

# Harris Teaching Workshop

## To the Curriculum and Beyond!

University of Alberta, May 15-16, 2014

Alex Brown and Chuck Lucy, co-organizers  
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Participants at the Harris Workshop used Google Docs to produce real time reports of the discussions. The following captures the dynamic and chaotic nature of conversations between passionate teachers. For those that participated in the Harris Workshop, this will serve as reminders of what was discussed. For those who were not able to participate, this document provides a rambling but complete sense of the discussions, and links to many useful resources. If you are interested in any of the content or have further questions, please feel free to contact either of the co-organizers at the addresses above. To all participants, thank you for your enthusiasm and insights. We hope to see you at future Harris Teaching Workshops.



**Harris 2014**

# Thanks to our Sponsors !

**McGraw-Hill Ryerson**: Contact Michelle Ritchie <[Michelle.Ritchie@mheducation.com](mailto:Michelle.Ritchie@mheducation.com)>

**Wiley**: Contact Beth Iskiw <[biskiw@wiley.com](mailto:biskiw@wiley.com)>

**Nelson**: Contact Alexis Andres <[alexis.andres@Nelson.com](mailto:alexis.andres@Nelson.com)>

**Department of Chemistry** at the University of Alberta

**Faculty of Science** at the University of Alberta

**Centre for Teaching and Learning** at the University of Alberta

# Schedule

## Thursday, May 15 E3-25 Chemistry (Gunning-Lemieux) Centre

9:00-9:45 am Introduction and Welcome by organizers

Introduction to CSC Accreditation (R. Boéré, Lethbridge)

Discussion of Workshop Goals

9:45-10:45 am Discussion Groups (Desired skills - what do we want)

10:45-11:15 am Coffee, Participant Bingo and Displays (E4-43)

11:15-12:15 Discussion Groups (Desired skills - how to get them)

12:15-1:30 pm Lunch, Participant Bingo and Displays (E4-43)

1:30-2:30 pm Reports from Discussion Groups

2:30-3:00 pm Coffee (Outside CAB 265)

3:00-4:30 pm Cindy Larive presentation and discussion (CAB 265)

5:00-6:30 pm Social Hour (Sherlock Holmes Pub, 8519 112th St)

7:00 pm Dinner, Glacier Room, Lister Conference Centre

# Cindy Larive

**Professor of Chemistry and Divisional Dean,  
University of California, Riverside**

**Title:** New Materials to Stimulate Active Learning  
in Chemistry Courses

**Co-Authors:** Jack Eichler and Richard Hooley

**Date:** Thursday May 15

**Time:** 3:00-4:30 pm

**Location:** CAB 265



# Tentative Schedule

**Friday, May 16 E3-25 Chemistry (Gunning-Lemieux) Centre**

9:00-10:30 am Discussion Groups (Engagement)

10:30-11:00 am Coffee (E4-43)

11:00 -12:00 Discussion Groups (Assessment)

12:00-1:00 pm Lunch and Displays (E4-43)

1:00-2:30 pm Reports from Discussion Groups

2:30-2:45 pm Coffee (E3-25)

2:45-3:30 pm General discussion, Conclusions, and Follow-up Planning

4:00 pm Adjourn

# Internet

All rooms will have wireless internet access

- UWS, eduroam, or Guest access
- See handouts or Tyler

All rooms have LCD projectors.

Google Drive used as living record of workshop (used to create [this](#) document)

# Break-out Groups

1. Each break-out has a **topic** for discussion.
2. **Facilitator** gets discussion going, maintain discussion,...
3. **Recorder** records the important points and to report these back to the general group.
4. "Harris Workshop 2014 Summary" in Google Drive is a living record of the workshop. <http://tinyurl.com/nqug4he>
5. If discussion strays from topic, GREAT!!!



# Canadian Society for Chemistry

## Undergraduate Accreditation

René Boéré, member, CSC Accreditation Committee



*Harris 2014*



# Accreditation of Canadian Chemistry Programs

<http://www.cheminst.ca/about/cic/csc/csc-accreditation>

The CSC manages the accreditation of undergraduate chemistry programs nationally and abroad. This program maintains national standards of education and promotes the portability of the qualifications of graduates from such programs.

The CSC's accreditation program provides a complete listing of both national and international undergraduate programs that have been accredited by the Society, guidelines for accreditation, and the opportunity for universities to submit an invitation to the CSC to accredit their programs.

## **CSC accredited programs:**

Programs are accredited for five years based on a review by the CSC's accreditation board which includes a site visit by a team of chemists; this is termed "1st cycle." Programs are then re-accredited for a second five-year period, termed "2nd cycle," based on a reassessment by the CSC's accreditation board. International accreditations require a site visit for this cycle also.

# Getting accredited:

The department head at a Canadian or international university should fill out the CSC accreditation application form and contact the Chair of the Accreditation Committee to set up a site visit.

Chair of the CSC Accreditation Committee:

Mark Workentin

Western University

Department of Chemistry

London, Ont.

[mworkent@uwo.ca](mailto:mworkent@uwo.ca)

Other members: René Boéré (Lethbridge); Gerry Poulton (UVic); Noel George (Ryerson); Brian Wagner (UPEI); Alison Thompson (Dalhousie); Jennifer van Wijngaarden (Manitoba); Marie Fraser (Calgary); Mohammad Yousef (York); *Nouria Al-Awadi (Kuwait)*.

# 1. The purpose of accreditation

- 1.1 Accreditation ensures that educational programs have the potential to prepare graduates to practice their profession in a competent scientific manner. It also helps to maintain national standards of education by providing an external audit service for programs, and by promoting the portability of the qualifications of graduates from such programs.
- 1.2 Accreditation should provide a broad basis for the recognition of acceptable degree programs while allowing differing details and breadth in curriculum development. Thus accreditation identifies to the constituent members of the Canadian Society for Chemistry (hereinafter referred to as CSC), and to other interested parties such as provincial professional associations, those undergraduate degree programs whose graduates satisfy the criteria for qualification for membership in the CSC.
- 1.3 Accreditation also fosters cooperation between educational institutions, and provides a medium for the interchange of ideas between universities and industry.
- 1.4 Accreditation will apply to individual degree programs leading to Bachelor's degrees, rather than to the Institution or Faculty. This is based on the premise that degree programs of different characteristics are to be found within the same institution.

## 3.4 Chemistry content requirements

*(NOTE: here and in subsequent sections, a 1.0 credit course shall be considered one which is typically designed to take place over two terms, while a 0.5 credit course is typically designed to take place over one term. A term is typically 12-13 weeks in length. For context, a typical undergraduate degree program in the sciences would be expected to require some 20.0 credits overall, with a student workload of 5.0 credits per academic year).*

The core program beyond the first year level shall include the equivalent of 6.0 credits in chemistry, including 0.5 credits in at least three of the five traditional subdisciplines of chemistry (analytical, biochemistry, inorganic, organic and physical chemistry). For pure chemistry programs, at least 0.5 credits in *each* of the five subdisciplines is required. (Departments presenting more specialized or interdisciplinary programs are encouraged to provide the opportunity for students to access 0.5 credits in each of the five subdisciplines.) In cases where courses are in an emerging discipline, an explanation of the chemical components of the course should be described in order for the accreditation committee to evaluate how the course would contribute towards the chemistry count. In addition, there shall be a selection of advanced course offerings to demonstrate a progression of learning within the chemical discipline to bring the total number of hours of instruction up to that described in Section 3.6.

In cases where the accredited program is not pure chemistry, it is recommended that the degree title reflect the nature of the program taken.

## 3.6 Hours of instruction

The Committee shall expect a program to include at least 2.5 credits in two or more of mathematics (algebra, calculus, statistics), physics, computer science and biology. In the case of pure chemistry programs, at least 1 credit in each of calculus and physics will be required. The inclusion of other cognate subjects as well as some liberal arts requirements is to be encouraged.

## 3.5 Non-Chemistry courses

The Committee shall expect a program to involve a total of about 1000 hours of laboratory and classroom work in chemistry, with the minimum hours of each being about 400. The laboratory hours should be distributed in such a way that every student is exposed to meaningful laboratory experience across the subdisciplines. Research-based laboratories, when they are a part of the degree program, should not constitute more than 50% of the required laboratory hours, and no more than 30% of the required laboratory hours may be spent in a fourth year independent research project. In this context, classroom work includes lectures, tutorials, and seminars. In view of the need to provide a broad educational experience to students in accredited chemistry programs, it should not be necessary to exceed this requirement of 1000 hours of chemistry instruction to an unreasonable degree.

## 3.7 Joint and interdisciplinary programs

The Committee shall evaluate the entire program to ensure that the chemistry content is a major part of the program. When the total hours of instruction are equivalent to those specified in item 3.6, and all other items of these guidelines apply, such programs can be awarded full accreditation.

## 3.8 Integrated course

Lecture and laboratory hours in integrated courses, i.e., courses involving some combination of the core subjects (listed in item 3.4), will be proportioned among the core subjects for the purpose of determining whether the requirements listed in 3.4 are met.

## 3.9 Laboratory work

Laboratory work shall include hands-on training on equipment currently used in research, industry and government laboratories.

## 3.10 Communications/teamwork/ethics

The Department shall explain to the SVT, with appropriate supporting documentation, how students' communication skills, including the writing of technical reports, are developed and evaluated in that program and they shall be invited to report to the Site Visit Committee on any aspects of the program that (i) address questions of ethical professional behaviour and (ii) are intended to demonstrate a capacity for teamwork among the students.

- Accreditation lasts for 5 years after acceptance of the Site Visit Team report by the Board of the CSC.
- Accreditation can be renewed for a further 5 years through a simple paper report.
- Accreditation is to be fully reviewed (new site visit) after 10 years.
- In many provinces, including Alberta, graduation from an accredited program provides entry into professional standing in the discipline of Chemistry.
- **Association of the Chemical Profession of Alberta** (<http://www.pchem.ca/>)

# Break-out 1: Desired Skills

- Share big picture of your program(s).
- What should an honors vs. majors vs. technical know?
- What technical skills should students have?
- What soft skills should students have?
- How should students be able to think?
- Everybody assigned to a break-out room.



## Break-out 2: Desired Skills

- What should be in curriculum to foster development of desired skills?
- Undergraduate Research E3-25
- Soft skills E3-49
- Professional skills W4-44
- Professional literacy W4-46
- Technical skills W5-58

# **Break-out 3: Fostering Engagement**

- Active Learning in Labs E3-25
- Active Learning in Lectures E3-49
- Discovery Learning W4-44
- Miscellaneous concepts learning W4-46
- Blended/Flipped Classes W5-58

# Break-out 4: Assessing Engagement

- Competency based assessment E3-25
- Lab based assessment E3-49
- Authentic learning outcomes W4-44
- On-line assessments W4-46
- Assessment of undergraduate research and soft skills W5-58

# Break-out 1: Desired Skills E3-25 (A-F)

- Differences between institutions/programs
- Priorities/differences between tracks (Honours, Specialization, General, Technologists)
  - Flexibility in programs
  - What are the differences for students?
  - What are students being trained for? Only a small portion of students will go on to Grad work in Chem
- Increased focus on soft/prof skills (additional courses? integrate with current?)
  - Critical thinking
  - Writing
  - Ethics
  - Group work/teamwork
  - Lit searches
  - Presentation
  - Debate/discussion
  - Data analysis
- Should we teach more *skills* (at the cost of content) so our students are better prepared as they move into new fields/areas/material?

# Break-out 1: Desired skills E3-49 (G-J)

Knowledge expected of spec./major/technical

- **spec** & **major**: same technical skills
- **spec**: greater understanding of the underlying theory
- **tech**: greater emphasis on technical skills

# Soft Professional skills — *employability skills!*

- understanding of QA/QC, GLP, ISO, safety
- ethics (ACPA requires & provides 8 hr course)
- basic business skills
  - project, risk, and finance management
  - understanding of legislation, IP
- [technical] communication skills
- career opportunities
  
- possible pChem course that covers these skills?
  - projects, industry speakers
  - taught in third/fourth year; open course

# How should students be able to think?

- problem solving skills
- willing to think independently
- willing to learn
- willing to take initiative
  
- chemists need to think of themselves as professional
  - take responsibility for themselves and their work
  - confident, independent learners
  - professional attitude
  
- need to recognize the limitations of their education

## \*\*Additional

- ability to adapt to change
- ability to learn new knowledge (science advances!)
-



# Break-out 1: Desired skills W4-44 (K-L)

- Information explosion - focus needs to be learning how to learn. Communication technology skills are important
- Note taking skills are a key skill that students need
- Three core skills: thinker, communicator, researcher as a way to organize every course. Assessment can be a challenge

# Break-out 1: Desired skills W4-44 (K-L)

- Give students flexibility to vary from procedure, design their own experiments.
- Balance in teamwork, builds skills but makes assessment more difficult.
- Connect lab to the lecture or recognize the disconnect. Use 5 min videos to introduce lab techniques, Framing the context for the lab work - what skills does the lab focus on.

# Break-out 1: Desired skills W4-44 (K-L)

- Important skill is to understand and appreciate risks and know how to work safely in the lab.
- Performance anxiety, focus on points rather than questions. The way we assess students tell them how we want them to learn.

# Break-out 1: Desired skills W4-46 (M-Sa)

- some research experience in your desired discipline
- U of A: split their honours thesis into two courses (401 (poster)/403 (presentation), not necessarily the same PI, UBC: full year course, full paper thesis
- :)

# Break-out 1: Desired skills W4-46 (M-Sa), cont'd

- hone their skills in a given discipline, lit review, write experimentals, lab notetaking skills, atmosphere (group meetings, etc.)
- students learn to fail! :(
- FOR MAJORS
- solid foundation of fundamentals, chemical literacy
- honours = major + research

# Break-out 1: Desired skills W4-46 (M-Sa), cont'd

- should science students have to declare a major? General Science vs. Combined Majors?
- Gen Sci: good for professional programs, sales, secondary education, but no foundation in any given science
- TECHNICAL SIDE: instrumentation, record-keeping, multi-tasking, trouble-shoot

# Break-out 1: Desired skills W4-46 (M-Sa), cont'd

- descriptive chemistry (chemical literacy)
- Campus Alberta: Duplication...good thing?
- yes, different campuses/geography gives different experiences
- broad range of programs is good, NAIT/SAIT- two year diplomas are useful

# Break-out 1: Desired skills W4-46 (M-Sa), cont'd

- All students should be able to teach, time manage, communicate knowledge, independence
- perseverance - know when to hold 'em, when to fold 'em
- skill set is consistent in Canada, vs. USA
- can't give up all the chemistry our students take



# Break-out 1: Desired skills W4-46 (M-Sa), cont'd

- chemical intuition
- chemical “spidey sense” (tingle!)
- critical evaluation of sources
- lab notebook skills
- writing
- explicit problem-solving skills
- students need more “chemical playtime” with low-risks

# **Break-out 1: Desired skills W4-46 (M-Sa), cont'd**

- labs don't have to be linked to lecture, stand-alone labs

# Break-out 1: Desired Skills W5-58 (Sh-Z)

## Skills:

Independent work

Safety

Time management

understanding

Proposing & testing a Hypothesis

Method validation

Data analysis

Proper Lab

techniques/competency

critical thinking

math skills (lacking?)

problem solving skills

Research skills

# Break-out 1: Desired Skills W5-58 (Sh-Z)

Where do all these skills Fall?

Lab

Communication

Student Research

Transferable skills

Technology

Degree Goals

Professional skills

Community Engagement

# Break-out 1: Desired Skills W5-58 (Sh-Z)

Can we narrow this down?

Critical Thinking

Individual-Team Skills

Communication Skills

Problem Solving

General Research Skills Safety

Organization-Time Management

# Break-out 1: Desired Skills W5-58 (Sh-Z)

Holes in the Degree Program:

Math skills (data analysis statistics)

Technical writing skills

Presentation skills

Problem solving skills

# BO 2: Desired Skills E3-25 - UG Res.

- NAIT: chance to work in groups of 3
  - researching financial, materials,
  - report at end
- WESTERN
  - has mixers for undergrads interested in research
  - 4th year thesis
  - workshops during ugrad (resume, presentation, etc.)
  - anonymous exit survey on ugrad research

# BO 2: Desired Skills E3-25 - UG Res.

- UofA
  - CHEM 299
  - leads to NSERC and opporunities
  - no 3rd year reseach course
    - more research experience desired
  - university research initiative (URI)
    - info on how to approach prof about research opportunities
  - Research Certificate in Science -- an annotation on transcript for work as undergraduate



# BO 2: Desired Skills E3-25 - UG Res.

- UofT
  - 6 week intensive course to train for sub-discipline
- faculty encouraged to talk about ugrad research opportunities in first/second years
- institutions with research in first, second, or third-year
  - URegina, ULeth, UVic, TRU, Mr. Royal, UofC

# B02 Desired skills E3-49 Soft Skills

- **Definition:** Skills required for application of knowledge to real problems. Beyond content.
- Is “Soft skills” the best term?
  - “Translational skills” or “Transferrable skills”
- What are they?
  - Critical thinking, creativity, curiosity
  - Asking relevant questions
  - Communication, interpersonal skills, negotiation, management
  - Presentation, defense, persuasion
  - Organization, teamwork, groupwork
- Are these integrated into our programs?
- Integrated in all courses? Targeted courses? Matching to students and their goals
- Assessment? Needs to be made consistent, and balance weighting with other components. Ways to do this in larger classes? Using clickers, small groups, staged exams
- Sacrificing content for skills training
- Defining learning outcomes/objectives: must be clear to students
- Institutional barriers: focus on teaching (not learning), competition, cultural change, training costs (students & faculty), time/resources for implementation, risk

# BO2 Desired skills: W4-44 Prof Skills

Professional skills — *employability skills!*

- understanding of QA/QC, GLP, ISO, safety
- ethics (ACPA requires & provides 8 hr course)
- basic business skills
  - project, risk, and finance management
  - understanding of legislation, IP
- [technical] communication skills
- career opportunities
- possible pChem course that covers these skills?
  - projects, industry speakers
  - taught in third/fourth year; open course

# BO2 Desired skills: W4-44 Prof Skills

## Observations

- skills are transferrable to careers beyond science
- students need to understand their skills and limitations
- bridge from *baccalaureate* → *industry*  
is similar to *high school* → *university*  
and the gap is **w i d e n i n g**

# BO2 Desired skills: W4-44 Prof Skills

Get a eCampus coordinator to promote and facilitate chemistry internships

- build academic:industry relationships
- liaise with ACPA
- government funding(?)
  - *Albertan's Working in Alberta*
- Concerns
  - degree takes longer
  - must teach summer courses

# BO2 Desired skills: W4-44 Prof Skills

Observations from international educational system

- China
  - choice of academic or technical
  - focus is on traditional instruction
  - limited opportunities for obtaining professional skills
- *Türkiye* (Turkey)
  - more theory
  - less problem solving

# BO2 Desired skills: W4-44 Prof Skills

## Comparison of US (California) system

- demographics:  $\frac{1}{3}$  to grad school,  $\frac{1}{3}$  to industry,  $\frac{1}{3}$  to professional programs
- have required 'professional' course
  - industry speakers
  - ethics
  - careers, grad school
- poster session from one required course (200-level analytical)

# **BO2 Desired skills: W4-44 Prof Skills**

## Athabasca University

- has professional ethics course
- has integrated technical components into English courses
- students are often upgrading
  - they have the technical skills
  - wanting to improve their understanding



# **BO2 Desired skills: W4-44 Prof Skills**

## Mt Royal University

- mix of wet and dry labs in first-year
  - dry labs have 'professional' component
- technical communication in laboratory program
  - first-year, each lab focuses on different components of lab report
  - end of course, students write complete report

# **BO2 Desired Skills: W5-58 Tech Skills**

- Facilitator - get everybody involved in the discussion
- Recorder - replace this text with brief highlights from the group discussion

# Break-out 2: Desired Skills

## Professional literacy W4-46

Attendees: Ryan Snitinsky – Masters at UofA; job searching; Kubarat Saliu – UCSB as postoc; Anna Jordan – Physical chem lab coordinator; Charles Lucy – Analytical Professor UofA; Christine Brezowski – Organic chem coordinator; UofA; René Boéré – Faculty, Ulethbridge.

- Described UofL – Chem3250 “Contemporary Chemistry”
- Charles: Chem 213/313 – a lab dedicated to writing, deals with plagiarism.
- UofA is moving to “modular” component that has 1.5 rather 3 credits.
- Reading component? Charles has a grad course with a “litterature log”, read 1-2 papers per week. Grade on qty; quality of papers selected; level of understanding.
- Ryan raised the issue of “chemical literacy” for all students who have taken a chemistry course. Suggestions: do case studies; list video’s on topics from the RSC, ACS, Joe Schwartz

## Break-out 2: Professional literacy (2)

- Ryan thinks that students with “several chem courses” cannot evaluate significance of chemistry in the workplace or daily life
- Demonstrations: drug actions; everyday examples; try to overcome compartmentalization.
- How does this fit into General Chemistry given how packed the curriculum is? Students do have an interest in science, but all the key decisions have been made by politicians and lawyers. These do not seem to be made on scientifically informed decisions.
- Charles suggests: “teach less content”. Blended learning, “take some of lecture time on line, and use the saved time to diversify class content”. Literature suggest that this can work well. The literature suggests that students often spend more time on the lecture.
- Lab: have a lab dedicated to chemistry in society. Analyze water quality; oil samples, etc. “Community service learning”. E.g. Pb in water in a city-wise survey of elementary schools.

## Break-out 2: Professional literacy (3)

- Training in how to work in a group could be part of this.
- Anna emphasized that assessment must remain valid. “Open assessment” where all can get an excellent grade is not valid.
- Teach how to find the the information.
- “Dioxins” – perhaps demonstrate how we go through the information sources, teaches them how we make the selection.
- The lab might be a good place to do some group work. Example of a lab course where the TA in Gen Chem can allows students who finish early the opportunity to try reactions on their own.
- Chemical literacy: chemistry is a “language of its own” with vocab, structure etc.
- TAs need training to do these “extra” skills. Gen Chem TAs are often beginners who need to learn many things.

## Break-out 2: Technical skills

- Learning environment -- need to find ways to encourage students to become an independent learner.
-

## Break-out 3: Active Labs (E3-25) SLIDE 1

- is everything active learning in the lab? NO: very different situation from “active-learning” classroom/lecture; lab is already “flipped” by its very nature
- **challenge**: increase engagement of students that do not want to be in the course (lab attendance is mandatory, lecture is not)
- must have clear and reasonable expectations that give students the opportunity to grow, be explicit in assessment rubrics, learning outcomes to show what learning is valued at start
- **goal**: increase learning: e.g. while experiments are running, improve understanding of processes being used; **issue**: hard to find a block of time to do an activity is difficult to find unless there is a long reaction time

## Break-out 3: Active Labs (E3-25) SLIDE 2

TA plays a key role in creating good learning environment, provide connections between theory and experiment; are novice teachers that require support and formal training as professional development

- strategies tried to improve student learning: in-lab quiz at start of lab period, on-line prelab quiz; expectation: students need to spend 1 hour prep for every 3 hours in lab
- other outside lab resources: online videos links to web resources info overload can be a problem
- students need to learn to work in groups for the “real-world”
- deliberate teamwork to increase engagement must be a structured activity, e.g. worksheet; **issue**: everything needs to be assigned a grade, need to let students know how they will be graded at the start
-



### Break-out 3: Active Labs (E3-25) **SLIDE 3**

by put the onus on students to increase engagement: e.g. give topic to the group, find literature and work together in lab to devise a procedure, then do the work in lab, assess the results; give team a problem description with keywords, consult literature, complete proposal forms before running expt.

- have students run same expt with some variable different, post group results put into Google doc for collaborative/ discussion purposes,
- first weeks of term: students work on “regular experiments” to get exposure to variety of techniques, not all students do every one, then be given a problem to solve in groups where members will have experience in a variety of experiments

# Break-out 3: Active Lectures (E3-49)

- font size inspired by Chris Cairo
- What is active learning?
  - getting students to do more than sit passively
- Examples of active-learning
  - team-based learning
  - IF/AT cards, can use in flipped classroom to quickly assess who has read the material
  - clickers, for participation only, not graded, make mandatory (10% buy in if made optional)
  - perhaps split grade, 50% for the answer, and 50% for answering
  - Treasure Hunt, put answers to questions in locations related to answers
  - bingo
  - skeletal lecture notes?
    - <http://pss.sagepub.com/content/early/2014/04/22/0956797614524581.abstract>
  - rooms with lots of whiteboard space, facilitate group work
  - think/pair/share - students communicate with students, fosters learning vernacular
- what about inactive learning?
  - taking pictures of notes
  - filled-in notes are NOT provided, forcing students to write in lecture or copy friend's notes
- Social Media?
- Resources?
- Group Presentations in smaller classes?
  - peer evaluation
  - time-consuming for instructor
  - loss of class time
- This slide is a joke, the REAL notes follow this slide

# Break-out 3: Active Lectures (E3-49)

- What is active learning?
  - getting students to do more than sit passively
- Examples of active-learning
  - team-based learning
  - IF/AT cards, can use in flipped classroom to quickly assess who has read the material
    - IF/AT: instant feedback assessment technique
  - clickers, for participation only, not graded, make mandatory (10% buy in if made optional)
  - perhaps split grade, 50% for the answer, and 50% for answering
  - Treasure Hunt, put answers to questions in locations related to answers
  - bingo

# Break-out 3: Active Lectures (E3-49)

- skeletal lecture notes?
  - <http://pss.sagepub.com/content/early/2014/04/22/0956797614524581.abstract>
- rooms with lots of whiteboard space, facilitate group work
- think/pair/share - students communicate with students, fosters learning vernacular
- what about inactive learning?
  - taking pictures of notes
  - filled-in notes are NOT provided, forcing students to write in lecture or copy friend's notes
- social media? anonymous discussion boards?
- Resources? RSC case studies

# Break-out 3: Active Lectures (E3-49)

- Group Presentations in smaller classes?
  - peer evaluation
  - time-consuming for instructor
  - loss of class time
- How much material should be given to students?
  - lecture notes just a condensed version of textbook?
- Allow and encourage students to challenge instructor

# **Break-out 3: Discovery Learning W4-44**

- insert discoveries here...

# Break-out 3: Miscellaneous W4-46

Miscellaneous concepts or orphan concepts for service needs and why do we bother?

- Useless? pipetting, titrating,...out dated?
  - Does it have to be titration after titration after titration?
- Why do we bother?
  - As a service course it is expected

## **Break-out 3: Miscellaneous W4-46**

Miscellaneous methods of teaching/Discovery based learning.

How do we get graduate students engaged in teaching

- teaching awards
- Graduate teaching and learning program
  - <http://www.gradstudies.ualberta.ca/gtl.aspx>



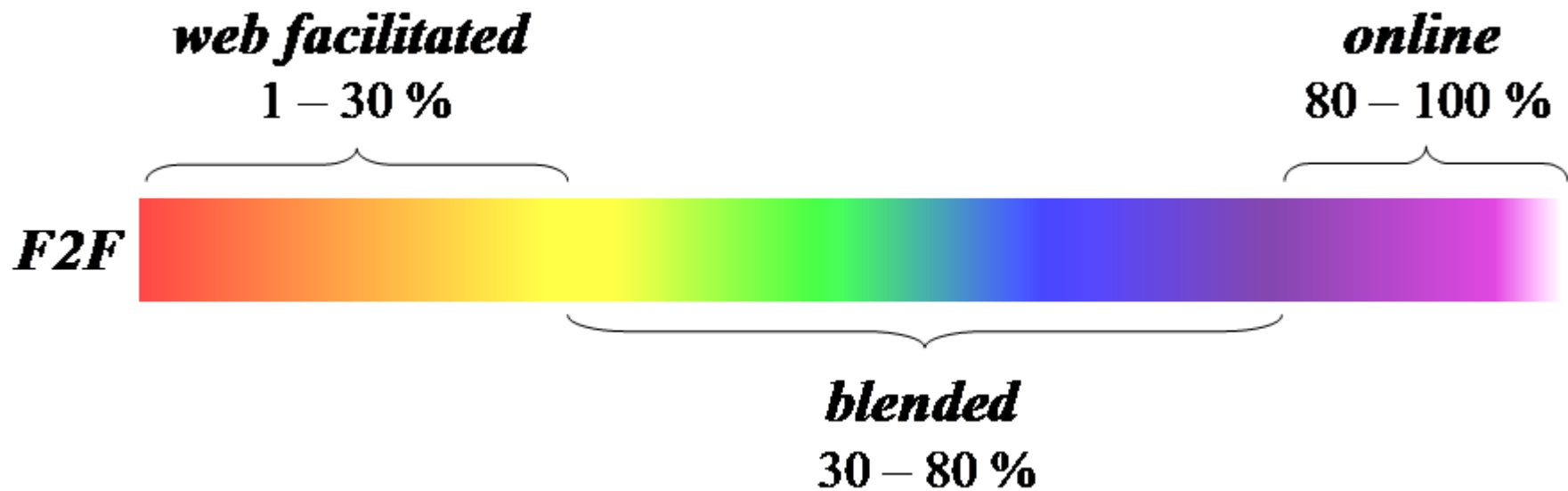
# Break-out 3: Miscellaneous/Discovery W4-46

Can you do discovery based learning in the lecture or just the lab?

- Is it possible to do in the lecture?
- How do we define it
- Things we do in Science 100
  - Bring white powder to class, break them into groups of 8 and argue what techniques they should use to characterize it.
  - Scaffolding a page of techniques
- Proposal on open laboratories for student based learning
- Need to have group work for discovery based learning

# Break-out 3: Blended/Flipped W5-58

- **blended** -- see pictures
- **flipped** -- students do lecture on own time before coming to class, do more active learning activities in class
- UAlberta Science MOOC
  - Dino 101 (35 000 students)
  - Paleo 200 (800 students)
  - limitation is number of students to write online exam



## Blended models

### Web-enhanced model

- No reduction of face-to-face time

### Blend I (70:30 ratio)

- 1/3 in-class is replaced with online activities

### Blend II (50:50 ratio)

- In-class and online sessions are equally balanced

### Blend III

- In-class lectures and online tutorials on a fixed schedule

### Blend IV

- Online lectures and in-class tutorials on a fixed schedule

### Blend V

- Hybrid lectures and tutorials

### Fully online model

- All activities were conducted online

***skeleton lecture notes***

***regular***

students given textbook  
prereading assignment

students receive lecture;  
complete notes

limited class time for  
active learning

*General:* students encouraged  
to consult the textbook and  
additional resources to under-  
stand material and prepare for

***flipped***

students watch lecture  
video before class;  
complete notes

lecture video quiz

concept summary;  
class time focussed on  
active learning

My intentions:

\* *flip-instruct* concepts that are  
being reviewed and built upon  
in CHEM 10x

***in class activities***

students complete  
problem set

problem set quiz

# Benefits

- prevideos: students spend more time watching and rewatching videos
- screen casting
- active in-class learning: promotes peer groups and teamwork

# Recording options

- Camtasia
- Adobe Connect
- Screencast-o-matic.com

# Concerns

- resources
- increasing class size
  - supplemental instructors (grad or undergrads) to assist in class
- videos (prevideos and in-class videos) decrease from the educational environment
  - fully online has lower retention rates
- WE — instructors — need to figure out how to facilitate active learning
- SI's need training to be effective

# Miscellaneous

- workload scales to the power of 0.4 [Walter Harris]
  - teaching 500 students is twice the work as teaching 100
-



## Break-out 4: Competency based Evaluation E3-25

- At the start, we had a discussion about what the term “competency based evaluation” means. This was never fully resolved
- A large thread of the conversation dealt with how to harmonize (i) content and competence amongst multiple sections of a course, specifically when the students had to go on to a next-sequence course and (ii) to ensure that content of parallel sessions is reasonably similar
- The consensus was this should be solved by having well defined “learning outcomes” for the courses
- Several examples of learning outcomes were provided; NAIT is returning to very specific course objectives, which are precisely tuned by the needs of the marketplace. Australia has a national set of threshold outcomes and objectives; these are on the web: <http://www.chemnet.edu.au/> also move toward demonstrated assessable standards

## Break-out 4: Competency based Evaluation E3-25 (2)

- Another thread dealt with fitting Boom's learning hierarchy into evaluation methods
- How is this harmonized when writing common exams?
- How is instructor teaching styles and student learning styles fit into a common evaluation rubric?
- Common exams for courses with parallel sections are run at Lethbridge and NAIT, UBC, Manitoba; not at UofA nor at UC-Riverside
- Many US universities use not just a local common exam, but an "ACS Standardized Exam" for key courses; this allows for comparisons amongst different institutions.
- Athabasca University has a (voluntary) pre-course self-diagnostic test that many students take before enrolling in Chem217 [http://www.athabascau.ca/courses/chem/217/am\\_i\\_ready/](http://www.athabascau.ca/courses/chem/217/am_i_ready/)

## Break-out 4: Competency based Evaluation E3-25 (3)

- A strong plea was made for being very intentional in defining AND discussing with students a very detailed set of learning outcomes
- When quizzes and midterms are discussed, the way that the questions are designed to measure the learning outcomes should be emphasized
- Students apparently appreciate this procedure, which is said to “de-mystify” the requirements for success in a given course.
- .
- At the end, we seemed to be in agreement that competency based evaluation is somehow tied to detailed pre-definition of learning outcomes, and should therefore go well beyond mere content-based evaluative methods.

# Break-out 4: Lab assessment E3-49

- interpersonal
  - transparency
  - TAs
    - casual conversations to generate comfortable environment
- engagement in material
  - answer an open-ended question
  - foreign students
    - often more difficult to engage

# Break-out 4: Lab assessment E3-49

- accessibility/accommodations
  - accommodation
- challenge figuring out if engagement should be assessed, given the different student personalities

# **Break-out 4: Authentic outcomes W4-44**

- witness outcomes here...

# Break-out 4: On-line assessment W4-46

What are people doing?

- quizzes: timed
  - not locked down

Observations

- low stakes
- people are using different LMSs
- possible to assess molecular structures online
  - [https://moodle.org/plugins/view.php?plugin=qtype\\_easyname](https://moodle.org/plugins/view.php?plugin=qtype_easyname)

# Ideas

- prelab quiz
  - shuts down at midnight before lab
  - students who don't complete are not permitted into the lab (must do make-up lab)
  - UCalgary: less than 1 %
  - Bryan indicated stealing of this idea
- create our own compilation of questions?
  - Google doc
  - Moodle format



# Ideas

- problem set quiz
  - quiz subset of problem set
  - quiz with different numbers (if possible)
  - quiz closes before answer key released
- ULeithbridge (and soon UofA) have large test bank of questions for online courses, so academic misconduct is [hopefully] reduced.
  - still need locked down location

# Concerns

- difficulty in marking problem-solving exercises
- giving student name & number to third party
- edits and questions submitted to third-party websites belong to the third party company
- cheating

# Break-out 4: Assessing undergraduate research & soft skills W5-58

## Undergraduate Research

- Publication is ideal outcome -- comes down to a matter of contribution
- Major components of evaluation: research proposal, final report, final presentation, supervisor evaluation, oral defense (1 hr long/ examiner, chair, supervisor)
- Research Learning Experience (RLE)- don't need to do original research, can work with instructor to produce lab manual, evaluation -- poster presentation, notebook, instructor evaluation, poster discussion
- Committee vs teaching assignment -- can use modules to do things that aren't sufficient for teaching assignment
- Communicate expectations to students

Rubric standardizes grading for the faculty, but also acts as a 'role model' for student

Notebook evaluation

# CHEM 299 UAlberta (Research Opportunity) Rubric

	1 strongly disagree	2 disagree	3 neutral	4 agree	5 strongly agree
1. The student showed a high interest in the research project.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. The student shows good potential ability for planning and organizing work and time	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. The student developed confidence in the laboratory setting.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. The student showed appreciation and understanding of suggestions from the supervisor.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. The student was dependable and was present in lab on a consistent basis (approx 3 – 4 hours per week).	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. The student attended group meetings.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

# CHEM 299 UAlberta (Research Opportunity) Rubric (cont)

	1 strongly disagree	2 disagree	3 neutral	4 agree	5 strongly agree
7. The student was a good team worker	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8. The student kept good quality laboratory notebook records.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9. The student was knowledgeable in and proactive with laboratory safety policies.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10. The student's writing about their research was clear and understandable. (If student has not yet had to write anything, do not fill out this line).	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11. The student spoke in a clear, organized and easily understandable fashion. (If the student has not yet had to present anything, do not fill out this line).	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Please provide any other comments you wish on the back of this page, especially noting the student's areas of strength and those in need of improvement. Feel free to discuss this evaluation with your CHEM 299 student and make suggestions for improvement. Winter term will include a presentation at the end of term and another evaluation from the supervisor.

# Break-out 4: Assessing undergraduate research & soft skills W5-58

Soft Skills = team work, ethics, attitude, communication skills, leadership

- Professional Skills <http://www.chemistry.ualberta.ca/LucyGroup/ProfessionalSkills.aspx>
- engagement grading to encourage student engagement
- how to read literature - highlighting important facts, interpreting
  - “how to read literature using scientific method” workshop as part of RLE 4th year class -- better to do in earlier years (marked on participation)
    - also exposes them to how to WRITE scientific papers
  - UPSL - understanding Primary Scientific Literature
- Differential credit for most contribution , e.g. 1st authorship
  - Participation mark--- x amount of marks to distribute among team members and scale grades according to contribution/ group assessment
  - issue of group dynamics -- random assignment instead of self selected groups
    - Group based on [sub]disciplines and area of expertise
    - Each student keeps a log of meetings to determine contribution
- How much of the course should be allotted for soft skills?
  - little-- b/c it's too objective
  - use rubric to standardize

# Literature Log (C. Lucy, Alberta)

**Context:** fourth year / graduate course on analytical separations. Purpose is to get students in the habit of critically reading the literature

**Assignment:** Throughout the term students are to keep a binder of papers they have read related to the course. The binder should start with a Table of Contents (template on next page), indicating each of the papers that have been read.

Students may select papers from the options listed in the Literature Log section in Moodle.

**Marking:** Assessment of the Lit Log uses the marking rubric below. Midway through the course an unrecorded assessment of your Lit Log will be provided. You may request additional non-recorded feedback. Literature logs must be submitted for marking by **Tuesday October 22<sup>nd</sup> 12:20 PM.**

# Literature Log (C. Lucy, Alberta) Marking Rubric

**Outcome:** average is high (~90%) but nonetheless discriminating.

Factor	Failing	Poor	Acceptable	Good	Excellent
Number of papers* (40%) 516: 1.5 / week 425: 1 / week	No papers (0%).	< 1 paper/wk < 0.5 paper/wk (0-10%)	1 paper/wk 0.5 paper/wk of ≥ acceptable quality (10-20%)	1-1.5 (0.75) / wk of good quality; or >1.5 (>1) of accept. quality (20-30%)	1.5 (1) /wk of excellent quality or >1.5 (>1) /wk of ≥ good quality (30-40%)
Quality of Papers (30%)	No papers (0%)	Poor relevance to course content; too applied (5-10%)	Somewhat relevant to course content (10-15%)	Clear and well integrated into course content. Some highly cited papers. (15-25%)	Clear and well integrated into key concepts in course. Mostly highly cited papers (25-30%)
Indications of Careful Reading (30%)	No marks on paper and no summary notes (0%)	Sporadic highlighting of text (5-10%)	Relevant highlighting of text and some margin notes (10-20%)	Relevant highlighting of text and margin notes that connect text to course material (20-25%)	As in good, with additional short summary of relevance/ importance of paper (25-30%)

\* Papers must be graded as Acceptable, Good or Excellent in Quality and Careful Reading to count towards the Number of Papers.