

ENGAGING STUDENTS IN SCIENCE

WHAT THE RESEARCH SAYS?

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WHAT IS THE PROBLEM?

- Basic statistics
 - Numbers of students enrolling in science declining – a world wide trend not only in Australia.
 - Lack of science graduates, professionals. (ACER; Rennie et.al, (2001).



WHY DO WE CARE?

1. The world needs scientists / problem solvers / critical thinkers
2. We teach science – we love it so why don't they?
3. How has the world of education changed since we were at school - how should we adapt to that?



ASSUMPTIONS:

- Learning works best when students are engaged and interested.
- Engagement is not entertainment – well not completely!
- “Negative attitudes can be changed to positive ones by teachers who consistently utilise strategies that foster engagement” (Palmer 2001 cited in Palmer 2012)



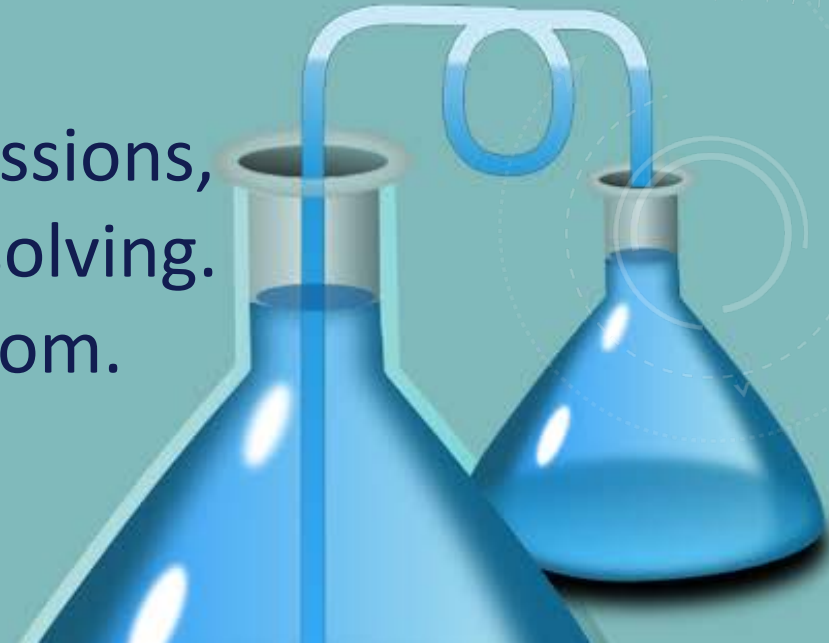
DAVID PALMER (2012) – ART OF TEACHING SCIENCE

- Three Strategies to Increase Engagement
- NOVELTY- supported by BRAIN STUDIES; something **new, unusual, unexpected** – releases dopamine focusses attention.
- PERSONAL RELEVANCE – does it have personal interest & personal value.
- SUCCESS –
 - self-efficacy theory – regular success builds confidence
 - attribution theory – when effort leads to success more effort follows.



NOVELTY

- 1. Information - can you present **new** or **surprising** facts?
- 2. Hands-on activities –
 - are the results **unpredictable**?
 - Can you make the results **surprising**?
- 3. Wide range of pedagogical techniques – discussions, debates, model making, open inquiry, problem solving. Key is variety in what is happening in the classroom.



PERSONAL RELEVANCE

- Personal Relevance is “Personal” and subjective – so can you relate the science concept to some aspect of the following?
- DANGER / ROMANCE/GENDER / CELEBRITIES / ENTERTAINMENT / MUSIC / WEALTH / FOOD



SUCCESS

- Early success can pay benefits later:
 - Success in Understanding
 - Success in Doing
 - Success in Assessment



SUCCESS IN THE DOING AND UNDERSTANDING:

- HANDS ON ACTIVITIES/LAB WORK AND INQUIRY BASED INSTRUCTION
- “The label ‘inquiry-based’ can be applied to a single activity, a sequence within a unit or to a whole curriculum unit. The label indicates students are constructing their understanding through participating in inquiry”. – (Science By Doing)
- Defines inquiry based instruction as “including hands on activities as a way to motivate and engage students while concretizing science concepts.” (Minner et al., 2010)



STUDENT INVESTIGATIONS

- Hampden-Thompson and Bennett, (2013). PISA Study. 12,000 students in the UK. Frequency of these aspects in the classes.
- Index of Interactions
- Index of Hands-On activities.
- Index of Student Investigations – when this was very frequent; led to lower levels of enjoyment.
 - Is this an issue of a “mono” approach when the other key factors are not as present.
- Index of Applications



INQUIRY BASED INSTRUCTION - RESEARCH

- Palmer (2009) - short inquiry lesson increased “situational interest” but was also a “novelty” for the students involved. What does this mean for extended investigations – how do you balance novelty and inquiry?



WOLF AND FRASER (2008) – EVALUATING INQUIRY INSTRUCTION

- A comparative study of Student centred Inquiry compared to teacher centred more traditional. Short time frame investigation.
- What is Happening in this class” instrument found that there was a significant difference between the inquiry and non inquiry groups with respect to student cohesiveness but that males seem to prefer the inquiry approach and females the non –inquiry approach. Females seemed to be worried about “doing the experiment the right way”.



CLASSROOM ENVIRONMENT INSTRUMENTS

- Selection of survey instruments that are designed to measure the attitudes and perceptions of students in classrooms – classroom environment has been seen to be an important and sensitive measure related to instruction strategies.
- WHAT IS HAPPENING IN THIS CLASS? (WIHIC) – measures different dimensions
- Student cohesiveness / Teacher support / Involvement / Investigation / Task Orientation / Cooperation / Equity.
- TEST OF SCIENCE RELATED ATTITUDES (TOSRA)
- Can be quite extensive but could be used by classroom teachers to give a snapshot and allows for a basis of conversations with students.



Seven scales in the *What Is Happening In this Class?*—WIHIC questionnaire. Some sample items

Student Cohesiveness—CO¹

- 1. I make friends among other students in this science class.
- 2. I know other students in this science class.

Almost never/ Seldom /Some times/ Often/ Almost Always

1 2 3 4 5

1 2 3 4 5

Teacher Support—TS

- 9. The teacher takes interest in me in this science class.
- 10. The teacher helps me in this science class.

Almost never/ Seldom /Some times/ Often/ Almost Always

1 2 3 4 5

1 2 3 4 5

Investigation—IN

- 17. I do experiments to test my ideas in this science class.
- 18. I am asked to think about the evidence for statements.

Almost never/ Seldom /Some times/ Often/ Almost Always

1 2 3 4 5

1 2 3 4 5

Involvement—IV

- 25. I talk about ideas in this science class.
- 26. I give my opinions during discussions in this science class.

Almost never/ Seldom /Some times/ Often/ Almost Always

1 2 3 4 5

1 2 3 4 5

Task Orientation—TO

- 33. Getting a certain amount of work done is important to me.
- 34. I do as much as I set out to do in this science class.
- 35. I know what I am suppose to learn in this science class.

Almost never/ Seldom /Some times/ Often/ Almost Always

1 2 3 4 5

1 2 3 4 5

1 2 3 4 5



CLASSROOM ENVIRONMENT

- KNOW YOUR STUDENTS:
 - Classroom environment instruments
 - Short surveys
 - ‘Take the temperature of the room’



SUCCESS IN ASSESSMENT

- Rubrics – How do students know what good work looks like?
- How can I achieve success if I don't know what I will be assessed on.
- Are we teaching scientific literacy (not vocabulary)
- Authentic Assessment – is the assessment “real world” requiring real-life skills?



EXTRA-CURRICULA

- Other things can impact -
- Early experiences spark that initial interest.
- Education Activity – competitions/ excursions/ project work, spark an interest; can lead to different success
- Career Advice – what role do you science teachers have in subject advice?



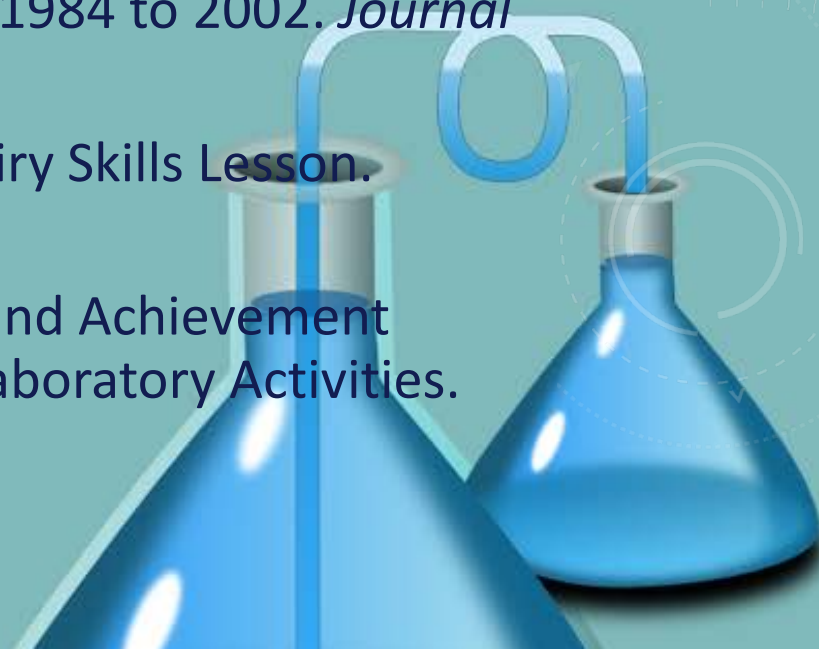
FINDING THE BALANCE:

- **SCIENTIFIC LITERACY:** Creating scientifically literate citizens.
- **EXAMS/ VCE RESULTS:** Issues of school/parent/department expectations.
- **KNOWING YOUR STUDENTS:** Where are your students coming from? How do you know what they think/feel about science at the moment.
- There is no quick fix or one hat fits all approach – sorry!



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