**Report On Student Achievement**

**Science** and **Technology**

**Aggregation: Term 2, 2016**

**Strand:      Physical World.**

The **Physical World** strand provides explanations for a wide range of physical phenomenon, including light, sound, electricity, magnetism, waves, forces and motion united by the concept of energy which is transformed from one form to another without loss.

By studying physics, students gain and understanding of interactions between parts of the physical world and of ways in which they can be represented. Knowing about physics enables people to understand a wide range of contemporary issues and challenges and potential technological solutions

                                                                 (New Zealand Curriculum Page 28)

**Achievement Aim   – the classes worked with a range of contexts**

**across these aims.**

**In their study of the Physical World students used their developing scientific knowledge, skills and attitudes to:**

1. gain an understanding of the nature of physical phenomena from practical investigation and the consideration of scientific models.
2. establish scientific concepts of energy and investigate ways in which  energy changes can be put to use.
3. explore and establish trends, relationships, and patterns involving physical phenomena
4. explain how physical phenomena are used in everyday technology and how such technology affects people and their environment.

Contexts studied during the Term 2 2016 units were  -  **Forces and Motion**

Teams to choose theme or themes:

***- Buoyancy, Floating and Sinking, Gravity, Weight, Flight, Parachutes, Air Pressure***

***This unit in Term 2 was all about students questioning, inquiring, discovering for themselves in an interactive context and communicating their findings. Teacher’s role in this is to know the science of physics, facilitate the learning experiences and conditions to allow the students to learn it for themselves.***

**Main Ideas Contained At Each Level Within The Strands:**

|  |  |
| --- | --- |
| **Level 1 Context studied:**  **‘Floating and Sinking’** | **Level 2**  **Context studied:**  **‘Motion - Push and Pull’** |
| *The ‘ Big Ideas’ in the* ***Matawhero, Orion and Kopu*** *units:*   * Some objects float and some sink. * A floating object usually lies on top of the water * An object that is light for its size compared with water will float in water * When an object is placed in water, it pushes water out of the way. (We call this displacement) * Sinking is a type of falling. * An object sinks unless something is holding it up. * We can make a sinking object float by changing its shape to increase its volume. * Usually an object with air trapped inside it will float.   **CONTEXT or SCENARIO:**  Using their newly found scientific knowledge about buoyancy and forces, create a raft that floats and carries objects (plastic teddies.)  *The ‘ Big Ideas’ in the Neptune unit:*   * There are lots of ways to make an object move. * An object doesn’t move until something happens to make it move. * We can make objects move slowly or quickly and in different directions. * An object can be moved by either a push or pull. * Some surfaces will stop an object in a shorter distance than other surfaces (friction) * A push or pull more easily causes movement on a surface when wheels, balls, or rollers are used. * We are unable to see forces, but we are often able to see their results. | *The ‘ Big Ideas’ in the* ***Earth and Ra*** *units:*   * There are lots of ways to make an object move. * An object doesn’t move until something happens to make it move. (action and reaction) * We can make objects move slowly or quickly and in different directions. * An object can be moved by either a push or pull. * Some surfaces will stop an object in a shorter distance than other surfaces. * A force called friction usually hinders the motion of a moving object.     **CONTEXT or SCENARIO:**  Using their newly found scientific knowledge about motion and forces to create or modify a toy that moves. |
| **Level 3 Context studied: ‘Air Pressure and Flight’** | |
| *The ‘ Big Ideas’ in the* ***Marama and Milky Way*** *units:*   * Forces are present everywhere. * Flight occurs due to forces acting and counteracting. * To every action there is an equal and opposite reaction. * Flying is controlled movement through the air * Some animal adaptations and machine structures make flight possible   **Science Concepts:**  **Level 2**   * Helicopters have rotor blades which are a special type of wing * Aeroplanes have wings and engines to keep them flying * Animals use their wings and muscles to fly * Seeds of some plants have structures that slow their rate of fall through the air   **Level 3**   * To sustain flying, the wings must be moving through the air * During flight, a wing turns air downwards (the action) producing an upward force  (lift)  in reaction * In straight and level flight, the lift force equals the downward force of gravity   **Level 4**   * The curved surfaces of aircraft wings and bird wings cause an upward force, giving lift when moving through the air * To control flight, it’s necessary to be able to make changes to wing and tail surfaces | |
| ***Values-*** *Throughout the unit the following values from The New Zealand Curriculum will be modelled, encouraged and explored.*   * ***Integrity,*** *particularly with experiments and ‘fair testing’ which involves honesty, responsibility, accountability and acting in an ethical manner.* * ***Innovation, Inquiry and Curiosity*** *by thinking critically, creatively and reflectively to evaluate a scientific process and outcome.* * ***Community and Participation*** *for the common good of the group*   ***Key Competencies-*** *Throughout the activities in this unit, there are many opportunities to develop the key competencies identified in The New Zealand Curriculum. In particular, this focus of learning develops the key competencies of:*   * ***Managing Self****(Managing oneself when doing Scientific experiments)* * ***Thinking****(Predicting, Observing, reflecting, questioning and discussing process/outcomes)* * ***Participating and Contributing*** *(as an individual and as a group member – active involvement)* * ***Using Language, Symbols and Text***   ***Te Totara Reach for the Stars***    ***Always Learning and Respectful             Smart Decisions and Self Managing*** | |

**Achievement Objectives At Each Level**

**(Science in the NZ Curriculum)**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Level One and Two** (generally Years 0 – 2, and Years 3 - 4 students)

**Level Three** (generally Years 5 and 6 students)

|  |  |  |
| --- | --- | --- |
|  | ***Level One and Two***  ***Programme***  **Science**: **The New Zealand**  **Curriculum (2007)** | ***Level Three***  ***Programme***  **Science**:**The New Zealand**  **Curriculum  ( 2007)** |
| **The Nature of Science – overarching unifying strand** The students will be able to: | | |
| Understanding about Science    Investigating in Science    Communicating in Science    Participating and Contributing | * Appreciate that scientists ask questions about our world that lead to investigations and that open-mindedness is important because there may be more than one explanation * Extend their experiences and personal explanations of the natural world through exploration, play, asking questions and discussing simple models * Extend their experiences and personal explanations of the natural world through exploration, play, asking questions and discussing simple models * Explore and act on issues and questions that link their science learning to their daily living | * Appreciate that science is a way of explaining the world and that scientific knowledge changes over time * Identify ways in which scientists work together and provide evidence to support their ideas * Build on prior experiences, working together to share and examine their own and others’ knowledge * Ask questions, find evidence, explore simple models & carry out appropriate investigations to develop simple investigations. * Begin to use a range of scientific symbols, conventions & vocabulary * Engage with a range of science texts & begin to question the purposes for which these texts were constructed * Use their growing science knowledge when considering issues of concern to them * Explore various aspects of an issue & make decisions about possible actions |
| **Physical World**  **Strand**  Students will: | **Physical inquiry and physics concepts**   * Explore everyday examples of physical phenomena, e.g. movement, **forces**, electricity & magnetism, light, sound waves & heat * Seek and describe simple patterns in physical phenomena | **Physical inquiry and physics concepts**   * Explore, describe and represent patterns and trends for everyday examples of physical phenomena, such as movement, **forces**, electricity and magnetism, light, sound, waves, and heat. For example, identify and **describe the effect of forces (contact and non-contact) on the motion of objects**; identify and describe everyday examples of sources of energy, forms of energy and energy transformations. |

|  |  |  |  |
| --- | --- | --- | --- |
| **Technology in the New Zealand Curriculum** | ***Level One***  ***Programme***  **Technology in the New Zealand Curriculum**  Students will gain knowledge, skills and experiences to: | ***Level Two***  ***Programme***  **Technology in the New Zealand Curriculum**  Students will gain knowledge, skills and experiences to: | ***Level Three***  ***Programme***  **Technology in the New Zealand Curriculum**  Students will gain knowledge, skills and experiences to: |
| Technological Practice | **Planning for practice**  Outline a general plan to support the development of an outcome, identifying appropriate steps & resources.  **Brief development**  Describe the outcome they are developing & identify the attributes it should have, taking account of the need or opportunity & the resources available.  **Outcome development and evaluation**  Investigate a context to communicate potential outcomes. Evaluate these against attributes; select & develop an outcome in keeping with the identified attributes | **Planning for practice**  Develop a plan that identifies the key stages & the resources required to complete an outcome.  **Brief development**  Describe the outcome they are developing & identify the attributes it should have, taking account of the need or opportunity & the resources available.  **Outcome development and evaluation**  Investigate a context to develop ideas for potential outcomes. Evaluate these against the identified attributes; select & develop an outcome. Evaluate the outcome in terms of the need or opportunity | **Planning for practice**  Undertake planning to identify the key stages & resources required to develop an outcome. Revisit planning to include review of progress & identify implications for subsequent decision making  **Brief development**  Describe the nature of an intended outcome, explaining how it addresses the need or opportunity. Describe the key attributes that enable development & evaluation of an outcome  **Outcome development and evaluation**  Investigate a context to develop ideas for potential outcomes. Trial & evaluate these against key attributes to select & develop an outcome to address the need or opportunity. Evaluate this outcome against the key attributes and how it addresses the need or opportunity |
| Technological Knowledge | **Technological Modelling**  Understand that functional models are used to represent reality & test design concepts & that prototypes are used to test technological outcomes  **Technological products**  Understand that technological products are made from materials that have performance properties  **Technological systems**  Understand that technological systems have inputs, controlled transformations and outputs | **Technological Modelling**  Understand that functional models are used to represent reality & test design concepts & that prototypes are used to test technological outcomes  **Technological products**  Understand that technological products are made from materials that have performance properties  **Technological systems**  Understand that technological systems have inputs, controlled transformations and outputs | **Technological Modelling**  Understand that different forms of functional modelling are used to inform decision making in the development of technological possibilities and that prototypes can be used to evaluate the fitness of technological outcomes for further development.  **Technological products**  Understand the relationship between materials used & their performance properties in technological products.  **Technological systems**  Understand that technological systems are represented by symbolic language tools & understand the role played by the “black box“ in technological systems. |
| Nature of Technology | **Characteristics of technology**  Understand that technology is purposeful intervention through design  **Characteristics of technological outcomes**  Understand that technological outcomes are products or systems developed by people & have a physical nature and a functional nature | **Characteristics of technology**  Understand that technology is purposeful intervention through design  **Characteristics of technological outcomes**  Understand that technological outcomes are products or systems developed by people & have a physical nature and a functional nature | **Characteristics of technology**  Understand how society & environments impact on &are influenced by technology in historical & contemporary contexts & that technological knowledge is validated by successful function  **Characteristics of technological outcomes**  Understand that technological outcomes are recognisable as fit for purpose by the relationship between their physical and functional natures |

***Achievement  Data – July 2016***

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Achievement**  **Level:** | **Early Level**  **1** | **Secure**  **Level 1** | **Level 2** | **Level 3** | **Level 4** |

***Class Level - Numbers of Students working at each level.***

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Year 1**  (158 students) | 48 | 110 |  |  |  |
| **Year 2**  (132 students) | 5 | 127 |  |  |  |
| **Year 3**  (133 students) |  | 13 | 120 |  |  |
| **Year 4**  (128 students) |  | 3 | 125 |  |  |
| **Year 5**  (109 students) |  | 2 | 33 | 74 |  |
| **Year 6**  (111 students) |  |  | 13 | 98 |  |

**ANALYSIS AND RECOMMENDATIONS**

**All Students:**

Number of students assessed across Year 1 - 6   **771 students.**

From the data above the majority of all year levels is either ***at*** or ***above***

the Achievement Band Expectation.

(**748** students at or above expectation Curriculum levels)

Overall throughout the school we have **97 %** of the students working ***at*** or ***above*** the

Achievement band expectation.   ***This is an excellent result.***

**Male Students (Total:369)**

From the data above the majority of all year levels is ***at*** or ***above*** the Achievement Band Expectation. (358 male students at expectation Curriculum levels)

Overall throughout the school we have **97 %** of the male students working ***at*** the Achievement band expectation.

**Female Students (Total: 402)**

From the data above the majority of all year levels is ***at*** or ***above*** the Achievement Band Expectation. (390 female students at expectation Curriculum levels)

 Overall throughout the school we have **97 %** of the female students working ***at*** the

Achievement band expectation.

**Maori and Pasifika Students:**

Number of Maori students (88) and Pasifika students (13) assessed across Year 1-6

**101 students**

 Of these students 98are either ***at*** or ***above*** the Achievement Band Expectation.

* Maori Students - 85 out of the 88 are at expectation levels, which is a result of **96.5 % of Maori students at expectation level.**
* Pasifika Students – 13 of our 13 students are at expectation levels, which is a result of **100 % at our expectation level.**

 For our Maori students and Pasifika students this is a result of **97 %** working ***at*** or ***above*** the Achievement band expectation**. *This is also an excellent result.***

**Students not achieving at expectation levels – 23 students**

Of these 23 students, 11 are ‘English as a Second Language’ identified and funded students, so are at a lower stage of development with literacy oral/written language development. Understanding of concepts and communicating this is a challenge for both students and teachers as prior knowledge can be limited. Of these  students achieving at one level below expectation levels, 17 of them (including the ESOL students) feature in our Learning Support roll, with learning at a lower base level than the cohort.

In comparison with the Social Sciences unit in Term 1, consistency has been maintained with these results with a slight improvement (96.2 % at expectation in Term 1, 97.0 in Term 2 Science and Technology unit.)

Of the students who have been at Te Totara longer than this year, they have all shown a rate of progress consistent with the general cohort, from the last ‘Science - Physical World strand’ data reported on in 2014.

**What went well with this unit of learning**

* This was a rich ‘hands on’ topic which the students really enjoyed. The teaching staff felt these units of work within the Physical world strand were of a high level of interest and successful for the students because of the interactive nature of the activities. They were able to make learning connections and draw on previous knowledge, including from our Aquatics lessons.
* The students got to follow the method of ‘a scientist’ and use scientific vocabulary. These activities encouraged them to predict (hypothesize), observe, record, evaluate and explain their findings, as individuals and pairs as well as in small/large groups.  They listened to each other’s ideas and encouraged experimentation. The students initially found the predicting and ‘fair testing’  quite challenging as they didn’t want to be ‘wrong’ however after a few experiments they began to see this as a normal part of scientific investigation.
* A number of experiments were conducted at all levels of the curriculum, which meant students gained an understanding of key concepts within each unit, based on their direct observation of the forces acting on objects, which led to directional movement, including floating and sinking . The students had the equipment and they were performing the experiments. This certainly challenged students’ assumptions about size, weight and propulsion forcing them to really ‘look’, observe and describe what they were seeing and hearing, not just what they ‘think’ they are seeing.
* Many students did their own experiments and investigated aspects of these with a link into the Home Learning, as an extension of their class work. This allowed the students to go over the experiment many times to enhance understandings. Interesting items were brought from home to test for buoyancy e.g. pumice.
* Excellent resources were sourced and used. These included additional personnel such as Jarred Capendale, a Physics teacher from Hamilton Boys High School who came and led a lesson in our Year 5-6 area on rocket making and fair testing. He talked about the forces that propel rockets and he used a hydrogen balloon to demonstrate. He then led a student based ‘film canister rocket investigation’ altering variables by using fins and a cone, also varying amounts of vinegar and baking soda paste. The results were very exciting and quite spectacular! The students also designed and made ‘Water Bottle Rockets.’

        Another engaging resource was the Youtube video’s Science Guy - Bill Nye with

        teachers across all levels finding this and the Suzy’s World DVD’s helpful and

        stimulating for experiments, particularly of low and high air pressure and airfoil

        wing shape.

* This unit leant itself to inquiry in an authentic way. Students were able to explore their wonderings and share them with others. The questions students explored were kept ‘tight’ and students had to find information using two sources. There was discussion around making sure the sources agreed with each other and which digital sources to trust. Findings were researched and presented in a variety of ways using E Learning.
* Students actively participated in STAR’s and Discovery learning opportunities in the pods where they could freely test objects, ideas and create understandings together, using key competencies as part of their exploration and learning.
* The Technology days were a great success. The ‘Blokes on Board’ raft building day in our Year 1 classes was a fantastic. The students very much enjoyed working with their dads, grandads and family friends. It was a great opportunity for the ‘blokes’ to be involved with their child’s creative learning.

In Year 2 the Technology day was also very successful. The teachers deliberately chose to not engage the parents in this part, as they wanted the children to be completely independent and create from their own design. This lead to a lot more trial and error and self-evaluation during the process, with other children making suggestions for modifications for a better outcome. The teachers reported the children were confident in the use of the materials and tools they used to help them. There was little or no adult assistance which really helped the students to problem-solve for themselves. The teachers commented that the STAR’s learning that these children did as Year 1 students’ was evidenced by their willingness and ability in this process.

* Our Year 3-4 classes focussed on simple machines in their environment and found lots of examples in action on the playground and the pulley on our big recycling bin. They particularly enjoyed designing and constructing mouse traps and catapults, challenging each other to see which design threw the object the highest or longest. They also relished the challenge of making a pulley inside the class to lift sand and creating levers.

 These classes also went to the Mystery Creek museum which gave real life opportunities to see forces at work and the change in machines and technology over the past 100 years and into present contexts. They enjoyed the use of the Seesaw app to share their learning with their families, parent comments were very positive as they haven’t previously seen the ‘physical’ things we do at school during the day.

* A particular highlight of this unit was the opportunities presented for sharing learning at assemblies, both through the team and full school forums. This is valuable in showing school wide learning progressions and showcases weekly on our website and Facebook pages. Teacher professional development in E Learning is increasing the link with families via the Seesaw app.
* Curriculum integration occurred with the learning areas of; **Science**, **Technology** (I.C.T., Materials, Production and Process strands), **English** (Oral – forming questions and hypotheses, Written - Explanation, Procedural, Explanation and Report writing, Reading and Research based), **The Arts**; Visual Arts – exploring shape and function. **Maths -** measurement of propulsion. Also our Senior students who are high achieving mathematicians extended their learning by measuring the speed and propulsion through a ‘fair testing’ process. They could see the links between Science, Technology and **Maths**.
* This is the second time that we have recorded school wide tracking of assessment data in the Physical World strand of the Science Curriculum. In previous years we have reported on the Material World and Living World strands.

In future years when we explore Physical energy again we will be able to continue to make comparative statements in relation to achievement information across this strand.  The teachers found that in all areas as these were new concepts to the students, the learning needed to ‘take a step back before we moved forward.’ The understandings at an earlier curriculum area had to be secured before the cohort-relevant curriculum level could be explored.

* Our ‘English as a Second Language’ (E.S.O.L.) students benefited from some prior knowledge and specific vocabulary teaching by our E.S.O.L. teacher before the unit began.  It is great to see our E.S.O.L. teacher and part time teachers attending our staff meeting so that everyone is aware of our learning and how it is being developed throughout the school. This was great preparation. Of our 113 funded E.S.O.L. learners the assessments show 102 of them as achieving the expected Curriculum levels in line with the cohort group. This result shows that **90.2 %** are achieving at the expectation level. This is a pleasing result given that for many of them scientific terminology is a very difficult barrier to overcome, however the benefit of direct observation of the experiments will have enhanced understanding. Also in terms of a knowledge of buoyancy and water many of our ESOL learners do not have the prior experiences with water that other Year 1 students have.

     Looking closely at the teacher’s assessment sheets demonstrate a growth in

     knowledge and skills for all our E.S.O.L. learners.

**Ideas for Future Action of this or a similar unit** (Linked to our Strategic Plan)

* Development of teacher knowledge and their own understanding, particularly in these more abstract concepts. Specific targeted professional development in scientific areas for teachers. This can often be gained by a sharing of what is meant by the ‘big ideas’ and how to achieve and assess these. Curriculum knowledge of concepts and units need to be discussed to ensure that we have a common understanding of the levels of the curriculum, where our expectations for student learning are and where the students are currently achieving at.

As Curriculum Manager, I continue to run a full staff meeting each term to facilitate planning, progressions and shared understandings of the following term’s unit. This was excellent with this unit as the ‘hands on’ activities were set up for the teachers to all experience and discuss for themselves, prior to facilitating this with their classes.

* We need to continue to ensure the concepts taught are relevant to the students in terms of their learning needs and abilities. Extension activities should be offered to the group that they are targeted for whilst the other students’ learning is consolidated, at the appropriate level, to ensure success for all.
* Teachers need a clear understanding of the learning progressions in the units they are teaching in order to differentiate for the learners. For our very young students the abstract content needed to ‘broken down into a more simple way’ to understand the key ideas.  This is also a focus area in our staff meetings to build understanding within the staff with sequential Science development.
* Teachers were encouraged to schedule four Science sessions per week to ensure content breadth and depth and also link literacy and maths to this context.  Allow for planning time to check and build, if necessary student’s prior knowledge before extending this into the ‘cohort-relevant’ Curriculum area. Use literacy times to build additional Science understandings.
* Continue to analyse and monitor a cohort of learners such as our Year 2 and 3 learners to check for trends and respond to emerging needs. With the units being sourced from Level 1/2 science resources, we need to ensure that what is being taught and assessed is the most relevant learning to increase understanding and skills.
* Teaching focus is to be ‘hands on’ learning as much as possible. As indicated previously this was very much the case during this unit.  The learning was very interactive and contributed to the high levels of student motivation, engagement and success.
* Simple Science investigations, which include home learning activities and informing the parents of the specific scientific focus, occurring throughout the unit and beyond into our learning plans for each student. The use of the Seesaw app and Edmodo to engage parents into sharing in their child’s learning

        This is a powerful model of interactive learning between home and school which

        leads to rich learning.

* Targeted purchases of equipment and resources need to be made in relation to specific teaching intentions. We found the experiment base of these units lead to excellent understandings based on direct observations and predictions, the equipment purchased had an immediate beneficial use.
* Continue to foster Curriculum depth in the physical world with relevant areas such as Electrical and Magnetic Energy and Wind and Wave Energy. This Science unit has fostered possibilities of greater Curriculum connection.
* Continue to support E.S.O.L. students through support programming with our E.S.O.L. teacher.   Use a variety of assessment procedures and ‘hands on learning to gauge/enhance their understandings of scientific processes.

        Prior vocabulary learning helped to increase the understanding of our E.S.O.L.

        students.

* Encourage teachers to share aspects of this type of rich learning through the team and school assemblies as it has clear benefits for both presenters and viewers and is an authentic context to share understandings.

Curriculum Recommendation: To reinforce and build on the learning from this year, plan to teach a unit focussing on Energy from the Physical World strand in 2018.

**This document on student achievement in Science - Term 2 2016 was**

**reported to the Board of Trustees Meeting on 22 September 2016.**

**The valuable input of all staff is acknowledged in the preparation of this report.**

**Anne Fraser**

**(Deputy Principal / Curriculum Manager)**