21st century education: Are we heading towards the right direction of improving teaching and learning as needed by educational transformation programme?

Yusup Hashim (Ph.D)
Professor of Instructional Design and Technology
Asia e University

ABSTRACT

There are not much dialogues or discussions going on relating to 21 century learning in Malaysia. But we have several dialogues on e-learning or use of ICT in schools specifically the implementation of Smart Schools (1999) to prepare students for the information age, EduwebTV (2009) to provide education for all and recently the use of virtual learning using FrogAsia (VLE) as the platform to implement virtual learning in schools. At this juncture, I think some are not sure or at least inquisitive how these educational technology innovations fit into 21 century education or at least understand the concept that form the framework of 21 century learning. Is 21 century education part of the overall educational transformation envisioned by Malaysian government? If it is, this paper tries to look at some of the development that influence e-learning in schools and discuss whether we are going into the right direction of using instructional technology or educational technology to facilitate and improve teaching and learning. Some of the issues discussed are the concept and framework of 21 century learning, instructional and learning theories and new strategies in teaching and learning and educational technology standards that drive teachers, students and school administrators to implement e-learning in 21st century education.

Introduction

This paper discusses about improving teaching and learning and the transformation programme affecting the school system in Malaysia. So, I would like to begin by explaining what is educational transformation and how it is related to instructional/educational technology and 21 century education. This will help us to understand the changes and direction that our schools are heading and the kind of students we are going to produce as well as to clear the confusion among teachers public and parents. Generally, when we say educational transformation, it means a systemic move from traditional educational system to a more modern and dynamic system in line with the social, cultural, economic, educational and technological needs of a particular time. Reigeluth (2012) considered this move or change as a systemic or paradigm change from industrial-age education to post-industrial education. To transform education or do a paradigm shift from existing situation needs change in the mindset involving all stakeholders, community, teachers and students. The transformation programme discussed includes teaching and learning, school management and administration and educational technologies that influence 21 century education. This will be done in the context of definition of educational or instructional technology which also went through several changes from 1963 period to 2004. Malaysia experiences this changes from 1920's to the present time from audio-visual period to ICT period of the 1990's and 20's debating whether instructional technology is a process or a product (Yusup & Razmah, 2006;Yusup & Abd Latif, 2010).

Let me begin by quoting the 2004 definition by AECT (Januszewski & Molenda, 2008) that states *'Educational technology is the study and ethical practice of facilitating learning and improving*

performance by creating, using, and managing appropriate technological processes and resources'

How does this definition explain the school transformation programme. Do you think that this new definition fits the 21 century learning? Let us analyse this definition and justify whether our school system is heading the right direction to prepare our teachers, students, administrators and curriculum for the 21 century learning.

The key word in the previous and present definitions is to facilitate and improve instruction and learning. But the new definition emphasized the study and ethical practice of facilitating and improving learning and performance. The 1994 definition states that educational technology is the theory and practice of designing, developing, utilizing, managing and evaluation of processes and resources (Seels & Richey,1994). Both definitions are quite similar that involve the study or theory and practice of facilitating and improving teaching and learning. The only difference I would say is the new definition emphasizes on ethical practices of creating, using and gathering of information beyond the traditional conceptions of research. There are abundance of online information that can facilitate research and this ethical practice is reflected in the 21st century learning framework which will be the main focus of this paper. So coming back to the notion of facilitating and improving teaching and learning, does educational technology as a product and process help teachers to teach, student to learn, administrators to manage instruction and curriculum relevant with present learning? We will look into some of the instructional and learning theories and the new development in teaching and learning strategies and the role of technology and media in 21 century education.

Instructional Theories and Instructional Design

We cannot isolate instructional theories with learning theories to help teachers to teach and student to learn in 21 century education. We know that learner-centred approach is the order of 21 century learning but mind you teachers still need to have skills to teach in order to facilitate learning. Merrill (2007, 2009) has identified 5 prescriptive principles of instruction or known as 'first principles' of instruction to produce an efficient, effective and engaged teacher. They are task-centred, demonstration, activation, application and integration principles:

1. Task-centred Principles
Learning is promoted when teacher provides specific tasks in problem based-learning or project-based learning.
- Instruction should use *task-centred* instructional strategy and *progressively* move to more complex task
- What are the specific tasks that the teacher needs the learner to do and achieve at the end of instruction. Example: Doing a presentation on solving soil erosion.

 2. Demonstration Principles
Learning is promoted when teacher shows or demonstrates how the task is to be done
- Instruction should provide demonstration of the skill consistent with the type of component skills: Kinds of skills, how to and what happens as in doing science experiment
- Instruction should provide the *guidance* that relates the demonstration to *generalities*
- Instruction should engage learners in *peer-discussion* and *peer-demonstration*
- Instruction should select, adapt or produce *appropriate media* for learners to observe the demonstration

3. Activation Principles
 Learning is promoted when teacher directs learners to recall, relate, describe or apply prior knowledge from relevant past experience as a foundation for new learning.
   - Instruction should activate relevant cognitive structures in learners by having them recall, describe and demonstrate relevant *prior knowledge* and experience
   - Instruction should allow learners *share* previous experience with their peer group
   - Instruction should allow learners recall or acquire a *structure* for organizing new knowledge (Eg, providing advance organizer, mind map, graphic organizer, checklist, ect)

4. Application Principles
Learning is promoted when teacher allows learners to practice and apply the newly acquired knowledge, skills, attitude and experience
   - Instruction should make the learner *apply* learning consistent with the type of component skills: Kinds of skills, how to and what happens as in doing science experiment
   - Instruction should provide intrinsic or *corrective feedback*
   - Instruction should provide *coaching* which should gradually withdraw to enhance application
   - Instruction should engage learners in *peer collaboration*

5. Integration Principles
Learning is promoted when teacher allows learners to integrate or transfer the new learning into everyday life
   - Instruction should provide the opportunity for learners to *reflect* on, discuss and defend their new knowledge or skill
   - Instruction should provide the opportunity for learners to *demonstrate in public* their newly acquired knowledge and skill
   - Instruction should provide the opportunity for learners to create, invent, discover or explore *personal* ways to use their knowledge or skill.
   - Instruction should engage learners in *peer-critique*

Merrill's instructional design theory is very much influenced by Gagne's nine events of instruction (1985). The difference is Gagne' shows the 9 events of designing and implementing a lesson plan as in tutorial while Merrill explains the universal principles of designing instruction. The five prescriptive principles of instruction can be used to design instruction in 21 century classroom. Some of the elements are emphasized in 21 century learning framework.

Learning Theories in 21 Century Learning

Understanding the various learning theories and how these theories evolved from behaviorism to cognitivism, constructivism and now connectivism help teachers to meet the challenge of 21 century learning. Teachers need to analyse all the learning theories and how each theory contributes and facilitates teaching and learning. Each of these theories emerged according to time, situation and the technology used at that time. Behaviorism was popular in 1950's where learning happens when there is a change in behavior using Skinner's programmed instruction machine; cognitivism in 1960's where learning is caused by mental structure as in information processing theory and the influence of computer; constructivism in 1980's an extension of cognitivism where learning happens when a learner is able to construct new knowledge with the help of ICT and finally connectivism in 21 century where learning happens when learners are

connected using web-based or online materials using mobile technologies and social media. Twenty first century teachers must be smart when and where to apply these theories. Most educators believed using a combination of these theories (eclectic approach) will help solve teaching and learning problems. In 21 century learning, as mentioned earlier teacher plays the role of a facilitator making learning more learner-centred, autonomous and self-directed. There are abundance of online materials to choose and leaners need to have the digital skills to use ICT to access the materials and use them just in time. They need to be connected with the technology and peer group to form global classroom to construct and create new knowledge and skills.

Paradigm Shift and New Roles in 21 Century Learning

Learning in 21 century calls for new roles for teachers, students and technology. Reigeluth (2009, 2012) suggested three new roles of teachers in new paradigm of instruction: Teacher as designer of student work (Schlechty, 2002), facilitator of learning process, and caring mentor for all round development:
1. Teacher as designer of student work: Teacher acts a 'guide on the side' not as a 'sage on the stage'. He designs the instructional space and the learning task space that is the instructional time and strategy needed to complete the learning task. For example slower learners may need more instructional time by providing them virtual mentor or customized tutoring 'just in time' to develop that skill individually for learners. Mastery learning, problem-based learning, project-based learning, inquiry learning and discovery approach provide good solution for teachers to design student learning.
2. Teacher as facilitator of learning process: Teacher develops personal learning plans, coaching or scaffolding student's learning when appropriate, facilitating discussions and reflection and arranging learning resources and physical facilities.
3. Teacher as a caring mentor: The teacher is concerned with the full and well-rounded development of the learner.

New Roles of Student in 21 Century Learning

There are three roles:
1. Learner as a worker: Learner is doing the learning while the teacher is the designer of learner's work
2. Self-directed learner: The teacher helps each learner to be independent, self-directed and self-motivated learner to prepare them for life-long learning
3. Learner as a teacher: The best way to learn is to teach. Learners will help other learners to learn as in peer tutoring practiced in massive open online courses (MOOC)

New Roles for Technology

New roles of technology in the new paradigm is to be a tool for learners to be self-directed learner for life-long learning and at same time to fulfill 4 major functions for the teachers: a) Keeping track of students' progress, b) plan student project in project-based learning, c) facilitate instruction to provide immersed learning as in simulation and virtual leaning environment and d) provide personalized learning.

The Need for 21 Century Skills

We are not aware that today's curricula (the what) and instruction (the how) do not fully prepare students to live and work in a digital information-age society. The world is changing and schools and higher institutions of learning need to change as well. As a result, employers today are

skeptical about taking employees who lack the relevant knowledge and practical skills (as in work-based learning) to create, build and help sustain an information-rich business and industry. This is the challenge faced by our education system that is to transform education particularly in teaching and learning to accommodate the 21 century learning. To do this it needs a concerted effort internationally or at least at country level to create partnership among governments, educators, academics and industries to make it happen and sustainable.

Now let us look at the skills required for 21 century learning and the conceptual framework of 21 century learning written by educational technology associations and educational experts. To do this, first we need to know what is 21 century learning?

What is 21 Century Learning?

Garrison (2011) provides the framework for 21 century learning in the context of e-learning in higher education. In his book *e-learning in 21 century* (2011), he pointed that e- learning is the educational system in 21 century and defined e-learning as electronically mediated asynchronous and synchronous communications for the purpose of constructing and confirming knowledge. The basis of e-learning is rooted in collaborative and constructive perspective with special emphasis on higher order thinking or critical thinking. Research in face-face and mediated instruction confirms the benefits of collaborative learning in supporting higher order learning (Garrison & Archer, 2000; Johnson & Johnson, 2009). Network learning supported by social media such as blogs and wikis facilitate collaborations between learner and learner and teacher and learner.

Twenty first century learning can be defined in terms of technology and learning skills. In terms of technology it means electronic learning using ICT or new technologies such as laptop, cellphone or tablet. In other words, learning or performance is facilitated using mobile technologies or mobile learning devices. In terms of learning skills, learners need the necessary skills to collaborate with others and connect through mobile digital technologies in a knowledge-based economy.

What are the learning skills required in 21 century learning?

AT21CS (Assessment and Teaching 21 Century Skills), a research group stationed at University of Melbourne Australia collaborating with a group of more than 250 researchers across 60 institutions worldwide categorized 21st-century skills internationally into four broad categories:

1. Ways of thinking. Creativity, critical thinking, problem-solving, decision-making and learning
2. Ways of working. Communication and collaboration
3. Tools for working. Information and communications technology (ICT) and information literacy
4. Skills for living in the world. Citizenship, life and career, and personal and social responsibility

The partnership for 21 century skills: Elements of 21 Century Learning

The partnership for 21 century skills has developed a unified framework for 21 century learning and education support systems that can prepare young people for a global economy. The framework describes the skills, knowledge and expertise students should master to succeed in work and life in the 21 century (Kay, 2008). Figure 1 shows the following elements of 21 century learning:

1. Learning and innovations that emphasizes the 4Cs: **C**ritical thinking and problem solving, **C**ommunication, **C**ollaboration, **C**reativity and innovation
2. Life and Career Skills
3. Core Subjects and 21 Century Themes
4. Information, Media and Technology
5. 21 Century Standards and assessments
6. 21 Century Curriculum and Instruction
7. Professional Development
8. 21 Century Learning Environment

1. Learning and innovations

Emphasizes the 4Cs:

a) Critical Thinking and Problem Solving
Reason Effectively
- Use various types of reasoning (inductive, deductive, etc.) as appropriate to the situation.

Use Systems Thinking
- Analyze how parts of a whole interact with each other to produce overall outcomes in complex systems.

Make Judgments and Decisions
- Effectively analyze and evaluate evidence, arguments, claims and beliefs
- Analyze and evaluate major alternative points of view
- Synthesize and make connections between information and arguments
- Interpret information and draw conclusions based on the best analysis
- Reflect critically on learning experiences and processes

Solve Problems
- Solve different kinds of non-familiar problems in both conventional and innovative ways
- Identify and ask significant questions that clarify various points of view and lead to better solutions

b. Communication

Communicate clearly
- Articulate thoughts and ideas effectively using oral, written and nonverbal communication skills in a variety of forms and contexts
- Listen effectively to decipher meaning, including knowledge, values, attitudes and intentions
- Use communication for a range of purposes (e.g. to inform, instruct, motivate and persuade)
- Utilize multiple media and technologies, and know how to judge their effectiveness a priori as well as assess their impact
- Communicate effectively in diverse environments (including multi-lingual)

c. Collaboration

Collaborate with others
- Demonstrate ability to work effectively and respectfully with diverse teams.

- Exercise flexibility and willingness to be helpful in making necessary compromises to accomplish a common goal.
- Assume shared responsibility for collaborative work, and value the individual contributions made by each team member.

d. Creativity and Innovation

Think Creatively
- Use a wide range of idea creation techniques (such as brainstorming)
- Create new and worthwhile ideas (both incremental and radical concepts)
- Elaborate, refine, analyze and evaluate their own ideas in order to improve and maximize creative efforts.

Work Creatively with Others
- Develop, implement and communicate new ideas to others effectively.
- Be open and responsive to new and diverse perspectives; incorporate group input and feedback into the work.
- Demonstrate originality and inventiveness in work and understand the real world limits to adopting new ideas.
- View failure as an opportunity to learn; understand that creativity and innovation is a long-term, cyclical process of small successes and frequent mistakes.

Implement Innovations
- Act on creative ideas to make a tangible and useful contribution to the field in which the innovation will occur.

2. Life and Career Skills

Today's life and work environments require far more than thinking skills and content knowledge. The ability to navigate the complex life and work environments in the globally competitive information age requires students to pay rigorous attention to developing adequate life and career skills, such as:
• Flexibility and Adaptability
• Initiative and Self-Direction
• Social and Cross-Cultural Skills
• Productivity and Accountability
• Leadership and Responsibility

3. Core Subjects and 21st Century Themes

Mastery of core subjects and 21st century themes is essential to student success. Core subjects include English, reading or language arts, world languages, arts, mathematics, economics, science, geography, history, government and civics.
In addition, schools must promote an understanding of academic content at much higher levels by weaving 21st century interdisciplinary themes into core subjects:
• Global Awareness
• Financial, Economic, Business and Entrepreneurial Literacy
• Civic Literacy
• Health Literacy
• Environmental Literacy
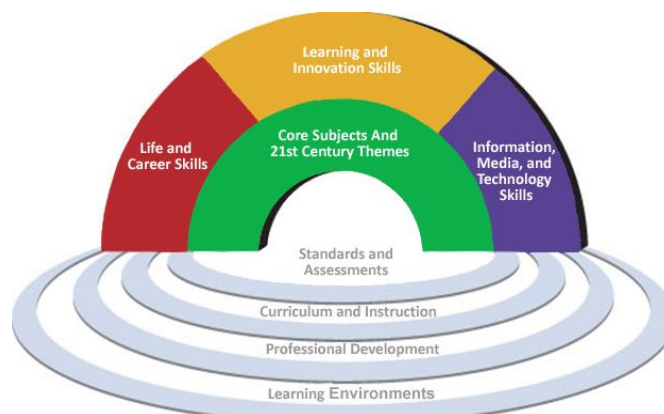
Figure 1: 21 Century Learning Framework

Learning and
Innovation Skills

Life and
Career Skills

Core Subjects And
21st Century Themes

Information,
Media, and
Technology
Skills

Standards and
Assessments

Curriculum and Instruction

Professional Development

Learning Environments

Figure 1 - P21 Framework for 21st Century Learning

Source: Partnership for 21 Century Skills (http://www.p21.org/our-work/p21-framework)

These core subjects must be taught in terms of the skills and knowledge required for 21 century learning. These skills can be classified as *process oriented* rather than *content oriented* (Bates, 2009). However it is a mistake to see these skills as being independent of the subject or knowledge domains in which they need to be used. For example, problem solving in medicine needs other content knowledge such as anatomy, biology, psychology and physiology, ect. In other words, learners must be able to use ICT or digital technology in order to function or survive in 21 century learning.

The important issue here in education is digital literacy/skills must be embedded within the core listed subjects or knowledge domain. So curriculum planners (what to teach), instructional technologist (how to teach and learned) and examination board (what is assessed) must work together to meet the 21 century learning goals.

If we are setting exams (or any form of assessment summative or formative) that do not explicitly address problem solving, critical thinking, digital literacy and communication skills, then learners will not focus on developing these skills. Similarly, when we use technologies for learning (as in flipped classroom approach) such as videocasts (youtube), podcast (audio) and digital graphics to support traditional lecture, these technologies or learning experiences must be reflected in the examination. For instance, if a teacher uses *youtube* that shows Tunku Abdul Rahman is explaining about racial integration to achieve independence, then students need to be assessed on that. Then only we can justify the money spent using technologies or media for learning. So we need drastic changes in our assessment system.

4. Information, Media and Technology Skills

Today, we live in a technology and media-driven environment, marked by access to an abundance of information, rapid changes in technology tools and the ability to collaborate and

make individual contributions on an unprecedented scale. Thus learners need to have information, media and technology skills to search and select useful information in the Internet, select and use appropriate media.

Media Literacy

Analyze Media
- Understand both how and why media messages are constructed, and for what purposes
- Examine how individuals interpret messages differently, how values and points of view are included or excluded, and how media can influence beliefs and behaviors
- Apply a fundamental understanding of the ethical/legal issues surrounding the access and use of media

Create Media Products
- Understand and utilize the most appropriate media creation tools, characteristics and conventions
- Understand and effectively utilize the most appropriate expressions and interpretations in diverse, multi-cultural environments

ICT Literacy
Apply Technology Effectively
- Use technology as a tool to research, organize, evaluate and communicate information
- Use digital technologies (computers, PDAs, media players, GPS, etc.), communication/networking tools and social networks appropriately to access, manage, integrate, evaluate and create information to successfully function in a knowledge economy
- Apply a fundamental understanding of the ethical/legal issues surrounding the access and use of information technologies

21st Century Support Systems

Developing a comprehensive framework for 21st century learning requires more than identifying specific skills, content knowledge, expertise and literacies. An innovative support system must be created to help students master the multi-dimensional abilities that will be required of them. The Partnership has identified four critical support systems to ensure student mastery of 21st century skills (Figure 1):

1. 21st Century Standards and Assessments

a. Standards
- Focuses on 21st century skills, content knowledge and expertise.
- Builds understanding across and among core subjects as well as 21st century interdisciplinary themes.
- Emphasizes deep understanding rather than shallow knowledge.
- Engages students with the real world data, tools, and experts they will encounter in college, on the job, and in life--students learn best when actively engaged in solving meaningful problems.
- Allows for multiple measures of mastery.

b. Assessment

- Supports a balance of assessments, including high-quality standardized testing along with effective classroom formative and summative assessments.
- Emphasizes useful feedback on student performance that is embedded into everyday learning
- Requires a balance of technology-enhanced, formative and summative assessments that measure student mastery of 21st century skills.
- Enables development of portfolios of student work that demonstrate mastery of 21st century skills to educators and prospective employers.
- Enables a balanced portfolio of measures to assess the educational system's effectiveness at reaching high levels of student competency in 21st century skills.

2. 21st Century Curriculum & Instruction

- Teaches 21st century skills discretely in the context of core subjects and 21st century interdisciplinary themes.
- Focuses on providing opportunities for applying 21st century skills across content areas and for a competency-based approach to learning.
- Enables innovative learning methods that integrate the use of supportive technologies, inquiry- and problem-based approaches and higher order thinking skills
- Encourages the integration of community resources beyond school walls

3. 21st Century Professional Development

- Highlights ways teachers can seize opportunities for integrating 21st century skills, tools and teaching strategies into their classroom practice — and help them identify what activities they can replace/de-emphasize.
- Balances direct instruction with project-oriented teaching methods.
- Illustrates how a deeper understanding of subject matter can actually enhance problem-solving, critical thinking, and other 21st century skills.
- Enables 21st century professional learning communities for teachers that model the kinds of classroom learning that best promotes 21st century skills for students.
- Cultivates teachers' ability to identify students' particular learning styles, intelligences, strengths and weaknesses
- Helps teachers develop their abilities to use various strategies (such as formative assessments) to reach diverse students and create environments that support differentiated teaching and learning.
- Supports the continuous evaluation of students' 21st century skills development
- Encourages knowledge sharing among communities of practitioners, using face-to-face, virtual and blended communications.
- Uses a scaleable and sustainable model of professional development.

4. 21st Century Learning Environments

- Creates learning practices, human support and physical environments that will support the teaching and learning of 21st century skill outcomes
- Supports professional learning communities that enable educators to collaborate, share best practices and integrate 21st century skills into classroom practice
- Enables students to learn in relevant, real world 21st century contexts (e.g., through project-based or other applied work)
- Allows equitable access to quality learning tools, technologies and resources

- Provides 21st century architectural and interior designs for group, team and individual learning.
- Supports expanded community and international involvement in learning, both face-to-face and online

National Educational Technology Standards (NETS)

To prepare 21 century, there is an urgent need to develop and implement National Educational Technology Standard to evaluate technology and pedagogical competencies among students, teachers and school administrators. The task is initiated by ISTE (International Society for Technology in Education) to develop standards for using technology in education. These standards are used by schools to assess technology activities. It started with National Educational Technology Standards (NETS-S) for students and then go on with NETS-T for teachers and NETS-A for administrators. These standards have been revised to accommodate the fast expanding ICT and digital technologies. In 21 century education, it is important for teachers to have current technology skills to facilitate and maximize teaching and learning. The role of technology in teacher education is explained in Technology Pedagogical Content Knowledge (TPACK) framework (Mishra & Kohler, 2006). NETS are developed to guide schools to integrate educational technology programmes in learning, teaching and school management in the digital age. The standard consists of the competencies that a student, teacher and a school leader needs to possess. I will begin by explaining the revised NETS for students:

ISTE Standards for Students (2007)

The revised standard is developed to evaluate the skills and knowledge students need to learn effectively and live productively in an increasingly global and digital world. The NETS for students are divided into six broad categories. Standards within each category are to be introduced, reinforced, and mastered by students. Teachers can use these standards as guidelines for planning technology-based activities for students to achieve success in learning, communication, and life skills in 21 century learning. The NETS for students are:

1. Creativity and Innovation

- apply existing knowledge to generate new ideas, products, or processes
- create original works as a means of personal or group expression
- use models and simulations to explore complex systems and issues
- identify trends and forecast possibilities

2. Communication and Collaboration

- interact, collaborate, and publish with peers, experts, or others employing a variety of digital environments and media
- communicate information and ideas effectively to multiple audiences using a variety of media and formats
- develop cultural understanding and global awareness by engaging with learners of other cultures
- contribute to project teams to produce original works or solve problems

2. Research and Information Fluency

- plan strategies to guide inquiry
- locate, organize, analyze, evaluate, synthesize, and ethically use information from a variety of sources and media
- evaluate and select information sources and digital tools based on the appropriateness to specific tasks
- process data and report results

4. Critical Thinking, Problem Solving, and Decision Making

- identify and define authentic problems and significant questions for investigation
- plan and manage activities to develop a solution or complete a project
- collect and analyze data to identify solutions and/or make informed decisions
- use multiple processes and diverse perspectives to explore alternative solutions

5. Digital Citizenship

- advocate and practice safe, legal, and responsible use of information and technology
- exhibit a positive attitude toward using technology that supports collaboration, learning, and productivity
- demonstrate personal responsibility for lifelong learning
- exhibit leadership for digital citizenship

6. Technology Operations and Concepts

- understand and use technology systems select and use applications effectively and productively
- troubleshoot systems and applications
- transfer current knowledge to learning of new technologies

Source: NETS·S © 2007 International Society for Technology in Education (ISTE).

ISTE Standards for Teachers (2008)

This is the revised standards of the 2002 ISTE NETS for teachers. This Standard for teachers is developed to evaluate the skills and knowledge teachers need to teach, work and learn in a connected global and digital-age society. All classroom teachers should be prepared to meet the following standards and performance indicators.

1. Facilitate and Inspire Student Learning and Creativity

- promote, support, and model creative and innovative thinking and inventiveness
- engage students in exploring real-world issues and solving authentic problems using digital tools and resources
- promote student reflection using collaborative tools to reveal and clarify students' conceptual understanding and thinking, planning, and creative processes
- model collaborative knowledge construction by engaging in learning with students, colleagues, and others in face-to-face and virtual environments.

2. Design and Develop Digital-Age Learning Experiences and Assessments

- design or adapt relevant learning experiences that incorporate digital tools and resources to promote student learning and creativity.
- Develop technology- enriched learning environments that enable all students to pursue their individual curiosities and become active participants in setting their own educational goals, managing their own learning, and assessing their own progress
- customize and personalize learning activities to address students' diverse learning styles, working strategies, and abilities using digital tools and resources
- provide students with multiple and varied formative and summative assessments aligned with content and technology standards and use resulting data to inform learning learning and teaching

3. Model Digital-Age Work and Learning

- demonstrate fluency in technology systems and the transfer of current knowledge to new technologies and situations.
- collaborate with students, peers, parents, and community members using digital tools and resources to support student success and innovation
- communicate relevant information and ideas effectively to students, parents, and peers using a variety of digital age media and formats.
- model and facilitate effective use of current and emerging digital tools to locate, analyze, evaluate, and use information resources to support research and learning

4. Promote and Model Digital Citizenship and Responsibility

- advocate, model, and teach safe, legal, and ethical use of digital information and technology, including respect for copyright, intellectual property, and the appropriate documentation of sources
- address the diverse needs of all learners by using learner-centered strategies providing equitable access to appropriate digital tools and resources.
- promote and model digital etiquette and responsible social interactions related to the use of technology and information
- develop and model cultural understanding and global awareness by engaging with colleagues and students of other cultures using digital-age communication and collaboration tools.

5. Engage in Professional Growth and Leadership

- participate in local and global learning communities to explore creative applications of technology to improve student learning.
- exhibit leadership by demonstrating a vision of technology infusion, participating in shared decision making and community building, and developing the leadership and technology skills of others.
- evaluate and reflect on current research and professional practice on a regular basis to make effective use of existing and emerging digital tools and resources in support of student learning.
- contribute to the effectiveness, vitality, and self-renewal of the teaching profession and of their school and community.

Source: NETS-T© 2008 International Society for Technology in Education.

ISTE Standards for Administrators (2009)

This revised standard is developed to evaluate the skills and knowledge school administrators and leaders need to support digital age teaching and learning, implement technology and transform the education landscape. The ISTE Standards for school administrators are:

1. Visionary Leadership

- inspire and facilitate among all stakeholders a shared vision of purposeful change that maximizes use of digital-age resources to meet and exceed learning goals, support effective instructional practice, and maximize performance of district and school leaders
- engage in an ongoing process to develop, implement, and communicate technology-infused strategic plans aligned with a shared vision
- advocate on local, state and national levels for policies, programs, and funding to support implementation of a technology-infused vision and strategic plan

2. Digital Age Learning Culture

- ensure instructional innovation focused on continuous improvement of digital-age learning
- model and promote the frequent and effective use of technology for learning
- provide learner-centered environments equipped with technology and learning resources to meet the individual, diverse needs of all learners
- ensure effective practice in the study of technology and its diffusion and adoption across the curriculum
- promote and participate in local, national, and global learning communities that stimulate innovation, creativity, and digital age collaboration

3. Excellence in Professional Practice

- allocate time, resources, and access to ensure ongoing professional growth in technology fluency and integration
- facilitate and participate in learning communities that stimulate, nurture and support administrators, teachers and staff in the study and use of technology
- promote and model effective communication and collaboration among stakeholders using digital age tools
- stay abreast of educational research and emerging trends regarding effective use of technology and encourage evaluation of new technologies for their potential to improve student learning

4. Systemic Improvement

- lead purposeful change to maximize the achievement of learning goals through the appropriate use of technology and media-rich resources
- collaborate to establish metrics, collect and analyze data, interpret results, and share findings to improve staff performance and student learning
- recruit and retain highly competent personnel who use technology creatively and proficiently
- advance academic and operational goals
- establish and leverage strategic partnerships to support systemic improvement

- establish and maintain a robust infrastructure for technology including integrated, interoperable technology systems to support management, operations, teaching, and learning

5. Digital Citizenship

- ensure equitable access to appropriate digital tools and resources to meet the needs of all learners
- promote, model and establish policies for safe, legal, and ethical use of digital information and technology
- promote and model responsible social interactions related to the use of technology and information
- model and facilitate the development of a shared cultural understanding and involvement in global issues through the use of contemporary communication and collaboration tools

Adapted from NETS·A © 2009 International Society for Technology in Education.

Previous studies on NETS

A number of technology leadership studies had produced mixed results. Anderson and Dexter (2005) reported that Productivity and Professional Practice and Learning and teaching had the highest performance while Leadership and Vision and Assessment and Evaluation had the lowest score. Another study by Saleh et al. (2011) on principal technology leadership and teachers' ICT application in two different school setting showed that Legal and Ethical Issues had the highest mean (3.02) followed by Productivity and Professional Practice and Learning and teaching with mean score (above average, 2.80) while Leadership and Vision had the lowest mean. Similar result was reported by Banoglu (2011) where the leadership and vision standards showed the lowest mean when tested for competency in technology leadership among134 school principals in Istanbul.

A study done by Yusup et al. (2008) on the use of instructional technology among school heads in selected best performance schools indicated that the overall performance of technology standards for school administrators was above average (76.6%) and the highest performance reported was in Teaching and Learning standard (86.4%) followed by Leadership and Vision (77.6%), Productivity and Professional Practice and Social, Legal and Ethical Issues (76.9%), and Support, Management and Operation (75.2%). The lowest performance was in Evaluation and Assessment dimension (66.5%).

Overall, the studies indicated school leaders performed better in the two dimensions of the NETS that is teaching and learning and productivity and professional practice (Anderson & Dexter, 2005; Yusup et al., 2008; Saleh et al., 2011). The performance of school leaders was low in leadership and vision (Saleh et al., 2011; Banoglu, 2011) and also evaluation and assessment (Anderson & Dexter, 2005; Yusup et al., 2008).

In another study on assessment of technology leadership among school heads revealed that school heads need to understand the social, legal and ethical issues on technology, have clear vision and technology plan to integrate educational technology, plan and implement comprehensive systems of effective assessment and evaluation and attend training on the technology integration to support productive systems for learning and administration (Yusup & Yusri, 2014)

In another another study on teachers' use of educational technology using the ISTE NETS for teachers (2002) indicated that teachers' competency level in all the standards is average low.

The highest standard reported is productivity and professional development while the lowest standard is social ethics, legal and humanities (Yusup, et al, 2008)

Educational Transformation and Educational Technology Programmes In Malaysia

Malaysia implemented several educational technology programmes as part of the school educational transformation programme. When did the transformation programme start? It may have started when the concept of educational resource centres (resource based learning) was introduced in the school system in the early 1980's. But some may argue that the educational technology transformation started when smart school concept was introduced in Malaysian schools in 1999 and was fully implemented in all schools in 2010. The general concept of smart school is to prepare students in the information age using ICT (Ministry of Education, 1997). The traditional or conventional school is systematically redesigned to improve teaching and learning as well as school management system to help students learn using innovative pedagogy supported by new learning and teaching technologies. This transformation programme is expected to transform traditional teaching and learning to technology-based learning and teaching. However, we still see teachers, students and schools practising traditional teaching in terms of technology and pedagogy. A study by Hamzah, Ismail & Embi (2009) reported that schools do not have sufficient instructional technology equipment and infrastructure, lack of appropriate software and learning materials, teachers are not ready for technology-based teaching and lack of training, burdened with administrative workload and learning is exam-centred. Teachers also believed that ICT used in smart school is only a tool (Hamid, 2011) to help them in the delivery of content. Another findings revealed that teachers faced resource, institutional, informational and attitudinal problems (Thang et al, 2010).

Later in 2007, EDUWEBTV was implemented to provide education for all using webTV. This innovative programme is expected to provide equal access to education to all students regardless of geographical location. WebTV is an Educational TV programme broadcasts by Educational Technology Division, Ministry of Education through the Internet to replace the synchronous on-air educational TV programmes broadcast by Astro, a commercial TV station. It is a video-based interactive educational portal providing learning materials for students and instructional materials for teachers to support teaching and learning. There are 4 channels in the EDUWEBTV portal, namely, News (Berita), Special program (Rancangan khas), Curriculum (kurikulum), and Guidance (Panduan) (BTP, 2013).

This innovative teaching and learning programme is expected to integrate web and video-based teaching and learning but as in smart school innovation, teachers and students alike are not using them fully. The issues raised are lack of TV pedagogy, technical problem and quality video that can support teaching and learning (Melissa, Fong, & Ong, 2010) and lack of professional development programme such as training, seminar and workshop to enhance computer self-efficacy among teachers (Mohd Arif, et. al, 2011). In another study Danial (2009) reported that teachers seldom use eduwebTV because unable to prepare eduwebTV lessons, no motivation and encouragement, poor ICT infrastructure especially Internet stability and access.

Virtual Learning Environment (VLE)

Finally in 2013 virtual learning as a technology for teaching and learning was introduced to all schools in Malaysia by Educational Technology Division, Ministry Of Education under the 1BestariNet project to provide more learning opportunities for the students and teachers to cope with conventional face-to-face classroom activities via the Internet. As in EDUWEBTV, this

innovation or educational technology transformation programme is expected to bridge the digital gap between rural and urban students by providing quality online materials to all Malaysians. Over 10,000 government schools in Malaysia are being equipped with the Frog Virtual Learning Environment (Frog VLE) and 4G Internet connectivity under the 1BestariNet project which is being carried out by YTL Communications and FrogAsia of the YTL Group. Using Frog VLE and high-speed 4G connectivity, schools use less paper, simplify administrative tasks, keep track of students' work, catering to different learning styles, and making lessons more interactive (http://www.frogasia.com/v3/frog-virtual-learning-platform-for-over-10000-schools-in-malaysia-wins-ict-provider-of-the-year/)

What is VLE?

There are several definitions on VLE and Virtual Classroom (VL). Few examples are given below to explain the two terms.

VLE is a system for delivering learning materials to students via the web. The system consists of assessment, student tracking, collaboration and communication tools. As a virtual learning system, it can be accessed both on and outside schools and can support students' learning outside the classrooms 24 hours a day, seven days a week. This enables schools to teach students not only during schools hours but extend the instructional and learning hours at home using the learning materials available or posted in the web. For those students who are absent in schools due to sickness or do not attend classes because of involving in co-curricula activities, may use the virtual learning materials and activities to compensate the missing classes.

VL is a term frequently used interchangeably with distance learning, online learning, e-learning, or Web-based learning. In distance learning, VLE can support distance learners who cannot regularly visit the campus due to geographic or time restrictions, for example those on distance learning courses, doing evening classes, or workers studying part-time.

A VLE, or learning platform, is an e-learning education system based on the web that models conventional face-to-face education by providing equivalent virtual access to classes, class content, tests, homework, grades, assessments, and other external resources such as open education resources or museum website links. It is also a social space where students and teachers can interact through threaded discussions, online forums or chat. It typically uses Web 2.0 tools for 2-way interaction, and includes a content management system (CMS).

VLE's are the basic components of contemporary distance learning, but can also be integrated with a physical learning environment which may be referred to as blended learning. VL can take place synchronously or asynchronously. In synchronous systems, participants meet in real time, and teachers conduct live classes in virtual classrooms. Students can communicate through a microphone, chat, or by writing on the board. In asynchronous learning, which is sometimes called self-paced or delayed learning, students are expected to complete lessons and assignments independently through the system. Asynchronous courses have deadlines just as synchronous courses do, but each student is learning at his/her own pace.

A VLE can also include students and teachers meeting online through a synchronous web-based application. The teacher is able to present lessons through video, PowerPoint, or chatting. The students are able to communicate with other students and teachers, as well as collaborate with each other, answer or pose questions. They can use the tools available through the application to virtually raise their hand, send messages, or answer questions on the screen given by the teacher or student presenter.

Virtual classroom

The term virtual means a simulation of the real thing, so a virtual classroom allows learners to attend a class from anywhere in the world and provides a learning experience that is similar to a real classroom.

Based on these definitions, schools need to plan how VLE can facilitate and improve instruction. Teachers need to plan instruction and learning blending the face-to-face instruction with virtual classroom approach. We cannot depend the VLE technology to take most of the burden of teaching and learning but used technology appropriately to enhance the traditional instruction. It is true that VLE can provide more and quality learning using VL technologies and pedagogy at anytime and anywhere at a distance or in live classroom using internet-based materials and open education resources. Using web 2.0 or social media to collaborate in virtual environment and taking online courses at a distance are potential examples of using VLE. Or we can practice flipped classroom approach by providing VLE experiences to enhance the live classroom presentation. So we need to look VLE as a teaching and learning approach that can facilitate teachers to teach and student to learn as stated in all educational technology definitions. The findings from research study on VLE highlighted some of advantages and disadvantages of using this technology of instruction.

Studies on VLE

Few studies were conducted to see the impact of virtual learning in teaching and learning. The studies below were done on adult learners enrolled in online distance learning program. The findings indicated that students viewed the virtual classroom as a supplement to classroom learning and virtual classroom has a moderate influence on their learning. Possible reasons could be the nature of the technical subject which requires problem solving and critical thinking skills with many pre-requisite knowledge chunks (McGill, Volet & Hobbs, 1997) supported by synchronous virtual learning environment as in live video conferencing and online forum via social media networking (Subramaniam & Kandasamy, 2011). Another study by Fong (2012) suggested that teachers should involve themselves in collaboration and mentoring via asynchronous mode of CMC regardless of distance and time in order to develop professionally.

The bottom line is: Do the various educational technology programmes improve or facilitate teaching and learning? Or do they lead us to the right direction of using and implementing instructional technology? I think we are much concerned on technology per se least to see how new learning and instructional technologies can facilitate and drive learning. Our business is to facilitate learning selecting and using the appropriate technology to achieve learning outcomes or performance. In teacher-centred approach, the teacher used the blackboard, white board, overhead projector or PowerPoint as a technology for teaching and learning, and sometimes flipped the classroom with other technologies such as youtube or podcast made available in the Internet to support conventional learning. The instruction can be delivered face-to-face or blended or fully online as in the Massive Open Online Course (MOOC) where thousands of students can learn at one time. Stanford University, Havard University and MIT are the pioneers to offer open and free online courses (Chu, 2012) and to date about 2.6 percent of higher education institutions are offering MOOCs and 9.6% are in the planning stage (Sloan Report, 2012). In Malaysia, the Education Ministry launched MOOC in September 2014 involving four compulsory undergraduate courses namely Islamic and Asian Civilization, Ethnic Relation, Entrepreneurship and ICT Competency (Berita Harian,19 September 2014). This is the first massive open online courses

initiated by Malaysian government offered to all undergraduates in Public Higher Institutions (IPTA) undergraduates. MOOC can be accessed at www.openlearning.com/malaysiamoocs

On the other hand in learner-centred approach especially in distance learning, the learning module (printed or digital) is designed to substitute the teacher using instructional design principles where students are expected to learn anywhere at their own pace and time. As in teacher-centred approach, OER are identified to support the learning module which can be accessed for free under Creative Commons Law.

Conclusion

In this paper, we have discussed the definition of educational technology and its relation with transformation programme and 21 century learning, instruction and learning theories, framework for 21 century learning, educational technology standards, and a brief look at some of the educational technology innovation programmes implemented in schools. These are some of the challenges and issues that need attention in 21 century learning. Our schools need to change and adapt to 21 century learning. Education is about adapting to the changing world. So what and how we teach need to change as well. But we must be sure we are heading to the right direction. Today we realize that teaching and learning have changed. For examples pen and pencil has changed to google, youtube, facebook, blog, teachers must keep pace and stay relevant to keep students engaged, student centred learning to provide experiences and opportunities and apply knowledge, students learn anytime anywhere, and can be accessed 24 hours a day or 7 days a week at any time anywhere, use multitude of technologies to access content, publish their own work, interact with the world, primary school students collaborating with others in several countries to study various topics, use videoconference to discuss world issues, conduct viva online, students doing project-based learning, work in group, do peer teaching and negotiate learning. These changes are affecting schools and are stated in the 21 century framework and NETS. So stakeholders, teachers and community need to collaborate to meet the challenge of 21 century learning. A school head or a teacher cannot do the change alone because it is a systemic change and this paradigm shift or transformation programme involved changes in the mindset as well (Reigeluth, 2009).

References

Anderson, R. E. & Dexter, S. (2005). School technology leadership: An empirical investigation of prevalence and effect. *Education & Educational Research*, *41*(1), 49–82.

Bates, Tony, E-learning and 21 century skills and competences, retrieved June 24, 2009 from http://www.tonybates.ca/2009/06/e-learning-and-21- century-skills-and-competences

Berita Harian (September19, 2014). Malaysia pertama di dunia laksana Moocs

BTP (2013). Pengurusan Sumber Pendidikan. Retrieved 12 November 2013 from http://bibliografi.moe.edu.my/SumberPendidikan/index.php/faqs/207-eduwebtv.html

BTP (2013). EduwebTV, retrieved 12 November 2013 from http://eduwebtv.com/v2/home/

Banoglu, K. (2011). School principals' technology leadership competency and technology coordinatorship, *Educational Sciences: Theory and Practice, 11*(1), 208-213.

Chu, J. (2013). *Learning from edX*. Retrieved August 28, 2013, from http://www.technologyreview.com/article/517836/learning-from-edx.

Churches, A. (2008). *Education for the 21st Century: The Basics.* Retrieved 14 November 2013 from (http://www.smlcs.org/publications/21stcenturyeducation.pdf

Danial Heryanto Zainal Abidin (2009). Penggunaan EduwebTV dalam pengajaran di kalangan guru sekolah rendah Daerah Klang Selangor. Tesis Sarjana Pendidikan, Universiti Pendidikan Sultan Idris, Tanjung Malim,

Fadzliaton Zainuddin (2012), Pusat Sumber Pendidikan Dalam Pembestarian http://www.slideshare.net/Fadzliaton/pusat-sumber-pendidikan-dalam-pembestarian-sekolahPusat

Frog, Virtual Learning Platform For Over 10,000 Schools In Malaysia, Wins ICT Provider Of The Year. http://www.frogasia.com/v3/frog-virtual-learning-platform-for-over-10000-schools-in-malaysia-wins-ict-provider-of-the-year/

Garrison , R.D. (2011). Learning in 21 Century: A framework for research and practice, (2nd ed). New York: Routledge.

Hamid, R.H. (2011). Teachers' Beliefs and Use of ICTs in Malaysian Smart Schools: a case study Retrieved 14 November 2013 from (http://www.ascilite.org.au/conferences/hobart11/procs/Hamid-poster.pdf)

Hamzah, M.I, Ismail, A. & Embi, M.A (2009). The Impact of Technology Change in Malaysian Smart Schools on Islamic Education Teachers and Students, *International Journal of Human and Social Sciences 4*:11 2009n.

ISTE National Educational Technology Standards adopted by the Oklahoma State University. Retrieved 13 November, 2013 from http://www.kelloggllc.com/tpc/nets.pdf

ISTE National Educational Technology Standards for students 2007 http://www.iste.org/docs/pdfs/nets-s-standards.pdf?sfvrsn=2

ISTE Standards (2012). http://www.iste.org/standards

Januszewski, A & Molenda, M. (2008). *Educational Technology: A Definition with commentary*. New York: Lawrence ErlBaum

Johnson, D.W. & Johnson,R.T.(2009).An Educational Psychology success story: Social Interdependence Theory and cooperative learning. *Educational Researcher,* 38(5), 365-379.

Kay, K. (2008). Partnership for 21 century skills, Retrieved 12 September 2013 from http://www.p21.org/storage/documents/ken_kay_-testiony_for_rnc_platform_committee.pdf http://www.pbs.org/wnet/wherewestand/reports/voices-on-education/video-ken-kay-president-and-founder-of-the-partnership-on-21st-century-skills/306/

Melissa N.L.Y.A., Fong, S.F. & Ong, S.L. (2010). An Evaluation of Instructional Videos in EDUWEBTV: Technical Qualities, Pedagogical Aspects, Engagement and Perceived Impact on Learning. *Malaysian Journal of Educational Technology*, 10(2), pp. 101-113.

Merrill, M. D. (2007). First principles of instruction: A synthesis. In R. A. Reiser & J. V. Dempsey (Eds.), *Trends and issues in instructional design and technology* (2nd ed., pp. 62-71). Upper Saddle River, NJ: Merrill/Prentice-Hall.

Merrill, M. D. (2009). First principles of instruction. In C. M. Reigeluth & A. A. Carr- Chellman (Eds.), *Instructional-design theories and models: Building a common knowledge base* (Vol. III, pp. 41-56). New York: Routledge.

Ministry of Education (1997). The Malaysian Smart School: A Conceptual Blueprint (1997). Retrieved 21 September, 2014 from (http://www.mscmalaysia.my/sites/default/files/pdf/publications_references/Smart_School_Blueprint.pdf)

Mishra, P., & Koehler, M.J. (2006). Technological pedagogical content knowledge: A framework for integrating technology in teacher knowledge. Teachers College Record, 108(6), 1017-1054.

Mohd Arif Ismail, Rosnaini Mahmud, Noraini Mohd Nor, Jamil Ahmad, Mohd Jasmy Abdul Rahman (2011). *Computer Self Efficacy: Teacher Readiness in Accepting Malaysian EduwebTV*

NETS –A http://www.iste.org/docs/pdfs/nets-a-standards.pdf?sfvrsn=2

Ng Siew Fong, Wan Fara Adlina Wan Mansor, Mohamad Hassan Zakaria & Nur Hidayah Mohd (2012). The Roles of Mentors in a Collaborative Virtual Learning Environment (CVLE) Project. *Procedia - Social and Behavioral SciencesVolume 66*, 7 December 2012, Pages 302–311

Reigeluth, C.M. (2009) Instructional Theory for Education in Information Age. In C.M.Reigeluth, C.M. & A.A. Carr-Chellman, A (Eds). *Instructional-design theories and model: Building a common knowledge base* (Vol. 111, pp. 387-399). New York: Routledge

Reiser, R, & J. V. Dempsey (Eds.) (2007). *Trends and issues in instructional design and Technology*. Boston: Pearson

Saleh, M.J., Kannan, S. & Leong, M.W. (2011). Principal technology leadership and teachers' ICT application in two different school setting. Paper presented at *International Conference on Application of ICT in Economy and Education (ICAICTEE, 2011)*, UNWE, Sofia, Bulgaria, 2-3 December 2011

Schlechty, P. (2002). Working on the work. New York: John Wiley & Sons

Seels, B. & Richey, R (1994). *Instructional technology: The definition and domains of the field,* Washington DC; AECT

Sloan Report (2012). *Changing Course: Ten Years of Tracking Online Education in the United States* retrieved 13 november, 2013 from http://sloanconsortium.org/publications/survey/changing_course_2012

Subramaniam, N & Kandasamy, M. (2011). The virtual classroom: A catalyst for institutional transformation. *Australasian Journal of Educational Technology 2011, 27*(Special issue, 8), 1388-1412. (http://www.ascilite.org.au/ajet/ajet27/subramaniam.pdf)

Thang, S. M., Murugaiah, P., Krishnasamy, P.,Hazita Azman, Tan Lay Yan &Lee Yit Sim (2010). Grappling with technology: A case of supporting Malaysian Smart School teachers' professional development, *Australasian Journal of Educational Technology,* 26(3), 400-416

World Applied Sciences Journal 14 (Learning Innovation and Intervention for Diverse Learners): 60-66, 2011ISSN 1818-4952

Yusup Hashim & Razmah Man (2006*., Teknologi Instruksional: teori dan amalam*. Tanjong Malim: Randys

Yusup Hashim & Abd Latif Ghapor (2010). The evolution of instructional technology in Malaysia, *International Journal of Instructional Media*, 37 (3).

Yusup Hashim & Yusri Yusup (2014). An assessment/investigation on Malaysian school heads' Technology leadership inclinations and activities. In Rosnaini Mahmud, Mohd Arif Ismail, Rozhan M.Idrus & Mahdun (editor), *Technology Enhanced Global Classroom Environment*. Bandung: Universiti Riau Press, pp. 41-50.

Yusup, H. (2013). Educational technology leadership in 21 century Education: Challenges for school administrators. Keynote 1 presented at Aminuddin Baki Education Institute, Genting Highlands, Malaysia, 18 June 2013.

Yusup, H., Saleh, M.N, Daud, A.R., Gapor, A.L., Raoh, I. & Hamzah, M. (2008). *Kajian tentang kompetensi guru menggunakan teknologi pengajaran di sekolah berprestasi tinggi.* Tanjong Malim: Universiti Pendidikan Sultan Idris.