

Adopting Educational Technology Solutions

LEVERAGING TECHNOLOGY IN SUPPORT OF TEACHING AND LEARNING

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Contents

Teaching Maturity - Integration of Technology in Support of In-Class Teaching and Learning.....	2
Where are Educators and Learners Today	2
SAMR Model.....	2
Technology Integration Matrix.....	2
Educator and Learner Foundation Teaching Skills	3
Progressive Technology Competency Development.....	5
“Blackboards” - Chalk and talk interaction.....	5
Text Books, eBooks and Hand-outs - distribution and referencing in-class.	6
Overhead Projectors and Slide Projectors.....	6
Computer driven presentations with Projection.....	6
Interactive Whiteboards in support of in-class learning.	7
Computer Supported Individual in-class learning	8
Computer Supported Collaborative in-class learning.....	9
Multi-classroom and Distance Learning.	9

Teaching Maturity - Integration of Technology in Support of In-Class Teaching and Learning

Where are Educators and Learners Today

It is important to understand the current teaching maturity level with respect to the adoption of technology in the class environment being targeted.

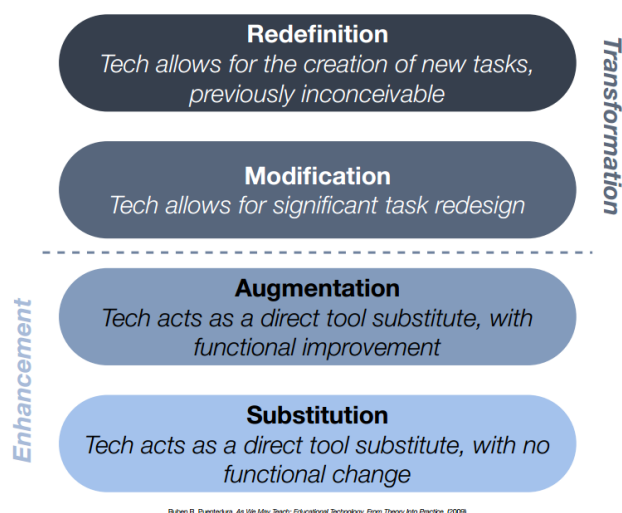
Over the years teaching methods in support of learning have embraced technology to positively impact both efficiency and effectiveness. The adoption and application of technology progresses through multiple stages, and requires continuous professional development in order to apply each new development effectively. Assessing technology adoption and usage in class should include assessments of educators and learners.

Considering in-class teaching, individual educators may have had access to, and embraced, certain lesson presentation and interaction management technologies and will be at different levels of competency in applying them. When considering the implementation and adoption of computer supported teaching, computer supported individual learning and collaborative learning, this can be seen as a progression and mastery of each step on the way will drive effective integration and sustainable adoption. It is key that the current level of educator competency be considered when implementing a new solution. Assuming compliance with competency levels can present problems with adoption, effective use of, and derivation of maximum benefit from technology solutions, unless training and professional development is part of the transition process.

Initial focus should be on the development of educator with respect to technology supported teaching competencies, before focusing on equipping learners with technology tools for in-class learning.

SAMR Model

One model used as an adoption indication reference is the SAMR model developed by Dr. Ruben Puentedura <http://www.hippasus.com/>. The SAMR model shows development in adoption of technology through 2 enhancement stages (Substitution and Augmentation) to 2 transformation stages (Modification and Redefinition).



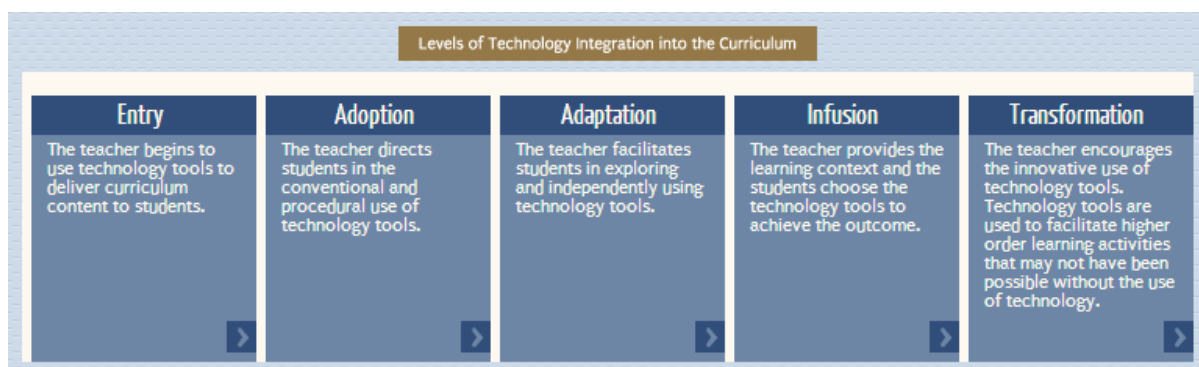
Ruben R. Puentedura, As We May Teach: Educational Technology, From Theory Into Practice. (2009)

Technology Integration Matrix

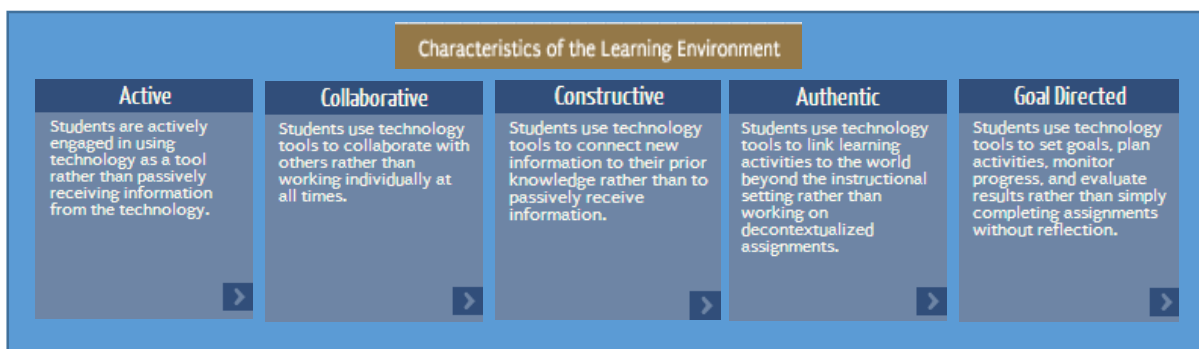
For a more thorough and encompassing example of adoption or technology usage maturity model, refer to the [Technology Integration Matrix \(TIM\)](#) TIM is as an excellent approach for evaluating technology adoption in support of teaching and learning and was developed in by the Florida Centre for Instructional Technology. TIM shows educator and learner progression in terms of technology integration and usage.

Five “Levels of Technology Integration” (Adoption, Adaptation, Infusion and finally Transformation) can be combined in a matrix with five “Characteristics of the Learning Environments” (Active, Collaborative, Constructive, Authentic and Goal Directed).

The “Levels of Technology Integration into the Curriculum” relate specifically to the roles of the teacher as a deliverer of content, a coach, a facilitator, a context creator and a driver of higher order learning.



The “Characteristics of the Learning Environment” relate specifically to learners use of technology.



Note that the SAMR and TIM models address a fully integrated technology supported educational model where educators and learners embrace and exploit technology to not only support but also transform teaching and learning.

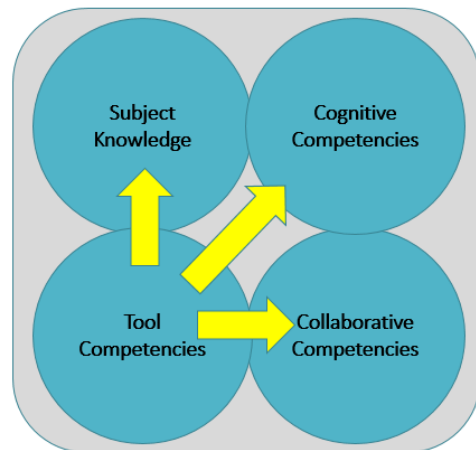
Models can assist greatly in determining a baseline representing educator and learners current level of adoption and application of technology. Used a reference, progress can then planned, guided and tracked using such models.

Educator and Learner Foundation Teaching Skills

Educators and Learners need to build subject matter knowledge, develop their cognitive competencies and collaborative competencies. Tools, computers and interactive technologies, may assist in each of these three areas if educators and learners develop appropriate tool competencies and are able to apply the tools effectively.

Educators must have teaching skills that support effective learning, before considering the application of technology in support of their teaching efforts. These foundation skills would include:

- verbal and written communication and language skills
- ability to speak clearly and build visual context by writing and drawing legibly on teaching surfaces at appropriate size for readability anywhere in the class
- preparation and production of curriculum aligned learning materials
- facilitation of a learning environment
- sequencing and controlled release of learning material to support progressive conceptual development, monitoring, assessing and guiding learners
- management of learner engagement and focus.



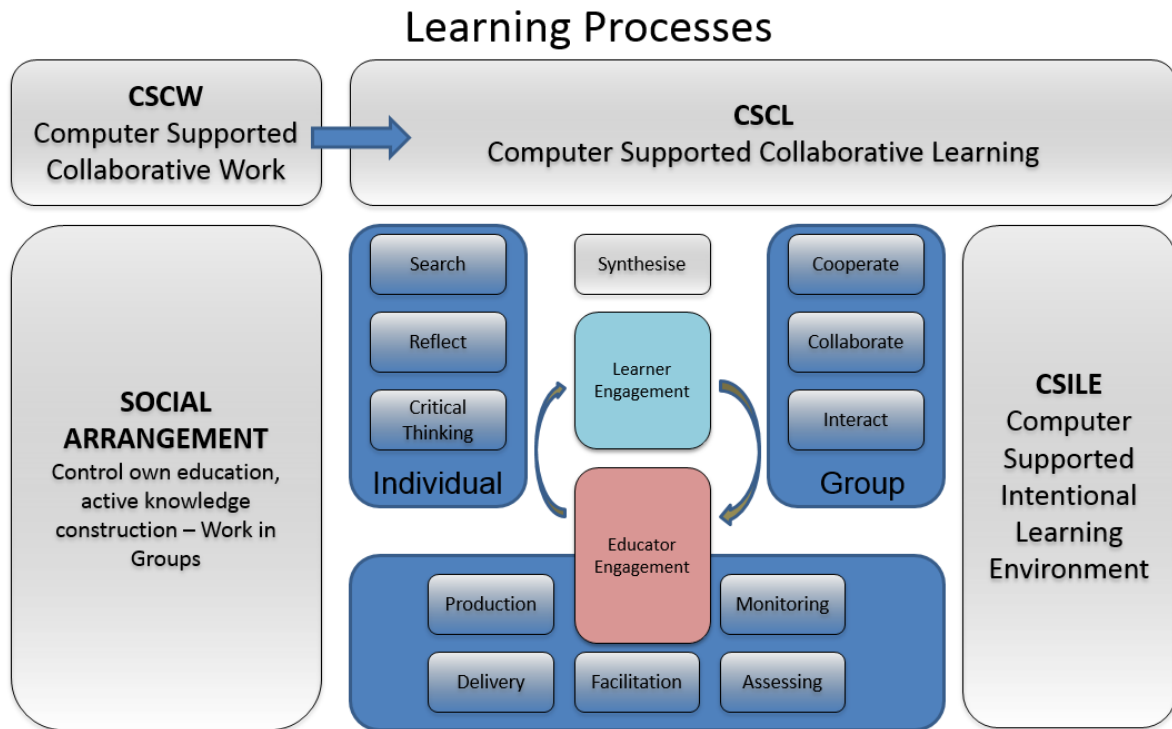
Learners must have appropriate learning skills. Independently of technology, learners must be able to:

- search for and identify relevant learning content
- critically evaluate information
- synthesise what is taught
- reflect on their own learning approach and progress
- take ownership of their own learning

When not working independently, educators and learners must be to communicate and interact effectively with others, cooperating and collaborating as and when required.

Work planning, time management, realistic goal setting, learning and study methods should be developed by learners with support from educators.

While technology can assist, the underlying considerations are that learning is an intentional process requiring active participation of learners in accordance with a social arrangement between learners and the educator. In an educator driven environment, the educator guides the learners along a development path from where they are to a targeted and defined outcome. On this journey, technology can be used to support teaching and learning, in each of the areas shown in the diagram below. If the use of technology is not specifically purposed to benefit any of the process areas in terms of effectiveness or efficiency, one should question the motivation for use.



Progressive Technology Competency Development

Educators and learners may choose to use technology to support their teaching and learning processes. Mastery of one level of competency allows for progression to the next level.

Taking a simplistic view of in-class technology adoption modelling, the following stages of technology competency development may also be considered:

- “Blackboards” - Chalk and talk interaction
- Text Books, eBooks and Hand-outs - distribution and referencing in-class
- Overhead Projectors and Slide Projectors”
- Computer driven presentations with Projection
- Interactive Whiteboards in support of in-class learning
- Computer Supported Individual in-class learning
- Computer Supported Collaborative in-class learning
- Computer Supported Multi-classroom and distance learning.

“Blackboards” - Chalk and talk interaction.

For centuries,

- Non-verbal lesson content is shared with learners as the educator writes or draws on a surface. Surface must be of suitable size and position for all learners to be able to view and read from learning positions in the class.
- Surfaces (slate / metal / glass etc.), and their colour (black / green / white etc.), have changed over the years. Modern whiteboards, with the use of coloured pens are simply an extension of a traditional chalk writing approach.
- A primary outcome using this approach is that educator time is spent during a lesson transferring information onto a board surface, and learner time is spent writing down or

making notes. This time could be spent engaging in more meaningful and beneficial interaction to stimulate participation and active learning processes.

- While an educator may have lessons prepared in advance, delivery is inhibited by the medium, and method of information transfer.
- A benefit of using this approach is that the release and flow of information is fully in the hands of the educator. No competing content sources or materials are in the hands of learners to distract them.

Text Books, eBooks and Hand-outs - distribution and referencing in-class.

- Benefits of using pre-prepared, and re-usable lesson materials include the consistency of quality as well as the reduction in time required to make content available to learners. Additionally, if learners are able to continue to have access to the materials, they may engage further in their own time.
- Using hand-outs or referencing text books or eBooks passes control to learners in terms of their attention focus. This is appropriate at times but may not be ideal for interactive and controlled engagement between educator and learners.
- Technology, as a platform for presenting eBooks is similar to text book distribution, but potentially opens the door to distraction due to the flexible application potential of learner devices. See section on Computer Supported Individual in-class learning.

Overhead Projectors and Slide Projectors.

- This is fundamentally different to using hand-outs as the educator can be in full control of information release and flow.
- Educators project through slides or transparencies onto an appropriate surface.
- This allowed educators to prepare learning objects and materials in advance and use them in class. Materials could also be re-used. Transparencies could be printed from a computer or hand-drawn, or may be used dynamically by educator writing or drawing on a transparency in class.
- The projection surface may have been a non-glare screen specific to the purpose, or simply a white or light coloured wall surface or standard whiteboard. As with all projection systems, consideration must be given to reflections and shadows, and presenters / educators needed to learn presentation techniques to ensure effective use.
- Skills needed here include blackboards skills as well as the ability to:
 - setup projector (positioning and focus)
 - control one's own positioning to avoid shadow challenges and obstructing the view of the projected image
 - control partial display or concealment of content
 - use of pointers to manage learner attention
- These skills set a good foundation for the introduction of computer driven presentations.

Computer driven presentations with Projection

Here a projector is used by the educator to share computer display content with audience / learners, but there is no direct interaction on the projection surface.

- SAMR – Substitution: From a SAMR model perspective, this may initially be considered as tool substitution, moving from overheads or slides to simply projecting a static slide presentation prepared in advance of the lesson on a computer.
- SAMR – Augmentation: Going beyond substitution to an augmentation approach, using a computer may allow for richer content, audio and video, to be included in a presentation through links or embedded content.
- SAMR – Modification: Looking at SAMR from a modification perspective, this allows for dynamic content display, not restricted to a pre-prepared presentation, use of electronic media and content services, either on the computer or if connected to a network or the internet, using external content portals. The educator may adapt interaction based on activity in-class and not be limited to following a fixed pre-planned flow.
- The biggest challenge with this approach is that the learner engagement may remain passive consumers of information, and in many cases the educator may be tied to the computer position and lose contact and control of class interaction.
- Skills needed for presentation using a projector include the ability to:
 - setup a data projector (position and focus)
 - control lights and room environment to ensure visibility
 - use computer effectively to access and control what is displayed
 - connect projector and computer
 - use multimedia applications and audio-visual peripherals (speakers) if using rich media content
 - use laser pointers to draw attention to a part of projected content
 - use presentation control devices (remote clickers) to enable educator to be freed up from sitting at computer and thereby enhance face to face engagement with learners
- Skills needed for locating or producing presentable learning objects (presentations and supporting materials) include:
 - Competence in the effective and relevant use of learning object production software for building presentations, documents and other relevant material.
 - Competence in using the internet, production applications, educationally appropriate portals as well as search tools and individual “cloud” services for storage and retrieval.
 - where educators are to do production of rich media learning objects (incorporating video and audio), they will need additional skills including ability to connect and use audio-visual peripherals such as microphones and cameras, visualizers (document cameras), specialised educational accessories (microscopes, probes) etc.
- These skills are key to underpinning the ability to embrace the use of interactive whiteboards and the various modes of use they present.

[Interactive Whiteboards in support of in-class learning.](#)

While Interactive Whiteboards may be considered as a simple extension beyond a traditional chalkboard, there are a number of development steps that educators need to master to ensure their effective and optimal use. Educators, individually, will have different levels of mastery and will be comfortable with different approaches and applications of Interactive Whiteboards.

- SAMR – Substitution / Augmentation: Considering the SAMR model, some educators will see Interactive Whiteboards simply as a “Substitution or Augmentation Tool” that may enhance some teaching activities.

- SAMR – Modification / Redefinition: Other educators may rise to see the potential for "Modification or Redefinition" of teaching activities, thereby facilitating a transformation in their learning environment.
- The level of adoption, and the ultimate outcomes are determined by the educators in question based on their readiness and willingness to embrace and be challenged by the application and potential of technology in support of their teaching methods and within their learning environments.
- A primary benefit of using interactive whiteboard solutions is that the educator can move from behind a computer to be in front of class as before. This improves contact between the educator and the learners, encourages interaction, and enhances the ability to control the class environment.
- The educators, and (under the control of the educator), the learners, are able to control the computer at the whiteboard or surface; interact with applications; annotate over presentation content; move between computer control and whiteboard function; use and exploit capability of multiple 'virtual whiteboards'; capture content for recall and reuse; recall earlier content where required; save and distribute content as appropriate etc.
- Educator skills required include skills mentioned earlier as well as the ability to:
 - setup computer connections with interactive whiteboard, projector and audio visual accessories
 - competently use the interactive application software for controlling computer
 - competently use the interactive application software to supporting interactive usage, annotating, use of value add learning aids, on screen ruler, protractor, charting, screen quizzes etc.
 - control class interaction and in learners engagement in an active learning scenario

Computer Supported Individual in-class learning

Moving from an area where all in-class technology has been at the disposal of the educator, we must consider placing technology in the hands of the learners. This is not the same as having a computer lab where learners are guided to acquire computer usage skills, typing, keyboard, mouse and application software training. What is being considered here, is the use of computers, by learners, to support learning relating to general curriculum subjects (Maths, Science, Language, History, Biology, Accounting etc.)

- Learners have own computing devices to support their learning activities
- Content on the learner devices, or accessible from the devices may include:
 - eBooks or other learning materials provided in support of lessons and subjects in accordance with prescribed curriculum
 - Endorsed third party supplementary content
 - Educator developed content
 - Learner developed content
 - Open content in the public domain
- Services on the learner devices, or accessible from the devices may include:
 - Application software for production, or reviewing of documents, presentations, and other learning objects
 - Applications for multimedia production and playback
 - Applications and utilities for browsing the internet, searching, cloud storage

As can be expected, computing devices in the hands of learners may contribute both positively and negatively. To ensure effective usage, educators should be in position to:

- Build trust and compliance between themselves and the learners to ensure a cooperative and productive learning environment can be sustained
- Manage learner participation and minimise distraction potential of learner devices
- Communicate electronically with learners, sharing of documents and content with them on their devices, and also being able to receive or collect learner work for assessment etc.

To facilitate learning using individual computing platforms, an infrastructure to support this must be in place, be reliable, and be secure.

- A network providing connection between educator and learner devices, and potentially an secure internet connection would be required
- Services to support communication between the educator and learners, as well as access for educators and learners to shared content repositories may be needed.

Computer Supported Collaborative in-class learning.

- This allows for the educator and learner computing platforms to be used together in a collaborative learning environment. Educator can allow learners to see educator content on own systems, as well as interact with educator content or share own content with other learners. The interactive whiteboard access can be at the board, or from any system in class that is connected to the collaborative session, controlled through the educators system.
- Skills required include the ability to:
 - connect to and support learners in connecting their systems to class networks
 - use classroom management software and collaboration software
 - guide learners in the use of required systems and applications
 - manage and moderate learner interaction and ensure purposeful participation of all learners
- Essentially the educator requires background knowledge and good skills in general ICT concept application including the general use and support of computers, tablets, interactive technologies, networks, the internet, web services etc.
- A computer supported collaborative learning environment places high demands on educators to guide learners in the effective application of technology aligned to the intentional learning objectives of the particular subject being addressed.

To facilitate collaborative learning using computing platforms, an infrastructure to support this must be in place, be reliable, and be secure.

- A network providing connection between educator and learner devices, and potentially an secure internet connection would be required
- Services to support communication between the educator and learners, as well as access for educators and learners to shared content repositories may be needed.
- Applications for communicating and collaborating, including for example, email, instant messaging, audio or video conferencing, object sharing, co-editing tools

Multi-classroom and Distance Learning.

Extending teaching and learning beyond the physical confines of a classroom can be achieved in a real-time or on-demand context. Real-time extension would include the ability of learners viewing and participating in the class at the same time as lesson is presented. On-Demand extension, typical of online learning, would require lesson to be recorded and made available for learners to access content, including but not restricted to text, images, streaming of video materials etc.

Real-Time Distance Teaching and Learning

- Extending a classroom environment with computer and interactive whiteboard by including network / internet connections to additional suitably equipped learning spaces will allow for a single educator to interact and engage with learners at multiple locations.
- Components needed to address this will be video conferencing tools with desktop / application sharing applications. Peripherals needed will include microphone and camera technologies.
- Skills required by educators include the ability to:
 - connect and effectively use audio-visual peripherals such as microphones and cameras, visualizers (document cameras)
 - ability to use video and audio conference tools and services
 - be able to speak clearly and be well structured in delivery of lesson
 - control and maintain attention and participation of remote learners

On-Demand Teaching and Learning Support

- Offering On-Demand teaching and learning requires lesson and related learning content objects to be recorded.
- Recording a lesson requires the same components as in a real-time context, but includes recording applications (capture elements of a lesson); course content management platforms (Learning Management Systems (LMS) or Course Management Systems (CMS) services for storing, organising and facilitating classes and access entitlement); as well as platforms for optimising and managing streaming of audiovisual content (Video Content Management Systems (VCMS), Webcasting and Streaming Services).
- Skills required by educators include the same skills as for real-time context, as well as the ability to:
 - Record, store, organise and structure lesson and course content to enable effective remote access to course content
 - Develop and manage remote assessments for learners
 - Use online communication tools to engage with learners and manage online interaction.
- Learners that are not in the same class as the educator do not necessarily have the same extent of visual cues to support and facilitate active participation in the discussions and lessons that the learners in-class do. The educator must be aware of this and ensure participation is maintained and learning objectives can be fully realised.