Rubric – Degree of Focus on Student Learning of Teaching Strategies

TEACHING PRACTICE	CONNECTING TO STUDENTS' EXISTING KNOWLEDGE		PROMOTING AND HARNESSING STUDENT-STUDENT INTERACTIONS
LEVEL 1	The instructor demonstrates or provides connections between prior knowledge and new knowledge, without involving students.		The instructor initiates interactions involving individual participation or instructor-student exchanges.
LEVEL 2	The instructor asks students specific questions to incite them to recall their prior knowledge but without addressing the limitations or conflicts of this prior knowledge, nor addressing the relationship with the new knowledge. Interactions occur between the instructor and a student, or several students		The instructor proposes activities that are carried out in groups and involve students interacting with each other. However, it is not possible to determine if the interactions create socio-cognitive conflicts. The instructor uses the interactions to demonstrate connections to the students.
LEVEL 3	The instructor solicits students' prior knowledge by asking them to identify, and compare in peer groups, the relationship between the prior knowledge and the new knowledge, as well as the impact on their own conceptions of the knowledge. Or the instructor places students in a context where they must create links between their prior knowledge and new knowledge to accomplish a task. This involves a dynamic exchange between students.		The instructor promotes student-student interactions around meaningful tasks, thus generating socio-cognitive conflict through the confrontation of their views and the attainment of consensus understanding. The instructor uses student-student interactions to have students make connections themselves.

Translated and adapted from St-Pierre, Bédard + Lefebvre by S. Isaac

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TEACHING PRACTICE	ENABLING THE STRUCTURING OF KNOWLEDGE		ENGAGING STUDENTS IN COGNITIVE EFFORT
LEVEL 1	The instructor organizes, links, structures and restructures knowledge for student consumption.		The instructor focuses learning around instructional strategies designed to increase student participation but finally involve only a small percentage of students.
LEVEL 2	The instructor involves one or several students in organising and structuring knowledge. Questions are used to guide students through relatively simple cognitive tasks, closely monitored by the instructor.		The instructor, through questions and comments, encourages students to use relatively simple learning strategies such as repeating, describing, enumerating, identifying, recalling, etc. Interactions involve the instructor and one or more students.
LEVEL 3	The instructor asks students to actively participate, in groups, in the organization, structuring and restructuring of knowledge. A context is established whereby students are required to implement complex cognitive processes over which they exercise a high degree of control.		The instructor proposes tasks which require complex cognitive processes such as comparing, contrasting, explaining, analysing, creating, synthesing, evaluating... The context created by the instructor allows students considerable control in the selection and use of these strategies. Meaningful interactions around course content consistently occur between students.

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TEACHING PRACTICE	SUPPORTING KNOWLEDGE TRANSFER AND APPLICATION		INTEGRATING ASSESSMENT IN LEARNING TASKS
LEVEL 1	The instructor's focus is on the acquisition of new knowledge in a single context. Connections between the current context and new knowledge are made by the instructor.		The instructor provides guidance about the nature and format of summative assessment, without reference to what students say or do in class. The instructor may highlight the important points to remember.
LEVEL 2	The instructor asks one or more students to use the new knowledge in a slightly different or more complex situation, and to make connections to different contexts.		The instructor implements formative assessment strategies that provide timely feedback for students on the areas they need to improve, but without providing strategies for students to regulate and deepen their learning.
LEVEL 3	The instructor asks students to apply the knowledge in new and / or more complex situations requiring the contextualization, decontextualization or recontextualization. Students may also need to generalize and / or specialize in order to accomplish these tasks.		The instructor implements formative assessment strategies as part of an ongoing process that provides regular feedback and offers specific strategies for students to deepen or promote self-regulation of their learning.

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TEACHING PRACTICE	DEVELOPING STUDENTS' REFLECTIVE PRACTICE
LEVEL 1	The instructor provides information or knowledge about metacognition, reflective analysis and critical thinking. She describes what to do and may explain why she has adopted a given approach.
LEVEL 2	The instructor provides examples of his reasoning and gives examples of metacognitive activity, reflective analysis and critical thinking. He often explains why he has adopted a given approach.
LEVEL 3	The instructor provides students with activities to practice metacognitive thinking, to develop a reflective practice and to exercise their critical thinking. She encourages students to bring a critical eye to their reasoning methods and final productions, and to describe and clarify the processes involved. She implements strategies to encourage students to self-evaluate and become aware of their own skills.

Reflective practice encapsulates the wide range of activities associated with thinking about your learning (or teaching) and is perhaps best understood as an approach which promotes autonomous learning that aims to develop deep understanding and critical thinking skills. Techniques such as self + peer assessment, personal development planning and group work can all be used to support a reflective approach.

Metacognition refers to higher order thinking that involves active control over the thinking processes involved in learning. Activities such as planning how to approach a given learning task, monitoring comprehension, and evaluating progress toward the completion of a task are metacognitive in nature. Metacognition is often referred to as **"thinking about thinking"** and can be used to help students **"learn how to learn."** Cognitive strategies are used to help achieve a particular goal while metacognitive strategies are used to ensure that the goal has been reached.

Metacognitive strategies involve executive regulation of thinking processes. They involve decisions that help

- to identify the nature of the task on which one is currently working,
- to assess current progress of that task,
- to adapt one's approach (order of steps, resources) or strategy/method for the task when necessary

Definitions adapted from http://www.hent.org/world/rss/files/metacognition.htm

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Lesson Plan for Teaching Practices Analysis: Buffers, Buffer Action, and Ocean Acidification[i]

Time	Phase	What the teacher does	What the students do
1 min		You've certainly seen headlines about the massive coral bleaching or dying and how this is the result of climate change. How is something as small as coral affected by atmospheric [CO_2]?	
2 mins		The tools in this lesson plan will enable you to: • define buffers and describe buffer action • describe the terms buffer capacity and buffer range • explain the buffering action of seawater • explain ocean acidification and discuss possible impact on biosphere (ie coral)	MINUTE PAPER Looking at the objectives, rate your own relevant background knowledge as LOW/MID/HIGH. Make a little note to yourself for later.
10 min		Use How Does A Buffer Maintain pH?[ii] to explain buffer action and the maintenance of pH in a buffer solution. Explain the terms: buffer capacity, buffer range, and the pH equation of a given buffer. Use examples 1+2 from the text to calculate changes in the pH values when a weak acid or base is added to a buffer solution. Discuss other examples of buffers in daily life, e.g., the buffering action of blood.	
10 min		Give instructions step-by-step + remind time left at half point: 1. 2 min 2. 3 min 3. 5 min	THINK PAIR SHARE 1. Alone: Write a 1-2 sentence definition of a buffer. 2. Pair: Together, ensure you have a definition that explains HOW a buffer acts to maintain a stable pH. 3. Share: Ask for 3-4 volunteers to read their definitions
8 min		Surface Ocean pH Levels[iii] • Run simulation to show global pH value (pH indicator strip) of oceans for given atmospheric [CO_2]. Vary the [CO_2] using slider at bottom. • Use "Options" tab to show different emission scenarios (Special Report on Emission Scenarios) and visualize the predicted ocean pH.	
7 min		Show video micro-lecture Ocean Buffer Chemistry[iv] to describe buffering in the ocean.	

		- oceans as carbon sinks (absorb atmospheric CO_2) but stable pH due to the buffering capacity of seawater (carbonate) - buffering range of oceans and the chemical implications of a higher dissolved [CO_2] (from increased levels of atmospheric CO_2) -> excess [H^+] -> acidification - Le Chatelier's Principle—increased [CO_2] concentration in seawater sequesters more carbonate (CO_3^{2-}) ions to keep the system in equilibrium. - ocean biota may be affected in the absence of freely available carbonate (CO_3^{2-}) ions.	
15 min		1. Create groups with 3-4 near neighbours. Divide room into 3 = groups a, b + c. "Together, answer your assigned question. You have 5 minutes" 2. At 3 min, say time half gone AND choose spokesperson to share their response. 3. For each topic, ask 2 groups to share their answer	BUZZ GROUPS a. Describe carbonate buffering in the ocean. b. What is ocean acidification? c. How would higher levels of atmospheric CO_2 affect ocean pH?
4 min		2. (After minute paper): Summarise the implications of the predicted pH value of oceans for different emission scenarios and the possible impacts on the Earth's biosphere	1. MINUTE PAPER a. What are the 3-4 key ideas you are taking away from class today? Write them down. b. Rate your own level of engagement in class today (LOW/MID/HIGH) and to what degree you are personally able to meet the objectives (LOW/MID/HIGH)
3 min		3. Show my 3 key ideas and get students to compare to their own lists.	4. REFLECTION a. Compare your background knowledge and in-class engagement to your success in identifying the key ideas and meeting the objectives. b. How satisfied as you with what you learned today?
60	*Total time*		

[i] Lesson plan based on the ideas of Dr. Pragya Gahlot, Sri Venkateswara College (University of Delhi), India.

ii Reading, "How Does A Buffer Maintain pH?" by LibreTexts™ introduces the topic of buffers and explains the chemistry of buffer action in solution through examples. https://chem.libretexts.org/Bookshelves/Physical_and_Theoretical_Chemistry_Textbook_Maps/Supplemental_Modules_(Physical_and_Theoretical_Chemistry)/Acids_and_Bases/Buffers/How_Does_A_Buffer_Maintain_Ph%3F

[iii] Simulation, "Surface Ocean pH Levels" uses visualization to explore changes in ocean pH levels for different atmospheric [CO2] corresponding to various emission scenarios (as published by the Intergovernmental Panel on Climate Change). Developed by The King's Centre for Visualization in Science (KCVS) https://applets.kcvs.ca/OceanAcidification/oceanAcid.html

[iv] Video lecture, "Ocean Buffer Chemistry" explains carbonate buffering in the ocean and the resulting effect on ocean biota. Prof. David Archer, University of Chicago http://www.kaltura.com/index.php/extwidget/preview/partner_id/1090132/uiconf_id/20652192/entry_id/1_16ghjcjg/embed/auto

Worksheet – Degree of Focus on Student Learning of Teaching Strategies

1	Action/activity from lesson plan that contributes to this aspect	level (0-3)	Improved activity (or why a modification, inclusion is not relevant)	new level
CONNECTING TO STUDENTS' EXISTING KNOWLEDGE				
2				
PROMOTING AND HARNESSING STUDENT-STUDENT INTERACTIONS				
3				
ENABLING THE STRUCTURING OF KNOWLEDGE				
4				
ENGAGING STUDENTS IN COGNITIVE EFFORT				

Worksheet – Degree of Focus on Student Learning of Teaching Strategies

5	Action/activity from lesson plan that contributes to this aspect	level (0-3)	Improved activity (or why a modification, inclusion is not relevant)	new level
SUPPORTING KNOWLEDGE TRANSFER AND APPLICATION				
6				
INTEGRATING ASSESSMENT IN LEARNING TASKS				
7				
DEVELOPING STUDENTS' REFLECTIVE PRACTICE				