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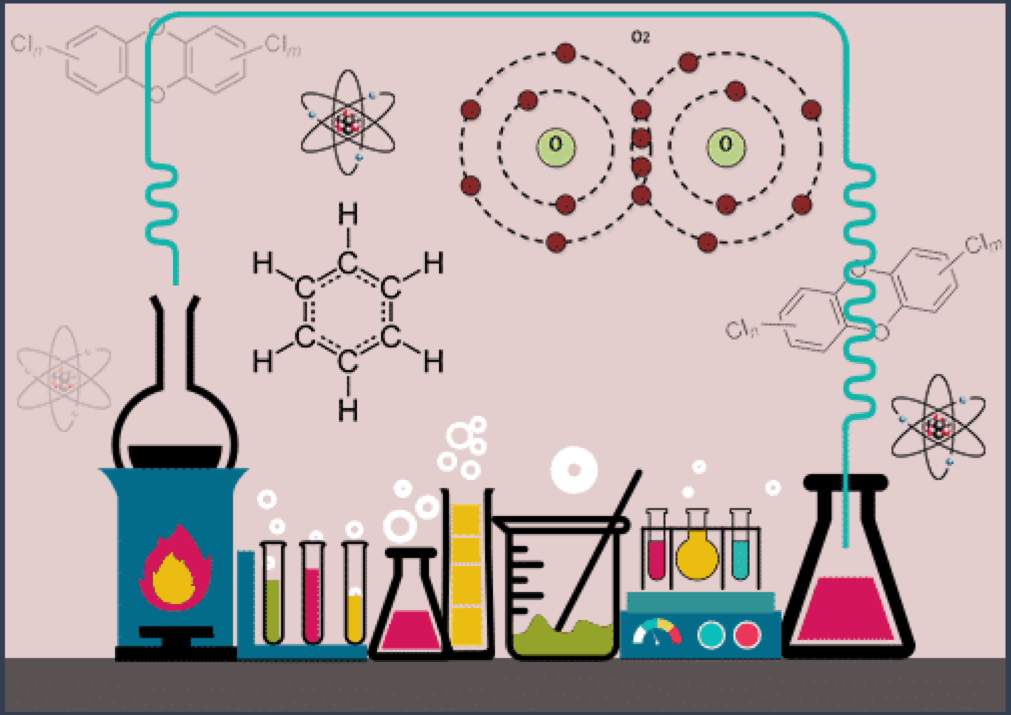
Can Mobile Technologies Promote a Student-Centered model in Online Chemistry?



Why Explore this question?..

According to Capterra (2017):

a. There is 1 smartphone for every 4.5 people in the world
b. As of 2017, 77% of US adults own a smartphone, up from 35% in 2011.
c. 92% of Millennials own a smartphone.
d. predicts that 45% of businesses will have a BYOD policy by 2020
e. 65% of all digital media is viewed on smartphones
f. The mobile market value grew by more than $53 billion in 2017.

Why Explore this question?..

The current trend is that mobile devices are becoming the preferred method in which students (and adults) are engaging with information and accessing the internet. As such, teachers must design a learning environment that incorporates mobile technologies to keep up with the times. But to successfully do this, time and effort must be focused on maximizing engagement with mobile technologies and not senselessly throw these technologies at our students (Faulconder et al., 2017).

Mobile technology is very widespread, but from my experience, few teachers capitalize on this. The limiting factors seem to be lack of time to experiment and a shift from the white/chalk board, which senior educators seem to think is cornerstone of teaching. Mobile learning is not about replacing how lessons are delivered, rather it's a tool to enrich the overall learning experience. Online activities require tools and theories that are educationally sound. In this project, I explore mobile learning theories that can be leveraged to promote student-centered learning in Secondary Chemistry.

The traditional chemistry class

Chemistry is often perceived as being a dry and boring science subject, mostly due to its traditional teaching method, static textbook readings, outdated worksheets, and lack of interactivity in visualizing of abstract chemistry concepts. Traditional chalk and talk teaching method make the learning process boring and does not actively engage students. Learning in chemistry has been delivered through a behaviorists philosophy (Woollard, 2010). By definition, behaviorism is a learning theory that focuses on observable behaviours and discounts any activities of the mind. In the Chemistry classroom, this involves drilling students with concepts until their behaviours change enough to acquire "new" behaviours. By definition, a change in behaviour constitutes learning.

Students, like animals, can be trained by identifying the necessary stimulus to promote the desired response. If a teacher wishes a student to learn a chemistry concept, it becomes a matter of presenting information in a way that changes a student's behavior in a desired way.

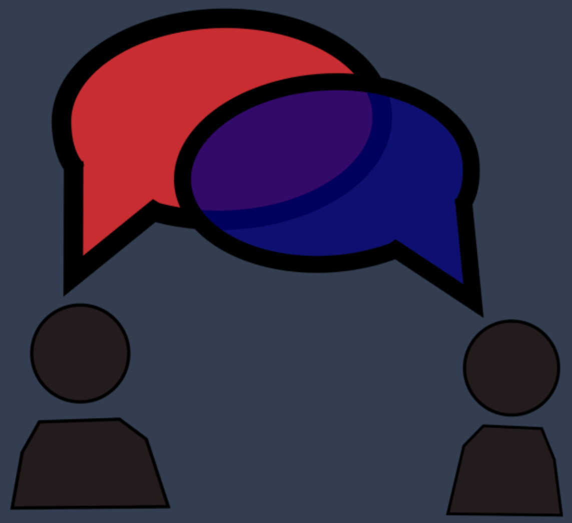
Theories for a Student-Centered Model

1) Transactional distance theory (Moore, 1997)

2) Quinn's 4C's (Quinn, 2011)

What is Transactional Distance Theory?

Dialogue



Structure

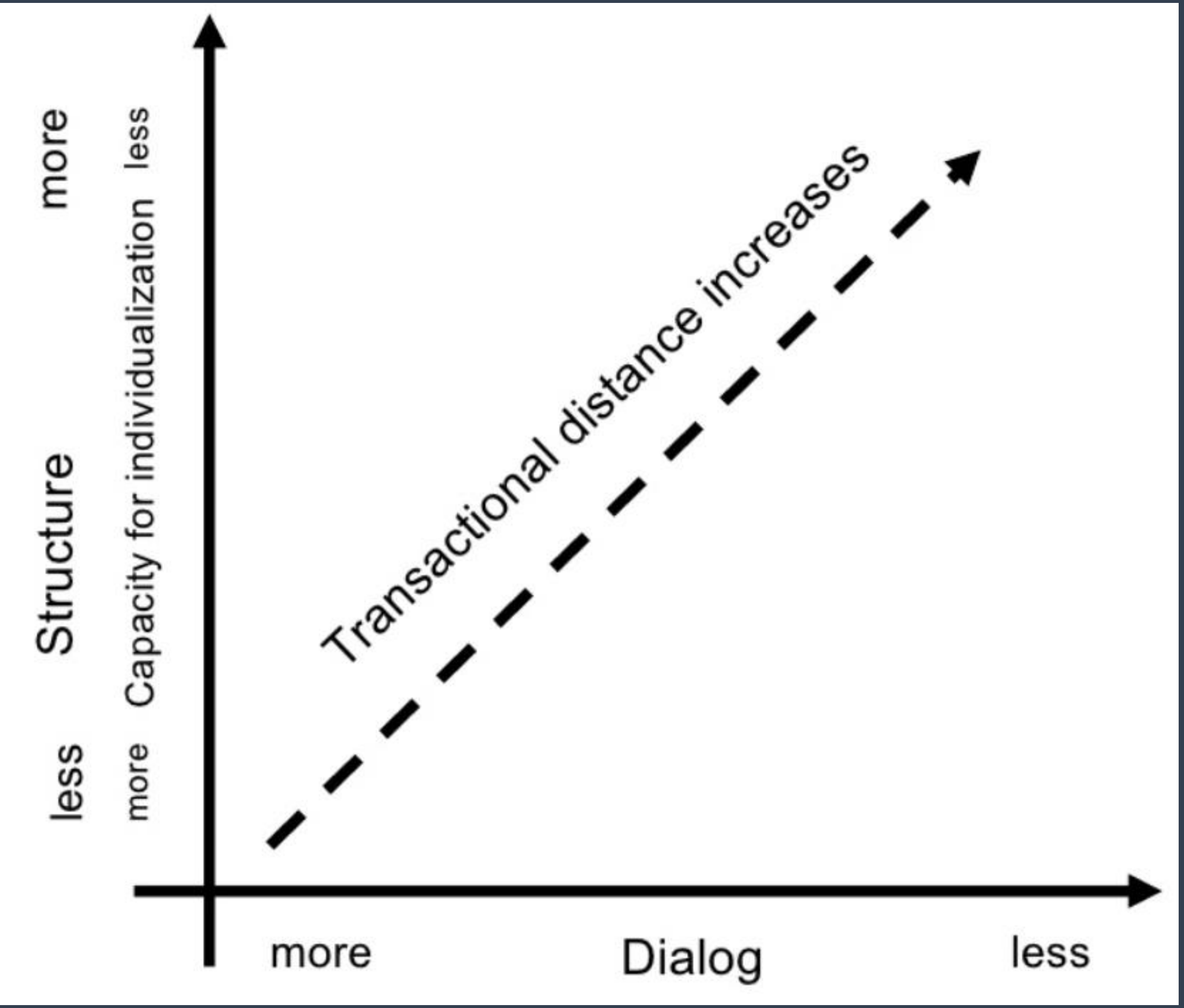
Autonomy

Transactional Distance Theory

Transactional distance (TD) theory is defined by the fact that distance is considered not only as a geographical separation but also (and most importantly) as separation between teacher communication and student learning (Moore, 1997). The transactional distance is controlled and managed by 3 interrelated factors: The course structure, dialogue between teacher and student, and learner autonomy.

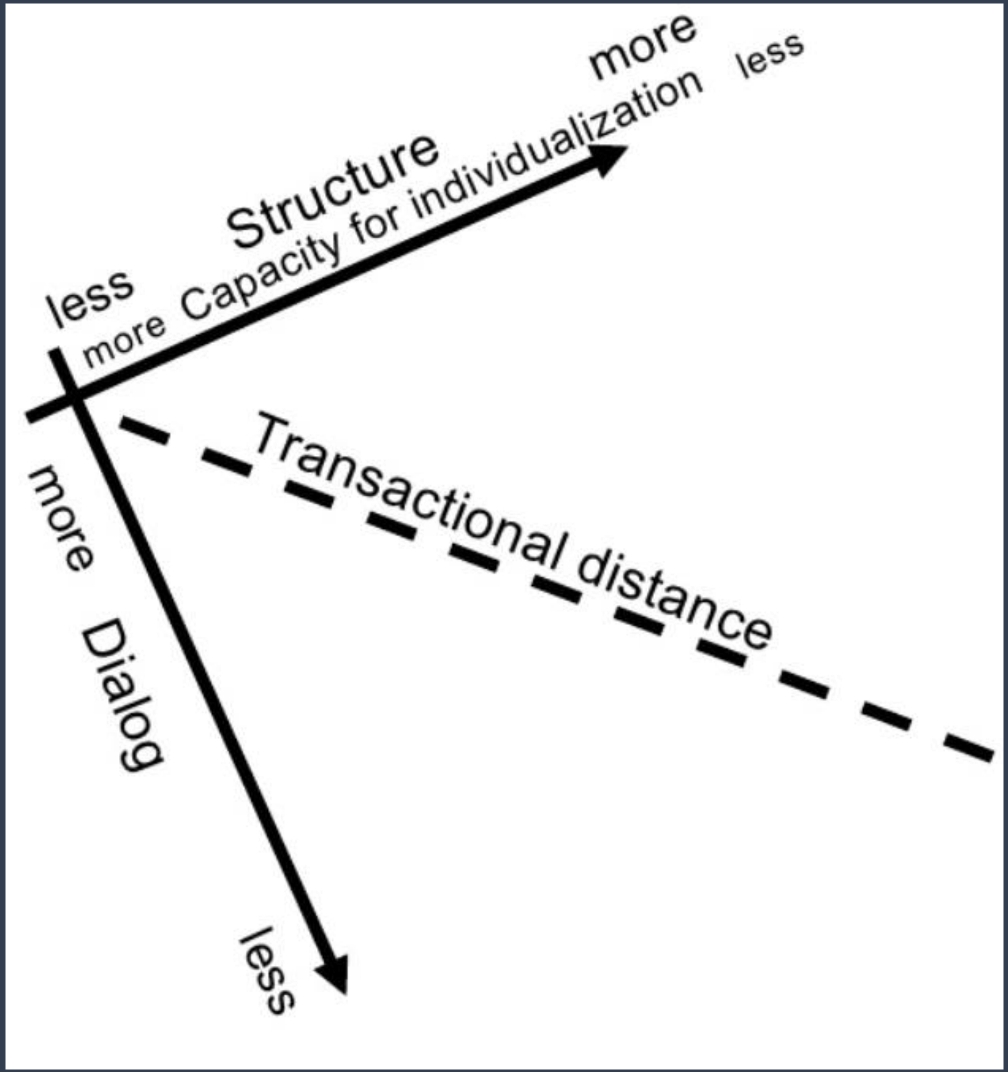
Moore points out that when talking about distance education we are typically talking about a teaching environment where the separation between the teacher and learner is significant enough that special teaching-learning strategies and techniques must be used. If the goal is student-centred learning within an online context, special care must be taken with student-teacher dialogue and course structure.

AVOID for Student-Centered learning:



When dialogue is decreased and replaced with a highly structured course, the transactional distance is increased. This leaves little space for learner autonomy, as the structure is completely fixed with no negotiation with the teacher as dialogue is diminished. As a consequence, the learning becomes teacher-centered.

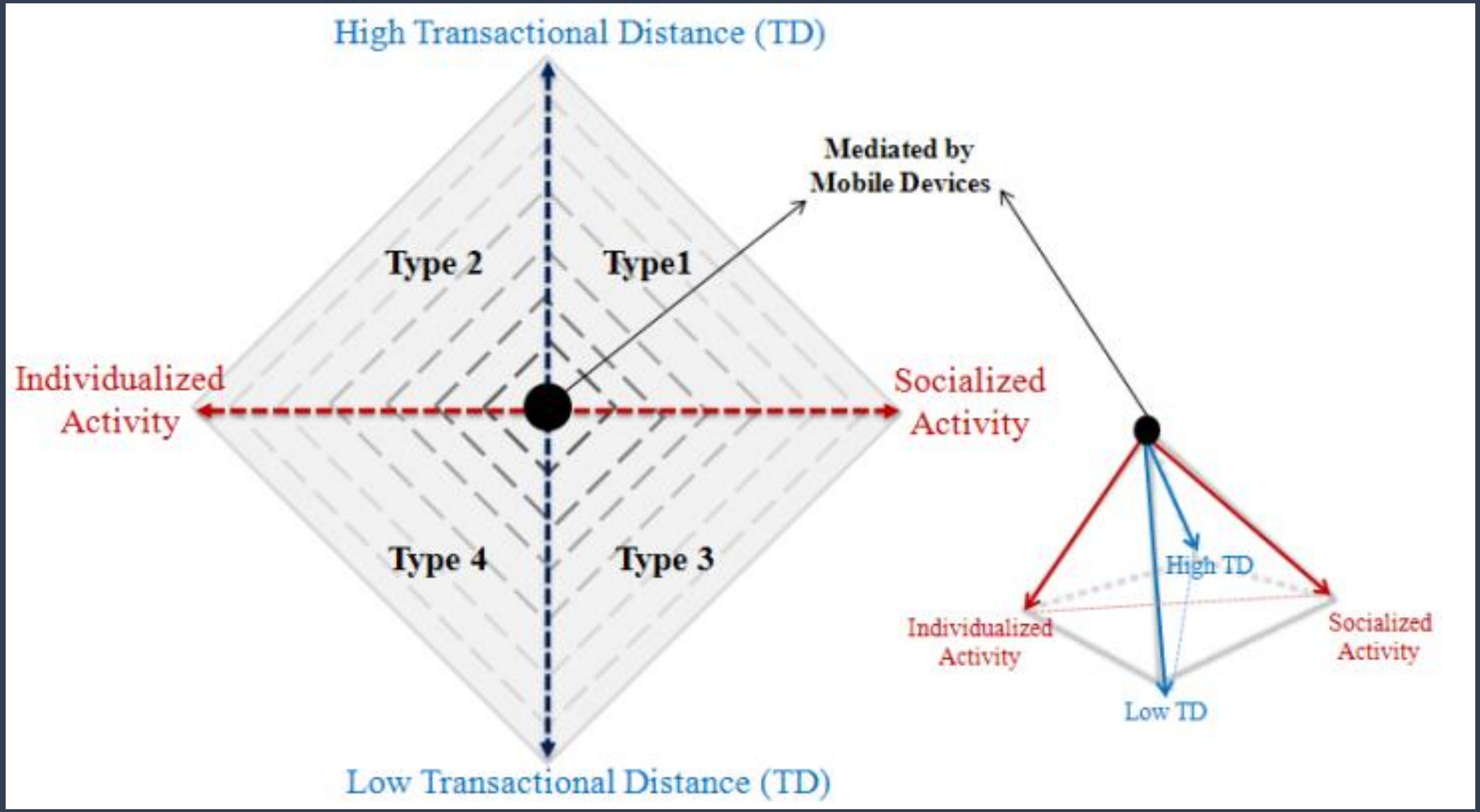
Excellent for Student Centered Learning:



When rigid course structure is replaced with increased dialogue between teacher and student, student autonomy sky rockets. Learning shifts to student-centered and now there is room for student exploration and individualization.

Transactional Distance Theory and Mobile Learning

Park (2011) expanded transactional distance theory and included socialized activity over a continuum.



In Park's research, he categorizes numerous examples of mobile learning in the context of distance education. He modifies transactional distance theory based on the affordances of mobile learning. This involved comparing mobile learning, electronic learning and ubiquitous learning presented in previous studies.

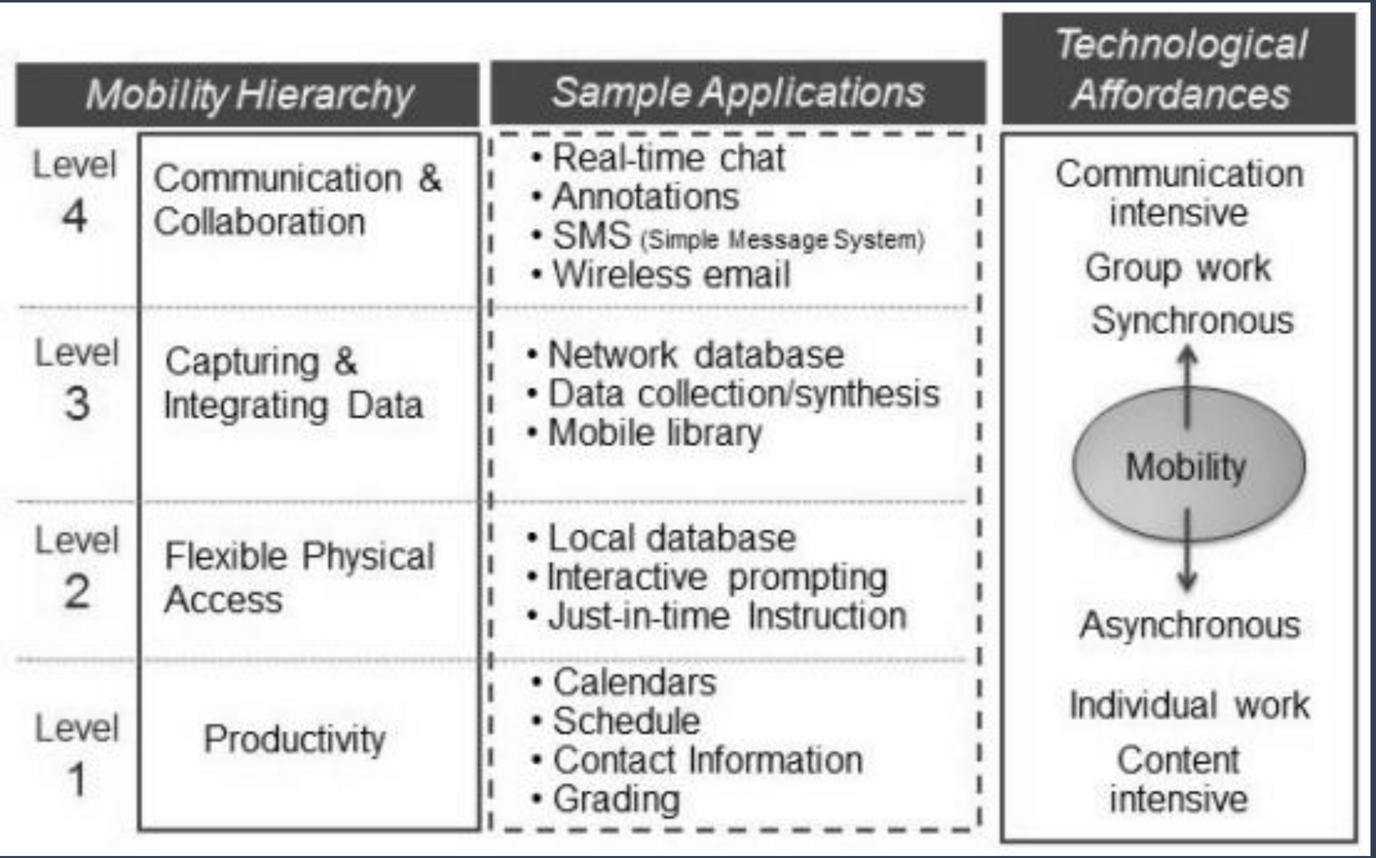
Park's Revised TD theory:

Type 1 - High transactional distance and high socialized mobile learning activity

Type 2 - High transactional distance and high individualized mobile learning activity

Type 3 - Low transactional distance and low socialized mobile learning activity

Type 4 - Low transactional distance and low individualized mobile learning activity



Important to the CCQ

Type 4 - Low transactional distance and individualized mobile learning activity:

This type of mobile activity refers to 1) less psychological and communication space between instructor and learner and 2) loosely structured and undefined learning content. On this basis, 3) individual learners can interact directly with the instructor, and 4) the instructor leads and controls the learning in an effort to meet individual learners’ needs while maintaining their independence

We have course dialogue and course structure.. Now let's set up some Principles for Mobile Learning

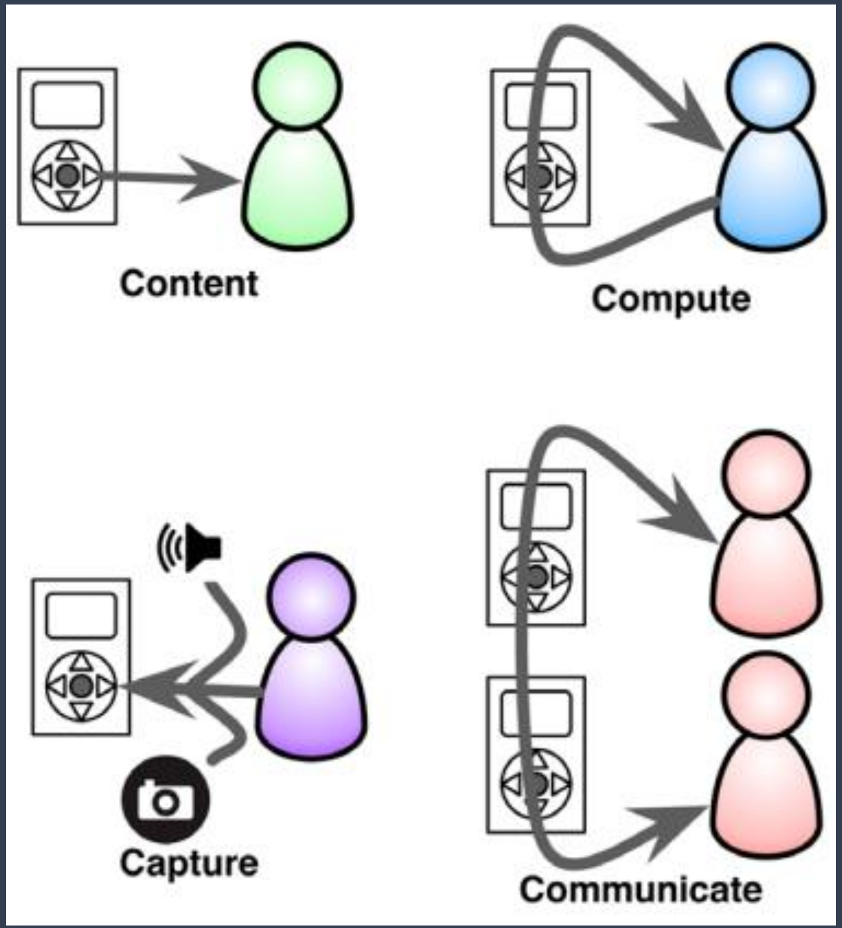
Quinn's 4C's (2011)

Content – the delivery of media including documents, audio, and video

Compute – the ability to perform calculations and have programmatic responses

Capture – capturing data from the local environment such as photos, videos, audio, or information from sensors such as location or direction

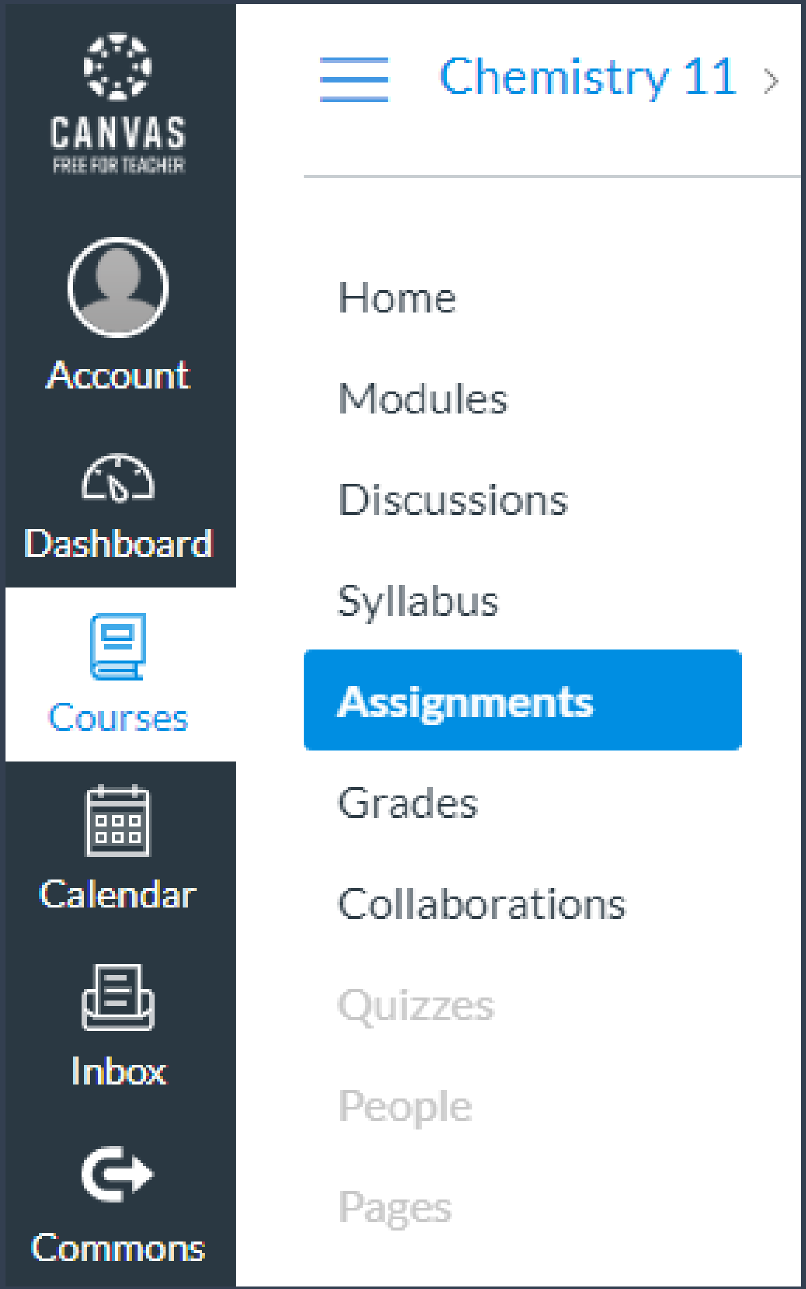
Communicate – the ability to reach others with text, voice, or even video



We have the theory.. But how does this look in practice?

Take care of Transactional Distance immediately…

In Secondary Chemistry, a mobile phone broadcasting system, classroom management system, and a networking system are all established for distance learners not only to download course materials but also to connect with the class in real time. Students can send messages and ask questions of the instructor using their mobile phones, and the instructor can respond to them with an oral explanation in real time. This function, enabled by mobile technology, supports a reduction of transactional distance.



Housing Content

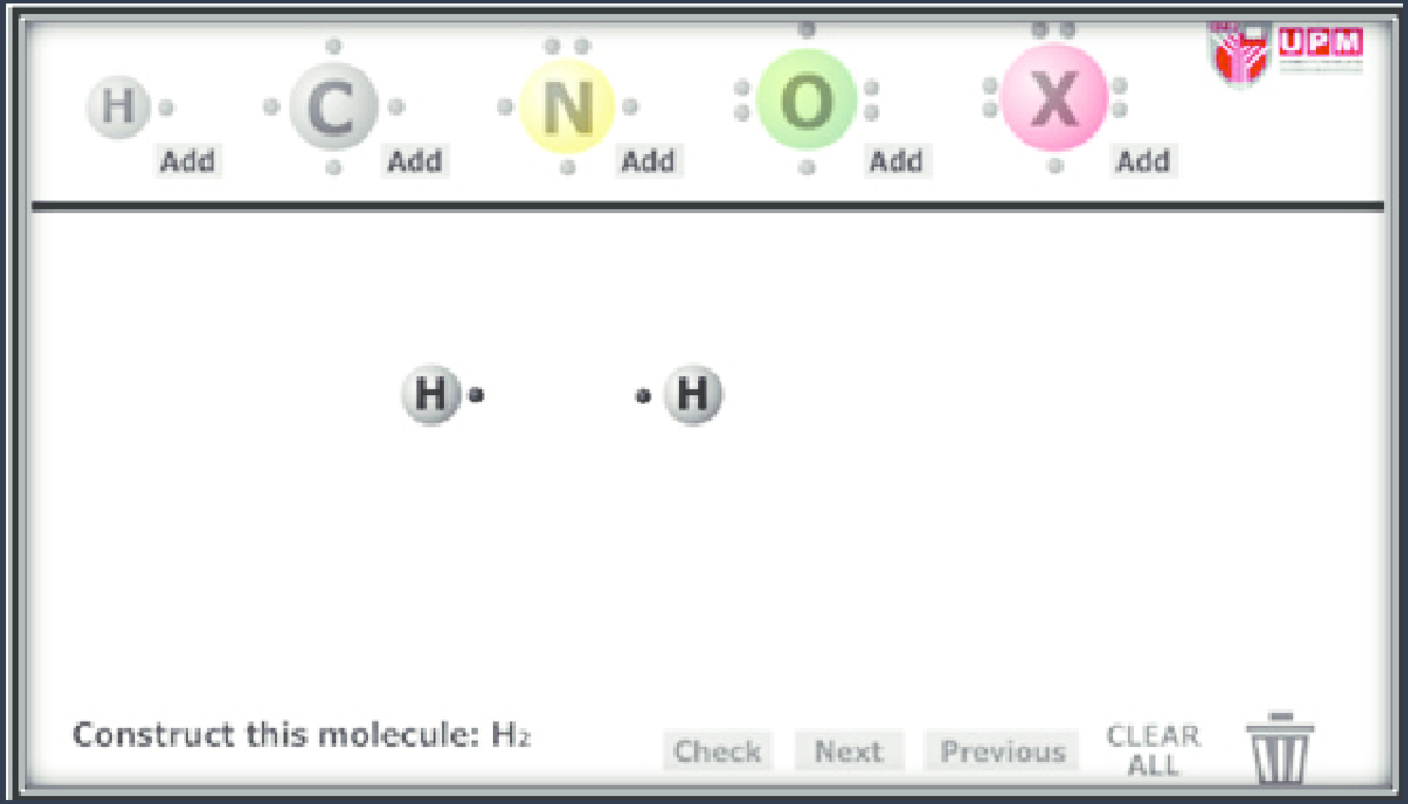
Canvas is the perfect LMS to house tools for student-centered learning. There is a free version that is accessible for all teachers. There is YouTube, SoundCloud, emaze, Slideshare, Prezi, Canva, Zoom and other web sites where instructors can create and/or post content for their students to view. I didn't even mention the host of content creation tools now available within course management systems.

The Rich Content Editor within Canvas will allow course content developers to create almost any type of content they need. The Rich Content Editor may not allow users to create content as fancy as a Prezi or emaze presentation, but the tools within Canvas are more than adequate especially if one puts a premium on substance over style.

Above all, students can access Canvas using any mobile device and access material wherever they are.

Applications For Computing

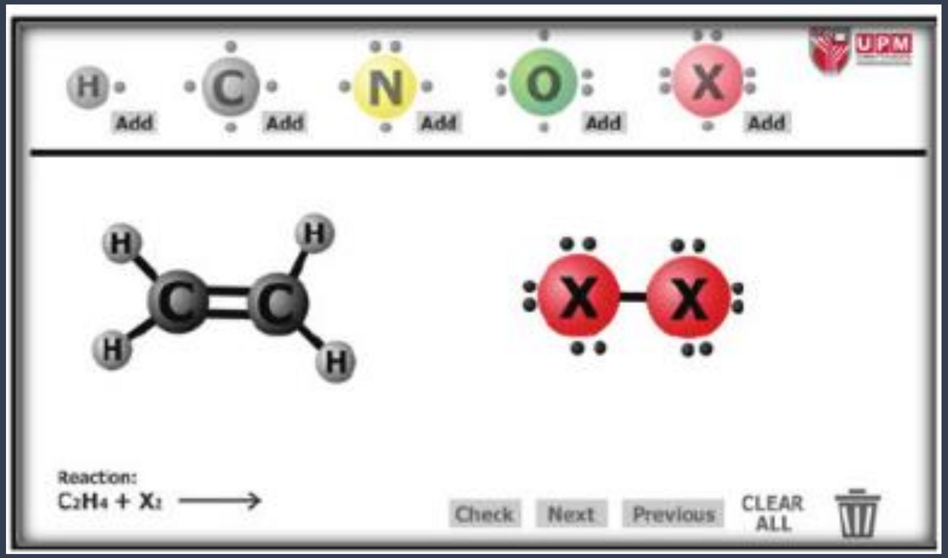
There are few apps on the market that are catch-all tools for student-centered learning in secondary Chemistry. Meaning these apps on their own aren't capable of capturing all four of Quinn's C's for mobile learning. To harness the potential of current mobile apps, it's up to the teacher to determine which tools to use depending on the different learning styles and capabilities of their students. A current tool that captures a few of Quinn's principles is the Organic Chemistry Reaction Application (OCRA) app.



OCRA

OCRA (Talib et al., 2014) is a unique mobile application that allows its users to create their own organic molecules using hydrogen, carbon, oxygen, and halogen atoms. In OCRA, the users are able to explicitly form and break chemical bond between atoms by sliding their fingers to move the electrons or atom, and predict logically the mechanics of fundamental mechanism reactions. Students are able to construct infinite combinations of organic compounds, while identifying the reaction used to create them.

Students can conceptually visualize the mechanistic steps in reaction mechanisms. This enables the users to understand the macroscopic and microscopic concepts of reaction mechanisms. A highlight of OCRA are its game-like features with the objective of acquiring correct answers by achieving specific goals.



Checkpoint..

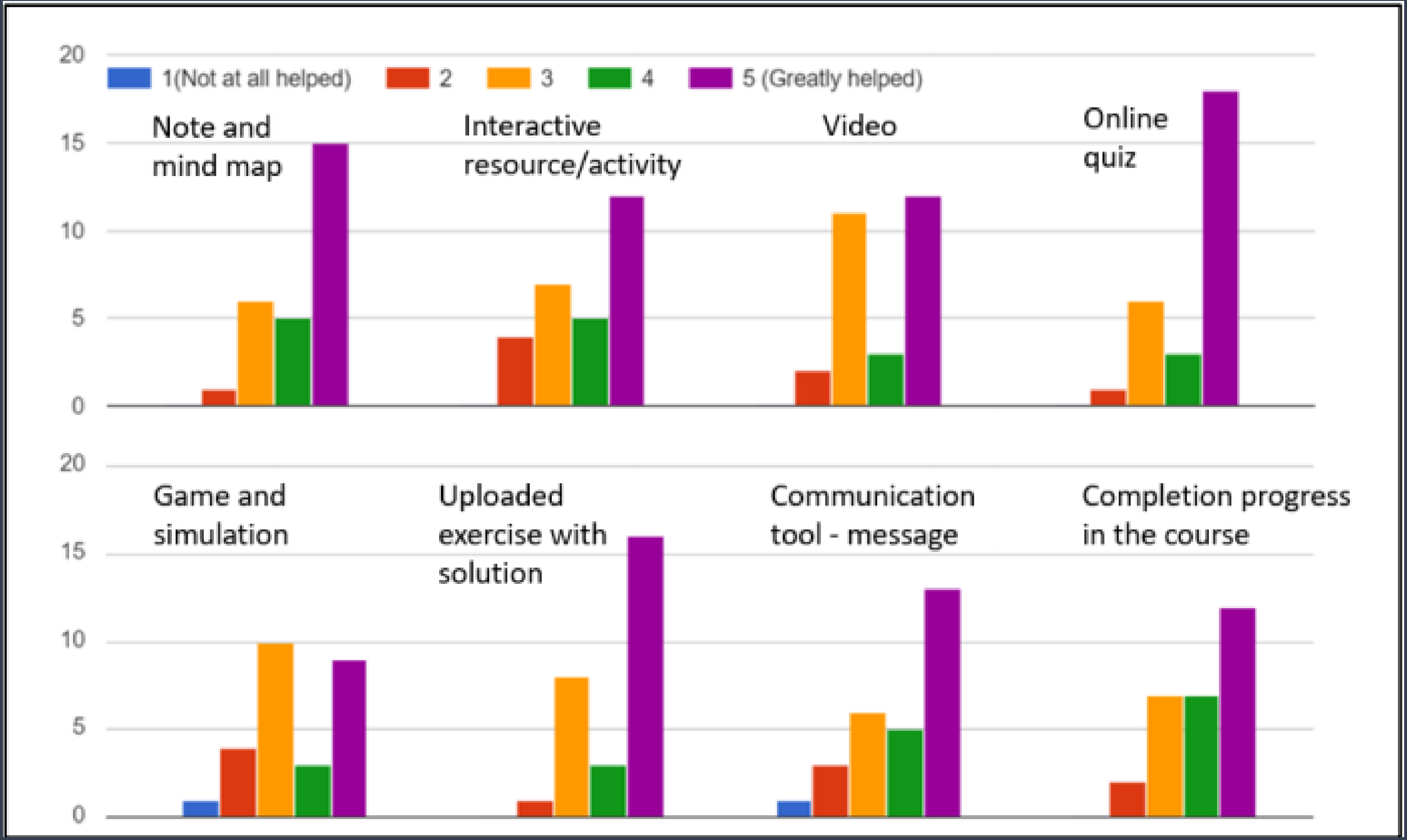
- ✓Transactional distance is narrowed through increased dialogue and the use of mobile activity.
- ✓Content is varied and is housed in an LMS that can be accessed with any mobile device
- ✓Student-centred mobile apps embedded in the LMS promote enriched learning opportunities for students and affordances for individualization.

Capture and Communicate

Mobile learning affords a student-centered model the most through Quinn’s principals of capture and communicate (Quinn, 2011). Chemists strive to understand the interactions between molecules and how these interactions produce our macroscopic world. For this and a myriad of other reasons, a sense of responsibility for bringing the voice of science to a conversation and a desire to share the joy of science is developed in the student. This has become infinitely easier with platforms like Instagram and Twitter.

In no other time in history have humans been able to capture information they have learned and communicate it to peers and the public within minutes. This is done not only with pictures and videos, but with also real time blogs and ePortfolios. Providing students with varied platforms for communicating their learning shapes the student-centred model

What do the Studies show?



In a recent study, Hsiung (2018) made e-Learning platforms available to students, where the students can access e-resources anytime and anywhere in a secondary Chemistry. Innovative technologies such as mobile clickers, simulation and augmented reality (AR) were integrated into classroom instruction. Most of the students found the e-resources provided useful and well prepared them for the assessments in the course. Their understanding and ability to answer questions had improved. They were motivated to study chemistry because it was more interactive and engaging. Overall, findings showed that these e-resources and innovative technologies improved student learning.

Moving Forward..

There is a need for the development of more authentic learning tools that specifically optimize the use of mobile applications to portray abstract and dynamic chemistry concepts at different levels (Sung et al., 2016). What lacked in my research were mobile tools that measured the level of student comprehension. My guess is with the rise of AI technology, better tools will surface that could recognize when authentic learning is occurring. To improve student centered learning, mobile technologies need to be created to accommodate the variety of academic background, learning styles, and tap into intrinsic motivation.

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