FUTURE READY

INSPIRE • CONNECT • TRANSFORM

Using design principles to design, implement and evaluate ICT-enabled pedagogical practices

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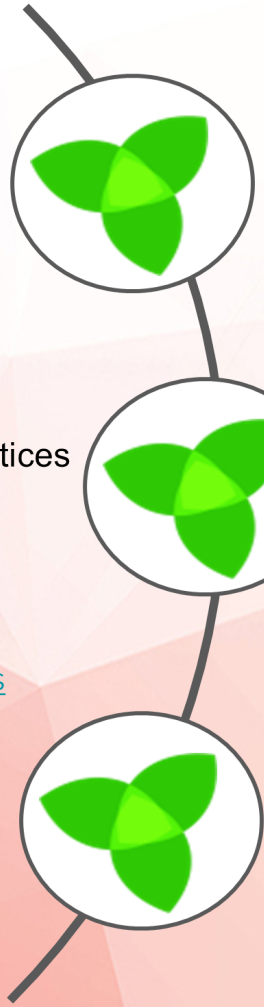
eduLab

An innovation programme which serves as a catalyst to transform ideas into classroom practices & builds synergy among schools, MOE, researchers and industry

http://edulab.moe.edu.sg/edulab-programmes



Builds on teachers' ideas to transform learning with technology

Provides strong support to develop ideas into practice and design prototypes for spreading in the wider system

Translates research into classroom practice

- Focus on the flow of content or student engagement?
- Provide instructions or diagnose learners' possible confusion?
- Provide information or enable students' exploration of the phenomena?
- Seek predefined answers from students or encourage negotiation of ideas?
- Engage learners in pre-defined activities or enable them to design their own artefacts?

How can eduLab learning designers document our design knowledge with project teachers in terms of our successes & failures in developing ICT-enriched pedagogical practices?

Design principles **mediate between learning theory and the design of learning**. When based on the learning mechanisms embodied in the design of classroom activities, participations structures, and social surround, design principles provide a framework for understanding how and why things work in the classroom. They **make explicit the design considerations that are critical** for iteratively analysing and optimising the design and implementation of the ICT-based pedagogical practices to improve student learning.

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Professor of Psychological Studies
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Presentation Overview

What are design principles?

Why use DPs?

How to use DPs?

What if I want to generate my own DPs?

What
are design principles?

Explicate **central** features of pedagogical approach

Highlight what works

What
are design principles?

Emerge from previous research & inform future design activities

Based on evidence

What
are design principles?

Bridge theories & pragmatic aspects of learning

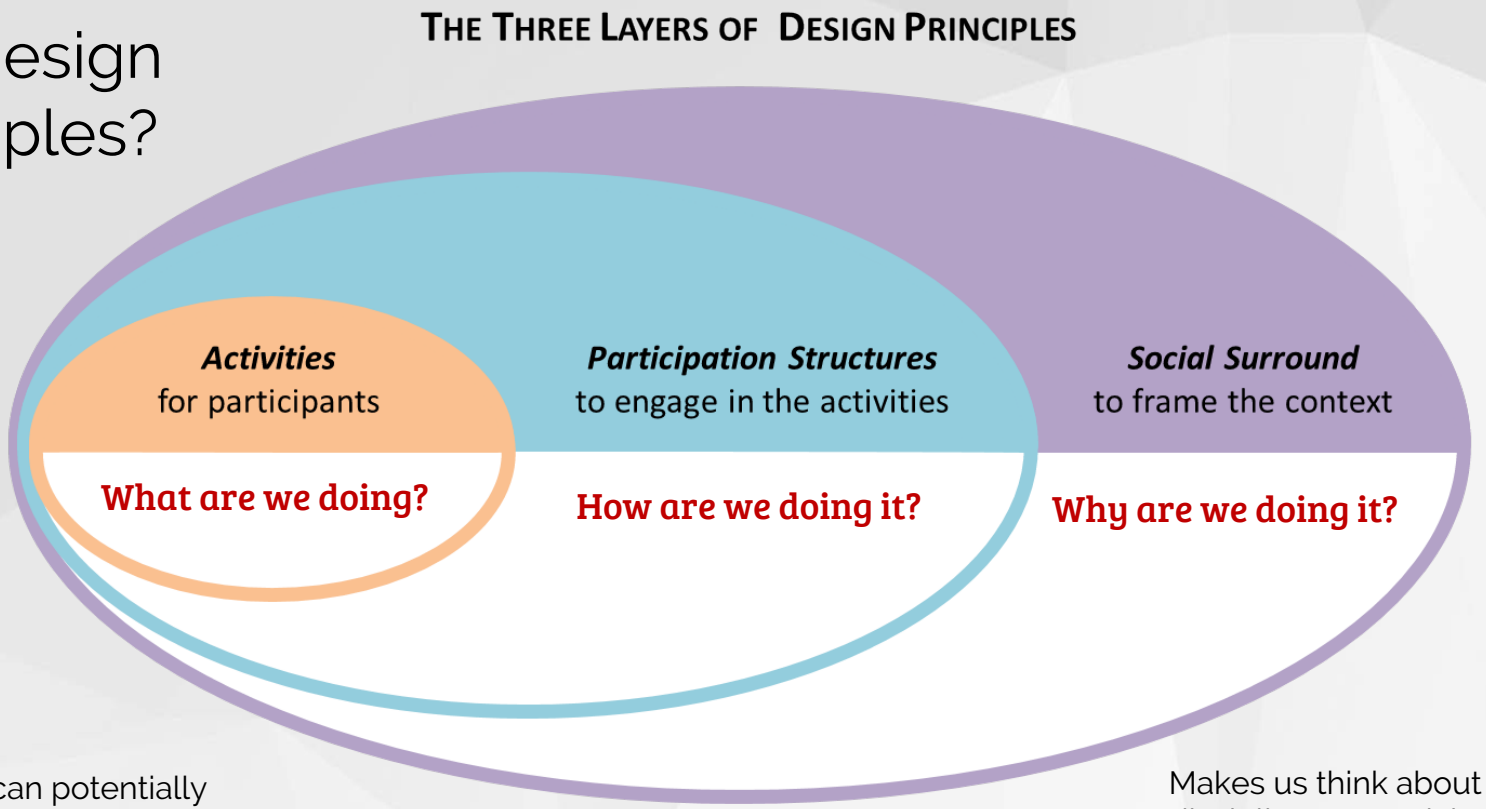
Guide decision-making

Why
use design principles?

Provides an instructional **structure** that can be operationalised in a **variety** of forms

Guard against chasing of fads & not lose sight of what is important

How to
use design principles?



DPs can potentially change the way we think about the lesson & how we should be planning or designing our lessons

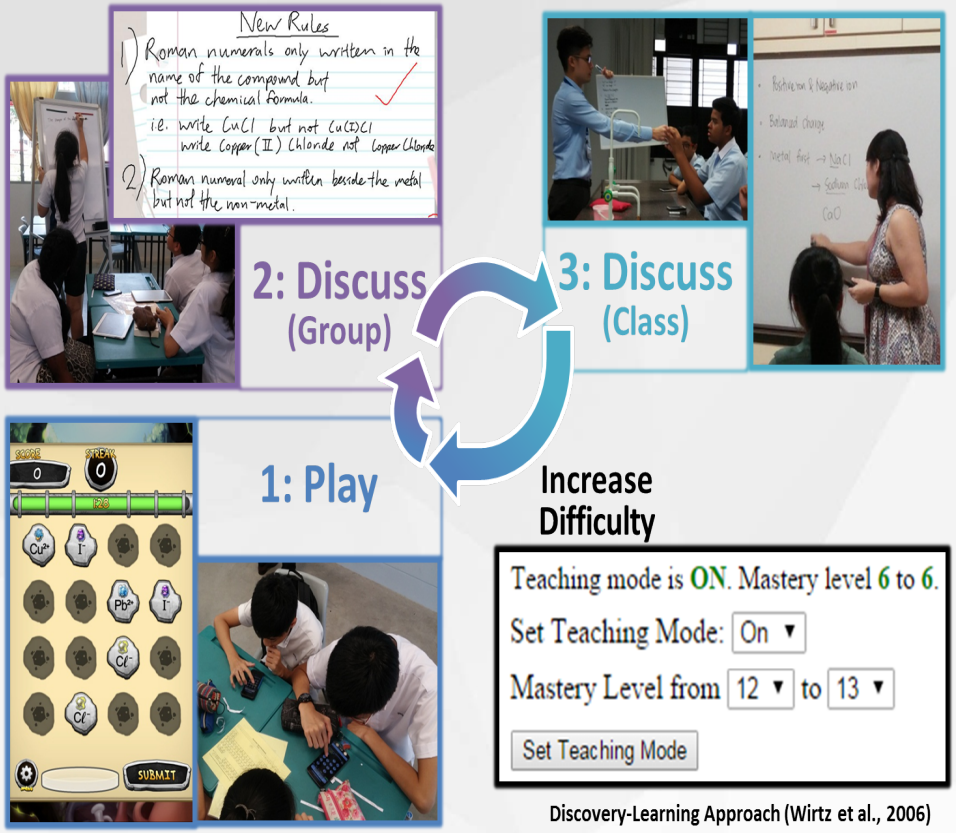
Makes us think about the disciplinary & social norms, which we don't focus a lot in our current practice

How to
use design principles?

Design Tool:	Specify critical design variables to test and optimise the design of the practice
Analytical & Reflection Tool:	Evaluate and reflect on the aspects of the design that are working well and those to be improved
Research Tool:	Specify critical variables that require measures to be created for assessing the effectiveness of the design

Learning Chemical Formulae & Names
Through Discovery-Learning

wRiteFormula in Action



Discovery-Learning Approach (Wirtz et al., 2006)

2015 wRiteFormula (WF) Design Principles

Activity: How to design WF tasks?

A1: Prior Knowledge
Activate and utilise prior knowledge of the periodic table and atomic structure throughout the lesson

A2: Purpose of Nomenclature
Establish the need for nomenclature rules to facilitate communication and unambiguous identification of chemical species

A3: Comparison and Deduction
Compare and contrast student-generated examples of ionic compound nomenclature to deduce categories of ions and compounds, and nomenclature conventions

Participation: How to engage students using WF?

P1: Involve Everyone
Ensure that all students can participate actively
E.g. ensure that all students have adequate access to the game; choose tools that enable whole class participation; use student-generated information in discussions

P2: Collective Construction
Create opportunities for students to collectively construct a common understanding
E.g. scaffold class discussions (use thinking routines); demonstrate how to negotiate differences; have students present, explain and test hypotheses governing the conventions in ionic compound nomenclature

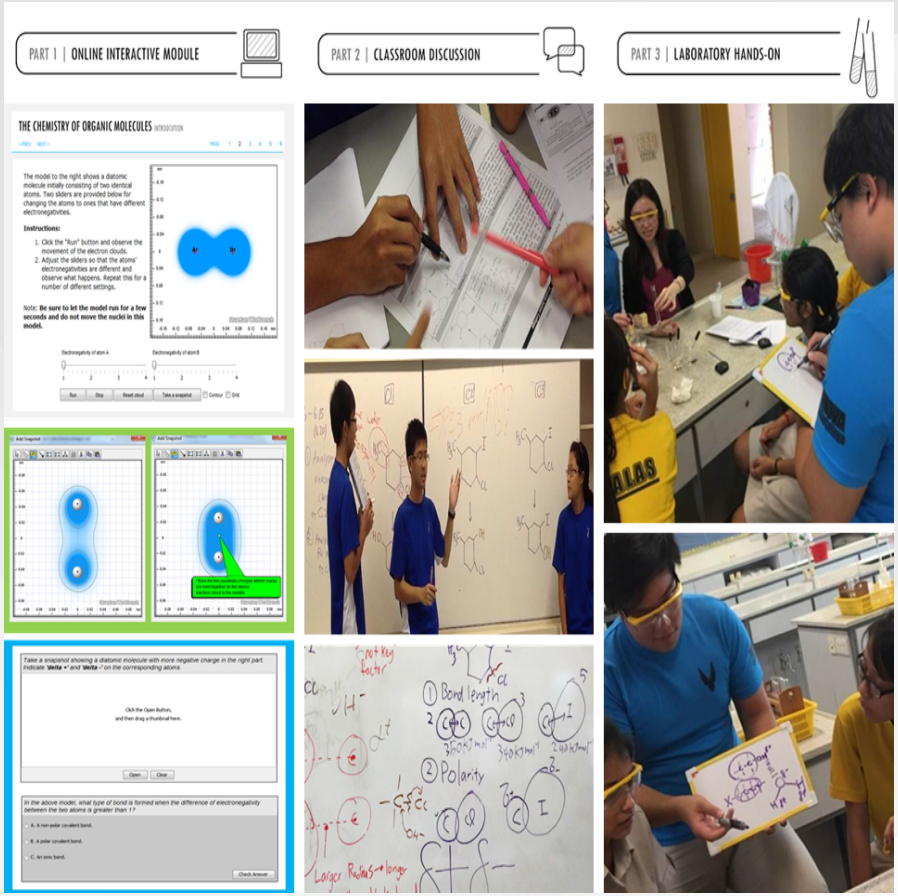
Social Surround: How to create a conducive WF environment?

S1: Scientific Values, Culture and Disposition
Encourage demonstration of scientific values, culture and disposition
E.g. explicitly communicate and reinforce expectations for behaviour and attitudes like being observant, analysing and looking for patterns, communicating clearly and concisely, using information responsibly

S2: Encourage Mistakes
Encourage students to make and learn from mistakes
E.g. explicitly communicate and reinforce expectations for behaviour and attitudes like listening respectfully to others, being persistent, resourcefulness

Learning Outcome: Mastery of Ionic Compound Nomenclature

Learning Organic Chemistry
Through Multiple Representations & Scientific Argumentation



DESIGN PRINCIPLES

MULTIPLE REPRESENTATIONS		SCIENTIFIC ARGUMENTATION
Synthesising & evaluating models using multiple representations	Activity	Evaluating multiple plausible solutions to a problem
Elicit ideas by annotations	Participation Structure	Small group peer critique and consolidation
Emphasis on fundamental concepts of organic chemistry	Social Surround	Scientific knowledge as tentative claims by communities and backed by evidence

Reflective Storytelling
Using Role Play & Apps

Strengthen idea development and write a more coherent story

Activities	Participation Structures	Social Surround
• [A1] Generate ideas without evaluation • [A2] Visualise ideas for development	• [P1] Enable collaboration • [P2] Encourage open sharing of ideas	• [S1] Create a safe space to explore ideas • [S2] Permit movement within the classroom

1. [A2] Tuning in through visuals

2. [A1, P1] Working in groups to brainstorm

3. [S1, 2] Role-playing of shortlisted ideas
4. [A2] Storyboarding through capturing & sequencing key scenes of story

5. [A2] Reviewing for logical links in story

Improving Sports Techniques
Through Video Analysis & Peer Feedback

Activities

- Make visible the sports technique as a structured sequence of steps
- Ensure repeated and mindful enactment of the sports technique based on video analysis and feedback

Participation Structures

- Enable students to learn from each other
- Scaffold the processes of reflection and giving constructive peer feedback

Social Surround

- Create a safe space to allow learners to fail, make mistakes and keep trying
- Focus on improving the sports technique rather than measuring the performance

Teacher demonstrates technique & how to give feedback with video analysis app & checklist

Students practise in pairs the technique & give constructive feedback based on captured video & checklist.

Teacher debriefs & consolidates learning with students

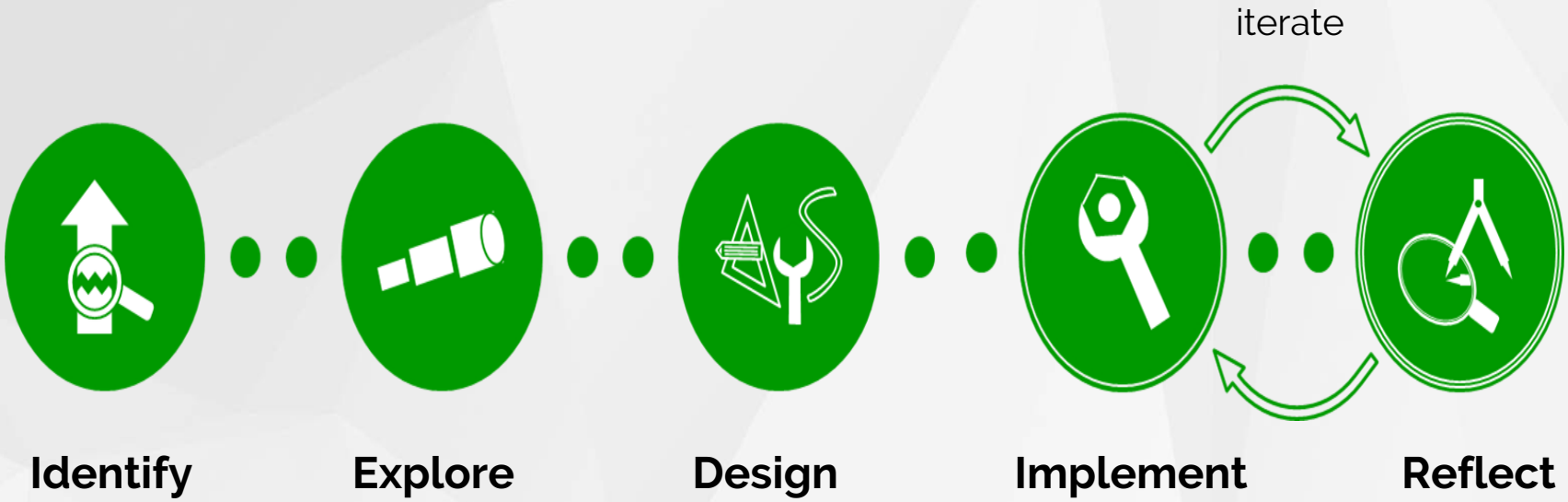
How to

use design principles?

[Please refer to Handout 1]

What if

I want to generate my own DPs?



Contact Us!

I want to generate my own DPs?

If you would like to find out about our work with design principles, or in need of lesson design resources:

Contact us

- Cindy Ong — ong_choon_cheng@moe.gov.sg
- Foo Seau Yoon — foo_seau_yoon@moe.gov.sg

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