TRAINING MODULE SERIES:
STUDENT-CENTERED LEARNING (SCL)
APPROACHES FOR INNOVATIVE TEACHING

Module 4: The Constructivist Lecturer

Rozinah Jamaludin, Lee Lik Meng
& Wan Mohamad Fauzy Wan Ismail

UNIVERSITI SAINS MALAYSIA

CENTRE FOR DEVELOPMENT OF ACADEMIC EXCELLENCE @ USM

Centre for Development of Academic Excellence (CDAE), USM

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Training Module Series: Student-Centered Learning (SCL) Approaches for Innovative Teaching

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Preface

Students are expected to achieve 21st century skills, which inculcate life & career skills, learning & innovation and information & communication technology (ICT) skills. Consequently, it has become the unwavering responsibility of educators to ensure that these skills are sowed in students especially at higher education institutions (HEIs). As such new methods of teaching and learning (T&L) have been continuously identified to devise techniques which are relevant and suitable for the students of the net generation. Parallel to that perspective, Student-Centered Learning (SCL) has been promoted as a new approach in T&L to support the rapidly changing educational environment. The Centre for Development of Academic Excellence (CDAE) has published the Training Module Series: Student-Centered Learning (SCL) Approaches for Innovative Teaching which consists of Modules 1 to 6 that will provide the basis for a training programme for academic staffs to enhance their pedagogical knowledge and skills. The modules were authored by an array of experts in the area of T&L, who have provided an overview of SCL in terms of definition, methodology and application.

Module 1: Introduction serves as a foreword to the concept of SCL by: (1) introducing the vision and mission of the National Higher Education Strategic Plan 2 (NHESP 2) regarding T&L through the soft power approach at the regional and global levels; (2) describing the 21st century skills that are needed for today's society and (3) specifying the outcomes of T&L in the classroom. Module 2: Philosophy of Student-Centered Learning (SCL) provides an overview of SCL and introduces the underlying philosophies that support the student-centered approach to teaching. The content of this module also describes the key benefits of SCL for students and lecturers and student-centered pedagogy (i.e. characteristics of the learners and the nature of the learning environment in the student-centered setting).

Module 3: Learning Taxonomies revolves around the learning taxonomies used in T&L that are based on Anderson and Krathwohl's (2001) revised version of Bloom's Taxonomy and Buckwalter's Taxonomy for the Health and Medical Sciences (1981). This module illustrates the basic principles of the learning taxonomies used in education and the classification of educational objectives (i.e. three domains: cognitive, affective and psychomotor). Module 4: The Constructivist Lecturer provides detailed methods that will assist the reader to become a constructivist lecturer via the application of constructivist approaches in T&L.

Module 5: Approaches to Student-Centered Learning (SCL) aims to offer teachers in higher education a variety of student-centered educational approaches. These learning approaches are presented in a straightforward manner, with opportunities for self-assessment and reflection to allow for the selection of the most appropriate SCL approach.

Module 6: Assessment in Student Centered Learning is a compilation of six individual units that includes the detailed description of assessment for the SCL approach which consists of definition, methodology and principles. This module also describes issues, benefits and challenges of implementing assessment and best practices for assessing students in the in the SCL.

On the whole, the modules are projected to be beneficial to the reader in terms of T&L, upon the understanding and consequently the application of the SCL concept. Each module in this series will definitely aid in the improvement of the T&L environment in USM and thus is recommended for all the academic staff of Universiti Sains Malaysia (USM).

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Module Description

Constructivism is a theory of how learning occurs. Specifically, it describes how learners construct knowledge out of their own experiences. Its approaches are therefore well suited for student-centered learning (SCL). In the application of this theory (some would call it a paradigm), the constructivist lecturer would use appropriate pedagogies that promote active learning as opposed to passive learning (in which the student is a mere recipient of knowledge). This module provides building blocks that will help you embark on your journey to become a constructivist lecturer.

Module Outcomes

At the end of this module, users should be able to:

1. Differentiate the various types of learning approaches from behavioural to the constructivist learning paradigm; and
2. Apply constructivist approaches in teaching and learning.

We have set only two modest outcomes so that you can make a quick leap forward, but we expect that in developing a true constructivist learning approach you will sustain a prolonged period of continuous learning, unlearning and relearning of your teaching skills with further outcomes. In fact, when you apply this module in your work as a lecturer, you will reflect and progressively identify other outcomes you wish to achieve within this module itself. We encourage you to (re)define your own goals to become a lecturer of the 21st century.

Before you read further, spend 5 minutes quietly thinking about the last lecture that you conducted and then answer the following questions:

- What did you do to prepare for the lecture?
- Visualise the scene at the start, the middle and the end of the lecture?
- What was the atmosphere like in the lecture hall?
- Write down some keywords to capture your thoughts or draw a mind map or a picture or just create some snapshots of your lecture in your mind.
- What do you think you are good at during your lectures (things that you are proud of)?
- Is there anything you would like to improve?

1 Introduction

The constructivist does not teach, at least not in the traditional sense of the teacher who is a master (or sage) dispensing knowledge to his or her students (the disciples). Most lecturers are familiar with the lecture mode for the delivery of lessons, mainly because we went through an entire education system, from primary school to university, focussed on paying attention to the teacher. Traditionally, the lecturer is expected to know everything there is to know about the subject that he or she is teaching. That knowledge is then transferred to the students, who sit passively in the classroom listening and absorbing everything that is said or taught by the teacher. Memorisation or rote learning skills are critical for students. The ability to regurgitate or recall the lessons during the examinations or tests is then taken as the definitive indicator or measurement that the students have learned from the prescribed syllabus.

Teaching, in this sense, is a one-way flow of information or knowledge from teacher to student. It assumes that there is one truth, which the teacher has mastered, thus making the teacher the authority who can then pass it on to the students in class. This is the objectivist paradigm. In the university environment, this is akin to a distinguished professor standing in front of tens or perhaps hundreds of students in a lecture hall giving a lecture about her pet subject for one or two hours, sometimes aided by a white board or flipchart or the now favoured PowerPoint slides.

The constructivist paradigm says that there is more than one truth (or more than one way to understand the facts or to see the truth). Each individual student will construct his own understanding of the same set of facts or knowledge based on personal experiences, level and extensiveness of prior knowledge, cultural and social upbringing and the influences of peers. In other words, knowledge must have meaning to the individual.

Below are different ways we see the same 'truth':

- Disposable cups: One group is oblivious to the environmental consequences of using disposable cups and therefore does not think twice about using them; a second group is aware that disposable cups are a waste of resources but will use them if they are assured that all used cups will be sent for recycling; a third group may totally avoid using these cups because they consider recycling as a further waste of resources.
- Vegetarians vs. meat eaters: This represents another ongoing struggle for sustainability. Vegetarians promote a meatless diet as necessary to save the world. Meat eaters think that it is unnatural to go totally meatless. In the middle are those who promote the middle path: eat more vegetables and less meat.

Knowledge must have context to be long-lasting and to have an impact on the learner. In information science, the data-information-knowledge model closely relates to the constructivist paradigm. The example often used is weather forecasting. Temperature readings, humidity and atmospheric pressure are merely data. The weather forecaster uses the data to predict rain, snow or sunshine for the next few days. The forecast is information. The average individual who reads the forecast then makes a decision about whether to bring his or her umbrella or overcoat to work. Information then becomes knowledge. For the person who did not bring an umbrella and it rained on the way home, his construct of the knowledge was probably based on a hunch that the forecast was unreliable or that he could beat the rain and get home without getting soaked. Perhaps if he got soaked a few times, he would reconstruct his view and show a greater appreciation for the accuracy of the weather forecaster. In its current incarnation, the constructivist model includes wisdom as the end point, but it is an elusive term. It suggests a higher-order understanding and tacit knowledge acquired through extensive experience, which adds value to the knowledge for more precise or refined reactions to the weather forecast. For instance, seasoned fishermen with years of seafaring experience may be able to read the waves, the winds and the clouds to decide whether the forecasts are reliable.

Some of you may argue that there is basic science or knowledge that represents laws or indisputable facts and therefore should be remembered or memorised by every student. We accept that proposition, but we also point out that even in the fundamental sciences there is a tradition of constantly challenging the 'truth' (or theories and laws) in order to advance the science. Black holes, for instance, challenge the laws of physics.

If you have supervised a post-graduate research student, you are familiar with and have adopted aspects of the constructivist approach to learning even though you may not have encountered the term 'constructivism'. As a supervisor, you have guided the student through the process of conducting proper research. The process of conducting scientifically sound research is just as important as the findings. During that process, the research student formulates a hypothesis or a statement of the problem and then proceeds to gather data, apply an appropriate method of analysis and finally accept or reject the initial hypothesis or statement of the problem based on the evidence. The outcome or findings of the research is entirely the effort of the student; it is not predetermined by the lecturer. In fact, the research student's interpretation of the data constitutes one construct about the world that he or she investigated. In a sense, you could say that the research student is an active learner facilitated by the constructivist lecturer-supervisor.

Clearly, constructivism is not a totally alien approach for you as a lecturer. In fact, you probably have used this approach often. We hope that this module will encourage you to become even more skilful in the art of facilitating learning and in the process appreciate even more the skills you have taken for granted.

Stop and Think

- Do you think that your teaching approach has something in common with the constructivist paradigm?
- Has reading the above discussion triggered your curiosity so that you want to know more about constructivism in particular and pedagogy in general?
- Do you feel that your work as a lecturer should be better informed by the theories and practices of teaching and learning?

2 Learning Theories for University Students

Students enter the universities in Malaysia at the age of 18 or 19 years; in many countries, people this age are considered to be adults. It is a difficult time of adjustment for most students, as they are leaving home to be on their own for the first time, attending classes that are big and impersonal and experiencing a cultural shock from an almost total dependence on the teacher in primary and secondary schools to becoming independent learners in higher education.

Adults expect and are able to exert more control over their learning in terms of what to learn, when to learn and how to learn. Malcolm Knowles proposed the andragogy approach as an adult education theory. In this approach, the strategies for learning are self-directed and autonomous. Adult learners are motivated by the relevance of the learning material to their work and personal lives and experience (including failure) is the basis for much of the learning. As such, problem-centered lessons based on real-world situations are preferred instead of the traditional focus on completing the content of a curriculum. Adults respond better to personal (or internal) motivations in order to learn as opposed to external motivations such as lecturers, parents or society.

The problem in Malaysia and in many other countries, including developed nations, is that the young adults entering university are in transition and most do not possess the qualities of the adult learner described by Knowles. They most likely do not possess the necessary skills for the constructivist approach, so as their educator you will need to assess their needs and build scaffoldings that will challenge them to progressively elevate themselves to become independent learners. SCL does not mean that you can just leave your students to find their own way or to do whatever they like.

How do we learn? As babies we mimic adults and as children we continue to learn from adults. We copy and repeat what we see others do or what we are instructed to do. We practise until we get it right. As adults we continue to imitate others. It is still the dominate mode of learning in our schools, but other approaches have also come into prominence. Based on observations and scientific studies, several prominent theories about learning have influenced how we teach. Below we describe those that are important for you to understand as you become a constructivist lecturer.

2.1 Epistemology of Learning Theories

Epistemology is the study of the origin, nature, grounds and limits of knowledge. In learning theories there are three dominant traditions: pragmatism, objectivism and interpretivism (Table 1). Pragmatism views knowledge as worthy of our pursuit but as a goal that is improbable to achieve. Knowledge is interpreted, negotiated and arrived at through consensus using experience and reasoning and does not necessarily reflect reality. There is no single truth.

Objectivism has dominated the epistemology in education. The objectivist sees reality as independent from the learner and therefore learning becomes a matter of transferring what exists in reality to what is already known by the learner. Knowledge tends to be seen as absolute and is equated with the truth. Because there is only one truth, there is no need to construct knowledge. It is acquired by experience. A lecturer who adopts this view may not be very receptive to students who ask difficult or challenging questions in class, especially if they appear to suggest that the lecturer is wrong and does not know everything. Behaviourism and cognitive information processing theory fall within the objectivist assumptions.

In contrast, interpretivists view knowledge from multiple dimensions that depend on the learners' frame of reference. Knowledge is neither uniform nor identical. It is constructed after an individual considers the available information and makes a personal interpretation. Truth in the absolute sense is not a concern. The constructivist view of cognition is much more consistent with this perspective. In constructivism however, knowledge may be collectively constructed and is seen as complex and tentative and subject to challenge or critique.

Table 1. Three epistemological traditions and their relationship to the study of learning

	Objectivism	Pragmatism	Interpretivism
Source(s) of knowledge	Experience, absolute and true	Worthy but Improbable goal	Reason
Assumptions about reality	Reality is objective, singular, fragmentable	Reality is interpreted, negotiated, consensual	Reality is constructed, multiple, holistic
Types of research designs	Pre-procedural learning, empiricism	Procedural learning	Naturalistic, constructed knowing
Associated with learning and instructional theories	Behaviourism, Cognitive information processing, Gagne's instructional theory	Educational semiotics, Bruner's and Vygotsky's views of learning and development	Piaget's developmental theory, link with constructivism

(Source: http://www.ucdoer.ie/index.php/Education_Theory/Epistemology_and_Learning_Theories)

2.2 The Paradigms of Learning

Learning paradigms are theoretical frameworks that guide how to teach or how to structure learning. They are informed by how we see or conceptualise knowledge and how we learn. The following three paradigms are the ones you will most likely encounter as a lecturer.

2.2.1 Behaviourism

As a learning theory, behaviourism applies the notion of conditioning as an external stimulus to learn a skill or knowledge. Usually, reinforcements (including rewards) and punishments are integral to the lesson plans. Psychologists, animal trainers, teachers and parents use the principles of behaviourism all the time to teach new behaviours or to stop bad habits.

Behaviourism currently is not so influential in education, but in the past it was widely applied for the training of skilled labour for repetitive tasks such as those in factories and even offices. In schools, the approach of giving students homework, which requires carrying out exercises repeatedly, is modelled after behaviourist theory. Various computer-aided software for education (called CAI, computer-aided instruction) in the early days of e-learning was developed to permit the student to repeat the lesson until they get it right. Designing online quizzes, which students can practise until they get all of the correct answers, fits this mode of learning. This is often referred to as 'drill and practice' and tutorial courseware. The proliferation of workbooks for primary and secondary school examinations (UPSR, PMR, SPM and STPM) feeds on this rote learning approach.

Essentially, the student starts with a blank or clean slate (educationists refer to it as 'tabula rasa'). The teacher then stimulates a change in behaviour that is then equated with learning. The teacher is not concerned with how the students process the information inside their heads. All the students need to do is to absorb the lessons by memorisation or carrying out a task repeatedly until they have mastered it. No critical thinking is required.

TRIVIA 1

Much of the work about behaviourism was done with animals. The Nobel Laureate Ivan Pavlov was famous for his experiments in the late 19th century to stimulate the excretion of saliva by ringing a bell (and other instruments). Pavlov's dog was fooled into thinking that the sound of the bell signalled the presence of food. This is called conditioned reflex and when applied in education it assumes that learning is automatic, no thinking needed.

TRIVIA 2

As a student, think of those days in school when the bell rang to signal that it is time for assembly, recess, a class period or time to go home. You are conditioned in that your reflex action automatically reacts when your hear the bell ring. Isn't this very behaviourist?

2.2.2 Cognitivism

Think of cognitivism as 'brain-based learning'. Cognitive theories of learning displaced behaviourism in the 1960s but had been challenged since the 1920s by Gestalt theorists who advocated the search for patterns instead of isolated events. Knowledge, in cognitive theory, is seen as schema or symbolic mental constructions. Thus, learning takes place when a change is made to the learner's schemata (or mental model). The focus is on the internal mental processes of the individual learner rather than on the external environmental stimuli. A schema is a unit of knowledge that maybe in the form of objects, sequences, procedures, actions, social situations or events. We use schemas for various purposes, such as solving a problem, recognising a face, going shopping or comprehending the text in a story or passage. During

learning a student creates new schema but may also use schemas to retrieve or to upgrade facts stored in memory.

The learner is very much like the computer as an information processor, except that the human brain can do more than store and process data or information or solve problems. The human brain is able to think and to know. When designing your lessons, you should be aware that cognition or the act of knowing (otherwise called learning) requires that the students possess cognitive skills. These skills must be taught. The first skill is the ability to concentrate or focus on something for an extended period of time. A second skill is perception or the ability to become aware through hearing or seeing and then to process and interpret and finally assign meaning to the stimulus. For instance, one perceives that objects that are farther away are smaller even though they have not diminished in size, but as we approach an object it appears to grow larger. The lack of experience can lead to misconceptions.

The third cognitive skill is memory, which can be further classified into receptive memory (the ability to recognise physical features or shapes such as letters of the alphabet); sequential memory (the order of observation, such as the order of letters in a word); rote memory (for automatic recall such as remembering the alphabet, multiplication tables and grammar); short-term memory (or working memory, which permits us to retain information just recently acquired for use in subsequent tasks; this is needed for constructing sentences, solving problems in a series of steps and even conducting a conversation); and long-term memory (the ability to recall information obtained long ago). Without memory we would have to learn things over and over again. Chunking or the breaking up of information into parts, is a technique that is used to both convey and to store information in short- and long-term memory.

Finally, logical thinking skills help a student find the relationship between facts and establish a chain of reasoning that will lead to a conclusion or understanding. It is the ability to think in steps. For example, it is sequential thought, which functions as a fundamental skill in mathematics.

Conceptually, learning begins when a stimulus is applied (visual, audio, taste, touch, etc). The brain processes it and searches in the person's memory for similar occurrences and assigns a meaning to it. If no schema exists in memory, a new schema is created. If one already exists, new information may result in the schema being modified or rejected. The process of modifying or creating new mental models results in learning.

Stop and Think

What do you consider to be the two most important differences between behaviourism and cognitivism? The next time you give an assignment to your students, how will you use this knowledge about cognitive skills? Do you assume that the students already have those skills?

A further concept within the information processing model of learning is metacognition, which refers to higher-order cognition or 'knowing about knowing'. It means the ability to understand and use appropriate strategies or skills to successfully complete specific learning tasks. Metacognition includes cognitive activities such as oral communication, persuasion oral and reading comprehension, writing, language acquisition, perception, attention, memory, problem solving, social cognition and various forms of self-instruction and self-control. Learners must learn skills to find main ideas, rehearse information, form associations or images, use memory techniques organise material and take notes and tests. Other skills include being able to check their level of understanding, predict outcomes, evaluate the effectiveness of efforts and plan activities to overcome difficulties.

Metacognitive abilities are developed progressively throughout a person's lifetime beginning at about 5–7 years of age. As they grow older and acquire new skills, children become aware of their own thinking and have the ability to recall and comprehend unfamiliar materials. The progressive acquisition of these abilities must be built into instructional content to encourage students to apply metacognitive strategies to improve their performance in school. Some skills are easy to acquire (i.e. just tell them what to do), whereas others require a considerable amount of practice.

Another skill that is directly involved with constructivism is the development of higher-order thinking skills. As learners build their knowledge by scaffolding, an instructor can utilize these students' abilities to develop their higher-order thinking skills by providing an intellectual challenge. These challenges may be in the form of project work, quizzes or examinations rather than just factual or procedural recall tasks.

Stop and Think

Every individual uses a personal schema that aids in their learning; these schemas may help or sometimes hinder learning. For example, a person who can drive a car should be able to drive other cars. What do you think will happen when someone who is familiar with an automatic transmission has to drive a manual transmission car or vice versa?

TRIVIA 3

The first diagrammatic map of London's rapid transit network was designed by Harry Beck in 1931 (Beer, 2000). Beck was a London Underground employee who realised that because the railway ran mostly underground, the physical locations of the stations were irrelevant to the traveller wanting to know how to get to one station from another: Only the topology of the railway mattered. Schemata may be also known as a topology diagrams, as scale and distance do not matter (unlike for a geographical map).

Anderson and Krathwohl (2001) revised Bloom's Taxonomy (1956). The revised thinking pyramid (Figure 1) places remembering as the lowest form of thinking and creating as the highest form of thinking.

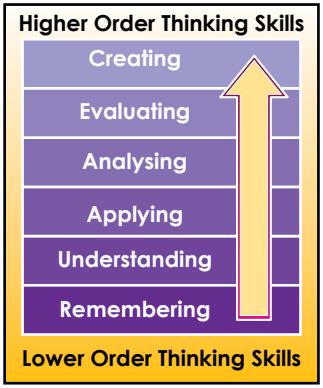


Figure 1. A revised version of Bloom's taxonomy was created by Anderson and Krathwohl (2001).

Therefore instructors coupling higher-order thinking skills with the emotional quotient would essentially encourage their learners to work effectively by utilizing their analytical ability to solve problems by essentially creating new forms of solutions that may or may not be the conventional approach to solve the problem. If learners are allowed and encouraged to look into new approaches, they essentially are creating new solutions by practising their higher-order thinking skills.

Stop and Think

What is a schema? What is your current schema about cognitive learning? Do you see learning as merely memorising or rote learning? Try drawing your schema as a mind map? Do you consciously take into account how students learn when you organise your lectures, assignments and projects? How would you use the concept of chunking in your lectures? How many things can a person remember at any one time? Is it the responsibility of lecturers to teach these cognitive skills?

2.2.3 Constructivism

There is much connectivity between cognitivism and constructivism, as both are brain-based learning approaches. One major difference is in how the thinking processes are conducted. Cognitivism explains how information is processed in the brain to become knowledge, but it assumes that knowledge is 'out there' waiting to be transferred to the learner. Constructivism, on the other hand, emphasises that that process is controlled by the student who creates his own understanding or meaning of that knowledge as he evolves through multiple stages of experiences. In this sense, constructivism is totally opposite of objectivism because of its fundamental assumption that there are multiple constructs of the same information. In other words, there is more than one truth.

You may find discomfort in the notion about multiple truths. After all, a fact is a fact. The Earth is round, end of story. Not so long ago, however, people thought the Earth was flat, until someone sailed around it.

TRIVIA 4

Who was the first person to sail around the world? Do you remember that it was Ferdinand Magellan (as taught to us in the history books)? That is incorrect, as he died in the Philippines and did not make the full circle back to Spain. Could it possibly be a Malay(sian), the servant and interpreter to Magellan? The National Maritime Museum website in the UK thinks so. Google it yourself!

In constructivism, remember that it is not the end point that is the ultimate or overriding concern. It is the process of getting there that should be the focus. Constructivism is about how people learn. It is focussed on the process of acquiring the knowledge, not on the knowledge per se.

In the traditional classroom, the focus is on completing the syllabus so that students are prepared for the examinations. In the constructivist classroom it is the journey, not just the destination that is given the prominence. This creates tension in many disciplines for which it is argued that the end product is the most important thing (e.g. being able to design a structurally sound bridge). However, there really is no conflict. Think of the constructivist approach as a change that can result in obtaining a better end product. As the facilitator of learning, you must learn to structure your lectures, classes and projects to lead your students through various stages of learning that culminate in the desired end product.

Is constructivism suitable for all types of courses? The short answer is yes. Is it suitable for all ages? Again, yes. It is gaining popularity even for elementary (primary) education in some countries. Is it appropriate for higher education in Malaysia, given that most students are focussed on rote learning? Yes, it is appropriate, but a lot of hard work from the ground up to build the requisite skills and mindsets among students can be expected.

As you embark on your own journey, we offer some well-established principles. Use them as guidelines but make it your own as you gain more experience.

1. Foster student autonomy: Respect students' ideas. Help them to discover their own identity by encouraging them to ask questions, analyse data and find their own answers. It lets them take responsibility for their own learning.
2. Ask open-ended questions: Even if you have the answer, do not reject outright the students' answers. Always give enough time for students to think and respond. Constantly remind yourself that there is no right answer.
3. Encourage higher-order thinking: Emphasise the need to analyse and then

synthesise (and create), not merely compile a collection of facts or other people's opinions.

4. Encourage dialogue: Discussion between you and the students and among the students helps students to reinforce their ideas and it exposes them to multiple perspectives.
5. Assign problem-oriented activities: Such activities help to develop problem-solving skills as students actively seek knowledge relevant to their disciplines.
6. Assign authentic real-world projects: Such projects create a rich, complex and realistic environment that challenges the students to re-examine their current schema.
7. Collaborative learning: Collaborative learning allows students to negotiate meanings and share ideas. Working in teams has to be learned, so you have to structure your projects and classes to progressively acquire the appropriate skills.
8. Encourage self-assessment: Through self-reflection, students become aware of how they learn. Students must be able to explain how and why they solved a problem in a certain way. They must be willing to reach deep down to recognise their weaknesses and strengths and acknowledge the external stimulus that triggered the learning.

Stop and Think

Look up Lev Vygotsky, Jerome Bruner, Jean Piaget and Howard Gardner. What do you see as their major contributions to the constructivist classroom?

2.2.4 Comparing the Three Learning Paradigms

Table 2 summarises the major differences among the three learning theories (or paradigms) discussed above. As you read through the table, pause to think back on your own teaching experiences (or if you are new lecturer, think back to all the classroom encounters you had during your university education). Are you able to relate specific instances of your classroom experience with the three paradigms? Which learning paradigm did you encounter or use most often? In which areas do you think you would need to put in more effort to become an even better lecturer? Do you feel that they are all appropriate for your classes?

Table 2. Differences in learning perspectives among the three learning theories

Behaviourism	Cognitivism	Constructivism
Learning Perspectives	***Learning Perspectives***	***Learning Perspectives***
• Views learning as a change in the form of frequency of behaviour	• Views learning as mental organisation of knowledge and the development of propositional networks of information and production systems	• Views learning as subjective and personal discovery-based for learners to take in information and process it in unique ways that reflect their needs, dispositions, attitudes, beliefs, and feelings
• Learning requires arranging stimuli in the environment so that learners can adapt to the proper responses and be reinforced	• Explain learning, thinking, reasoning, problem solving, transfer, and learning of complex skills	• Construct own perspective of the world based on individual experiences and schema; promote collaborative learning and rich and real-world learning
• Learning is seen largely as a passive process; learning can be discrimination, generalisation, association, or chaining	• Learning involves mental activity; either the short-term or long-term memory	• Learning is an active, problem-solving, and constructive process that occurs as the learner is given and accepts a degree of responsibility and ownership for her or his own learning; students need to explore their own understanding, to make choices among them, to justify and test different ideas, and to evaluate them for themselves, in both familiar and unfamiliar situations
• Knowledge is viewed as given and absolute (objective knowledge)	• Knowledge is viewed as symbolic, mental constructions in the minds of individuals; still viewed as given and absolute, just like in the behaviourist school	• Knowledge is seen as relativistic (nothing is absolute, but it varies according to time and space) and fallible (nothing can be taken for granted)
Instruction Perspectives	***Instruction Perspectives***	***Instruction Perspectives***
• Focus learners to emit the desired behaviour in response to a stimulus; states objectives	• Focus on how learners receive, process, store, and retrieve information in memory	• Depends on learners and environments; provides for active, self-regulating and reflective learners
• Less concerned with what learners do but more concerned with what learners know	• Less concerned with what learners do but more concerned with what learners know and how they come to know it	• Creates opportunities for students to make their own ideas explicit, share them with others, subject them to critical scrutiny, and test their robustness by observation and/or experiment
• Based on the 'stimulus-response' model	• Based on three stages of the 'Information Processing' model; uses a variety of attention, encoding, and retrieval aids	• Based on the 'generative learning' model that consists of three distinctive teaching phases (focus, challenge, and application)

Source: Adapted from Driscoll, M.P. (2000)

TRIVIA 5

The constructivist paradigm is also widely used even for elementary schools (e.g. in the US) starting from a very young age. Check out http://www.dalton.org/philosophy/plan/ (includes examples of lesson plans for kids). Constructivism has also been adopted by the Ministry of Education for use in Malaysian smart schools.

Stop and Think

Do you think the Ministry of Malaysian Education should adopt constructivism in primary school?

3 How to Be a Constructivist Lecturer?

This module is designed as a quick reference to get you started quickly, but learning to be a constructivist lecturer will be a long journey that likely will stretch the length of your career in academia. We have the following advice for you as you relearn the skills to embrace constructivism. Our goal is not to totally eliminate instruction. Our goal is to expand the skills so that you can in turn expand those of your students in order to prepare them for life in the 21st century.

First, be aware of the kind of person you are, because it influences how you will interact with your students. As a constructivist lecturer, one of your greatest virtues will be patience. You will find that lessons take longer to accomplish, especially when you know that the students still do not have the skills to be constructivist learners. When you ask questions in class, be patient. Learn to wait for responses from the students. You will have to learn how to deal with the awkward moments of silence while waiting for answers. You will need perseverance and persistence to keep asking questions and waiting for answers, even though you already have the answers and all the students are giving you 'the look', saying silently: 'Just give us the answers already!' You will frequently encounter a passive audience and it will take substantial effort on your part to get the students to take an active role in their learning.

You may be an expert or authority and know everything there is to know about your subject area. You should, when appropriate and necessary, demonstrate your command of the knowledge or expertise, if only to make your mark and convince your students that you are not the proverbial 'blind leading the blind'. As a constructivist lecturer, however, your job is to design a journey of discovery with multiple pathways that may all lead to the same destination. You need to constantly remind yourself to focus on the process of learning. What you know is obviously important, but this is not about you. Focus on the student.

Design the journey with several 'rest stops' so that you provide opportunities to reflect and to modify the pathways leading to learning. Design your lessons so that they build on prior knowledge. If there is no prior knowledge, however, then you have to provide the scaffoldings or stepping stones or building blocks so that the students are not grasping at thin air. Plan your lessons and projects with interconnected sections or parts with increasing complexity.

Finally, how will you know that your students have learned? The experts in education will tell you that learning has taken place when the students' schemata have been modified. In plain language, you must be able to detect changes in the students' understanding or perceptions of the subject matter.

The constructivist classroom should never be dull and quiet. It needs agitation and confusion to spur learning. You must be prepared for a rollercoaster ride. You will encounter moments of triumph as well as moments of despair.

3.1 Lectures

The lecture is probably your most common mode of teaching. For a normal everyday lecture, the lecturer will prepare lecture notes and then convert them to a PowerPoint presentation. During the lecture, the lecturer will talk to the students continuously for 2 or 3 hours depending on the lecture time. The students are expected to quietly absorb and take notes and sometimes the students are allowed to ask questions. The lecturer eventually will give the PowerPoint slides to the students as lecture notes and students are expected to study these notes prior to taking their exams. This approach develops only the simplest thinking skills, such as memorising facts and accurately recalling those facts.

How can you incorporate SCL in your lecture? Here are some suggestions:

1. At the start of your lecture,
    a. Ask students to recall their prior knowledge from previous courses, lectures, experience or informal sources Orienting the students and activating their schemata will improve their learning. Given the limitations of sensory and working memory, do not talk too quickly, but 'chunk' the information provided into meaningful and relatively brief sentences.
    b. You should then connect their prior knowledge to the present lecture. The use of analogies, metaphors and similes will rapidly create new

connections with existing schemata. The use of frequent summaries, guiding statements and cognitive maps can help students to change their schemata, which can then be elaborated upon by the students themselves.

2. Provoke thinking during the lecture
   a. Include slides to remind you to pause and ask thought-provoking questions.
   b. Allow students time to think and respond; accept responses without being judgmental; probe and prompt; do not show favouritism.
   c. Reconnect to the lecture flow.
   d. Allow sufficient time to build student confidence, but not at the expense of your lecture goals.
   e. Every 15 minutes, pause for interaction (sometimes ask students to ask questions or give opinions or comments; or you can ask thought-provoking questions); scientific evidence suggests that you can maintain attention for about 15 minute spans/periods.
3. At the end of the lecture,
   a. Ask students to summarise their understanding of the lecture.
   b. You then provide a simple summary of the lecture (keep to four or five key points, even though most people can remember seven plus or minus two facts at any one time).
   c. Provide advance questions for the next lecture.

3.2 Tutorials

Tutorials are conducted after a few weeks of lectures, usually to allow further interaction and clarification after students have completed prescribed activities (e.g. reading and exercises). In the past, students would read and would be expected to regurgitate the facts back to the lecturer/tutor without invoking their critical thinking skills. The original intention was to force the students to complete their homework and assignments. This is not regarded as SCL.

Below are some ideas about how to incorporate SCL into your tutorials:

1. The tutorial should be used to encourage the students to voice their views or positions.
   a. Students should not just repeat facts or what the authors say.
   b. Encourage divergent viewpoints.
2. Selection of reading materials: Choose articles with different perspectives or viewpoints.
3. Determine how to deal with areas like mathematics/physics and natural

sciences for which fundamental knowledge/facts are required as prerequisites. This is in line with the constructivist approach, in which the lecturer encourages students to use active techniques (experiments, real-world problem solving) to create more knowledge and then to reflect on and talk about what they are doing and how their understanding is changing. The lecturer makes sure students understand his or her pre-existing conceptions and guides the activity to address them and then build on them. They also need to encourage student participation in discussion

4. The lecturer should allow the students to lead the tutorial. The lecturer should choose a position in the room that shows his or her willingness to take a less dominant role.
   a. Ensure that every student has the opportunity to lead. Every student should consistently take active part in all discussions.
   b. Be aware of dominating personalities. Encourage them but ensure that other students have equal opportunities to participate. Probing questions, reflective questions and 'thought' questions can all contribute to this process, as can the psychological and physical environments in which learning takes place.

3.3 Projects

Projects allow the learner to apply the knowledge that they have learned from the class, discussions, lecture notes and tutorials to produce a product that would function in the real world. The instructor would normally provide a scenario, with a term of reference and the general scope of the project. The main idea is to provide a 'simulated' approach towards achieving a set goal. Fundamentally it allows the learner to apply their conceptual knowledge to create a real-world product. This is an excellent opportunity to allow the learner to take centre stage. The instructor should play a very minimal role (i.e. to facilitate, guide or advise if the students are experiencing a challenge that they are unable to resolve).

Working on a project is an application of conceptual knowledge to create real-world products. While completing a project, groups of students are required to interact, cooperate and collaborate to complete the assigned task and achieve the goals within the limitations that have been set by the instructor. This encourages the learning of tacit knowledge in addition to the explicit knowledge that is normally presented in a more formal setting (e.g. classroom, lecture, tutorials or readings). This activity allows students to learn through self-awareness (often called experiential learning). Moreover, cooperating and collaboration allow students to share their tacit knowledge and learn from self-awareness and experiences shared by other learners.

The instructor must be aware that there are topics that are not suitable to be learned through certain mediums. For example, learning to swim using online resources is not feasible. Some projects may have limited success with online learning, such as learning to play a musical instrument, because visual examples may provide a clear understanding of finger placement but pitch quality, tempo or creativity may be more difficult to learn online. These types of projects should be completed by face-to-face practices between the learner and others. In general, physical or psychomotor skills are very difficult to learn from published sources or through the online medium.

Instructors also should be aware that prior to being assigned a project, the learner must possess fundamental knowledge about the field so that they can proceed efficiently. The lack of underlying factual knowledge would jeopardize the success of the project to be completed.

A case study represents a very specific situation at a given moment in time, so limited variables may be manipulated to exert a certain level of control over the situation or environment. A basic question that may be asked of the students is: Can a case study be a project or can a project be a case study? A discussion may be initiated by the instructor to determine the general feeling or understanding of the students regarding the question.

Some examples of projects include:

- Design studio in architecture or engineering;
- Web design and multimedia productions;
- Solar energy acceptance, suitability and challenges;
- Programming for computer science;
- History: role playing or situational enactments;
- Podcasting; and
- Videocasting/Streaming.

Stop and Think

Projects usually depend on the scenarios that determine the terms of reference and scope of the project. Simulations usually represent a controlled form of an environment in which a project may take place. When do we apply scenarios and when do we use simulations and would this choice depend on the field of study?

TRIVIA 6

The word project comes from the Latin word 'projectum', which actually originally meant 'something that comes before anything else happens'.

3.4 Lab-based Activities

Lab-based activities involve a controlled environment in which students are required to interact with determined variables to achieve a desired outcome, regardless of whether the lab activities involve a wet science lab, a dry computer lab or a lab that requires using equipment that is representative of a real work situation. Learning that is required to be executed in a lab is the learning of procedures within that environment. The sequence of steps to be taken is usually rigid and sequential. This sequence is usually related to a procedure for which skipping a step may not provide the expected result. The sequence is often expected to be repeatable and provide the same or similar results.

Stop and Think

Should all lab-based activities be confined to a lab? Can field trips also be considered a lab-based activity?

TRIVIA 7

How many kinds of labs are there in education? Count them.

Lab-based activities involve procedural learning. Some of the tacit skills required are making observations and finding relationships or correlations between the variables that are being used, studied or manipulated. Students are expected to be very observant and record their observations as the variables are manipulated or as the procedures are carried out in accordance with the anticipated sequence.

As the learner proceeds with procedural learning, the sequencing of the various steps have to be taken into account; an important part of this process is making observations. One of the main tenets of constructivist learning is the creation of new knowledge by acquiring new data and building it on top of the present learner's schemata. Thus, one of the most convincing ways to determine if new facts or data should be accepted is to 'see it with my own eyes'. Observations play a very important role in that regard. Based on such observations, learners can build new connections relating the newly acquired data and facts with their present schemata. Their decision-making process would accept, assimilate or reject these new data; this process is the essence of building knowledge via constructivist understanding.

3.5 Field Trips

A field trip is organised by the lecturer as an extension of the classroom (Figure 2). There must be an educational purpose for the trip and it usually is to bring the students to the real-world environment so that they can study or observe the subject matter in its functional or natural setting. Field trips must be educational and fun and stimulate multiple intelligences, even if they are planned for adult learners. A field trip can be used to provide experiential learning to reinforce lessons learned in class, especially when pictures and words do not do justice to the real thing or when the authentic environment could invoke emotions, feelings of surprise or even dread and apprehension. It is a group activity with a specified time frame, usually of a short duration (from several hours to a whole weekend).

Figure 2. Seeing the real thing up close: Kids at the Louvre Museum, in Paris are visually mesmerised as the teacher points out and explains features of a masterpiece. The kids were provided with handouts on which to write notes as part of the lesson plan.

In contrast, field work, which is considered to be a subset of field trips, is associated with a prolonged period of observation or data collection, either in the natural environment or in a community or urban area. If you take your students out into the field to collect data for your funded research, it could still qualify as a field trip. It should, however, be integrated into an existing course as a life project either to learn the subject matter or research methodology or both.

Field trips also are appropriate to stimulate tactile and kinaesthetic students who learn better through touch and play. Such trips are often justified on the grounds that they allow students and teachers to build better rapport in an informal setting. It is not sufficient to want to just give the students a break from the routine of attending classes.

The crucial point is that field trips should be educational yet fun. Very often, however, field trips are nothing more than an excursion or tour in which students are taken to places of interest where briefings may or may not be held. In many cases, students are not briefed on the learning objectives, are not provided with materials to support the learning and are not required to submit any reports or reflective journals after the trip. Students are left very much on their own to figure out what they have learned, so the learning is not consistent across participants.

Field trips are most appropriate for constructivist learning, particularly to encourage active learning. To plan an effective field trip, consider the following:

- Is the field trip appropriate for your course? Is it in line with the course objectives? It should be a task or activity that you cannot replicate in the classroom. It must be practical in nature (the practical aspect of theory or theory in practice). Consider the amount of time and cost to the student and the school as well as the possible disruption to other classes. Frequent field trips can only be justified if the learning cannot take place anywhere else except in the natural setting.
- What are the learning objectives? What do you want students to learn from the trip? Communicate it to the students in the form of e-handouts or pre-departure briefings.
- Do you have a lesson plan? When the students reach the site, what do you want them to do? Do you have specific topics or exhibits on which you want the students to focus? Will there be on-site briefings by knowledgeable persons or will it be a self-guided tour? Do you ask your students to prepare a list of probing questions based on background reading or the learning objectives? How will the knowledge acquired during the field trip be used as a shared reference for future classes? Do you expect the students to learn to work in teams and show leadership?

- How will you know that learning has taken place? Is it the learning which you intended or were there surprises? Will you be giving a grade for the field trip? Consider the use of reflective journals, which can be in various forms and media (including multimedia), for the students to express their experiences in creative ways (so that those who are talented in ways other than writing can also excel in the assignment). Hold a debriefing session after the trip (even at the site). What was learned? What was not?

Do give students a break from the classroom routine but plan it well. Field trips must lead to meaningful learning.

4 Integrating Essential Skills for SCL

4.1 Note Taking Skills

Students frequently do not realise the importance of note taking and listening skills. Therefore, we suggest the 5R system:

- Record;
- Recall;
- Recite (repeating key concepts from class);
- Reflect (connecting class ideas to other notes and readings); and
- Review regularly.

The following format provides the perfect opportunity for following through with the 5 Rs of note taking:

1. Record: During the lecture, record in the main column as many meaningful facts and ideas as you can. Write legibly. Do not write down everything that you read or hear. Notes should consist of key words or very short sentences. Always ask permission first from the lecturer or interviewee if you use recording devices such as electronic voice recorders, cameras or videos.
2. Recall: Summarise the ideas and facts concisely. Take accurate notes. You should usually use your own words, but try not to change the meaning. Summarising clarifies meanings and relationships, reinforces continuity and strengthens memory. Also, it is a way of preparing for examinations gradually and well ahead of time.
3. Recite: Recall, repeat facts and ideas from the lecture as fully as you can, not mechanically, but in your own words and with as much appreciation of the meaning as you can. Then, uncovering your notes, verify what you have said. This procedure helps to transfer the facts and ideas into your long-term memory.
4. Reflect: Try to reflect by making sense out of the courses and academic

experiences and ideas that you have gone through. Ask the students' opinions about the subjects they are studying by continually labelling and indexing their experiences and ideas and put them into structures, outlines, summaries and frames of reference. Ask them to rearrange and file outlines, summaries and frames of reference. Best of all, they have an eye for the vital; for the essential. Unless ideas are placed in categories and reviewed from time to time, they will become inert and soon forgotten.

5. Review: Spend 10 minutes every week or so on a quick review of the notes. You will retain most of what you have learned and you will be able to use your knowledge currently to greater and greater effectiveness. Do not keep notes on oddly shaped pieces of paper. Keep notes in order and in one place.

Stop and Think

How would you prepare to improve your note taking skills? How often do you review your notes? Do you write notes in notepad, notebook, etc.? Do you take snapshots during your lecture? Do you ask permission before recording the notes?

TRIVIA 8

Have you ever used a highlighter pen to highlight the important text, used subheadings, made mind maps or Venn diagrams, written an outline or even written a summary using some of the techniques used in note taking?

4.2 Mind Maps and Concept Maps

Most of us think of Tony Buzan when the term 'mind map' is mentioned, but the technique has been used for several hundred years. You only need paper and pencils to get started. In its simplest form, you start in the middle of the paper and work your way out to the edge of the paper to create an octopus-like diagram. You can use it to represent a key idea, concept or task. The elements or components that make up the central idea are grouped and form branches radiating out from the centre.

Colours and images or graphics can be drawn next to keywords. Typically, only one word is used for each branch.

Mind mapping requires practice, so you should allow for multiple opportunities to learn the ideas and techniques with practical applications in assignments. You will find that some students love it, whereas others will only use it if they are forced to do so by the lecturer, even though they can produce very good mind maps. If you choose to use mind maps or encourage your students to use mind maps for assignments, treat it as a tool to build knowledge, not as a final representation of knowledge acquired. Emphasise the process rather than the construct (or end product).

Concept maps are similar to mind maps because they are graphical representations of a person's schema (Figure 3). However, concept maps contain a theoretical construct of how we organise knowledge. Obviously, a concept map starts with a concept, which is defined as a 'perceived regularity or pattern' that may either be an event or an object and is usually represented on the map with one or more words (but symbols may also be used). These concepts are organised in a hierarchical format, with a typical concept map starting from the top and flowing down. However, you can be creative and start from the left or even in the centre. Each concept is linked with words (called propositions) that express its relationships with other concepts.

As such, you can actually read a concept map as though you are reading a passage from a book, except that all of the big ideas from the entire book (with a little imagination and exaggeration) are captured within a single image. You also can start 'reading' from anywhere in the map and work forwards or backwards or even sideways, unlike the sequential nature of books, for which you usually have to start from the beginning (of the book or chapter) and work your way page by page to the end. This is not to suggest that concept maps can be used to replace books or journal articles as the materials for learning. These maps are tools for learning that can help learners (students and lecturers alike) to work through the big ideas in their reading materials.

A concept map is an effective tool to use during class discussion to document the process and progress of learning and it provides a visual focus to generate collective agreements. It is a very flexible medium, does not need electricity or high-tech equipment and encourages active construction of knowledge in a collaborative environment. If you, as the lecturer, decide to draw and distribute concept maps as part of your lecture aids, remember to leave enough space on the maps for the students to add on or further explore concepts. Think of concept maps as a form of scaffolding or framework, not the final or definitive summary of your lecture. Do not use concept maps to obtain the definitive or correct answer for your class assignments.

For use in a constructivist classroom, you should design concept maps to allow for multiple interpretations or representations by students. Emphasise to your students that the maps are not to help them memorise lectures.

To create a concept map, start with a focal question (or questions). The concept map below captures the outcome of a discussion with students after three weeks of background reading about how city planners should plan and design an eco-city (Figure 3). Students were assigned by negotiation to research various aspects needed to design an eco-city, but ultimately they had to synthesise the information and knowledge and apply it to the design of a city. The concept map reminded them of their agreement about the main components and their interconnections for the eco-city; however, it was subject to refinement as the studio project progressed to the final product: a conceptual plan for the eco-city of Batu Kawan in Penang.

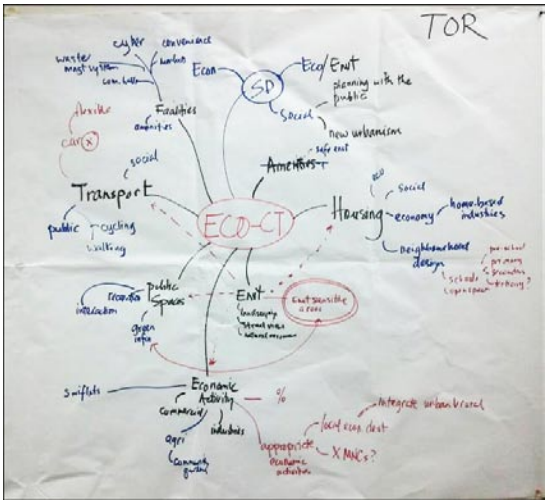
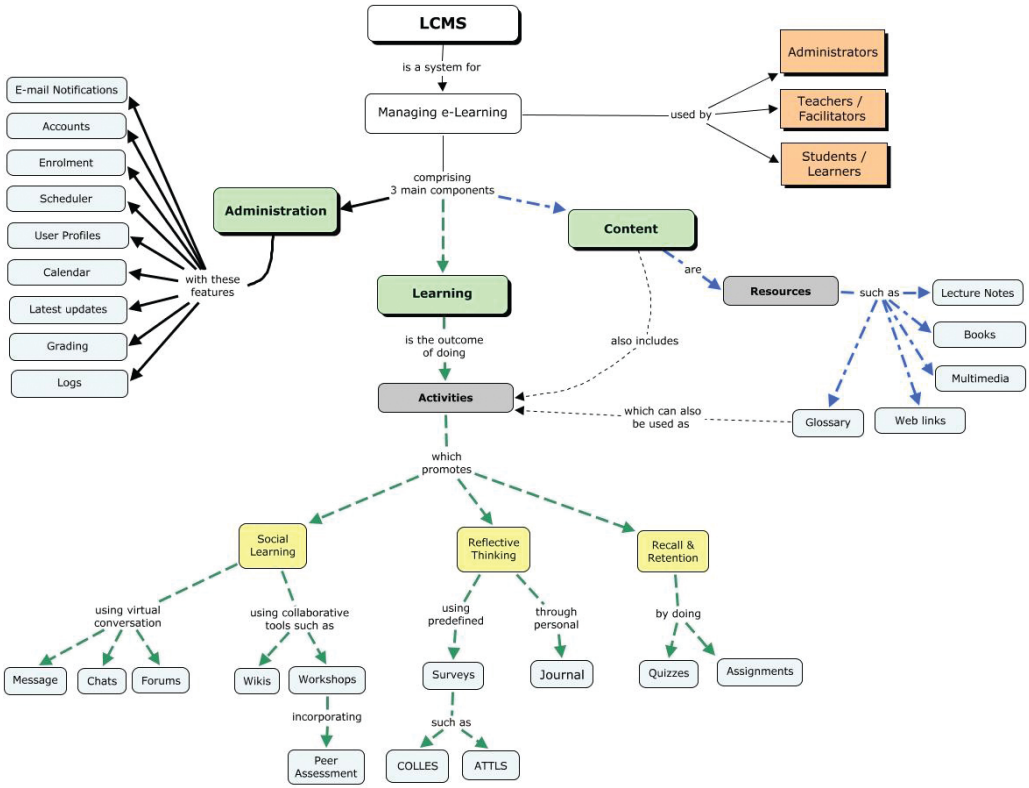


Figure 3. A concept map that was hand drawn on the flipside of a large piece (about 1 m square) of used paper.

The concept map below was developed for an e-learning training workshop using CMap software (Figure 4). This software is easy to learn and is available for free download with constant upgrades. It can be used for very simple to very complex multi-map constructs. A web-version allows for collaborative learning as students contribute to the creation and modification of concept maps. The software also allows you to create links to resources on the web. You can also add images to each concept. Maps can be simplified by creating multiple linked-maps. Note that CMap software is available from http://cmap.ihmc.us/. It includes resources on how to create concept maps and the theoretical basis for the software. Open University UK distributes the Compendium software for knowledge mapping at http://openlearn.open.ac.uk/.

You can read this concept map like you are reading an article because the key ideas are linked with propositions. The design of the map uses the idea of chunking through colours and spatial grouping and leaves enough white space to distinguish patterns and to provide room for students to extend the ideas by drawing on the printed maps.



What is a Learning and Content Management System?
created by Lee Lik Meng, Dec 2006

Figure 4. A concept map about Learning and Content Management Systems (LCMS), drawn using the CMap Tool. It captures all of the main ideas on a single image, so it serves as a useful tool to trigger memory recall. This type of map can be used as a lecture note or during a lecture to organise the flow and keep you focussed. This map is structured for beginners without complex feedback loops.

Stop and Think

1. How do you usually organise your thoughts when writing an article or book?
2. Do you use chapter or section outlines?
3. Do you have to modify the outline as you write or do you keep strictly to the outline?
4. Would the concept map be a useful tool to help you develop ideas and concepts to create your outlines?
5. For your next lecture, take a piece of paper and at the top write down a single word (or two) that reflects the theme of your lecture or presentation. What are the main ideas or messages you want to get across to your audience (keep it to 3 to 5 big ideas). Write down these words below the first word(s) you wrote. Draw connecting lines between the first and second levels. Add some words to explain the connection if necessary. For each of the second level concepts, think about 3 or 4 main points you want to say. Proceed until you think you have captured everything you want to say. Now, go back to the top and read down. Did you forget anything? Do you think some ideas are not important and can be removed? Use multiple colours to work through the map as you add, modify and delete.

4.3 Emotional Quotient (EQ) Skills

EQ skills are based on Howard Gardner's multiple intelligences concept. He postulated that everyone has several types of intelligence at the same time, but the level of each of the intelligences is not equal. This explains why some learners are very good at music or are able to give an oral presentation convincingly. EQ is primarily based on the learner's inter- and intrapersonal skills. Basically it is the ability of the learner to:

- Identify and interpret emotions of others so as to be able to react appropriately;
- Be self-aware of the learner's personal emotions;
- Be able to manage emotions, either personal or those of others; and
- Be able to influence others and manage conflicts.

If the learner's EQ is high, then the learner will do well in cooperative and collaborative environments. Because the ability to work with others in an effective social setting is important, these learners will thrive and be able to provide inspiration to other learners and resolve conflicts when the need arises. Learners with high EQ can work very well in social networks and therefore can be more effective than when working alone.

Stop and Think

Do students who are very emotional have a high EQ? Should instructors group students with high EQ together to complete a task, as it is expected that they will do well?

TRIVIA 9

Sherlock Holmes, a fictional detective created by Sir Arthur Conan Doyle, is famous for his higher-order thinking skills as well as his analytical conclusions. These conclusions are supposed to be based on his astute observational skills as well as his knowledge of human psychology and the general sciences. Which criminal investigation branch would really love his skills? Try to solve this puzzle: 'A man has been found dead hanging from the ceiling in a windowless and barren room with only one door locked from the inside. The clues are the room key found inside, a puddle of water and that his hands and feet were tied. Was he murdered? What questions should you be asking yourself?

4.4 Group Dynamics

Students are often grouped together to form small groups and assigned the task of completing a particular project during the academic course. Individuals maybe randomly assigned to work together towards a common goal, which is usually completing the assigned project or assignment. Instructors have to be aware that comfortable interactions do not necessarily occur smoothly, as there may be strong personalities adhering to their innate feelings. Myers and Briggs (Myers & Brigs Foundation) created a series of psychological tests to determine which type of dominant personality an individual has. However, these tests are very tedious and

comprehensive, so instructors are not able to administer them within the confines of a course during a semester.

Group dynamics take into account that when interacting with each other, groups of individuals will demonstrate several characteristics, such as:

- Interaction and influence;
- Social status (junior, senior, leader, follower, etc.);
- Conflict and resolutions;
- Task focus and responsibilities;
- Group cohesion; and
- Interdependence.

These characteristics represent the common dynamics within each group. There are many factors that influence these characteristics, ranging from size of groups to level of focus towards task completion. An instructor has to be aware that group dynamics play an important role in getting individuals to work together to achieve a common goal or. By being aware, conflicts may be avoided or reduced and a more effective process will emerge to complete the task. As SCL coupled with a constructivist approach would require students to interact and be interdependent, instructors should be ready to move some individuals around or rotate responsibilities within each group or between groups to allow individual development while working towards achieving the overall goals and objectives.

Stop and Think

What are the differences between cooperation and collaboration and between dependent and interdependent? Does this affect group dynamics?

TRIVIA 10

It is now common for multinational companies to administer psychological/ psychometric tests to identify the dominant personalities among their employees to determine the best roles for everyone involved in a group project. School counsellors also want to use it to help with career placement.

4.5 Presentation Skills for a Constructivist Lecture

Everyone has had a professor who goes on and on during the lecture, speaking to no one in particular for an hour or more. He makes no eye contact with the students but focuses on the whiteboard, the screen or perhaps still writes on the plastic sheets on an overhead projector. Although he utilises state-of-the-art presentation software (such PowerPoint or Keynotes), it is filled with text and he reads every single word from the start to the end of the lecture. Many of us encountered professors like this during our own university education, yet we did not turn out too badly. After all, we are now lecturers and professors ourselves. Surely there must be a place for this form of lecturing.

In reality, times have changed. In particular, the education model is shifting (or has shifted) from the objectivist to the constructivist paradigm. If we do not unlearn our old habits and pick up new skills relevant to producing the workforce of the 21st century, we might find ourselves redundant and irrelevant in the very near future.

We do not expect lecturers to learn how to become orators, but lecturers definitely should learn some key skills to become student-centered teachers, as this will promotes active learning. Here we focus on how you can improve your presentation during lectures by shifting some of the attention to your students. You may still need to acquire the more generic presentation skills from elsewhere (just Google it).

Figure 5. A lecturer needs presentation skills to connect with his or her audience

Lecturers must find ways to connect with their students (Figure 5). When you are preparing for your lecture, you might want to remember the following:

- The advice most often given for an effective presentation is: Tell them what you want to tell them; then tell it to them; and finally, tell them again what you just told them'. Essentially, do not ramble on and on. Most students can only remember a limited number of things at a given time, so do not overload them. Remember that they might be attending several hours of lectures a day (perhaps from 8 am to 8 pm on some days). Design your lecture to focus on main ideas or points and provide opportunities for the students to read further.
- Try to use a variety of stimuli, from keywords (text) to photographs, illustrations, images, short video clips and even objects you can hold in your hand and wave around while you talk. Incorporate these stimuli into your presentation slides if you can. You need to stimulate the various intelligences of the students.
- Instead of the usual lecture, plan something different, such as a discussion using mind maps, either prepared in advance or hand drawn on the whiteboard or flipchart as you interact with the students. On another day you could use objects or artefacts. Forget the slides once in a while.
- Think about how you can get the students to take an active part in your lectures. If you are using slides to make a presentation, integrate slides for questions and answers. Make active participation a crucial part of your lectures.

Some guidelines for your behaviour during the lecture are as follows:

- Do not read from the slides or from your notes. Use the notes and slides as talking points to trigger your memory. If you think you have a lot to say, cut it down. Keep it to 3–5 main points.
- Face your students. Maintain eye contact without being intimidating (don't keep staring at the same student).
- Pace yourself and don't rush. Create a sense of anticipation to keep the students interested. Allow time for your audience to absorb a chunk of information before moving to the next.
- Speak clearly but inject life into your voice. Put emphasis into certain words. A monotonous voice may put your audience to sleep.
- Do not be as stiff as a mannequin. Move a little and use hand gestures for emphasis. When appropriate, move into the audience for closer rapport.
- Remember to insert slides to remind you to pause and ask for questions from

the floor or to ask questions to generate active participation. Remember to wait and give enough time for the audience to think and respond. Learn to deal with awkward silences. Think of probing questions or ask simpler questions, wait for the answers and then build up to the tough questions. Don't just ask a tough question and when you don't get a response, you immediately give the answer.

- If you run out of time and cannot finish all of the slides, do not rush through to finish them. A constructivist class can be very slow moving if there are many questions and interjections from the students. This means that the students are engaged and interested. Allow enough opportunities for the students to take the lecture further on their own. Remember, it is the process rather than the destination that is important. If necessary, allow a few minutes for students to recap. In reality, many will not have time to read further and thus patience will be necessary.
- You may be the subject matter expert, but do not intimidate your students into feeling that their own understanding does not matter. Learn to accept students' answers without brushing them off as the wrong answer (although sometimes it may be necessary to let them know that the answer is not correct). Your presentation skills as a constructivist lecturer must include skills that encourage interaction.

Your presentation skills as a lecturer should demonstrate your command of the field without being definitive and final. You should challenge and stimulate your students to think and to process what you say in class to construct their own perceptions or knowledge. The art of communication is a valuable skill for a constructivist lecturer, but it is also a requisite skill for the students. Occasionally, you can have a role reversal, with the students honing their presentation skills by being the ones leading the lectures.

4.6 Report Writing Skills

As lecturers, you are typically required to carry out research and to write books, journal articles or reports so that you will be familiar with report writing. Our concern is with the students. Students are very often required to submit a written report as part of their assignments or projects, either to document the work done or as the outcome or product of the study. In its simplest form, a five-page essay is required to be submitted about a specific topic (sometimes lecturers tell students they can write on any topic they choose). It has become almost a norm for students to rely on seniors' work that has been passed down for several generations, complete with mistakes (including typo errors). With the availability of Google, students have developed a new approach

called (cynically) 'copy-edit-paste', which is a small innovation from straightforward 'copy-paste'. If you ask students 'Why?', they will tell you that 'it doesn't matter what they submit' because many lecturers do not provide feedback or their grades seem to be quite standard (everyone expects a B; only a rare few get the A). In reality, it is often too much to expect lecturers to read and comment on tens or even hundreds of reports or assignments every single semester.

Plagiarism is quite rampant, but it also is quite easy to detect with online software. Our focus here, however, is on how you can improve the report writing experience of your students. When you give an assignment that culminates in the submission of a report, you should use it as an opportunity to facilitate the acquisition of good report writing skills as well as to develop the students' construction of knowledge.

The Internet has abundant resources on how to write a report, which students unfortunately don't pay much attention to because they do not see the need to upgrade their skills. As a constructivist, you should assess the level of skills of the current batch of students in terms of their ability to carry out 'research' (i.e. formulate questions, seek other data and references, analyse, synthesise and create knowledge) and then report back on their work. If those skills are absent, you must provide them with the scaffolding on which to build up their abilities and confidence. In assessing and evaluating the reports, emphasise to the students that marks will be awarded for various components (e.g. structure of the report; analysis and synthesis, not mere copying and pasting). When reports represent a high percentage of the grade, you should build in progressive assessments to help the students improve. Always try to pick a few good points to balance out the negative remarks about the report. Finally, remember that reports are not merely about the written words. Recognise the special talents of some students who are more graphically oriented. A beautifully formatted report is not only attractive but more readable and engaging. Ultimately, a report is a tool of communication to get the student's ideas across to the reader.

Below, we present a concise summary about report writing:

- Report writing begins with being asked to write a report. Reports are documents that can be short or substantial in size. Writing a report involves examining a given problem or issue and suggesting a practical solution. When asked to write a report, students are provided with information and are expected to competently analyse that information, draw consistent conclusions and make sensible and practical recommendations.
- Before writing a report, tell your students that they must be clear by asking themselves:
    1. Who am I writing for?
    2. Why do my readers want this report? (What are the objectives?)

3. What will my readers understand? (How much don't they know?)
4. How much do they want from me?

- Basically, a report should include the following:
  1. Title Page
  2. Abstract
  3. Introduction
  4. Materials and Methods
  5. Results
  6. Discussion
  7. Conclusion
  8. References
- Reports should be as long as they need to be but no longer. Brevity is desirable, provided the necessary information is properly communicated. Some suggestions are to avoid reproducing standard information (e.g. calibration curves) and avoid appendices unless there is a specific reason for them. Consider each sentence and ask if it meaningfully contributes to the report?
- A report should consider the background of the fictitious person described in the project scenario. The quality of the report can suffer both from overly detailed as well as incomplete descriptions.
- Only the title page, abstract, introduction and references should start on a separate page; the other sections should not. However, a heading should be used to indicate the beginning of each section. Subheadings within sections can be an excellent way to further organise the report.
- Scientific writing does not have to be elegant, but it must be precise. To state 'The data were plotted and seemed to agree with the theory.' is not precise. To state that 'The pressure drop across the column in inches of water was plotted on log-log coordinates as a function of air flow rate in cubic feet per minute. The plot, shown in Figure 3, was close to linear and the slope of the best straight line, 1.92, was close to 2, as predicted by theory.' is precise. Whenever possible, words such as 'small', 'large' and 'greater than' should be used in conjunction with actual numbers.
- A table or figure should never be inserted into the report without first referring to that table or figure in the text. Reference to a figure should include a brief description of what it contains and what it contributes to the point under consideration. Figures and tables should be merged into the text or placed on a separate page immediately following the first page on which they are mentioned; they should not be collected at the end of the report. Follow the

American Psychological Association format for labelling.

- References must be numbered in the order in which they are cited. It is good practice to attribute and acknowledge: Attribution protects against charges of plagiarism and acknowledgement shows a generous nature.
- A suitable font is Times Roman, 12 pt.
- A uniform verb tense should be used throughout the report, preferably past tense.
- The imperative mood (i.e. as if giving directions or orders) should not be used. The purpose is to state what was done, not to tell other people what to do.
- Because reports are formal, the first person (singular 'I' or plural 'We') should not be used.
- Sentences should not start with 'It' unless the object that 'It' refers to is absolutely clear from the context.
- All text should be double-spaced to allow room for comments.
- All pages, including figure pages, should be numbered consecutively.
- Long sentences should be avoided; two or more short sentences should be used instead.
- An excellent way to improve style and grammar is to have others proofread the report and/or you can use a grammar checker, spelling checker, plagiarism checker or some other proofreading software at http://ed.grammarly.com/editor/view/.
- Needlessly fancy presentation (bold, italic or underlined fonts, colour in text or figures) should be avoided unless it truly enhances the clarity of the report.

4.7 Research Skills

Students asked to conduct research frequently ask how to search the internet and what resources are useful. Below are some answers:

4.7.1 How do I search the internet?

- Narrow your topic and its description: identify and pull out key words, phrases and categories; and
- Use a search engine: Does it contain a directory of topics? Find the best combination of key words to locate information you need and enter these in the search engine.

4.7.2 What are some useful resources?

- Search engines, such as Search Engine Colossus, link to search engines from 148 countries.
- Find directories that organise information and links. For example, the Open Directory Project is a comprehensive human-reviewed directory of the web. IPL2 features a searchable subject-categorised directory of authoritative websites, links to online texts, newspapers and magazines. You also can ask an IPL2 Librarian through the online reference service. Infomine is a comprehensive virtual library and reference tool for academic and scholarly Internet resources, including websites, databases, electronic journals, bulletin boards, LISTSERVE, online library card catalogues, articles, directories of researchers and other types of information.

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The advent of the Internet, with sophisticated algorithmic search engines, has made accessing information as easy as lifting a finger. No longer do we have to make costly efforts to find the things we want. We can 'Google' the old classmate, find articles online or look up the actor who was on the tip of our tongue. Studies suggest that when faced with difficult questions, people are primed to think about computers and that when people expect to have future access to information, they have lower rates of recall of the information itself and enhanced recall instead for where to access it. The Internet has become a primary form of external or transactive memory, where information is stored collectively outside of us. Therefore, has Google affected the way people remember information?

4.8 The Classroom Environment

If you give a lecture as though you are talking to yourself, you can be assured that your students will tune out. Do you get annoyed if you find your students sleeping or daydreaming in your class and not paying attention to what you are saying? Sometimes it is the content of the lecture (students will say it's boring). At other times it is because of the way you presented it. Very often no matter what you do, the students are so exhausted from a full day of sitting in classes that they cannot keep their eyes open even if you show your anger and scold them in class. Often you will feel insulted (that the students think the subject or you are so boring that they sleep in front of you) or you will feel that it is a waste of time to put in all the effort to prepare a great lecture (from your point of view) when it is not appreciated by the students.

Many factors need to be considered to keep your students interested (and awake) during lessons. One of these factors is the classroom environment. If you do not like the setup of the room, change it. Disrupt the arrangement occasionally to remind yourself that attention should not always be on you at the front of the room.

Most lecturers will not have to teach in a 'classroom' as big as the hall shown in Figure 6. You will not be able to change the configuration of the hall, but you can still try to interact with students by asking stimulating questions every 10 or 15 minutes. Let your audience members feel that you expect a response and that you are eager to hear their response. Learn to wait for responses from the floor. After you ask the question, scan the room from left to right and count to five. You will need to learn how to pick up interesting 'shout backs' from the floor when they happen all at once. Repeat a few of the answers over the microphone to let the students know you are listening. Try not to reject answers or say that they are wrong (remember the constructivist paradigm). Sometimes, however, it is necessary to say that it is not the expected answer without embarrassing the student. Very often you will already have an answer that you expect to hear, so when you hear something similar or close to it, pick up on it and move forward in your lecture. It is not necessary to heap praise on the respondents all the time. Just acknowledging the answer (by repeating it with vocal emphasis) is praise enough for the respondent from the floor.

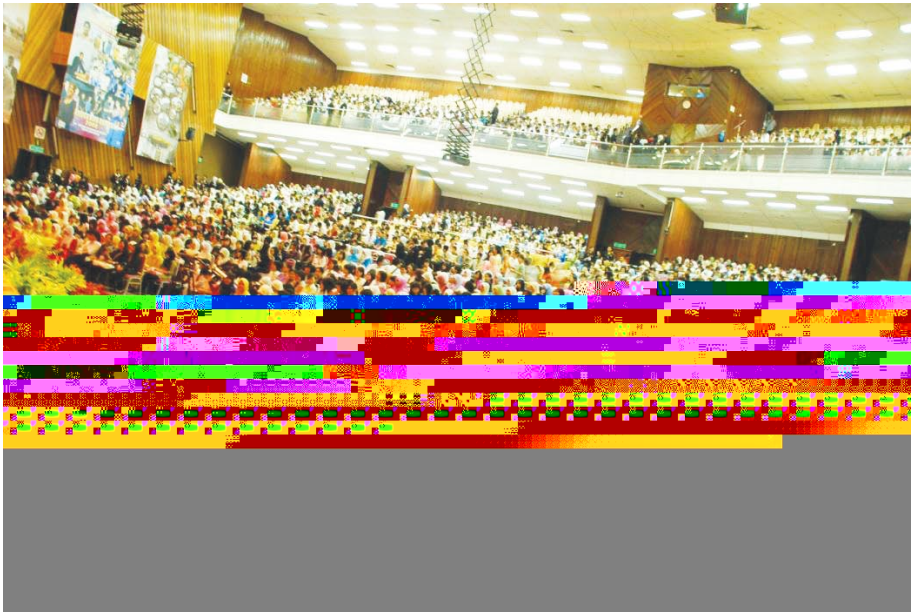

Figure 6. About a thousand new students gathered to listen to speeches at USM's Dewan Tuanku Syed Putra. Lectures almost as big as this are also held here for some university level courses required to be taken by every student. Is it possible to interact with and hold the attention of such a big audience for 1–2 hours?

It is a good idea to check out unfamiliar venues so that you can interact effectively with your audience. Even if you cannot change the room's configuration or the seating arrangements, there may still be items or furniture that may hinder the ability of audience to see you or the screen. If you use slides, you should make sure that your entire audience (from all corners of the room) can see the screen and the text or images clearly. Be aware of where you stand while you are speaking. If you like to move around when giving a speech or lecture, you may need to learn how to be just as effective speaking from behind a podium because of the way the equipment is set up. If you bring gadgets, gimmicks or exhibits to aid your presentation, you will need to make sure you have a place to put your materials organise the flow and still have enough space to move around.

Lecture halls and classrooms are designed based on the objectivist paradigm (i.e. to focus all the students' attention on the master in the room, the teacher and the whiteboard). Many small lecture or tutorial rooms also cannot be readily modified because the chairs are welded or fixed together in a row (the motive being to prevent chairs from being removed to other rooms). These rooms are not configured for active learning focussed on the students.

For active participation, such as in class discussions, presentations or collaborative work, consider other configurations for your classroom. You can temporarily rearrange the furniture into a horseshoe or circular shape that is suitable for group discussions or whole class presentations (Figure 7). For class presentations or discussions, bring the students closer to the student presenters, preferably in a horseshoe formation. Proximity with each other compels students to focus on the speaker instead of private conversations with the friends seated next to them. It also encourages interaction and friendly exchange. Lecturers should take a back seat and listen in on the conversations but should provide feedback at the end of the session.

Figure 7. Active learning is promoted by arranging tables so that groups of students can discuss and prepare flipcharts for later whole class presentation. Group sizes should be between 5 and 7 and preferably include students with different talents (analytical, drawing, writing, verbal presentation, etc). In the active learning class, students do not just sit and listen.

5 Assessment

Assessment is the process of evaluating students' acquisition of new knowledge. It is a comparison between the beginning of the instruction and the end of the arranged session. Typically, after enrolling in a class and interacting with the instructor, other students and colleagues for a period of 14 weeks, the student will demonstrate whether or not the desired outcomes have been achieved. There are two major forms of assessment: summative (which is at the end of the semester) and formative (which usually is ongoing throughout the semester). As the common practice for any course is to integrate practical and theoretical knowledge, the formative assessment is usually an opportunity to demonstrate practical skills and the summative assessment evaluates whether all of the knowledge has been acquired as demonstrated through tests and examinations.

5.1 Summative Evaluation

Summative evaluation is the culmination of all the knowledge acquired, demonstrated through performance in quizzes, tests and examinations. At the end of the semester, the students are required to undergo an examination that tests their knowledge of all that has been deemed important or required by the course instructor. In such assessments, instructors are encouraged to formulate questions that allow students to demonstrate their knowledge learned during the course. The questions should be a mixture of different type of questions ranging from factual data, procedural knowledge, problem solving and analytical deduction or inference.

5.2 Formative Evaluation

Formative evaluation has the following characteristics:

- It focuses on the journey, not just the end product;
- It allows students to grow instead of focussing on completing the curriculum; and
- It allows improvements and corrections to the instructional approach to accommodate weaknesses or unique requirements or learning styles.

Formative evaluation is an excellent avenue to allow students to be directly involved in the assessment process. A simple but fruitful exercise is to discuss with students how to develop an assessment matrix that would represent the goals of the course in which they have enrolled. Questions that could be asked during the development of the matrix include:

- What should be considered an 'A' grade for a certain assignment?
- A 'B' indicates a certain level of achievement that is different from an 'A'

and a 'C'. What would we be required to determine what these differences are, as well as what is lacking or missing to warrant a certain grade?

- How should the assignment be done and with whom and what is the scope and what are the limitations?

The instructor, of course, has to moderate and facilitate the process of creating the assessment matrix. Once exposed to the course outcome and goals, the discussions may begin. The instructor must allow all students to participate or identify individuals or groups that are representative of the class student population.

As all students are not identical, the practices and activities should allow the learners to explore all possibilities. Some students may be comfortable working with groups or prefer to contribute within predetermined boundaries. The instructor should be aware of the various learning styles of these students and concentrate on the process of learning rather than just achieving the final goals. Cycles of completing a set procedure or demonstrating a practical set of skills would allow the weaknesses of each student to be reduced, as the cycles would provide an avenue to correct weaknesses that have been identified. This approach would allow students to grow and improve themselves. Learning is more than just memorisation of facts or procedures; it is the acquisition of knowledge and its assimilation into their present schemata to create new relevant knowledge.

5.3 Assessment Vs. Evaluation

Assessment is conducted to determine what lessons have been learned or not learned, whereas evaluation is performed to determine the degree to which planned course outcomes have been achieved. For evaluation, the development of a matrix is very useful to both the learner and the instructor; it helps align their expectations and reduce confusion. There can be subtle differences in what constitutes an 'A' versus an 'A–'; if these are not quantified, the student's expectations may differ from those of the instructor and these differences may result in a conflict between what the student expects and what eventual grade he or she obtains.

6 Technology for SCL

Technology is defined as tools that facilitate the acquisition of knowledge. The integration of technology into the learning process is an expected step for students of the present generation. Information and Communication Technology (ICT) has fully infiltrated the lives of the present generation. ICT is ubiquitous and is seen as being seamlessly integrated into the learning and nurturing process.

As the amount of information available has increased at a geometric rate, so has accessibility to it. However, the filtration process requires other tools. The most common tools available at most institutions are search engines and productivity software (e.g. Microsoft Office). Communication software such as email, short messaging systems (SMS) and information sharing portals such as Facebook have become preferred destinations to share information. Another favourite multimedia sharing portal is YouTube. The main challenge for educators is to utilise these technologies for education and sharing of information. With the advent of these technologies, new fields of education have been formed, including e-Learning, online learning and distance education. An instructor is able to glean their favourite technology from websites dedicated to the use of technology for education (e.g., a great resource is http://c4lpt.co.uk/top-100-tools-for-learning-2011/).

One great use of collaborative technology is the Wiki. A fine example is Wikipedia, which is basically an encyclopaedia where everyone has an opportunity to contribute to the details and facts concerning a particular topic. Strategies to ensure accuracy, validity and security have to be implemented to avoid misleading or inaccurate facts. Discussing and brainstorming these strategies among the learners of a particular class would be an excellent effort to involve the students to be more empowered with their own learning, essentially upholding the principles of SCL.

7 Rules to Live By as a Constructivist

Having read through the preceding sections, you likely are overwhelmed by so much new knowledge. This checklist for the constructivist lecturer is to remind you how to conduct yourself in various situations. We have applied the maxim of 7 ± 2 to these rules. Learn the first five first, then aim for two more. When you have remembered all nine, give yourself a cheer. Always remember, however, that a constructivist's journey is never finished.

1. Be patient;
2. Accept all answers;
3. Provide scaffoldings;
4. Do not be too quick to give answers;
5. Know your big ideas;
6. Make your learning relevant and current;
7. Do not be the 'sage on the stage', but instead be 'a guide from the side';
8. Focus on continuous learning; and
9. Enjoy the journey!

8 Conclusion

Constructivist theory remains the main theory used for SCL in 21st century classrooms. Lecturers should understand the principles and use them to guide the students. Understanding the epistemology of learning paradigms helps lecturers tune in to which paradigm he/she belongs to. This module provides some suggestions on how to be a constructivist lecturer. The lecturer's role is not only to observe and assess but also to engage with the students while they are completing activities, wondering aloud and posing questions to the students to promote reasoning skills. Therefore, the three major roles for facilitators to support students in constructivist learning environments are modelling, coaching and scaffolding, as was discussed in this module.

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