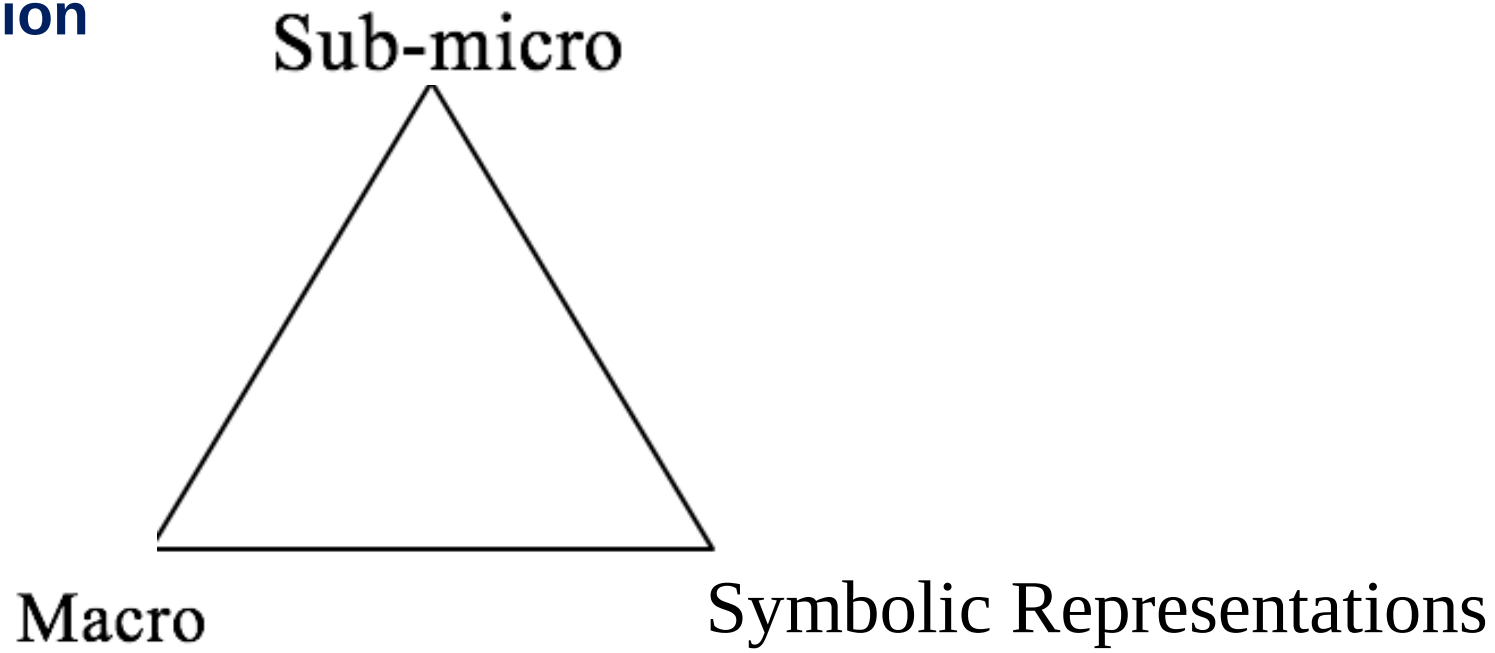
Teaching and Learning Chemistry

Three levels of representation

?

How do I implement ICT in teaching chemistry? (e.g., hands - on /practical experiment lesson)



Example depicting triplet nature of chemistry modified from Johnstone's model (Johnstone, 1991)

Frameworks: The Johnstone's triangle model (Johnstone, 1991)
The Student Representation Construction Approach (Prain & Tytler, 2012)

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Teaching and Learning Chemistry

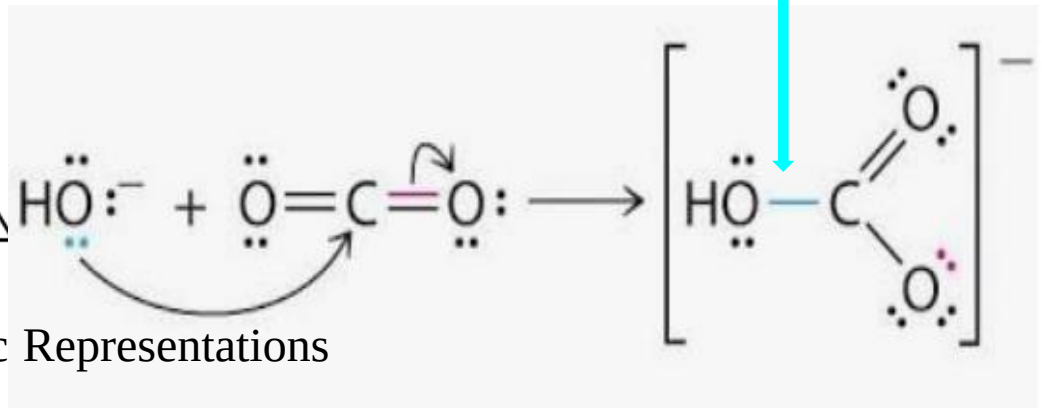
Particulate interaction of molecules

Covalent bond

Carbon Dioxide in water

Sub-micro

Macro



Symbolic Representations

Interpret the electron sharing process?

Oxygen atom of Hydroxide ion
Electron Donor
Nucleophile

Carbon atom of Carbon dioxide
Electron Acceptor
Electrophile

Electron

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A brief teaching sequence in chemistry

Topic: Nucleophiles and Electrophiles

Teaching duration: 50 minutes, tutorial

1. Probe students' prerequisite knowledge (MCQ questions as diagnostic assessment)
2. Introduce the topic of Nucleophiles and Electrophiles and the learning intention.
3. The Johnstone triangle model and the Student Representation Construction Approach as the teaching frameworks.
4. Activities leads to the concepts (including formative assessment)
    - ✓ *Macroscopic Activity: Practical experiment / Virtual experiment*
    - ✓ *Sub-microscopic Activities: Ball and Stick Model, Animation, Simulation etc.*
    - ✓ *Symbolic Activity: Lewis structures and equation*
5. Link the activities to the concepts
6. Unpack the concepts
    - ✓ *Definition of Nucleophiles and Electrophiles*
    - ✓ *Characteristics and examples of Nucleophiles and Electrophiles*
7. Application of students' understandings
    - ✓ *Online or in-class exercise as a form of summative assessment.*
8. Close the lesson

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References

Haleem, A., Javaid, M., Qadri, A. M., Suman, R. (2022). Understanding the role of digital technologies in education: A review. *Sustainable Operations and Computers, 3*, 275-285.

Johnstone, A. H. (1991). Why is science difficult to learn? Things are seldom what they seem. *Journal of Computer Assisted Learning, 7*(2), 75–83.

Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *The Teachers College Record, 108*(6), 1017-1054

Poyo, S.R. (2016). *Transforming traditional practices of teacher preparation to meet changing needs of digital learners: A first step Intervention by assessing and addressing needs of pre-service teachers in a dual learning environment*. [Doctoral thesis, Duquesne University].

Prain, V. & Tytler, R. (2012). Learning through constructing representations in science: A framework of representational construction affordances. *International Journal of Science Education*, *34(17), 2751-2773.*

Schmidt, H. G. (1983). Problem-based learning: rationale and description. *Medical education, 17(1),* 11–16.

Schmidt, H. G., & Moust, J. H. C. (2000). Factors affecting small-group tutorial learning: A review of research. In D. H. Evensen & C. E. Hmelo (Eds.), *Problem-based learning: A research perspective on learning interactions* (pp. 19–51). Lawrence Erlbaum Associates Publishers.

UNESCO. (2023). *Information and communication technology (ICT) in education. https://learningportal.iiep.unesco.org/en/issue-briefs/improve-learning/information-and-communication-technology-ict-in-education#:~:text=Information%20and%20Communications%20Technology%20(ICT,%2C%20store%2C%20and%20manage%20information*.

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THANK YOU

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