

The 21st Century Classroom



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Peter Niass, a former science teacher, is an education consultant with Keepad Interactive and has a strong interest and expertise in how technology can enhance pedagogy in the classroom.

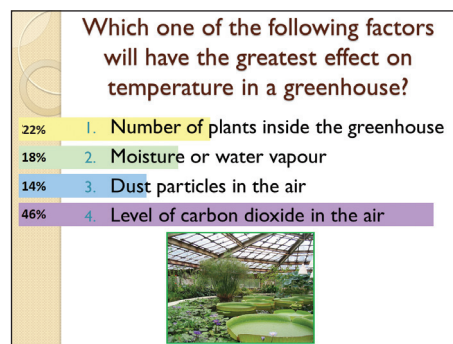
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“Which one of the following factors will have the greatest effect on the temperature in a greenhouse?”

- A) Number of plants inside the greenhouse
- B) Moisture or water vapour
- C) Dust particles in the air
- D) Level of carbon dioxide in the air

This question is a TurningPoint slide question projected onto an eBeam Interactive Whiteboard (IWB) in a 21st century secondary school science classroom. Familiar with the TurningPoint Student Response Systems, students quickly answer via their wireless TurningPoint Keypads and their votes are instantly projected onto the eBeam IWB via an Epson EB-450W projector; with the following results:

- A) Number of plants inside the greenhouse -22% [6 votes]
- B) Moisture or water vapour -18% [5 votes]
- C) Dust particles in the air -14% [4 votes]
- D) Level of carbon dioxide in the air - 46% [13 votes]



Now with all 28 students committed to a position, the teacher offers the class an activity-based learning opportunity to explore the question further; especially considering the majority of students answered incorrectly.

To begin exploring the list of factors for the experimental answer, a sun lamp is shone on two identical glass jars, each with a temperature probe inserted and connected to a Fourier Data-logger device. The screen of the Fourier Data-logger shows two real-time temperature graphs simultaneously. When the lamp is turned on the temperature graphs steadily rise to show the same increased temperature reading.



The teacher uses an Epson DC11 Document Camera (Visualiser) to project an image of the experiment onto the eBeam IWB for the class to observe. Digital snapshots and video are taken on the Epson DC11 unit at various times of the investigation to record proceedings, with the teacher making annotations with virtual ink on the IWB to highlight the key data-logger points. The teacher informs the class that she will make the digital content available to the students for inclusion in their report to be completed for homework.

The teacher then adds a potted plant to one of the jars, leaving the other empty, and shows the results live on the eBeam IWB. The reaction of the students confirmed that the majority were surprised by the unexpected result. It was clear that the student's popular prediction of carbon dioxide having the greatest effect on temperature increase is incorrect, and the jar with the plant was clearly warmer due to the greater biomass.

At various intervals throughout the lesson the teacher initiated group discussions and peer instruction to discuss, rationalise and debate the results. The mixed and surprising results challenged the students to explain their observations, and the teacher-led discussions were both lively and informative.

Now the teacher re-polls the class on the original question and all 28 students selected the correct answer. This is a good example of how using data loggers to collect empirical evidence can teach and clarify common misconceptions about science. It is also a good example of how technology such as IWB's, Student Response Systems, Projectors, Document Cameras and Data-loggers can enhance pedagogy.

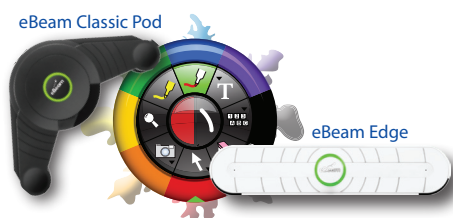
This scenario also provides a view into the teaching modality of the modern 21st Century Classroom. It is an example of an interactive learning community; a place where the learning is taking place in an organic and interactive way, where students are engaged and have a voice in the learning process.

Students can monitor their own understanding levels against that of their peers in a low key non-embarrassing manner. Teachers can monitor understanding levels and formally or informally assess students whilst gaining timely and valuable feedback that allows them to proactively intervene in the learning cycle (formative assessment); rather than find out too late that the required skills, knowledge and understanding levels have not been achieved.

Interactive teaching and presentation technologies are turning the classroom into a positive, effective, engaging and fun learning community. So let's further explore the teaching enhancing technologies from the above scenario:

eBeam Interactive Whiteboards: are now a focal point of the 21st Century Classroom. The modern day IWB is highly portable, marker pen friendly and can readily convert any existing passive whiteboard or smooth flat surface into a fully interactive workspace. It can be placed in your carry bag and can be taken from classroom to classroom. It is also often installed on a semi-permanent basis in designated classrooms and can operate with any data projector or work as a digital copy-board in its own right.

There are two eBeam IWB models, the eBeam Classic Pod and the eBeam Edge that offer an easy to learn and use tool palette interface and has a large interactive area of 2.4m and 2.7m respectively. Both models offer USB connectivity and are available with optional Bluetooth for cable free operation. The following two software modes are available with each model:



eBeam Projection mode: for use with a data projector providing the ability to annotate with "digital ink" directly over any rich, live or web based content projected onto your whiteboard. With Projection mode you receive the powerful Scrapbook, Record & Playback, Handwriting Recognition, Gallery, Onscreen Keyboard and Board-casting functionality. Board-casting, also referred to as Data-conferencing, allows you to share multiple interactive workspaces via the internet whether the eBeam IWB's are located in the same building, city or internationally. Students can also log-in to a meeting share session and observe the lesson from their computer.

eBeam Whiteboard Mode: allows operation of the same eBeam Classic or Edge IWB without a Data Projector. The Capture Software mode acts like a digital copy-board and allows the teacher to digitally capture all notes made with normal marker pens (in special sleeves) on the standard whiteboard directly to their computer.

To allow a teacher to roam the classroom whilst still operating the eBeam IWB, introduce the eBeam Inscribe 200e Wireless Tablet, as it contains the tool palette functionality allowing interactive control of the IWB from anywhere in the classroom. Hand the Inscribe unit to a student and have both the teacher and student interacting in the same interactive workspace session.

The eBeam IWB suite ranges in price from under \$800 to \$1400 ex GST depending on the model whilst the eBeam Inscribe 200e Tablet is priced around \$375 ex GST.

Data Projectors (including Interactive models):

Data projectors come in many form factors and brightness levels and have two major projection technologies - 3LCD and DLP and two major aspects - XGA (4:3) and the widescreen WXGA (16:10). Data Projectors like the Epson 455Wi are interactive and, like the eBeam IWB, will turn your passive whiteboard into an interactive workspace.



Epson EB-450W / 455Wi

For use in teaching, where you need the best compromise between computer text, images, web, video use and colour brightness, we recommend the Epson 3LCD range with a WXGA aspect as that better suits whiteboard use (wide format) and also reflects the native WXGA resolution of notebook computers. Wherever possible, we recommend mounting Short Throw (ST) and Ultra Short Throw (UST) projectors on the wall above the whiteboard to minimise the shadow effect. We recommend the following Epson projectors for classroom use: EB-1760W [portable], EB-1915W & EB-1925W [desktop or ceiling installation], EB-410W (ST), EB-450W (UST) and EB-455Wi [Interactive UST]. These recommended Epson models range in price between \$1,200 and \$2,400 ex GST.

Student Response Systems: To turn a classroom into a fully interactive learning community add a Student Response System (SRS). A SRS is a standalone highly portable polling system that allows students to answer questions and share opinions in real time. A SRS generally consists of wireless hardware in the form of Keypads, a USB Receiver and polling software of varying capabilities and pricing. Teachers can conduct both "Formative and Summative Assessment" with an SRS or just extract opinions and understanding levels in a low key non-confrontational manner.



A SRS is the most engaging technology available to educators today as it gives every student a voice and creates a truly connected learning community. The use of a SRS promotes the silent majority and allows teachers to monitor the pace of a lesson whilst seamlessly elevating the engagement levels of the students. A SRS should provide instant anonymous (informal) or disclosed (formal) assessment functionality.

A good SRS will have a variety of functional and reliable interoperable keypad input devices at various price points, to cater for wireless or web enabled device compatibility, operate over a broad spectrum of channels, connect remote participants and locations, handle large volumes of responses instantly and integrate into common Learning Management Systems (LMS) like Moodle and Blackboard.

The TurningPoint 2008 software seamlessly integrates with the world leading presentation software in MS PowerPoint whilst the TurningPoint Anywhere software will allow voting to occur over any computer software application making it ideal for IWB use. The TurningPoint SRS comes in credit card sized keypads, assessment and text answer based NXT Keypads and as a ResponseWare web enabled software app for notebooks and smartphone devices. TurningPoint includes TestingPoint and TurningKey

for assessment and provides powerful reporting functionality with over 30 powerful reports that can be generated in Excel or exported as a CSV file. The TurningPoint Suite also contains Remote Poll that allows concurrent polling sessions held in different geographic locations to be run as a single session over an internet connection.

The TurningPoint SRS is the most powerful on the market and yet is easy to learn and use; enabling teachers to write questions on the fly with ease. From a communications perspective the RF Keypads can operate over 82 different RF channels with a range of 70 metres. Teachers can also utilise the handheld TurningPoint Anywhere Receiver that will collect and display all responses without the need for a computer; perfect for impromptu polling sessions or for use on a bus, museum excursion or field trip.

The world leading TurningPoint SRS offers Infra-red (IR), Radio Frequency (RF), and web enabled connectivity and costs from \$1,200 to \$2,900 ex GST for a 30 Keypad Kit depending on configuration.

Document Cameras / Visualisers: In days of old, a flat overhead projector was used to project books, transparencies or sheets of paper onto a screen. Today, a digital version of this technology is available in the form of a Document Camera (Visualiser) which is able to capture a 2D or 3D image digitally as stills, or even record an event as a movie. This gives the teacher an engaging and highly visual tool to capture, save and present information (content creation) that can be projected directly to the IWB.



We recommend the highly portable Epson DC06 (2MP) Document Camera for normal use or the Epson DC11 (5MP) for use where higher resolution or time lapse photography is required for experiments or for use with a microscope etc. Document Cameras are now very affordable and cost from around \$425 to \$650 ex GST.

Data Loggers / Sensors: The best way to understand science is to "Do Science"! There is no better way to experience the scientific process than by using data loggers to generate accurate and useful results for an experiment. The Fourier Nova 5000 Data Logger is a full colour touch screen computer designed for laboratory use and rugged outdoor field conditions. For schools with available computers, Fourier offers the impressive low cost USBLink which connects up to 4 sensors to a PC or laptop to allow the same type of functionality as a Nova5000. Leading the way with mobile devices, the Nova Air, allows students to wirelessly connect their sensors to an iPod, iPhone or iPad. Their results can be emailed directly from the field to lab based computers. Fourier data-loggers include the award winning MultiLab software and have over 65 sensors available.

Fourier also offers the complete learning solution like the physics based Dynamics System that is ideal for students to experience scientific concepts including: Kinematics, Dynamics, Newton's Law, Impulse & Momentum etc. Pricing ranges from around \$19 for an entry level sensor up to \$799 Ex GST for a full computerised standalone data-logger with touchscreen.

Learning is an interactive and organic process. The interactive and engaging technologies available today are completely redefining how we teach and learn. The modern, interactive 21st Century Classroom is far more dynamic and empowers teachers and students to create an engaging and enjoyable community based learning experience. ☺