

## To “C” the Future by Innovating the Present

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### Abstract

This article reports on the investigation of the present situation with regards to the use of technology and its application for the field of education. The goal of this paper is to categorise several “C” factors that should be considered to help educators “see” into the future. It provides several views and consideration in broad categorisations of the available technologies in terms of their potential use on education as well as present current approaches of their utilisation. The five “Cs” are constructivism, convenience, customisation, convergence and control. These five “Cs” are meant to serve as a guide for us to consider when we try to select and assess new approaches or technologies as to their potential for success; this is crucial as our ultimate goal is to improve our teaching approaches and to ensure that meaningful learning is experienced by our students.

### INTRODUCTION

The pace of technology change in recent years has been very rapid and educators are faced with exciting as well as daunting times. Educators are constantly researching ways to improve the teaching learning process to help students learn meaningfully and efficiently. Technology by itself has a strong attraction and appeals to a user and this is even more so for an educator as technology today represents an integral part of the teaching learning equation. Change represents a constant in today’s world of rapidly evolving technologies and educators are hard pressed trying to keep up with these changes. Many educators feel that it would be ideal if we can predict or see into the future to deal with this evolution. Traditionally, almost all technology in the form of hardware or software that has been invented or introduced has not been created specifically for the field of education and therefore has to be adapted by educators to meet the desired goals of teaching and learning. Popular productivity software such as “Microsoft Office” has become almost standard software utilised to either directly or indirectly support the teaching learning process. However, the initial introduction of this software (as its name implies) was actually to support activities normally found in offices and not in schools or classrooms. Educators, being very resourceful persons, have adapted and utilised this software to help support school-related activities; in other words, they have taken an innovative approach to adapt the software to meet their needs.

Innovation is defined as “an idea, practice or object that is perceived as new by an individual or other unit of adoption” (Rogers, 1995). Educators are usually very optimistic about any innovation and the term innovation in itself conjures up perceived images positively. There are several characteristics in any innovation and these are:

- 1) Relative advantage
- 2) Compatibility
- 3) Complexity
- 4) Trialability
- 5) Observability

By its own definition and characteristics, any innovation would have a degree of uncertainty as it represents new alternatives for solving problems. The difficulty lies in determining the probabilities of these new alternatives as being superior to previous practices and how educators

then cope with these uncertainties. Would it not be wonderful to be able to see the future and thus reduce these uncertainties as well as improve the adoption rate of any innovation? As what educators perceive and act presently will affect the future, it would then be prudent to observe and investigate the present situation with regards to technology and its application for the field of education. The goal of this paper is to categorise several “C” factors that should be considered to help educators “see” into the future.

## CONSTRUCTIVISM

The current pedagogical approach towards the understanding of learning that occurs within learners is based on the constructivist approach. A simple elaboration for constructivism is that it deals with how learners learn. The generally accepted definition is that learners construct their knowledge based on previous experiences and the relevance of the current information presented. Educators can help by providing scaffoldings or cognitive support as a learner embarks from one threshold to a higher one and this process is further enhanced by an environment which encourages social interactions. The additional “Cs” in this section would also include communication, collaboration and cooperation which are very relevant in today’s elaboration of the utilisation of information, communication and technology (ICT) or for teaching and learning. Researchers in the field have suggested that students would learn better and have a higher degree of retention if a lesson has been designed utilising a constructivist approach. The current proliferation of communication technologies among the younger generation would include the use of the Internet for e-mail and live chats to allow discussion and collaboration towards completion of a project which is not bound by borders or geographical locations.

The younger generation, however, prefers to use *instant messaging* (IM) as well as short messaging systems (SMS) and has even created its own language syntax [e.g., R U OK (are you all right?), IMHO (in my humble opinion) or BRB (be right back)] and skills such as “thumb-boarding”. As new communication technologies allow a different level of communication and interactions, an educator should consider their unique characteristics and view them as innovation to be considered to help the younger generation explore new avenues of working together to achieve a common goal. A simple example is the use of SMS as a polling or voting tool to reflect the popularity of an individual as voted by a mass audience. In the local scene, this form of polling is reflected in the reality show *Akademi Fantasia*, indicating a potential that may be used in a learning environment.

Referring to this model, several companies have created and incorporated this form of “voting” to help enhance the teaching learning process. The users or students have to undergo direct interaction and be able to voice their “opinions”, therefore reflecting their understanding of a lesson by using a “clicker” to collectively vote for their favourite answers ([www.msnbc.msn.com/id/7844477/](http://www.msnbc.msn.com/id/7844477/), accessed 31 August 2005). Here, students are presented with questions during and after a lesson and are required to “vote” their favourite answers. This information is displayed almost instantaneously on the screen to help both the instructors and students reflect if they are on the right track or off the beaten path.

*“...Professors used the clickers to survey students to check their comprehension of the material, Bradforth said. The surveys sometimes showed that the students easily grasped topics the professors thought would need a lot of explanation and stumbled on those they had thought the students understood. That can make for better teaching, Bradforth said, though it requires significantly more work from professors, who have to think about their lesson plans in a different way, and learn to respond to the feedback they’re now getting from students...”*  
[www.boston.com/news/education/k\\_12/articles/2005/05/08/interactive](http://www.boston.com/news/education/k_12/articles/2005/05/08/interactive)

technology changes classroom experience at colleges/accessed, August, 2005). 30

This is one example of an innovative approach on the utilisation of a technology not originally created specifically for education.

### **CONVENIENCE**

With the advent of wireless interface technologies, educators are presented with another innovation, communication and connectivity sans wires. A whole plethora of new acronyms, representing different technologies, such as *3G* (third generation), *MMS* (multimedia messaging systems), *Wi-Fi* (wireless fidelity) and *Wi-Max* (wide area wireless local area network), represents some of the new abilities to allow educators reach the learners conveniently without the messy entanglement of wires. These new abilities have spawned new fields and reinforce or reinvent old paradigms of communication. Wireless technology is able to solve the common problem of the “last mile” where users are next door to a high speed/ high bandwidth fibre optic network but are unable to connect due to either legacy technology or the unavailability of interface technologies. It is common now to find moderately technology savvy users utilising these wireless abilities to create their own PANs (personal area networks) to share common input/output resources such as scanners and printers as well as Internet connections. An educator may now find it feasible to utilise as well as share scarce resources normally found in a school environment to improve the teaching and learning environment.

The adult learners are now able to participate and continue their education through the use of the World Wide Web which is another convenience and is in line with the present concept of life long learning. Web-based instruction now allows non-traditional students to actively participate in a formal or informal academic programme (Khan, 2001). These students are no longer tied to the requirements of being in a particular location and time. They are now able to actively participate within a range of time convenient to them and still fulfil academic requirements. Lessons, references, tutorials, interactions and evaluations are now possible through online technologies. Educators can now interact with a large number of students regardless of their geographical locations as well as their personal timetables. The basic paradigm of distance education has not changed but it is now more convenient as richer resources, in terms of variety, quality as well as quantity, are now more readily available for students and instructors have more options to give to their students. Interaction is also improved as instructors may now respond faster to a student’s request and also strategise better interactions among students through guided discussions for varying group sizes. However, it requires a heavier commitment on the part of both the students and their instructors as expectations are much higher and better time management is required to handle larger groups of students as well as higher quality of project assignments.

### **CUSTOMISATION**

The next “C” is how things are adapted to suit an individual or institution. Customisation means to adapt a product to meet specific specifications as identified by a user or institution. Presently, available products or software are very adaptable and flexible and therefore they can be easily customised.

Today, a user has more freedom and abilities to customise either the software interface or repurpose the original function of the hardware to fulfil his/her requirements. A simple example is the availability of various ring tones to distinguish an individual’s mobile phone from another as well as to reflect an individual’s unique personality and preferences. This in turn has created a new field for the adaptation of common songs and tones to be converted to a form that can be downloaded into the mobile phone either free of charge or for a nominal fee. A popular computer software interface is the development and use of “skins” where icons and buttons reflect a chosen theme. “Skins” are available for all forms of software interfaces, ranging from

common computer applications such as operating systems *Window Desktops*, e-mail software *Mozilla Thunderbird* and browsers *Mozilla Firefox*.

Customisations, however, are not limited to just “skins” but also involve adapting the software or hardware to meet institutional needs. Various types of powerful authoring and presentation software, such as Authorware, the Macromedia Director, Microsoft Office PowerPoint and Macromedia Breeze, allow users and educators to create specialised courseware or presentations to meet the needs and goals of individuals or institutions. These types of authoring and presentation software are very powerful in terms of multimedia manipulation as well as interactive features to help create a rich learning environment. Again, they were not directly created to meet an instructional or educational purpose but as a tool to allow rich interactive presentations to be created quickly and effectively.

Customisation fits in easily with the general concept of an innovation and with the present configuration of available software and hardware, an educator is able to customise technology to meet his/her goals by means of adaptations.

### **CONVERGENCE**

The information found in the digital world is either 1 (one) or 0 (zero) in their purest and basic form. Therefore, any object that has been digitised is in this format. Logic dictates that this digital object can then be shared, exchanged and manipulated either by means of software or hardware facilities. The implication for educators is very exciting as almost any object can be integrated into a piece of software as long as the object has been transformed from its original form into a digital copy. Hardware facilities would then allow these digital copies to be transferred from one location to be shared with another user elsewhere at an amazing speed. Hardware facilities would then have multiple functions besides their primary function. An excellent example of hardware digital convergence is the added functions of the common mobile phone. It is now a common expectation that these phones would be able to take colour photographs, high quality digital video recordings, record audio signals, playback high fidelity songs, be an SMS device, as an interface to the Internet and still function as a communication tool to make the common phone call. With the reduction of size but with added functionality, practically no one would leave home without carrying one or feel comfortable if it is forgotten.

The mobile phone has now converged in terms of functionality as a personal communication and entertainment facility and as a personal digital assistant. In fact, when an individual loses a mobile phone, the usual complaint, and his/her major cause of being upset, is the loss of the information recorded on the SIM card rather than the actual loss of the device to make a phone call. Educators should exploit this phenomenon and think of innovative ways to use it to help the teaching and learning process. The younger generation is now very comfortable with using the SMS facility to share jokes and forward messages and has created a new social environment for interaction and communication.

Convergence in terms of software now allows users to create digital materials that combine several fundamental elements for the presentation of information to include multiple media capabilities and characteristics, commonly referred to as interactive multimedia (Alessi & Trollip, 2001). Multimedia consist of several elements which include texts, static and animated visual effects and audio and video recordings; however, due to the results of convergence, the functions and advantages of these individual elements have blurred and it is now quite difficult to classify any material to be referred to simply as a visual recording or as an animation (Boyle, 1997). There are realistic animations simulating a video recording, while video recordings may include animated graphics accompanied by high quality sound to help educators present information in an innovative manner.

With the advent of more mobile equipment, a new field is now emerging which converges several facilities and functions of available technology as well as blends software presentations

with pedagogical approaches. This field is labelled mobile learning (Wan Mohd. Fauzy, 2004). Here, mobile learning refers to the mobility of both the learner and the instructor. Learners usually tend to be non-traditional students (working adults) whose needs differ as they tend to be mobile due to their career commitments. Instructors are also getting to be more mobile but would still like to be in touch with, and available to, their students and thus be able to monitor their progress and offer assistance if required. This is only possible following the convergence of the various software and hardware technologies. There are now portable hardware equipped with software commonly found in powerful desktop computers which are capable of recording both still and video images, upload/download files, browse the Internet, check emails, serve as entertainment machines and still enable phone calls to be made. It is difficult to classify these types of mobile equipment as many of them are able to carry out all the functions that have been presented. Personal digital assistants (PDAs), laptops, palmtops and mobile phones are now able to carry out all these functions. The more common machine that a mobile user would be carrying is either the laptop for more serious interactions or a multimedia equipped mobile phone for more convenience but with restrictive interactions due to the nature of it being smaller in terms of screen size as well as the “keyboard” or “thumb-board” for data input.

## CONTROL

In the context of this paper, control is the empowerment of a user or an educator in terms of choice and competency. As mentioned earlier, very few technologies in terms of hardware and software were specifically created to be used for education. However, due to the resourcefulness and innovative nature of educators, many of these technologies have been adapted or modified to be used in a teaching and learning environment.

There is a now a large movement to share resources and expertise as well as provide a serious challenge for commercially available software and resources. One such initiative is the Open Source Initiative ([www.opensource.org/](http://www.opensource.org/)). For example, in terms of open source software (OSS), the primary code of a piece of software is made available for free and any user may download it to either use the basic functionality of the software or he/she may add or remove components that are not suitable for his/her needs or purposes. When programmers are allowed to read, redistribute, and modify a source code in a piece of software, the software evolves – they improve it, adapt it and fix “bugs”. This can happen at an astonishing speed to produce better software than the traditional closed model, in which only very few programmers can see the source and everybody else must blindly use an opaque “block of bits”. This exemplifies the true essence of education which is knowledge for all and everyone collaborates and builds on prior knowledge. This is the alternative economic model of accessibility for the public good. Examples include Linux, Firefox, Thunderbird, OpenOffice, 7-zip and Gimp.

The only restrictions are that the primary code cannot be sold or utilised for profit and all the modified software must be made available to be shared with other users. This is truly a collaborative effort in every sense of the word. The OSS represents an alternative for users to either purchase commercial software, such as Microsoft Office, or use OSS e.g., as Open Office or Star Office, as a viable alternative. Programmers and other technology savvy personnel are collaboratively working together to enable the OSS to be seamlessly integrated with commercial software to help initiate a “weaning” process from such commercially available software. This has resulted in the OSS which covers almost all the commonly used software by users. The commonly used software can be generally classified as:

- a) Productive software
- b) Compression software
- c) Visual manipulation software
- d) Web application software/ multimedia software
- e) The learning management system (LMS) software.

The LMS software under the OSS realm is called *Moodle*, and the basis of this software is deemed to be grounded in constructivism; in other words, this software has been developed with the educator in mind. As the function of the software implies, it allows the educator to manage his interaction with students in terms of resource management, teaching strategies, collaborative interactions and discussions as well as the evaluation process of the students' performance. Although one of the highlights of commercial software is the quality and available technical support, OSS developers and users work very closely and are trying to provide support and solutions (such as their commercial counterparts do) free of charge. The OSS movement is not limited to just software but by its very basic philosophy of sharing and collaborating, other forms of OSS have now emerged. A famous example is the effort by the Massachusetts Institute of Technology (MIT) to make its entire course syllabi available for everyone ([www.ocw.mit.edu/index.html](http://www.ocw.mit.edu/index.html)). The philosophy of MIT OCW (Open CourseWare) initiative is based on the conviction that the open dissemination of knowledge and information can open new doors to the powerful benefits of education for humanity around the world. MIT OCW is a free and open educational resource for faculty, students and self-learners around the world. It is a publication of MIT course materials, does not require any registration, is not a degree-granting or certificate-granting activity and does not provide access to any MIT faculty. However, it hopes to establish a community and resource for information exchange that will lead to a greater understanding of OSS and their applications.

The second mini “C” here is competency. How do we determine the competency of a user or even an educator? Here the primary focuses are training and evaluation. For anyone to be competent with whatever task that he/she has to carry out, a certain level of competency has to be exhibited or determined. It would be unfair to expect that the individual is able to obtain this knowledge without any help or support. With reference to constructivism, all users would be able to learn and comprehend new knowledge with the help of scaffolding and relevant information. So training has to be designed taking into account their background, present competencies and the required new knowledge (Driscoll, 1998). Educators can now take into account available technologies and the various instructional design models as they plan their instruction. For educators to determine their competency levels, they can be evaluated by either formal programmes or examinations by certified bodies. A more democratic and less stressful method, nevertheless, would be through peer reviews/evaluation. Some educators may find this uncomfortable but this form of evaluation with regards to competencies would really focus on core skills and knowledge. Another less direct approach would be to share their work through a common facility such as a web database where there is an active exchange and flow of ideas for a particular topic. An example of this is a Website called the Multimedia Educational Resource for online learning and teaching (MERLOT), which is,

*“...a free and open resource designed primarily for faculty and students of higher education. Links to online learning materials are collected here along with annotations such as peer reviews and assignments...”*  
(<http://www.merlot.org/home.po>)

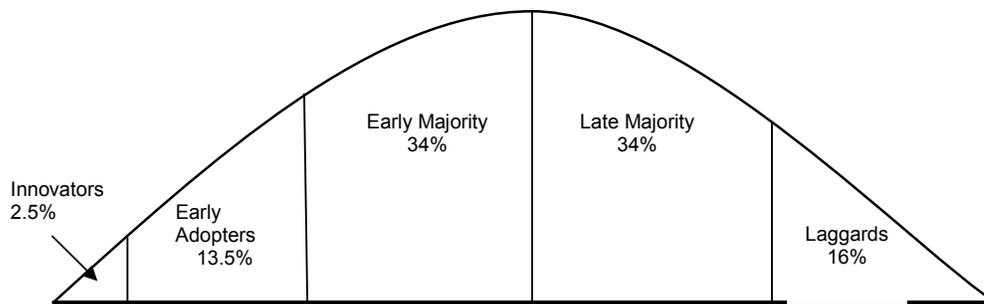
From the description presented in the home page, it can be seen that this Website functions on several levels, as a resource for educators to use and share learning materials, to help students with their assignments, encourage peer reviews and even provide syndicates for their contents to be made freely available to users without costs.

The last “C” in this section on control is the answer to the issue of whether there be control or is there a lack of such control. The answer to this question will vary, depending on who the question is directed at. Some educators and administrative bodies who are more inclined toward a conservative stand would answer that there must be control and that there is a lack of it. Others would, nevertheless, argue that there should be no control and that there is already too much of it, thus limiting creativity and the innovative educator. There is a formal theory to explain the various approaches and positions that individuals will take with regards to new ideas

and this may explain the statement concerning their stand on the issue of control. According to Rogers (1995), all adopters of an innovation would fall into several categories (Figure 1). The categorisation consists of the following five stages:

- a) innovators
- b) early adopters
- c) early majority
- d) late majority
- e) laggards

As the categorisation suggests, there would be groups of people who would be willing to try something without much hesitation, some would take the popular approach, some would adopt a stance after a “wait and see” period and then accept it while the last group would only adopt something when it has absolutely no choice or is forced to do so.



**Figure 1:** Adopter Categorisation on the Basis of Innovativeness

Educators who would prefer less control and think that there is already too much of it may fall into the category of innovators or early adopters. Those who feel that there is already too much freedom and that there should be more control may be classified as the laggards, as they are uncomfortable adopting new ways, being satisfied with their current methods.

## CONCLUSION

As the theme of this paper revolves around *Innovation in Education*, it would be ideal to be able to predict the future of any educational innovation in terms of adoption and more importantly, the success of the application. However, the success of the application and adoption of any innovation would depend on the knowledge, awareness as well as the attitude of the individuals interacting with this new approach or product. The teaching and learning decision making process would be simplified for educators to determine which innovations should be accepted and will be successful and to avoid ill-conceived innovations. The purpose of this paper is to provide several views and consideration in broad categorisations of the available technologies in terms of their potential use in education as well present current approaches vis-à-vis their utilisation. It would very difficult to avoid the traps of predicting the future as no one can confidently predict the outcome of anything, there being an infinite number of variables to account for, especially in the field of education. This paper is an avenue to share and collaborate on ideas as well as, to a certain extent, influence the future direction of educational technology in Malaysia. It would then be prudent to discuss and present the current world trends involved in technology, education and the various approaches being applied. This would serve as a scaffold for us to connect our past experiences as educators with the current situations and to encourage all educators to keep an open mind in terms of innovations. These innovations may be in the form of repurposing present technology to suit our needs, to utilise readily available resources or to share resources by making them assessable for others to use. The five “Cs” are meant to guide us when we try to determine the potential success of new approaches or technologies –

our ultimate goal is to improve our teaching approaches and to ensure that meaningful learning is experienced by our students.

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