Effective Use of Technology

Chapter 4

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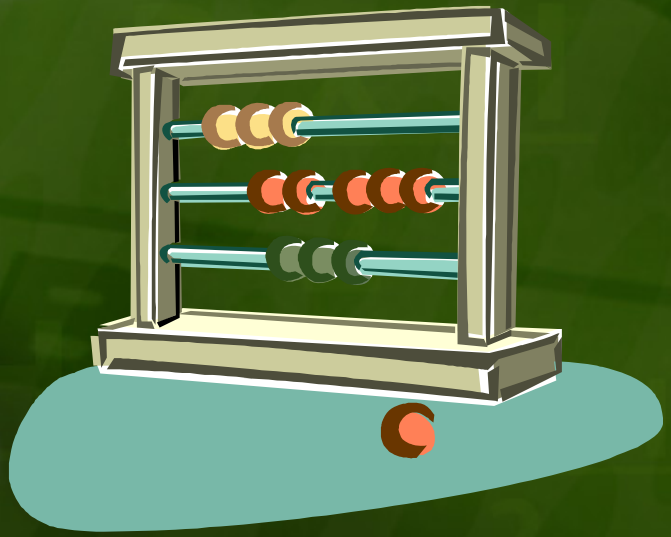


Technology and Mathematics

To become effective users of technology teachers need to make informed decisions about how and why to integrate different types of technology into their classroom practice – the ideal arrangement and use will support students' learning of mathematics.

Technology can be:

- **Master** – students can become dependent on technology; teachers may feel restricted in their knowledge
- **Servant** – can be used as a fast, reliable replacement for pen and paper calculations
- **Partner** – can facilitate understanding and provide new perspectives

- Ideally technology is an **extension of self** when it is integrated into course planning and everyday lessons – it can seamlessly underscore concepts and allow students the freedom to explore and enhance their understanding.

Factors influencing technology use:

- Previous skill/experience in working with technology
- General pedagogical beliefs
- Access to hardware, software, and tech support
- Students (perceived abilities, motivation, behaviour)

Advantages

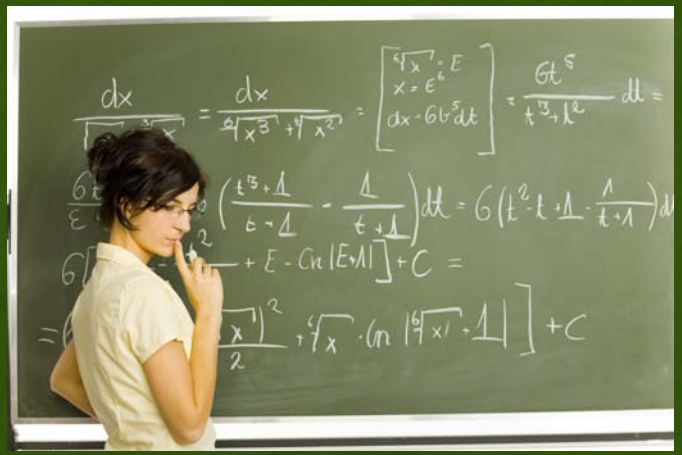
- Learning can be enhanced "by encouraging an understanding of mathematics as richly connected concepts (Goos, Stillman, Vale, p.76)"
- Technology supports and extends mathematics lessons by providing immediate visualization - particularly useful for visual learners

- More possibilities for data collection: larger sets, more realistic examples, such as instruments that measure temperature
- Possibilities for displaying connections to foster interdisciplinary study
- Many additional online resources are available for lesson enrichment

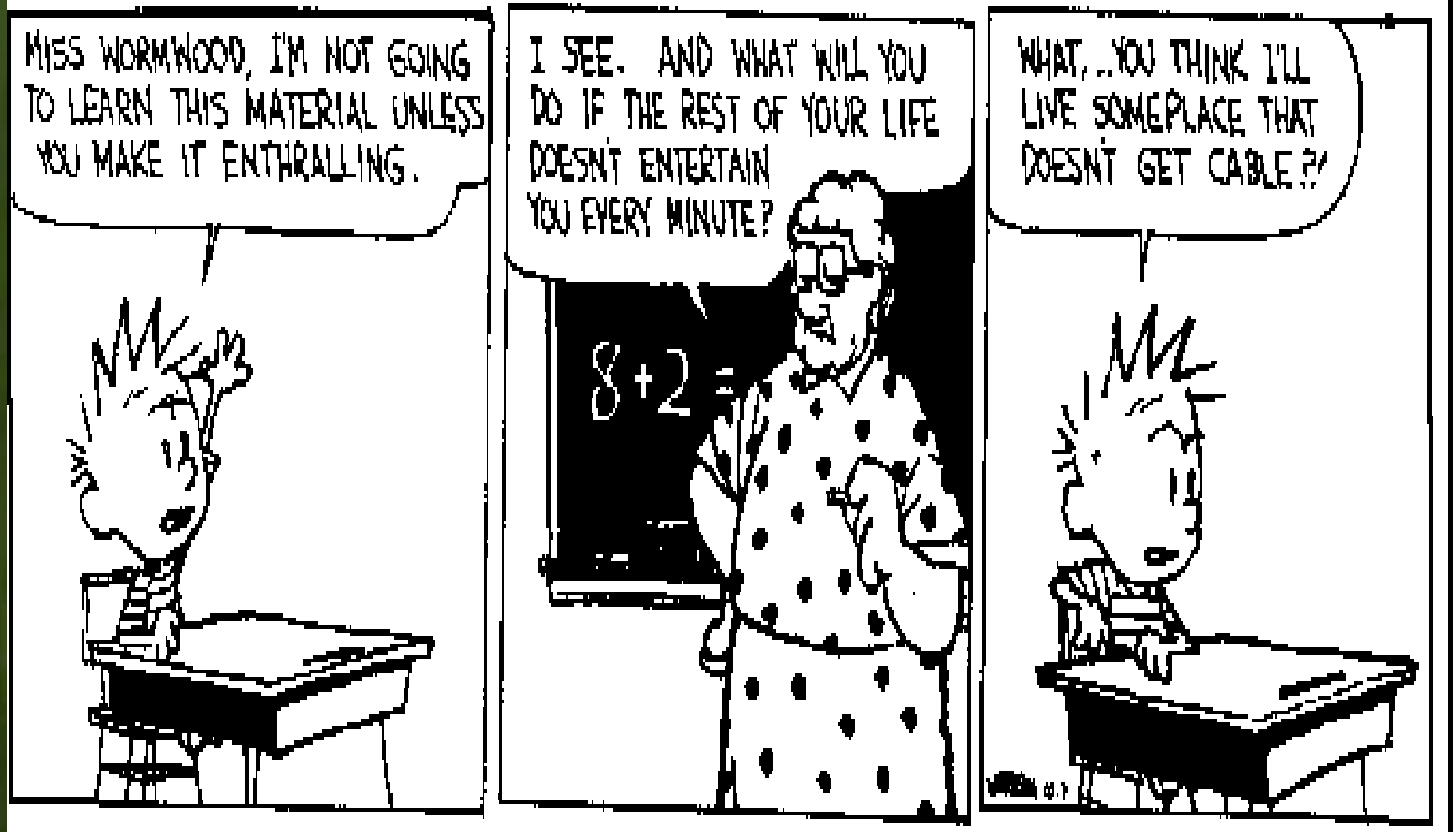
Disadvantages

- Curriculum design can easily lose focus through technology use. Extra effort required to keep emphasis on students' learning and to maintain investigative learning environment
- Rapid change in technology requires teachers to continuously update their knowledge

- Students may not learn to justify their reasoning or observations without careful teacher intervention; they may become dependent on the technology
- Budget restraints may restrict use of technology in math curriculum



Calvin and Hobbes



Potential benefits

- Learning from instant feedback
- Observing patterns
- Making connections between multiple representations
- Working with dynamic images
- Exploring simulated or authentic data
- Visualization
- Finding and sharing mathematics

Useful technologies

- Calculator (graphing)
- Excel
- GeoGebra
- SMARTboard technology
- Tools such as Anim8or and KompoZer
- Various interactive math websites
- Internet forums (for students and teachers)

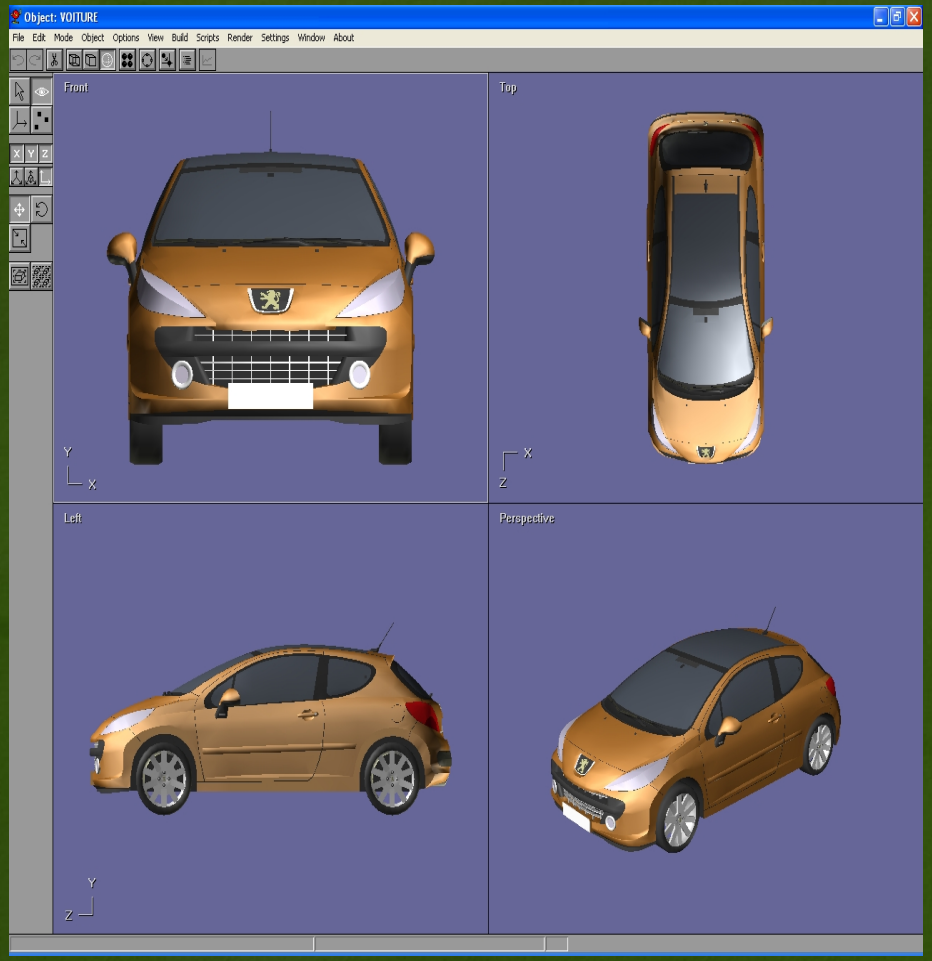
Anim8or and KompoZer

Using software to visually explain certain math topics

- For example, there is a software program that uses 3-dimensional graphics to create animated objects and figures.
- This program is called Anim8or.

- Its small size, ease of use and easy-to-follow tutorials make it a gateway into the world of 3D graphics for many computer users who normally would never get a chance to try their hand at modelling and animation.

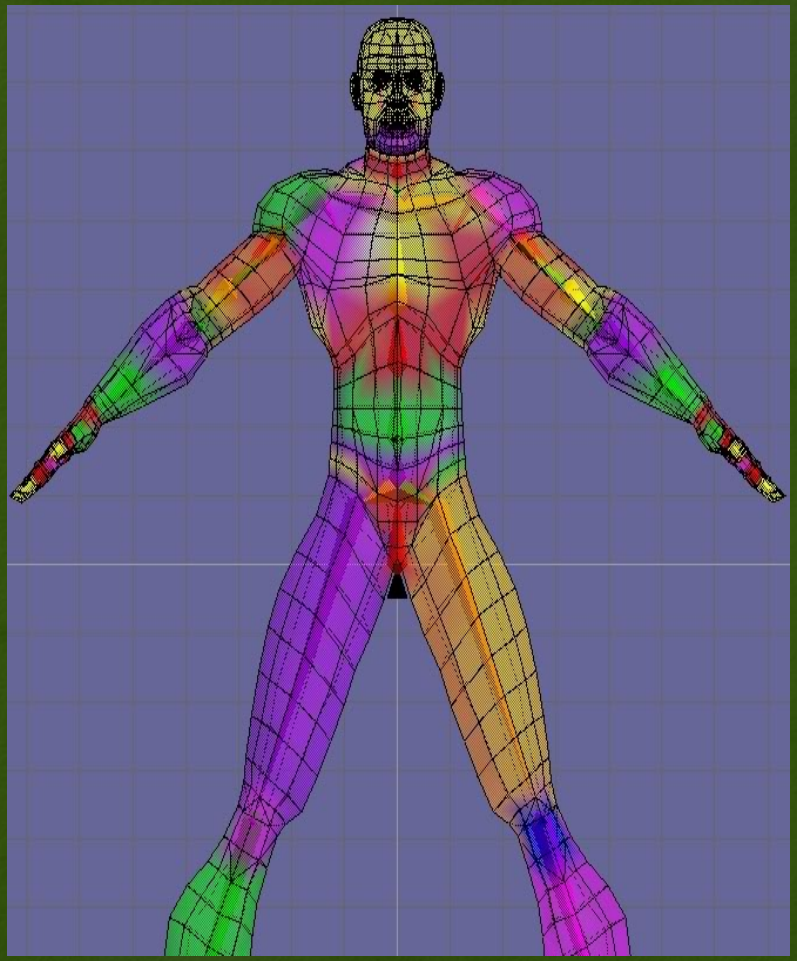
Incorporating Anim8or into the math classroom.



Transformational Techniques

- The use of Anim8or can show how graphs translate, rotate, and reflect by changing coordinates.
- If we first show a geometric object in Anim8r such as a rectangle, we can then use Anim8or to show how these objects can rotate, translate and reflect over a graph.
- Tutorials in Anim8or might help here.

Showing Symmetry



Showing Symmetry (ctd)

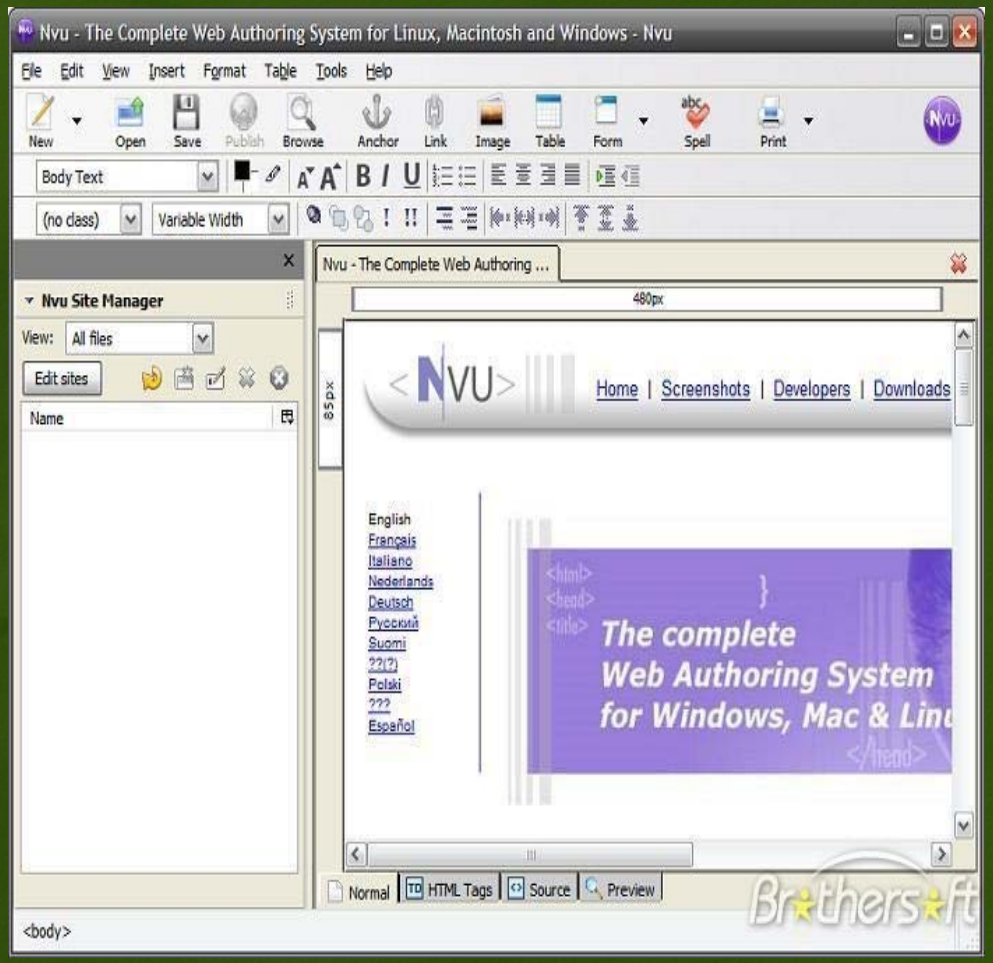
- The previous slide can be used as an example of how to use Anim8or to explain symmetry of objects.
- In the previous example, the human object can show symmetry or even a reflection of an object along the y-axis.

Using web pages to keep organized

- Another useful piece of software is a program called KompoZer.

- This program allows people to create their own web pages from scratch, starting with an empty shell and finishing with a web page along with titles, links, etc.

Keeping organized with KompoZer



Useful for teachers!

- Teachers might find KompoZer useful for creating class web pages along with keeping track of student records.
- Teachers would be able to post notes, notices and tutorials which the students could access from home.

Useful for students!

- Teachers could get students to create their own web pages to keep themselves organized.
- They could also get the students to create a digital portfolio which they could place on their web page and update when they need to.
- Also, students could use this software to organize everything they collected over the school year into their own personal website which could help them prepare for their final exams.

Web-Pages and Programming

Web-Pages

- KompoZer is a free software available to everyone to easily create web-pages.
- It has many purposes and uses as it pertains to the classroom.
- All course material and information the student would need can be posted here.
- For example all the students' assignments, homework, course evaluation, etc.

Web-Pages

- It keeps everything organized and in one centralized place.
- Students often lose paper copies of things.
- A web-page gives them easy access to all files, you don't have 10 students asking the teacher for an extra copy because they are gone.
- In general it is a good form of communication outside of class.

Programming

- All recent math majors had to do a computing course in programming.
- Every numerical mathematical problem can be written as a program to help in the problem solving experience.
- You can link these programs to your web-page where they can assist students in solving problems.

Programming

- I have constructed 3 such examples that you will see shortly on Quadratics, Volume, and Radians.
- There are hundreds of examples in the back of each high school text book with no solutions.
- Such programs can help students check their answers against the computers.
- It gives them the opportunity to go back over their work and find errors if there were any to try and give a better understanding of the material.

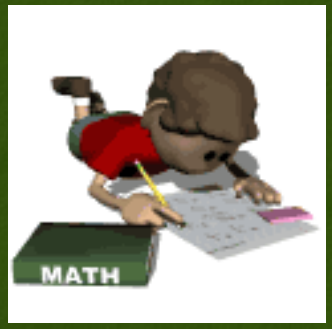
Programming

- We don't expect the students to know how it works, once it is linked off of your web-page the student never has to see the code.
- ***Some downfalls***
- Students might try to use this tool to do their work for them, but in math there is more than just the final answer.
- Also as I will demonstrate now, you can make a program refuse to answer certain questions, like the ones on an assignment for example.

SMARTboards

Benefits

- Appeals to visual/touch learners (visualisation and interaction)
- Can be used outside of classroom time by the teacher (for planning)
- Makes **all** games more interactive



Limits

- Many materials for primary/elementary, somewhat limited for intermediate/secondary
- Requires students to “go up to the board”
- Many broken links online
- The software for the SMARTboard must be installed on the computer you are using, otherwise it’s the same as a projector

“Ink layer”

- Imagine an overhead on top of a text book for taking notes or drawing a diagram
- “Markers” and “eraser”
  - Sensors for touch so the “markers” and “eraser” don’t actually do anything, so you can use your finger
  - Another option if “markers” go missing is the side bar on the left side of the screen
- Right mouse button and keyboard button near where “markers” are kept so you have access to all the keys you would normally be able to use
- May take screenshots or videos of your work (to keep track of student progress or for personal research)
- Lots of training available on the SMART website (some of which is free)

http://www.education.smarttech.com

- This website offers free resources specific to Canada and some provinces (not Newfoundland).
- Click on the “Educator Resources” tab, then under “Lesson activities” click on “SMART Response Question Sets” which will take you to
- http://www.education.smarttech.com/ste/en-US/Ed+Resource/Lesson+activities/Senteo/CA.htm
- Also note that some resources may be downloaded in French

- http://standards.nctm.org/document/eexamples/chap6/6.5/
- can be used to look up lesson plans (includes interactive activities)

- http://library.thinkquest.org/C006354/match.html
- math game, beginner-expert asking math multiple choice questions

- http://woodgears.ca/eyeball/
- useful for students to practice visualizing parallelograms, bisecting angles, etc.

- http://www.crayonphysics.com/
- Crayon Physics – a very interactive game that can be used with or without a SMART board to encourage problem solving

In conclusion…

Technology helps subject matter become immediately relevant to students, as well as helps visualization.

There are many forms of technology and countless uses in the classroom – teachers are limited only by their imagination and resourcefulness!