Developing integrated learning experience for pre-service science teachers

PGDE (Science) Team
Anthony, Kennedy, Annie, Carol
“The integration helps me organise and recall what I’ve learnt in the semester. Learning about the same topic in different classes helps me view that topic from different perspectives, which improves my learning.” (Student Teacher Reflection)
Outline of the presentation

- Challenges and problems of the old PGDE model
- Our efforts to develop an integrated learning experience
  - Alignment of timetable
  - Integration of learning in own course
  - Coherence across the courses
  - Integration in teaching practice
Educational Studies and Major Methods

Educational Studies

ES is irrelevant!

Teaching is about “knowing-how”

Major Methods
University and Schools

The theories are too good to be true!

The classrooms are too true to be good!
Integration in the new PGDE

- Co-planning
  - Understanding of the students
  - Understanding of the teachers
  - Sharing of ideas and materials
  - Emerging approach

Integration but NOT redundancy
Alignment of timetable

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<tr>
<th>Sem</th>
<th>Session</th>
<th>Week</th>
<th>Date</th>
<th>Content</th>
<th>Instructor</th>
<th>II</th>
<th>CLI</th>
<th>Bio Major</th>
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<td>KC</td>
<td>Teacher ethics and professionalism</td>
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<td>13 Sept Tue</td>
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How people learn

Motivation

Assessment
Week 1 Day 1

1.6 Diffusion

Learning objectives
After this topic you will be able to:
- use the particle model to explain diffusion
- describe evidence for diffusion

Particle size
A teacher sets up the apparatus below to demonstrate diffusion.

Key Words
- diffusion

Understanding Shulman (1987) through analyzing learning materials
Tinkering School: *Are they teaching something worth learning?* (https://www.ted.com/talks/gever_tulley_s_tinkering_school_in_action#t-110678)

What are the ideas of Tinkering School that you could incorporate in your future practice?

3.

4.

Curriculum conception + Science Education Policy + Personal reflection
Interesting Promoting Methods

Secondary School teachers love their subjects...
You love Biology

Many of your students don’t!!!

Why is it important for your Ss to love biology?

State the biology topic(s) you find it difficult to teach/learn. State the reason(s) why you think the topic(s) is/are difficult to teach/learn.

Different themes (e.g. motivation)

James

- Plants – it is difficult to make the lessons interesting especially in the parts of explaining the anatomy of plants

Boring topics....

- Plants
- Photosynthesis/respiration
- Molecular Genetics
Teachers spend less class time teaching about plants and rarely use plants as examples of biological concepts (Uno, 1994).

Textbooks tend to provide less information about plants than animals (Uno, 1994).

Many students develop a poor attitude and understanding about plants (Schussler and Olzak, 2008).

EDUC7162 Teaching and learning of Biology Session 5 Preparatory Task

Name (in full): English Name: Date:

Direction:
1. Upload your responses to the following questions on or before 22nd September, 2016 (Thursday).
2. Resume the file with your English name e.g., Session 3 Prep Task_Sam

1. Recall your experience of learning biology; do you still remember any episode that facilitated your understanding of biology? Please describe the specific episode(s) in details.

Note: If you cannot recall any specific episode, describe in general your experience of being a biology learner. Were the biology lessons you had interesting? Why or why not?

Enoch

I still remember what makes me having such large interest in Genetics. It is an experiment in a biology class back in high school. It was a 2 hours lesson and the teacher told us that we were going to extract our own DNA, but before that, we needed to know the steps, background and theory in order to perform this experiment. Through this teaching approach, the experiment not only help us to link what we learn into reality, but it can also motivate us to learn.
Motivation = Expectancy X Value

- Expectancy: The extent to which the learner expects success in their learning.
- Value: The value of the learning to the learner.

What research tells us....

- ARCS Model of Motivational Design

- 2 important steps for promoting and sustaining motivation in the learning process:
  - Attention
  - Relevance

Key idea: From simple to complex

B. Varying the mode of delivery

- http://www.youtube.com/watch?v=J3QE8ILmMec
  - PCR song
Educational Inquiry

- Teaching of theories
  - Value-expectancy Theory of Motivation
  - Mindsets (Dweck)
Inquiry learning task:

- Find resources in your subject area (biology/chemistry/physics) on motivation and write on Moodle illustrating how these materials illustrate II principles on motivation (Between Sessions 1 and 2)
- Show and Tell and explain resources in Session 2
Sharing in class

Session 2

**Task 1**: Sharing of teaching resources

- **Sharing**: Briefly introduce the teaching resource and explain how you would use that in your teaching
- **Learning from others**: Listen to your peers’ sharing and jot down some ideas
Task 2: Lesson plan Analysis

- Discuss the lesson plan in relation to motivation learning principles
  - What is the lesson flow?
  - How would you examine the lesson plan and worksheets in relation to motivation and meaningful learning?
  - How can you improve the lesson plan further?
Example of SE Moodle Writing: 3 things you have learned (1)

- Clear Rules and Consequences

For example, the school sets a strict rule about sleeping in class. When my mentor teacher found that a student fell asleep, other students tried to remind him. Every student is responsible to obey the rules and agree that other students who break the rules have to be punished (consequences), and so they are less likely to have the misbehavior.
Example of SE Moodle Writing: 3 things you have learned (2)

Give specific praise on observable behavior and clarify future expectation.

For example, the principal praised the students once he got on stage; he praised them for their discipline (attentive and quiet) and showed positive expectation. He said the hymn is so good... It is not enough for you just to listen and good if you can sing louder (intrinsic: giving hints on valuable behavior..and how they can improve)
CLI pre-lesson task

- Identification of a difficult topic for students to learn

- Plant biology:
  - Large number of complicated steps involved in photosynthesis (light reaction, dark reaction, electron transport chain, etc.)

- 2016, 5:43 PM

- Memorisation of the steps was required and very difficult
- Difficult processes to visualise
  - Low motivation to learn about plants
  - Lots of difficult and unfamiliar terms
  - Detached from daily life
  - Biochemistry knowledge required, but students may not have this pre-requisite knowledge
CLI lesson

How do we assess?

- Discussion on how we assess
  - Left Hand Rule in electromagnetism
  - Ideas of mole
  - Students’ motivation of learning plant biology

1. Identify the learning goal(s) you want to assess
2. Suggest instruments
3. Choose the instrument and explain your choice

Role of co-teachers
- Participant
- Facilitator
- Inquirer
Integration of knowledge learnt from Methods, II, SE and CLI

Lesson planning
(Methods, CLI)

Strategies to assess students’ motivation
(Methods, CLI, II, SE)

Co-teacher as facilitator

Learn from the teachers of Methods, CLI and II

Student’s Motivation of learning Plant Biology

1. Learning Goal
   - Appreciate critical importance of plants in life
   - Knowledge Goals: understand process in plant that contribute to life & env.

2. Conversation:
   - Do you like this topic? Scale of 1 to 10
   - Checklist
   - Eye-contact, questions from students

3. Measurement is actually CHANGING
   - Self-reflection.
   - SS: What is my intrinsic motivation?

   ASSESSMENT “AS” LEARNING
   - Meta cognitive
   - How do we know?
     - Moodle response
     - Exit slips
     - Ask student What do you like most?
Students’ reflection on CLI

1. Students are not motivated to learn about plants:
   We can give seeds to students to plant without telling them which plant seed it is, and ask them to keep a journal of the process. When people have to take care of something, they usually get attached to it. Students are likely to be more appreciative of plants when they have to take care of one. Later, when we are teaching students about leaf structures, we can examine leaves of the plants students have grown. We can also talk about different plant adaptations using the different plant species students have grown as example. This will make learning about plants more interesting, personal and relevant to their everyday life.

2. Students do not understand the importance of plants in our lives:
   Ask students to draw on mini-whiteboards what will happen if all the plants in the world suddenly disappeared. This should elicit very interesting scenarios to make learning interesting and to help students understand the importance of plants.
Reflection on your teaching for improvement
by Carol Kwai Kuen Chan - Monday, 6 February 2017, 11:33 AM

After you have taught your first few classes, you can reflect on your teaching for improvement.

You may consider these guidelines:
What did I plan to do? What actually happens? How has my teaching reveal the gaps? What are the strengths and problems? What have I learned about myself, my students and my teaching? How would I do this teaching differently? How would I like to change in my future teaching?)

You can also include other ideas and reflection you think that are helpful.

Please build on what your classmates have written and engage in sharing and learning together.

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Re: Reflection #1 on your teaching for improvement
by Hau Ching Christine Lui - Saturday, 18 February 2017, 9:50 PM

Similar to Kevin, I am also teaching a Form 5 Class. I am teaching them Physics Chapter Electromagnetic Induction of Straight wires and the left hand rule. I experienced the same issue as Kevin, where some of the students are used to exam oriented, didactic teaching style. Their previous teacher (which is also my mentor) would simply project the textbook on the screen and scroll. However, when there are difficult problems, he would do them on the blackboard.

My class is one of the top, smartest classes in the school. Their mathematics base is very good and they ask many well thought questions. Before I started teaching, my mentor had told me this class have very strong character and that I will know more when I start teaching them.

Overall, the first week of SP has been very overwhelming and partly discouraging. There are many things I need to work on but I still have many questions in my head as the suggestions my mentor provided me left me even more confused. One of the main issues is the difference between me and my mentor. My mentor has taught physics for 35 years. He is extremely knowledgeable and a great teacher for didactic teaching and shifting. Some of the suggestions he had given me were:

- I should teach FAST. The P5 are strict schedule and I must cover everything in the textbook in the given amount of lesson time.
- There will always be students who are lagging behind and it is the responsibility of the teacher to catch up and ask for help.
- Using the blackboard takes too much time, better to project it on the screen.

Conversely, I believe my time management is an issue, but I dont believe this applies to teaching fast. I would like to select important examples and problems to go through with the class, but the teacher insists on teaching everything that is in the book. Most of the time, my mentor advise us to be patient and I would want to speak to another experienced Physics teacher. Nevertheless, my mentor spends time on giving me suggestions. Although I do not agree with all of them, I will selectively take what I find useful. I also wish I can have more autonomy as he would be at the back of the class rushing me and "summarizing" at the end of the session, whereas he actually taught rather than summarizing.
During Main Teaching Practice

Critical Incident Analysis

**EDUC6701/6702/6710 Methods course: Biology, Chemistry, Physics**
Main Teaching Practice Review Activity Sheet

Name (in full): ___________________________  English Name: ___________________________
University No: ___________________________  Date: 18th March, 2017

**Directions**

**Task 1: Critical incident analysis**

1. Identify a critical incident related to teaching or learning that has *caught your attention* during your school experience and carefully analyze it. Select an important *dilemma* for you as a teacher that has made you reflect on the problem or that has forced you to make a decision. Build your analysis by answering the following questions. Be prepared to share your views.

(a) Briefly describe the critical incident.
(b) What was the problem or dilemma? Briefly describe the problem or dilemma you encountered.
(c) Why was it important or relevant to you?
(d) How did the dilemma emerge? How did it develop?
(e) How did you try to solve the problem? What was the rationale for your decision?
(f) How did the dilemma or problem influence your beliefs about teaching or learning?
(g) What would you do the next time?
Mid-MTP discussion session
Critical incident encounter by a student

Do teachers have favoritism? A student that I frequently call upon has become disengaged from my class...now avoiding me...both that student and I feel uncomfortable...

I tried to use instructional differentiation and asked higher-order questions...I want students to feel good to make question level appropriate but now it didn’t work...

Why did you ask that question? Why is that significant to you?
I usually ask students questions randomly… I have not thought much about differentiation so have not encountered similar issues before.

Your student has experienced what I had experienced in my secondary school life.. My teacher always called upon me…

What do others think about this incident?
Instructors’ responses

What other differentiation strategies could be implemented?

What is the rationale behind using differentiation? Maybe we could reconsider why using differentiation in the first place.

Even when certain practice is good, I would not use it in every possible instance. Applicability depends on context.
Multiple solutions / insights

Maybe we could deploy a larger variety of differentiation strategies.

Observe more before taking any drastic actions.

It is not good to keep applying the same pedagogical strategies, even when those are good practices.
Building bridges? Interdisciplinarity!

Integrated Inquiry

Major Methods
Different kinds of integration?

- Epistemic integration
- Ecological integration
- Curricular integration
- Pedagogical integration
- Structural integration
Expert teachers show capacity to ‘theorize practical knowledge’ and to ‘practicalize theoretical knowledge’. (Tsui, 2003)