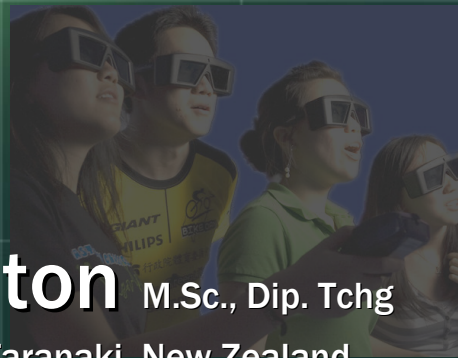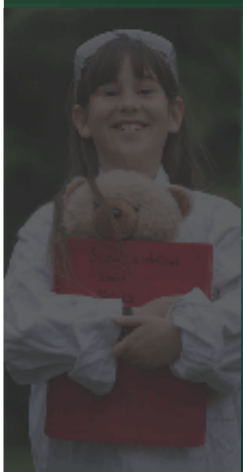# RIGEL – learning from life

Communities of learning via a connected curriculum
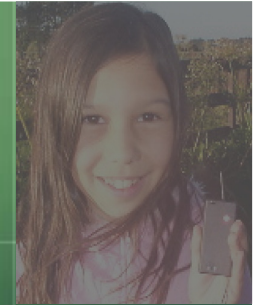
Michael Fenton M.Sc., Dip. Tchg

Inglewood High School, Taranaki, New Zealand

NEW ZEALAND

Background Information

☐ **Country:** NEW ZEALAND
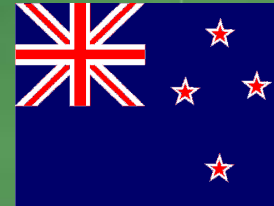
☐ **School:** Inglewood High School, Taranaki
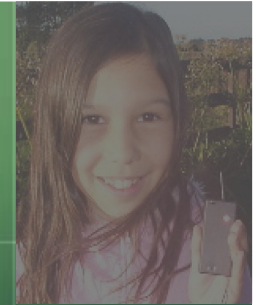
☐ **Designation:** Mathematics/Science/Computing teacher

☐ The innovation, lessons, student products of learning, evidence of improved learning, educational theory and research...on the next pages...

One example of a lesson

Learning areas

Science, mathematics, ICT/computing, electronics/robotics, physical education, art

Levels

Primary, Intermediate, Secondary

Objectives

To produce an Olympics Games event for the school
To learn about electronic sensor systems
To develop teamwork skills
To develop communication skills
To help students develop a positive view of the nature of science
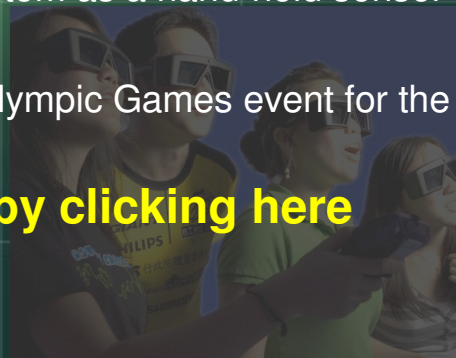
Description/

Students use the RIGEL system as a hand-held sensor unit during a science round robin activity

Students later develop an Olympic Games event for the school.

Download by clicking here
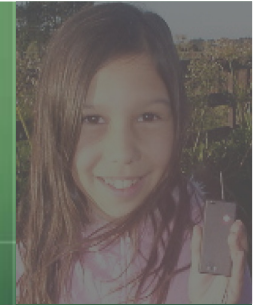
**Lesson Plans /
Assessments /
Evaluations**

Software / Hardware

Notebook PC, Data projector, RIGEL sensor units, RIGEL instruction sheet (in lesson plan), 6 different activity stations with simple UV, light, magnetism etc sources, 'Robot Wars DVD segment, "Who wants to be a millionaire" (created in Game Maker by Michael Fenton)

www.nexusresearchgroup.com

Click to download…

Authentic learning using mobile sensor technology with reflections on the state of science education in New Zealand

A research project for the New Zealand Ministry of Education

Michael Fenton M.Sc, Dip. Tchg.
www.nexusresearchgroup.com

e-Learning Fellow
2008

This Powerpoint presentation only contains a small portion of the year long research…

A significant finding involves the state of science education in New Zealand…

Issues raised appear similar to those in the Asia Pacific region, USA, Canada and Europe…
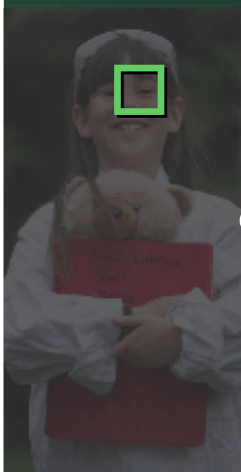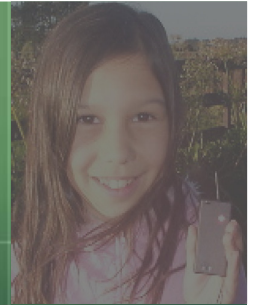
What is 'innovation' ?

A high standard of creative and innovative adaptation is achieved when computers are used to :

- ☐ combine many different kinds of data in a unique format (multimedia)

- ☐ connect new tools of communication with the learning process (networks)

- ☐ assist, expand, complement and

  accelerate human thought
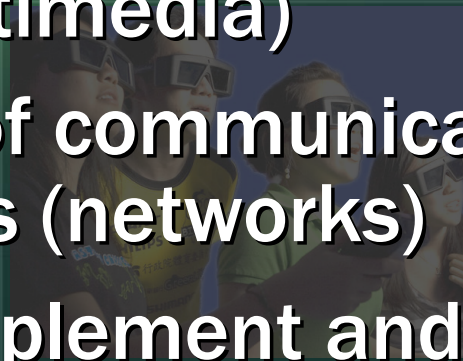
Innovation in education
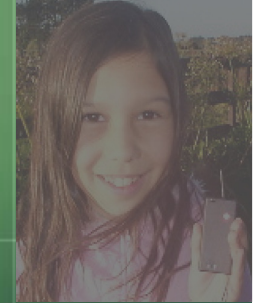
The goal of innovation is positive change, to make someone or something better or adding value to existing process or product

Innovation = (Creativity x Risk Taking)

OR

Innovation = (Invention   x   Exploitation)

RIGEL is a new ICT…

Multi-discipline learning is possible between, but not limited to, any of

- Biology
- Chemistry
- Physics
- Astronomy
- Earth Science
- Forensics
- Mathematics
- Physical Education
- Robotics/Electronics
- Game design
- Geography
- Music
- Art

See *The Education Weekly*, June 18th 2007

Real-world Interactive Games and Electronics Link

- remotely monitor or activate equipment or machinery.

- monitor alarms and act as a security system

- monitor respiration and heartbeat

- link a player remotely to games on a computer or 3D games projected into a room

- encourage exercise

- Hearing / visual aid
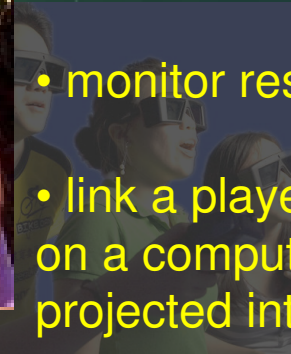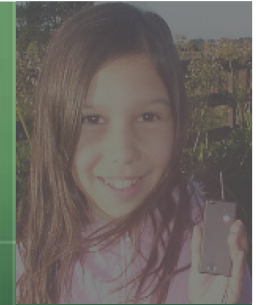
Innovation as an invention

- y^{pods}
  - Stand alone hand held units OR
  - Networked

- Wire or wireless networks
  - In class; around school
  - Collect data from home, farm, environment; send real time data to class!
  - Process control; monitor and control equipment from school via the web!

- Inexpensive and flexible
  - Easy to reprogramme
  - Robust
  - Multi-purpose
  - Extends use of existing well-known software and turns calculators into data loggers and remote control units…

- **Each student can have one in their pencil case!**

personal computer

y^{pod}

y^{pod}

y^{pod}

y^{pod}
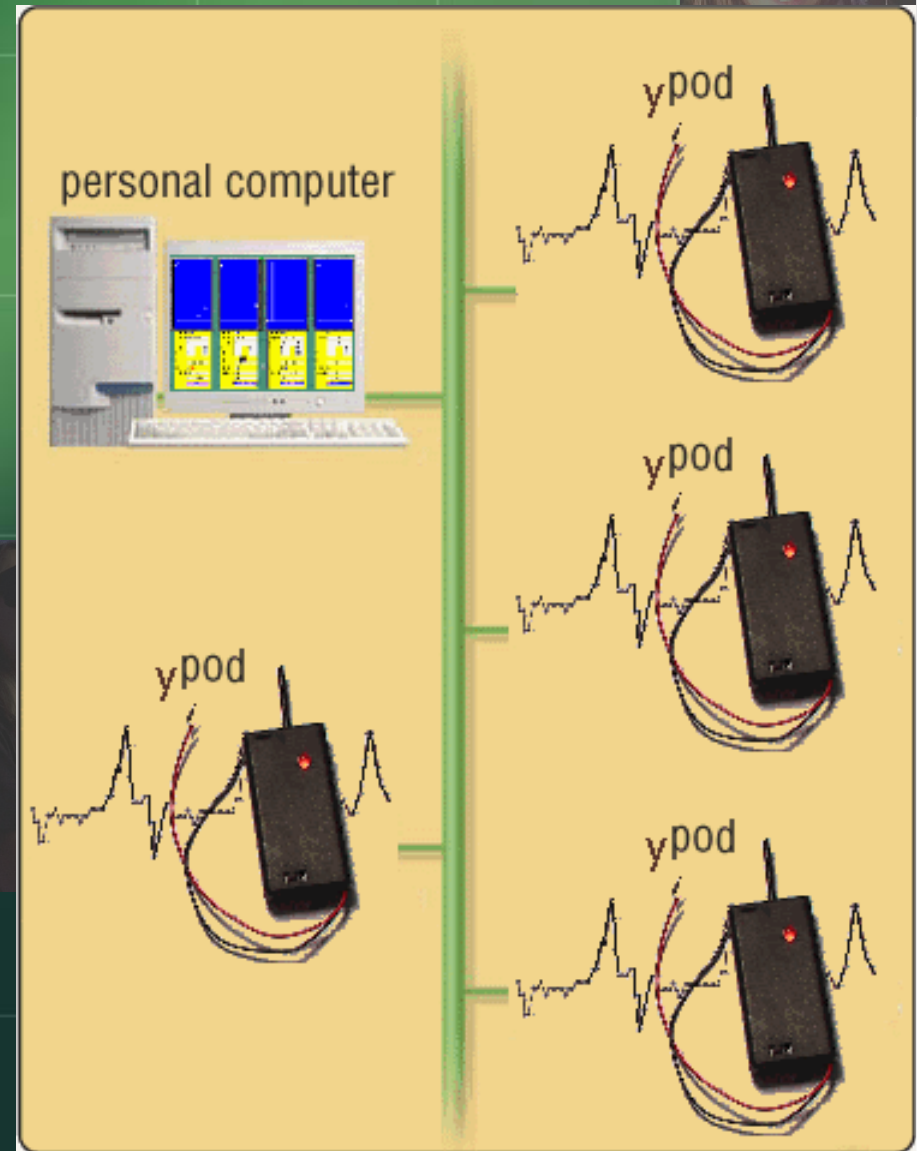
Innovation as exploitation
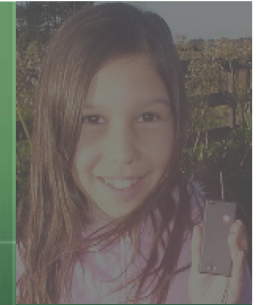
Low cost

Suits both student centered learning and expert teacher practical work

Relevant to all education systems supporting a science-based economy

Open-ended… extends usefulness of existing technologies

Assessment tool as well as learning tool

Hearing / visual impairment

☐ **Example: RIGEL unit outputs data as high/low tones. Blind students hear the trend in the data...**

RIGEL: changes learning

- PICAXE circuits used in non-electronics classes
- Science covertly learnt in non-science classes
- Significantly higher rates of engagement, motivation and enjoyment
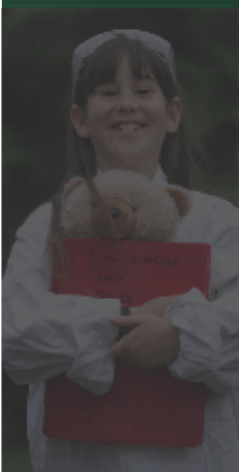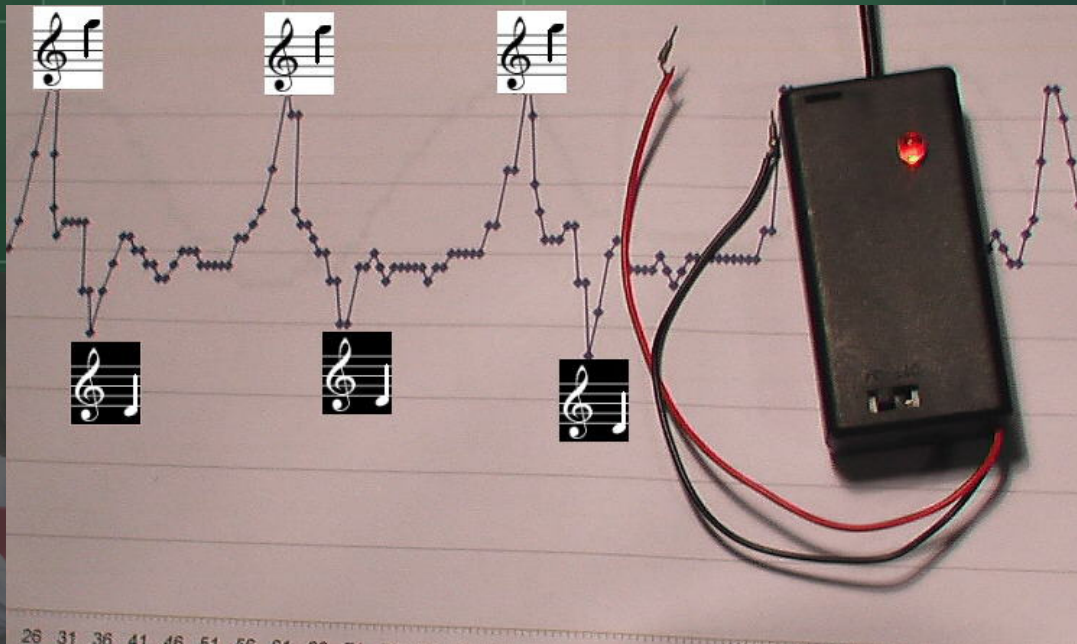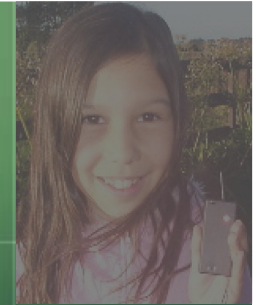- Significantly higher identification of authentic knowledge
- Game software connected with data logging makes game design software more useful, and real-world data sensing more fun
- Readily available applications (mobile / desktop) plugged into
- Takes computing out of cyberspace and back into the real world
- Less 'cost' in terms of teacher input to motivate and drive learning
- Students show an increased willingness to be independent learner
- Problem based learning for senior national examinations
- Differentiated learning
- Enables students with hearing or visual difficulties to engage in data monitoring and interpretation of science data.
- Professional development tool for teachers...share data in real time experiments and discuss what is happening via the 'chat' facility.
- Empowers indigenous cultures to participate in science-based learning using home and family as legitimate contexts for learning.
- Cost effective $$$
- Use of calculator as remote control or data logger
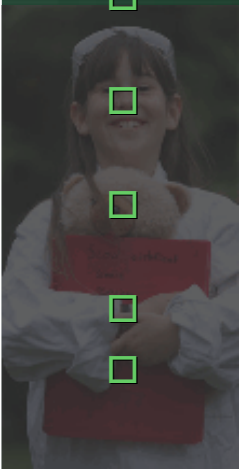
Olympic Games event

Click here to download windows media video…

Interactive Art

Electronics kits purchased by Year 9 & 10 maths students leads to learning about

- ☐ **Morse code**
- ☐ **Binary code**
- ☐ **Games programming**
- ☐ **Networking protocols**
- ☐ **Integrating technology into fashion and art**

Physical fitness
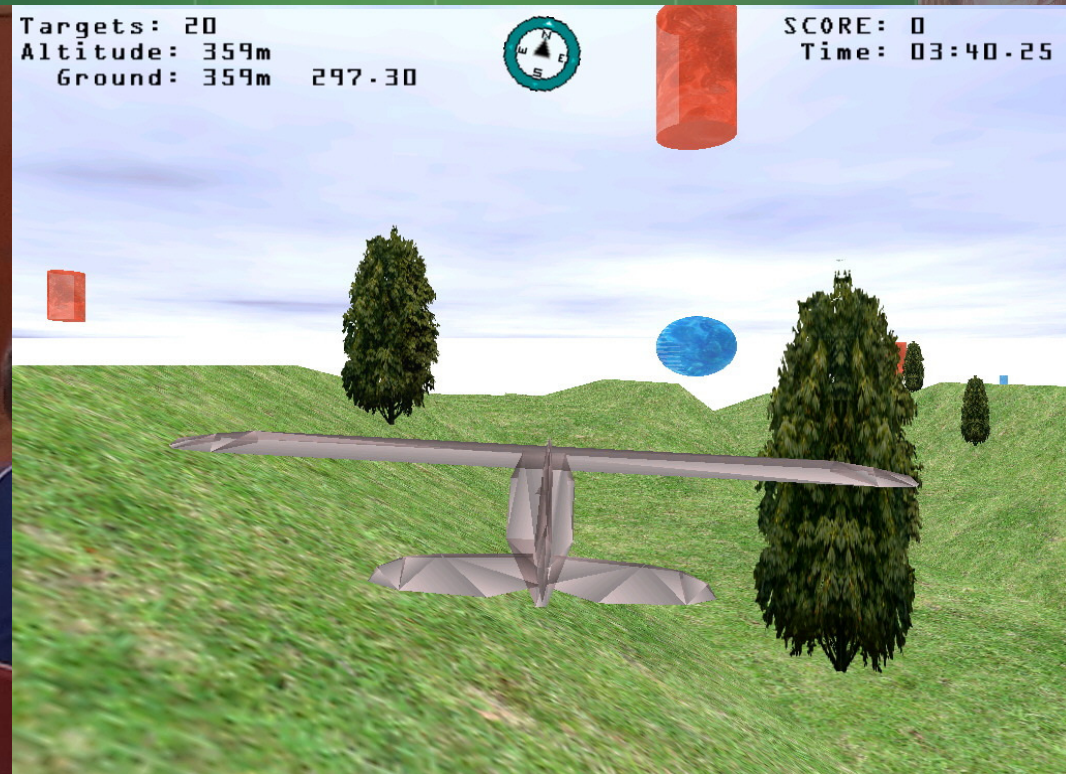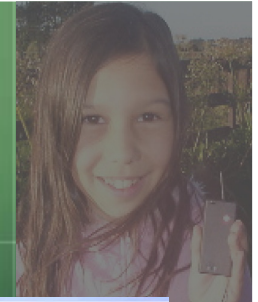
A RIGEL sensor unit on the exer-cycle is linked to the RIGEL 3D flight simulator projected on a large screen in front of the student

…pedal to stay in the air…steer with the handle bars…look out!!!
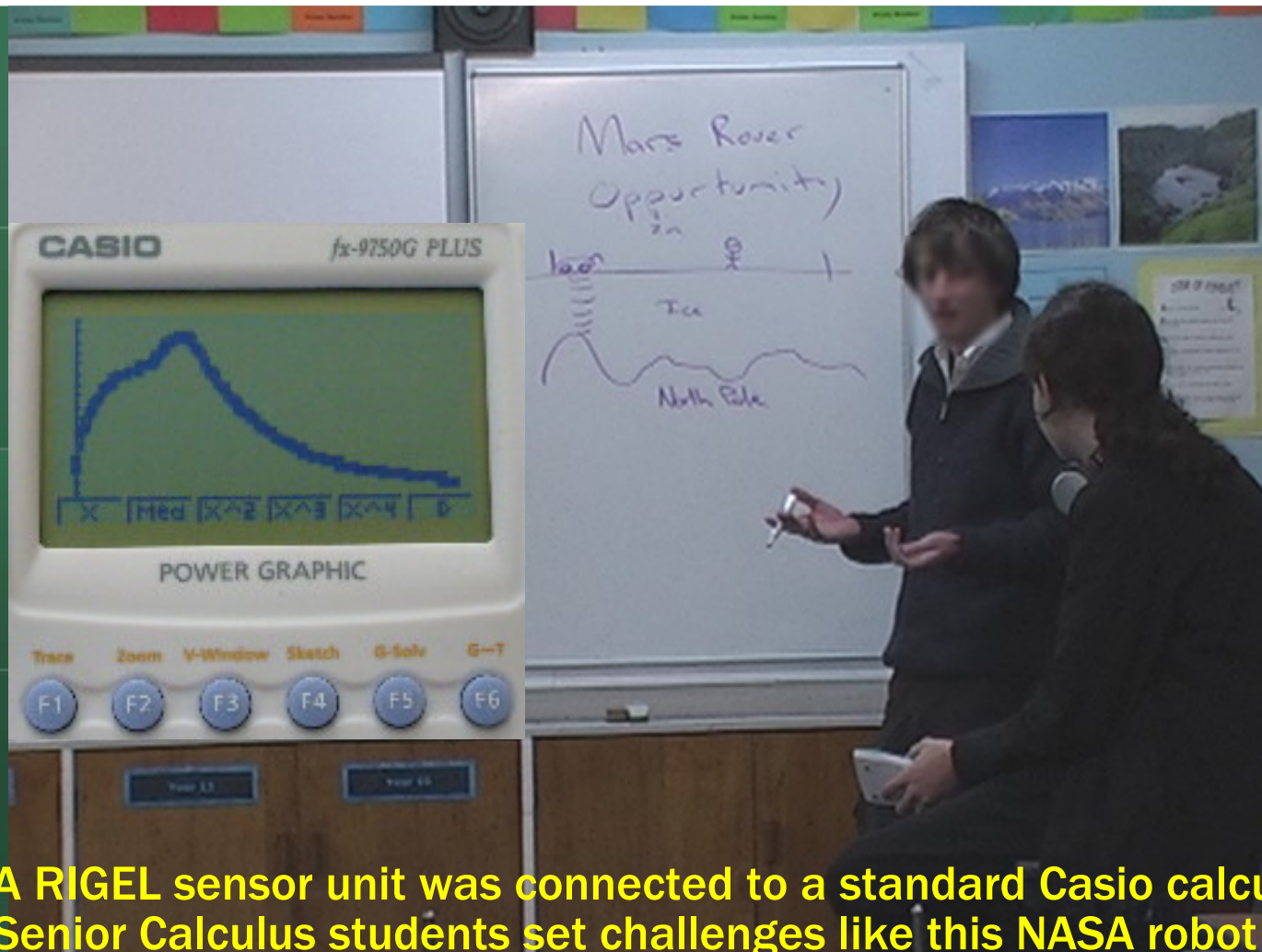
A RIGEL sensor unit was connected to a standard Casio calculator. Senior Calculus students set challenges like this NASA robot scenario...using an ultrasonic rangefinder...

Students are coached through the "learning cycle" process as they actively engage the learning environment both in and outside the classroom.

Peer teaching was common.

Engaging students

- ☐ **"an experience like no other I have had at school"**

- ☐ **"I never realised I had the patience to finish something off properly"**

- ☐ **"I found out I am interested in electronics"**

- ☐ **"I never knew scientists did real things with real people outside a lab"**
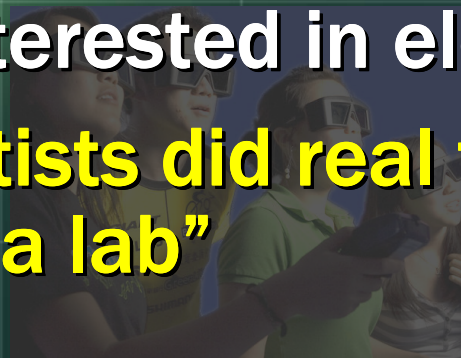
…more evidence in my lesson plan…click here.

Interviews and surveys…
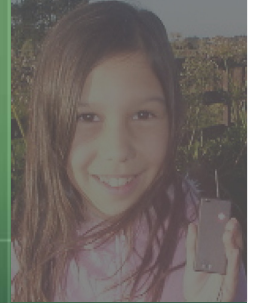
- 81% (21 out of 26) could list 4 types of sensor and discuss at least one sensors usefulness in everyday life

- 85% (22 out of 26) learnt something new about science/technology or about themselves
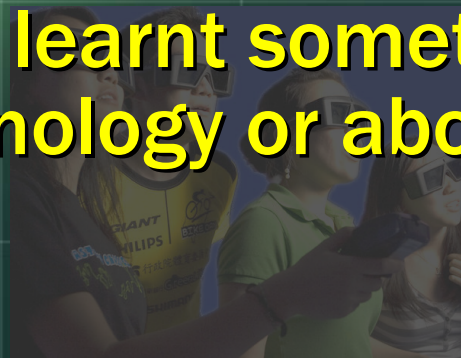
- 85% (22 out of 26) have changed their view of what scientists do or how they work
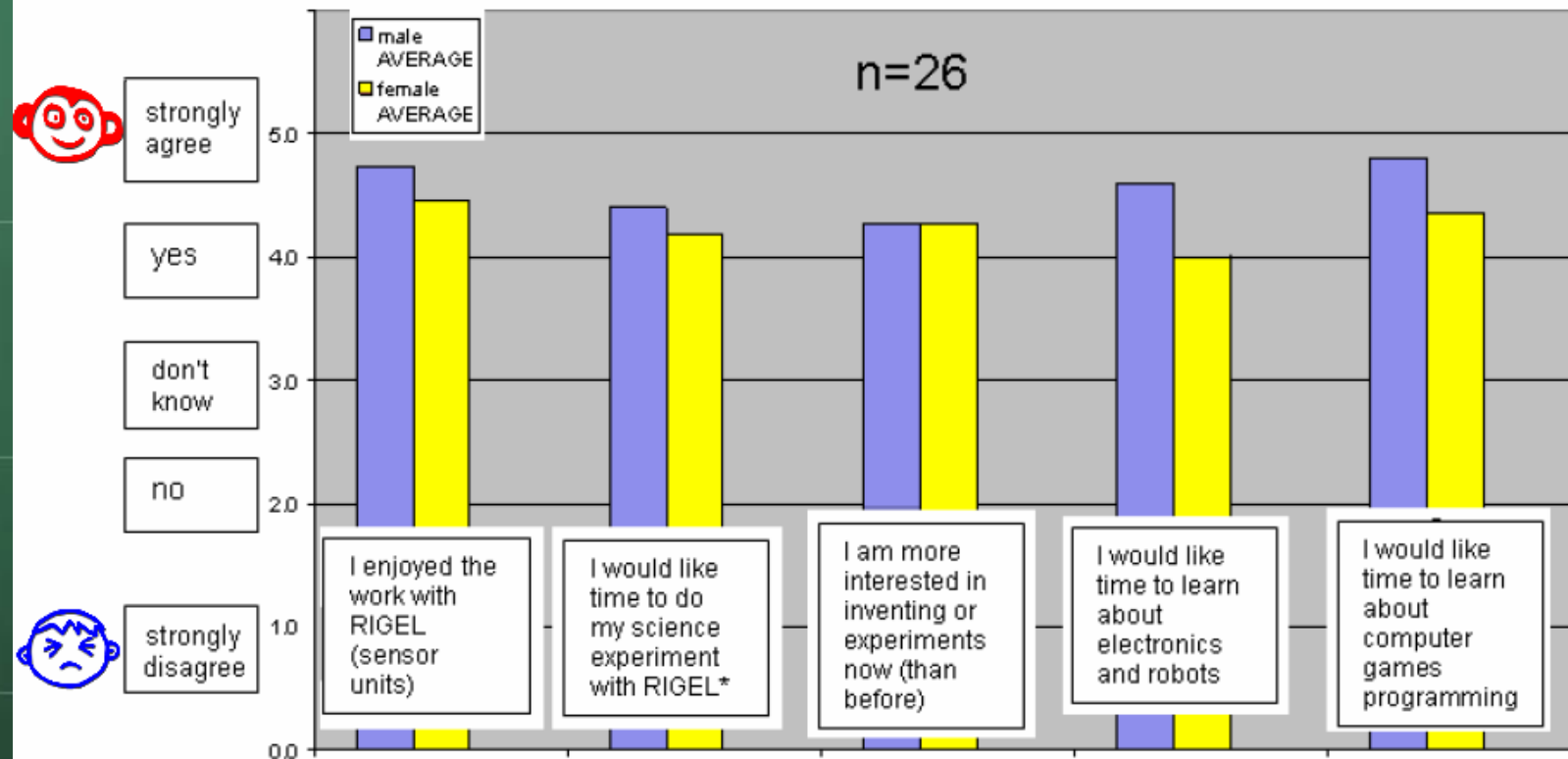
Figure 13: Results of Year 7/8 survey

Q1: NO students score less than 4
Q2: One student scored 3, all others 4 or more
Q3: Four students scored 3 or less, all others 4 or more
Q4: Two students scored 3, all others 4 or more
Q5: One student scored 3, all others 4 or more

85% of students learnt something new about science/technology or about themselves.

85% of students had changed their view of what scientists do or how they work.

Equally successful with Maori and Pakeha ethnic groups

Equally successful with boys and girls

Empowering the community

CONNECTED COMMUNITIES

Science & maths teachers	Cultures 'Ka hikitia'	world experts	local industry	home/farm marae

CONNECTED APPLICATIONS

Word PowerPoint Excel Access Explorer

TCP/IP
FTP
mobile web

serial or
USB link

THE CONNECTED CLASSROOM using RIGEL

Standalone handheld units

PC or networked units

CONNECTED PEDAGOGIES

Discovery learning
Problem based learning
Case studies
Science Fair Experiments
Authentic learning
NCEA focus
Constructivist
Positivist

CONNECTED TO SUCCESS

High level thinking   FUN!
High engagement
Changing attitudes
FUN!   Scholarships
Winning projects
FUN!   Authentic learning
Teamwork
Excitement

CONNECTED TECHNOLOGIES

mobile web	2D/3D games	2D/3D simulators	robotics	data logging	graphic calculators	industrial control

CONNECTED CURRICULUM

Sciences Fashion ICT Technology Gifted&talented
Mathematics Health&Fitness Art Special needs

CONNECTED ASSESSMENT

Assessment FOR learning	(portfolio; experiments)
Assessment OF learning	(summative; formative)

Use of a mobile technology to empower students and teachers.

Some of the work I do as an educator…

Empowering others…

Facilitating change…

Build communities of learning…

for example…

1. School

- E-Learning Fellow and ICT advisor

- Gifted and Talented students advisor

- Staff professional development facilitator

- Science and technology curriculum advisor

- Pandemic / Public Health advisor

- Ministry for the Environment *EnviroPower* renewable energy and power generation project technical advisor and educational research consultant

2. Taranaki region

- **Taranaki Science Fair organiser**

- **'Teachers as Leaders' professional development convenor**

- **Regional Game design contest and regional Robotics competitions...see next slide!**

2009 GAME CONTEST

Game Maker
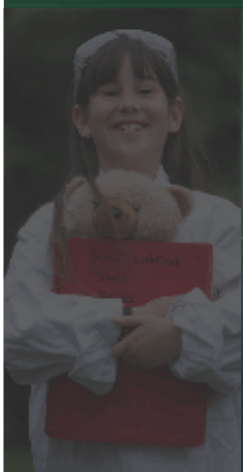
Are you ready kids?

**Enter your software in the Science Fair _AND_ the Bright Sparks contest...
THAT'S A CHANCE TO ENTER THREE CONTESTS WITH JUST ONE ENTRY!**

Design Categories:

- Educational **game** (eg, trip through the body, maths, history, reading, etc)
- Educational **simulator** (eg, planet orbits, chemical reactions, physics, etc)
- **Process control** (eg, transmitting and collect data to control a glasshouse)
- **Best application** software and novel use of Game Maker

Registration:

You must register your intention to submit a programme **by July 1st** 2009.
Registration forms, rules and ideas available at **www.nexusresearchgroup.com**

Contact Inglewood High School to attend Game Design classes for this contest.

Entries:

Entries must meet the requirements below and be received by **August 1st** 2005.

Entry requirements:

- **Original source code** using in Game Maker of Scratch must be submitted (eg, Game Maker acceptable formats include *.gmk or *.gm6). No installers will be accepted.
  Your programme MUST run under secure mode in Game Maker. That means your programme isn't executing external files (such as DLLs) and it isn't allowed to change or delete files outside the working folder it operates in.
- A **programme design document** (see General Rules and Conditions).
- Intellectual property and copyright belongs to the author(s). Original source code **will not** be distributed for any purpose other than judging without the author(s) permission. Runtime EXE versions of selected entries will be made available for downloading from the Nexus websites for promotional and teaching purposes.

Great prizes to be won!

NEXUS
Nexus Research Group
www.nexusresearchgroup.com

Download **Spongebob** and other games

Robots 2009 CONTEST

Primary, Intermediate, High School...and businesses!

**Enter your robot in the Science Fair _AND_ the Bright Sparks contest...
THAT'S A CHANCE TO ENTER THREE CONTESTS WITH JUST ONE ENTRY!**

Robot Categories:

- **Racing bots** (fastest on a straight track – no remote control permitted!)
- **Budget bots** (under $50 but with the as many abilities as possible)
- **Celebrity bots** (best mock-up of a famous robot from TV or film)

The TARDIS and a Dalek from 'Dr Who' will be making a guest appearance...

Registration:

You must register your intention to submit a robot **by July 1st** 2009.
Registration forms, rules and ideas available at **www.nexusresearchgroup.com**

**www.nexusresearchgroup.com
for entry forms and robot designs and circuits!
Contact Inglewood High School to attend a Robots workshop.**

Venue date and times:

The Robots 2009 event will be held **Sunday August 2nd 2009** from **11am to 3pm** at Inglewood High School.

Don't forget students...your robot can also be entered into the Science Fair the next day!

Great prizes to be won!

EXTERMINATE!

!
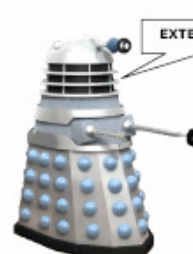
I'm off to get my registration form in!

NEXUS
Nexus Research Group
www.nexusresearchgroup.com

3. New Zealand

- **Conferences / broadcasts**

- **Publications/press articles/blog**

4. World-wide

☐ **Science/Technology/Education website**

☐ **Conferences/video**

☐ **International collaboration/consultation**

eg, United Kingdom, United States, Australia, Mexico, India...

Lastly…learning from others

- In New Zealand we have a concept of '**ako**' ; the educator is also learning from the student.

- Among Maori, 'ako' is grounded in the principle of reciprocity and also recognises that the learner and whänau (famliy) cannot be separated.

- Ako is about **productive partnerships** – Mäori students, whänau, hapü, iwi and educators sharing knowledge and expertise with each other to produce better mutual outcomes.

- Ako also acknowledges that **culture counts** – knowing, respecting and valuing who students are, where they come.

I hope to meet as many of you from overseas as possible…

I still have lots to learn myself…!

Mike :)