MINISTRY OF EDUCATION
Te Tāhuhu o te Mātauranga

This newsletter and the Secondary Student Achievement Professional Learning and Development initiative is funded by the Ministry of Education. The providers are The University of Auckland and Te Tapuae o Rehua consortium.

National Newsletter: All Sciences including Agricultural and Horticultural Science

Information and resources for middle leaders in secondary schools | Term 4 2014

Tena koe, Greetings to you all, Kia orana, Fakaalofa lahi atu, Malo e lelei, Talofa lava, Talofa ni

Update on Sciences for Term 4 2014 -In this issue

- Quality teaching to support priority learners
- Ways to support your students to success in the externals
- Programme design for Year 12 and 13 science courses
- Ideas for Year 11 contexts
- Adapting Year 9 and 10 tasks.

Quality teaching supports priority learners

Term 4 may be short, but you now know your learners well, so it's time to review their achievement data from previous terms to identify where to focus the time available for quality teaching to support your priority learners.

Use data on the learner to identify:

- Which students do not have the understanding of the content needed to achieve?
- What do you, as a teacher, need to do to help these students learn?
- How can I ensure they will achieve the necessary learning?
- Is their need a literacy one? Can they read the question?
- Is their problem in identifying the science theory/ideas that apply and how to use these to respond to the question?
- NZQA Student exemplar responses to external questions to help these learners develop capability in identifying the response required and how to write using science ideas/terms

The important role for you, as teacher, is to identify the strategies most likely to help these students to progress in their science learning and achievement. Building consistent literacy practices and tracking progress can support students to achieve success in externals. Begin by ensuring your learners can move from the easier to the more difficult aspects: from

- **identifying key ideas within the text**, to
- **linking aspects of information in the text** to
- **connecting visual information with written text to make simple inference(s).**

Once students can confidently carry out these processes with the text of external questions, they may need support to **give a reasoned and clear interpretation of specific aspects of the text where they bring their content knowledge** to the situation given. This process is a definite step up in thinking and leads on to the ability to **support their explanation or analysis with sufficient and relevant evidence derived from the text** of the question as well as from their own science content knowledge.

Targeting the learning from now to externals will make better use of limited time to address gaps in student knowledge and skills. Many students "know science content" but have had little practice at identifying the specific science ideas needed to answer scenarios of exam questions. Some actions are:

- Getting students to summarise their learning and identify the gaps in their understanding;
- Breaking down questions and exemplar responses to identify what the question requires and how to address this;
- Practising planning written responses to first identify the science ideas needed;
- Using literacy activities to support the use of science language
- Getting students to share the thinking process they are using to identify the way to answer questions;
- Developing materials to support students to write acceptable responses e.g. using graphic organisers, planning steps for written responses.

National Co-ordinators

Mikhal Stone
Northern and Central North regions
m.stone@auckland.ac.nz
Mob: 021 1871 664

Kate Rice
Central South and Southern regions
kate.rice@otago.ac.nz
Mob: 021 793 771

Regional Facilitators

Northern region
Ian McHale
The University of Auckland
i.mchale@auckland.ac.nz

Natalie De Roo
The University of Auckland
n.deroo@auckland.ac.nz

Central North region
Simon Taylor
The University of Auckland
sp.taylor@auckland.ac.nz

Central South region
Stephen Williams
Te Tapuae o Rehua
stephen.williams@otago.ac.nz

Central South, Southern regions
Judith Bennetts
Te Tapuae o Rehua
judith.bennetts@canterbury.ac.nz

Kate Rice
Te Tapuae o Rehua
kate.rice@otago.ac.nz

Southern region
Sabina Cleary
Te Tapuae o Rehua
sabina.cleary@canterbury.ac.nz

Planning for 2015 Effective Data monitoring

There is no one piece of data which gives the full picture on student needs and achievement. It is important to keep track using several sources:

- Pass rates in internal and external standards compared to national pass rates
- Science Achievement standard pass rates disaggregated by teacher
- Department pass rates disaggregated by gender and ethnicity
- Total credits per student achieved by course
- Comparisons between departments/Science strands

This data must continue to be analysed and monitored throughout the year with all science staff engaging and discussing trends, enabling identification of areas to improve in the department. The Teaching as Inquiry process provides a means for monitoring that improvement and allows individual teachers to inquire into the effectiveness of their teaching in enhancing student achievement and engagement. Data driven improvement goals can be identified, and strategies put in place to achieve them. This can include use of more formative assessment approaches, specifically developing scientific literacy and clarifying teachers understanding of assessment requirements in Science.

Through these practices teachers can build students' capability to reflect on their learning and take action to think critically about how the new science ideas fit with their existing concepts. For learners it is likely to involve a shift from dependent to independent learning and requires a teaching process to support this shift (*for further ideas refer to Newsletter 2 2014*).

The Science Teaching and Learning Guidelines provide ideas on other approaches to quality teaching and learning in the Effective Pedagogy section. To explore go to:
http://seniorsecondary.tki.org.nz/Science/Pedagogy

Programme Design: Science in the New Zealand Curriculum

How is the review of Year 12 programmes for 2015 progressing? Now that achievement in any of the Level 2 or 3 Achievement Standards can contribute to University Entrance under the generic "Science" course, you may want to consider taking advantage of this shift and offering a Science course at both Level 2 and Level 3. Think about co-constructing courses with students at the start of the year in response to their interests. Such an exciting opportunity helps to engage students and aligns with the NZ Curriculum concept and offers students a voice in their learning options. Additionally this recognizes that all students do not need to study all the sciences in Level 2 and 3 as their pathways are not progressing to a full tertiary science option and a more generic science course enables students to keep their interest in sciences alive.

A departmental focus could be a discussion about broader potential learning pathways for Year 12 and 13 students in the sciences.

To examine some of these possibilities follow the link to a number of ideas shared in the Sciences Teaching and Learning Guide -
http://seniorsecondary.tki.org.nz/Science/Learning-programme-design/Sample-learning-courses

Some ideas for discussion questions to use with your team were shared in the Term 2 newsletter.

Possible assessment opportunities for a range of learning contexts could come from Education for Sustainability (2.1, 2.2); Chemistry (2.2, 2.3) Physics (2.1, 2.2, 2.5), Biology (2.6, 2.8, 2.3), Earth & Space Science (2.1, 2.3, 2.4), Agricultural & Horticultural Science (2.1, 2.8, 2.10)

Other contexts that led to learning success

Science Facilitators have come across more great examples of learning contexts used in Year 11 Science from different regions. These new examples use a familiar context to locate the concepts to be learned. In all of these, the context had specific learning outcomes that were shared with students and clear success criteria for both lessons and assessments.

A Year 11 class with mostly Māori and Pasifika students was keen for their physics learning to center on the waka. All students had taken part in waka ama racing and through this context investigated the linear relationship between mass of the paddlers in the waka and time taken to travel a fixed distance under a constant force. Students made model catamarans and

Important links and resources

The Science Teaching and Learning Guide Part 2
This guide is now live on:
http://seniorsecondary.tki.org.nz/Science
The new sections cover learning programme design, connections and pedagogy.

The Agricultural and Horticultural Science Teaching and Learning Guide
The link for this guide:
http://seniorsecondary.tki.org.nz/Science/Ag-and-hort-science

Science online – the Science Specific site on TKI contains links to new resources, Science Capabilities activities and Nature of science activities
http://scienceonline.tki.org.nz/New-resources-to-support-science-education

Useful links and resources

Literacy and Numeracy page on NZQA site
There is a new Literacy and Numeracy landing page live on NZQA.

It was developed in order to have all of the information from NZQA and TKI sites accessible in one place - worth bookmarking for easy access.
http://www.nzqa.govt.nz/qualifications-standards/qualifications/ncea/subjects/literacy-and-numeracy/

tested them with different loads using two modified gutters filled with water placed under each hull. A constant force was provided using a pulley and a mass attached to one end of a fishing line. Students were supported with the literacy demands through teaching and learning to build capability to address the different components of a practical assessment. Deconstruction of a discussion from an excellence exemplar helped students develop their ability to write a discussion. An ELL student was also supported with translations into Samoan of key words from the assessment task. More information on waka ama at Level 4 of the curriculum in te reo Māori with an English translation can be found at http://eng.keitemohiokoe.tki.org.nz/Overview-of-Physics/Canoes-2 . Resources on this site focus on harakeke and dyes used in Māori cloaks.

One school has been experimenting with videoing student presentations for their assessment of S1.14, Astronomical cycles. The students learn about each of the cycles then work in groups to tape each other drawing their own diagram and using it to explain three of day and night, seasons, lunar phases, eclipses or tides. They email their teacher or upload to google docs. Those that don't have their own device use a school laptop with camera facility. This has helped to engage some less able students who are achieving better than they did with written assessments.

Another school has been using a context of food science at Level 1, learning about diabetes, a huge issue in their rural community. Students look at the food they eat and special diets also. Then they are assessed using a variation of the energy in a peanut experiment. Food snacks such as *Cheezles* are broken into pieces to look at the effect of surface area or weight on energy output, using AS 90930. Energy output is measured by temp increase of a test-tube of water.

Designing or adapting tasks/activities to develop Science Capabilities

Following the Progressing Junior Science Workshops held throughout the country, schools have been engaging with the Science Capabilities to focus their teaching and learning on the processes of science as defined by the capabilities. This can help students practice the thinking, questioning and actions needed to become informed citizens. Existing learning activities can be adapted to strengthen a particular capability as shown on http://scienceonline.tki.org.nz/Introducing-five-science-capabilities

One school identified the need to develop students' ability in critically thinking about variety of ways used to represent science ideas including models, graphs, charts, diagrams and written texts. The capability "Interpret Representations" suggests ways to build this aspect of scientific literacy. A unit exploring the circulatory system used a variety of representations of the heart. These included: looking at various images and diagrams of the heart; carrying out a dissection on a sheep's heart; watching videos and animations that show blood flow, function of valves, and electrical conduction in the heart, as well as looking at ECG's. Students selected the two models that best helped them understand the heart, and supported their choices with explanations using:

- What does the representation tell you?
- How does the representation help you to understand the heart?
- What particular aspect of the heart does it help you to understand (e.g. structure, function)?
- What is missing from the representation?
- How could the representation be improved?

Another school is adapting the common task of measuring the speed of vehicles on the road to develop the "Engage with Science" capability. Students gather and process data to calculate the speed of vehicles as in previous years by recording distances and times outside the school. They will critique their evidence by considering the time of day they collected their data, type of vehicles etc. Their evidence will be used to make a recommendation to the NZTA Transport Agency on the possible lowering of the speed limit outside the school.

Science Inspired Mentors (SIM). This group has been a successful initiative in Hamilton. This has provided an opportunity for science leaders and teachers in Hamilton secondary schools to meet regularly and share

Links to moderator newsletters

Remember to keep up with these for latest information on the assessment tasks and achievement standards.

Agriculture/Horticulture
http://www.nzqa.govt.nz/qualifications-standards/qualifications/ncea/subjects/ag-and-hort-science/moderator-s-newsletter/may-2014/

Biology
http://www.nzqa.govt.nz/qualifications-standards/qualifications/ncea/subjects/biology/moderator-s-newsletter/may-2014/

Chemistry
http://www.nzqa.govt.nz/qualifications-standards/qualifications/ncea/subjects/chemistry/moderator-s-newsletter/february-2014/

Earth and Space Science
http://www.nzqa.govt.nz/qualifications-standards/qualifications/ncea/subjects/earth-and-space-science/moderator-s-newsletters/may-2014/

Physics
http://www.nzqa.govt.nz/qualifications-standards/qualifications/ncea/subjects/physics/moderator-s-newsletter/february-2014/

Science
http://www.nzqa.govt.nz/qualifications-standards/qualifications/ncea/subjects/science/moderators-newsletter/february-2014/

Clarifications
Also refer to the clarifications for science:
http://www.nzqa.govt.nz/qualifications-standards/qualifications/ncea/subjects/science/science-clarifications/

good practice. The group meet after school hours, schools take turns to host the sessions and currently the group have been engaged in discussion on the qualities of science leadership- What does it take to be a science leader? Other discussions have centred on: What is working well in our schools? What is not working well and how we could collaborate to support one another to make a real difference in schools in the Waikato region? The meetings address current research, are stimulating and productive, and the response from teachers has been overwhelmingly positive. The group believes it is a fresh way forward and the collaborative spirit of the forum has been rewarding.

Science Subject Area Alerts

Teachers of Agriculture and Horticulture

As planning for 2015 is underway, consider aligning your programme with the four strands identified in the Agriculture and Horticulture Teaching and Learning Guide. It is time to shift the focus to teaching and learning from the narrow focus on assessment.
Also a reminder that engaging with Ag or Hort blogs might provide access to a range of useful information to use to engage students. One example is: http://keithwoodford.wordpress.com/2010/05/29/updating-devil-in-the-milk/

Teachers of Physics

Physics scholarship 2014

Students taking scholarship physics will need to cover the following 3.5 Modern Physics standard material in addition to Mechanics, Waves and Electricity:

> The Bohr model of the hydrogen atom, the photon; the quantitisation of energy; discrete atomic energy levels; electron transition between energy levels; ionisation; atomic line spectra; the electron volt, the photoelectric effect , wave / particle duality, qualitative description of the effects of the strong interaction and Coulombic repulsion, binding energy and mass deficit; conservation of mass-energy for nuclear reactions.

Teachers of Biology

Keep a lookout for possible PLD opportunities for Term 4 being provided by your Regional BEANZ representative. There are also some regional sessions from Maurice Wilkins Centre on offer.

Teachers of Chemistry

In a conversation with a first year Chemistry lecturer, the comment was made that students need have "developed thinking skills to achieve in Chemistry at tertiary level", and "rote learning did not support this". This was expanded by the comment that students needed to be able to apply their chemistry knowledge to explain a situation such as why mercury beads up and does not spread over and wet glass, or why it takes a vast amount of energy to crush crystals into nanopowders. Questions for applying knowledge in organic compounds learning might include consideration of why polymers with longer chains produce more viscous liquids or why most polymers have little odour or taste. Surely such questions fit within the parameters of the teaching and learning in Chemistry at Level 8 and similar applications could be found at Level 6 and 7 of the NZ Curriculum.

Teachers of Earth and Space Science

Considering ideas for Level 7 and 8 courses based on Earth and Space Science? Help in planning can be found at http://seniorsecondary.tki.org.nz/Science/Learning-programme-design/Sample-learning-courses/Earth-and-space-science-focus/L7-Earth-and-space-science

Science online

Remember to explore the materials on the Science Capabilities and Use of Digital Learning Technologies in Science http://scienceonline.tki.org.nz/New-resources-to-support-science-education

Ideas on approaches to use in science can be found on Literacy on line on TKI - http://literacyonline.tki.org.nz/Literacy-Online/Secondary-Literacy/Teacher-needs/Literacy-in-the-learning-areas2/Literacy-in-Science/Teaching-Inquiry-Planning-to-meet-student-needs

A sample unit plan for Material World can also be found at http://esolonline.tki.org.nz/ESOL-Online/Teacher-needs/Teaching-and-learning-sequences/Units/Secondary-mainstream

Secondary Student Achievement professional development

The Secondary Student Achievement professional development is funded by the Ministry of Education. The Government goal is that 85% of all 18-year-olds will have achieved NCEA Level 2 or an equivalent qualification by 2017. Support is available to all middle leaders in the form of workshops, clusters and e-newsletters in every learning area and in a range of subjects. Intensive, in-depth support is also being provided for selected schools or departments allocated by regional Ministry offices.