

This issue of CDTL Brief presents the last instalment of a two-part discussion on the issues surrounding **Learning Styles**.

Applying Learning Style in Instructional Strategies

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With a shift in emphasis from teaching to learning at all levels of education, a variety of active learning strategies have been advocated to optimise learning. It is also well recognised that how best a person learns may be influenced by social, psychological, emotional, environmental, and physical factors, as well as the individual's learning style. One of the key elements in getting students involved in learning lies in an understanding of learning style preferences which can have an impact on the individual's performance and academic achievement.

There are a variety of models used to characterise learning styles. While the concept of learning styles has different definitions, learning styles are thought to represent an individual's unique approach to learning. Four prominent schools of thought on learning styles include Dunn & Dunn's environmental preferences, Gardner's multiple intelligences, Kolb's experiential learning cycle, Honey & Mumford's learning types, and Gregorc's mind styles. It is generally agreed that an understanding of the dominant learning preference will be useful in designing effective instructional strategies to facilitate learning and to capitalise on the individual's potential.

Dunn & Dunn's Three Basic Learning Styles

Despite the wide range of learning models, the three basic perceptual learning styles as described by Dunn & Dunn are *visual*, *verbal* and *kinesthetic/tactile*.

Visual learners relate most effectively to visual displays like written information, notes, diagrams and pictures. They tend to prefer sitting at the front of the classroom to avoid visual obstruction, to have a clear view of the instructor when they are speaking so that

they can see the body language and facial expression. Visual learners often prefer to take detailed notes to absorb information. They learn best by writing down key points, and visualising what they learn. They follow written instructions better than oral ones.

Auditory learners relate most effectively to verbal lectures, discussions and by listening to what others have to say. Written information may have little meaning until it is verbalised or read aloud. Auditory learners like participating in class discussions and debates, as well as discussing ideas verbally. They would rather listen to a lecture than read the material in a textbook. They are good in making speeches and presentations.

Kinesthetic/tactile learners learn through moving, doing and touching. Kinesthetic learners learn best through a hands-on approach. They may be considered hyperactive, take frequent breaks and may become distracted by their need for activity and exploration. In learning, they skim through learning materials to get a gist of the content before settling down to read it in detail. They enjoy working with their hands.

Gardner's Multiple Intelligences

Gardner's Multiple Intelligences theory focuses on the content of learning. The seven intelligences are *Linguistic/Verbal*, *Spatial/Visual*, *Bodily Kinesthetic*, *Logical/Mathematical*, *Musical*, *Interpersonal*, *Intrapersonal*. While the first three learning styles conform to the basic perceptual learning styles as described by Dunn & Dunn, the inclusion of all seven intelligences are conceived as a more holistic approach to learning in the real world.

Honey & Mumford's Learning Model

Viewing from another perspective, based on Kolb's experiential learning cycle, *Concrete Experience* => *Reflection* => *Theory* => *Preparation*, Honey & Mumford (1982) developed a model of learning styles by linking the different stages of Kolb's cycle to produce a model of four descriptions of learning styles. The four types are called *Activists*, *Reflectors*, *Theorists* and *Pragmatists*.

Activists involve themselves fully without bias to new experiences. They are open-minded, enthusiastic, constantly thriving for new challenges but are bored with implementation and long-term consolidation. The activist would enjoy learning through games, competitive teamwork tasks and role-plays.

Reflectors prefer to step back to ponder and observe others before taking action. They are in general cautious, may be perceived as indecisive and tend to adopt a low profile. The reflector prefers learning activities that are observational (like carrying out an investigation) and give allowance to ponder upon.

Theorists adapt and integrate information in a step-by-step logical way. They prefer to maximise certainty and feel uncomfortable with subjective judgements, lateral thinking and anything flippant. The theorist prefers learning activities that explore the interrelationship between ideas and principles.

Pragmatists are keen to try out ideas, theories and techniques to see if they work in practice. They are essentially practical, down-to-earth people, like making practical decisions, act quickly on ideas that attract them and tend to be impatient with open-ended discussions. The pragmatist prefers learning activities which are as close as possible to direct work experience.

It is generally agreed that a combination of different types of learners will make an effective team in an organisation. In discussing an issue, the most likely question the *Reflector* will pursue is *Why* it is important; the *Theorist*, in contrast, will be interested in *What* it is all about; the *Pragmatist* will be concerned with *How* it can be applied in the real world; while the *Activist* will be keen to know *What if* we were to apply it here and now.

Gregorc's Mind Styles

Gregorc sorts people along two continua: *Abstract*—*Concrete* and *Sequential*—*Random* according to the individual's ability to organise and register information. He believes that people have various combinations of strength.

Applications in Teaching and Learning

A large proportion of adult learners have a dominant visual learning style followed by an auditory preference. A smaller proportion are kinesthetic/tactile learners. It is possible some of us may have a combination of styles. However, no one uses one of the styles exclusively. For example, when given a new task, visual learners prefer to see a demonstration, diagram or slides before embarking on the task; auditory learners prefer verbal instruction or talking with someone about it; while the kinesthetic learners would prefer to jump right into the task. In a learning situation, we, as instructors, could adapt to the diverse learning styles of different individuals by using multiple approaches of 'hearing', 'seeing' and 'doing' activities. For example, in a lesson, the use of good audio-visual aids and good presentation skills will appeal to the visual and auditory types, while group interaction and activity will appeal to the kinesthetic/tactile type. In addition, interpersonal and intrapersonal intelligences are essential in enhancing learning through teamwork, and reflection on individuals' strengths and weaknesses. By appealing to different learning styles, more effective learning can be achieved to facilitate attention, motivation, memory and comprehension.

There are several approaches to involve multiple learning styles in a course. One good example is project-based learning. Such projects inevitably demand that students approach a topic with multiple skills: verbal, visual and kinesthetic. It also facilitates students to contribute using their own preferred style while experiencing other styles. The activist can contribute effectively by his enthusiasm and initiative in generating ideas; the pragmatist in his practical approach will get the project started; the theorist will ensure the project is carried out in a logical sequence based upon certain hypotheses; and the reflector will effectively put together evidence of prior experience/knowledge and integrate them into the project. Another strategy that incorporates the diverse learning styles is the use of multimedia instruction.

In conclusion, although it is not possible to take into account all the learning styles of each individual student, by closely examining students' reflections, teachers can make their approach more comprehensive in its appeal to diverse learning styles. Some studies have supported matching teaching to learning styles; there is, however, no consistent agreement on the benefits of stereotyping or labelling individuals to certain learning styles. In fact, exposing students to different learning styles may be a more practical approach to help them develop their multiple intelligences to the maximum potential.

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NUS Students and Biggs' Learning Process Questionnaire

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Introduction

In Semester I of 2001–2002, the Learning Process Questionnaire (LPQ) (Biggs, 1993) was given to a total of 475 students from three science-based modules, namely GEM1503K Chemistry in Space, FST2102 Chemistry of Food Components, and BL1306 General Biology. At the same time, an earlier version of Biggs' questionnaire was also given to students studying GEM1503K. The earlier version of Biggs' questionnaire classifies students based on their motivation and studying strategy while the later edition of LPQ was used to distinguish if NUS students engage in a surface, deep or achieving motivation or strategy. A comparison between U.K. and NUS students' response to the earlier version of LPQ will be discussed. However, it must be pointed out that the survey of the U.K. students was conducted during the 1970s, so it is not possible to discern whether the differences between the two populations are cultural or due to the 25 years spanning the two groups, or both.

Before discussing the results of our surveys, it is important to understand the meaning of the three different learning styles identified by Biggs—surface, deep and achieving approaches (Biggs, 1987). With surface learning, students aim to satisfy the course requirement (e.g. pass the examination by concentrating on the surface features of the learning task). With deep learning, students try to understand the underlying meaning of the content, for self-development or for the sake of understanding. With achieving learning, students try to attain the highest grade possible. Each approach (called a 'scale' of learning) can be measured by two 'subscales': motive and strategy (i.e. approach = motive + strategy). Measures of approaches to learning will also measure students' motivation.

Results and Discussion

LPQ (Biggs, 1993) has been widely used as a tool to measure the inspiration and attitude towards learning in many countries and a variety of cultural backgrounds. It consists of 42 questions, half of which determines students' strategies to learning while the remaining determines the motivation for learning. There are three strategies to learning and three types of motivation: surface, deep and achieving. Seven questions are dedicated to each type of strategy and motivation. Whilst deep and achieving motivations and strategies appear to be the most desirable in the current social environment, surface motivation and strategy are generally driven by society. The key to success is a balance of all surface, deep and achieving motivations and strategies.

In the first survey, 475 students from three science-based modules (as mentioned above) completed the survey. The students were from a mixture of the arts and sciences streams. The data was analysed according to the categories as described by Biggs (i.e. surface, achieving and deep). For each student, the category with the highest score was given 1 mark. If two categories' scores were the same, 0.5 marks was given to each category, while if all the categories' scores were the same, 0.33 marks was given to each category. This means that if a student scored highest in surface motivation, compared to deep and achieving motivation, he was classified as surface motivated. The students' preferred choices of motivation or strategy are summarised in Table 1 below. A correlation matrix among motivations and strategies, as well as students' examination results is presented in Table 2.

From the survey, it is found that students who are surface motivated are generally realistic and mainly motivated by the final outcome of their effort. The

students' first and foremost objective of pursuing tertiary education is to obtain a degree, which will land them a reasonably comfortable and well-paid job. Indeed, surface motivated learners are encouraged in a society where the rewards for staff that perform are limited by their education level. Many students who participated in the survey are found to be surface motivated (Table 1). This is not surprising because it is generally believed in this society that an individual without a degree will not go far. Students who are only motivated by extrinsic factors tend to be less interested in most of the knowledge they learn during their days in university, believing that it will not help them in their future career. Thus, these students will tend to learn just enough to pass, and be afraid of failure because of social pressures.

Table 1: Number of students responding to each type of motivation and strategy

	Motivation	Strategy
Surface	169	146.8
Deep	174	175.8
Achieving	132	152.3

Surface motivated students appear to use surface strategies for studying where surface motivation and strategy are positively correlated (Correlation = 0.535, c.f. Table 2). Often, these students who use a surface strategy are dependent on and expect to learn everything from the lecturer. They are also found to be syllabus bound. Most will avoid disagreement with lecturers perhaps as a sign of respect or perhaps they are afraid that it will affect their grades.

Deeply motivated learners are believed to show interest from within and often have the initiative to go beyond their syllabus to satisfy their thirst for knowledge. According to the survey conducted, more than a third of the students are deeply motivated and thus are keen to acquire new knowledge. Of the three subjects for which the survey is conducted, two are essential for

most of the students taking the subjects (i.e. General Biology and Chemistry of Food Components). Students from the General Education Module (GEM), Chemistry in Space, are found to be more deeply motivated, which is probably because the subject is not related to their field of study and they have chosen the subject due to interest. Over 40% of the students are found to be deeply motivated.

Students showing intrinsic motivation are likely to use the deep approach to learning (Correlation = 0.605, c.f. Table 2). Such students are able to adapt to the ever-changing environment by continuous learning, helping them to discover as well as understand new ideas. Satisfaction is often achieved through deep understanding of a subject. Deep learners are flexible and all rounded. Thus, it is expected that they are able to excel in almost any field into which they venture. More than a third of the students participating in the survey use the deep learning approach to their study.

Achieving motivated students are inspired by good grades. Although many students want to do well in their studies, many find the top grades unattainable. In fact, most students will not sacrifice their popularity or relationship with other students to achieve good grades. Thus, fewer students are achieving motivated according to the survey (Table 1). In institutions of higher learning institutions, students' aim is normally to graduate with a degree, and if admitted for an honours degree, they tend to aim for a second-class upper and less often a first class. Achieving motivated students are found to use all three different strategies to achieve their objective (Table 2).

Achievers plan and work strategically to realise their objective. They are well organised and consistent with their revision. In addition, in order to achieve good grades, they know the importance of paying attention to important points mentioned during lectures and tend to spot questions for examinations. Mainly, both deeply motivated students and achieving motivated students

Table 2: Correlation among motivations and strategies as defined in Biggs' LPQ, and examination results

	Exam	Surface Motive	Deep Motive	Achieving Motive	Surface Strategy	Deep Strategy	Achieving Strategy
Exam	1.000						
Surface Motive	0.011	1.000					
Deep Motive	0.065	-0.077	1.000				
Achieving Motive	0.082	0.330	0.376	1.000			
Surface Strategy	0.015	0.535	-0.064	0.346	1.000		
Deep Strategy	0.021	-0.029	0.605	0.368	-0.049	1.000	
Achieving strategy	0.108	0.146	0.344	0.350	0.117	0.465	1.000

$n = 475$, $|r| > 0.090$ are significant to 95% confidence, $|r| > 0.137$ are significant to 99% confidence

appear to apply this strategy. This is shown by the positive correlation between achieving strategy with deeply and achieving motivated students (Table 2).

The most surprising result seen in Table 2 is the statistically insignificant correlation to the 99% confidence level between examination scores and all types of motivations and strategies. There is a slight positive correlation, at the 95% level, seen in those adopting an achieving strategy. To us, this seems both good and bad. It appears bad because if we wish to encourage deep learners and achievers, we would like to see a positive correlation with examination marks. In contrast, it appears good because there is no positive correlation between surface learners and marks. However, if we desire to discourage surface learners, we would like to see a negative correlation with marks, although one must wonder if surface learners care about their grades other than that they simply pass.

In general, students' responses to the questions in Biggs' LPQ depend much on their environment and social influences. Such a conclusion is not new and evidence on the influence of social environment in students' attitude dates back 40 years (Crowne & Marlowe, 1960). Watkins (1996), who conducted a survey on secondary school students in Hong Kong, showed that social desirability greatly influenced the approaches of students towards learning and may show that students in the region are more inclined to deeper approaches to learning compared to Western countries.

The second survey, based on an earlier Biggs' questionnaire, had a total of 215 respondents from the GEM1503K Chemistry in Space module. It is important to note that these students are first year, first semester undergraduates, so their responses largely reflect their school education rather than a tertiary education, as well as their expectations of their university education. Furthermore, the questions asked were general, not module specific. The survey was chosen because it was also conducted on 2208 undergraduate U.K. students in the 1970s (Entwistle & Ramsden, 1983). The survey itself consisted of 64 questions and was similar to the more modern Biggs' LPQ except that many more subcategories were included. Due to space constraints, we will only discuss the statistically significant differences between the two correlation matrices here.

Perhaps as to be expected, the U.K. students exhibited a significant negative correlation between those adopting a deep approach to their learning and those adopting a surface approach. That is, the U.K. students who attempted to understand the material tended not to engage in rote learning. In contrast, local students adopting a deep approach were less extreme. There was no significant correlation found between deep and surface learners. This means that more of our deep learners adopted a surface approach as well and were more extrinsically motivated than the U.K. students. Interestingly, our meaning orientation (deep learners) students were no more fearful of failure than the U.K. students, where in both samples, there was little or no correlation observed between indicators of meaning orientation students and fear of failure.

The correlation between our meaning orientation students and those adopting an achieving orientation were very similar to the U.K. students, with two notable exceptions: (1) Our students adopting a deep approach correlated more positively with a strategic approach than the U.K. students, and (2) intrinsic and achievement motivations in local students were more strongly linked than the U.K. students.

There were many significant differences seen in our students who indicated they were disorganised in their study methods. In our sample, we found that first year NUS students were significantly more syllabus bound, afraid of failure, extrinsically motivated, adopted a strategic approach to their study and were more improvident¹ than their 1970's counterparts in the U.K.

Likewise, there were also many differences between our students and the U.K. students as far as our comprehension learners² are concerned. Of our students using comprehension learning as one method of dealing with material, it was found that they also used the strategic approach more, were more inclined to be syllabus bound, and were more extrinsic and achievement motivated than the U.K. students. Furthermore, our comprehension learners utilised all areas of styles and pathologies, be it improvidence, operational learning³ or globetrotting⁴, unlike their U.K. counterparts.

The final significant differences between our students and the U.K. students were for those who used a

1. Improvident: able to remember facts and details, but unable to fit them together into an overall picture; cannot easily 'switch tracks' when working on a problem. Such students prefer to follow each line of thought as far as it will go and remember things best if they concentrate on the order in which the lecturer presented them. Tutors would want them to be more adventurous in making use of their own ideas.
2. Comprehension learners: learners who are often set off on long chains of independent and sometimes only tenuously related thought by ideas in books. In understanding a puzzling idea, they let their imagination wander freely to begin with, even if they do not seem to be much nearer a solution.
3. Operational learning: learning by dealing with each part of a topic or problem in order, working out one at a time; following well tried out

strategic approach to learning⁵. Students who were globetrotters and operational learners, and were syllabus bound correlated more strongly with the strategic approach than their U.K. contemporaries.

Conclusion

Perhaps one of the most interesting aspects of the comparative study is the validity of common conceptions held by staff regarding NUS students, at least for this small sample size. For example, it is often thought that NUS students are *kiasu*, or fear failure, more than Westerners. The results of this survey show that this is simply not true, except in those students who have disorganised study methods. Our students fear failure no more, or less, than the U.K. students. Another conception held is that local students are more extrinsically motivated. This does appear to be true to some extent. More of our meaning orientation students are extrinsically motivated than the U.K. students, where the latter students correlated slightly negatively with extrinsic motivation. However, our achievers and surface learners are just as extrinsically motivated as the U.K. students. Finally, another common conception is that our local students coming straight out of junior colleges are operational learners. Except for those that adopt the strategic approach and comprehension approach to learning, our junior college students are

no more operational learners than the 1970's U.K. students⁶.

Based on the results of the Biggs' LPQ, we would like to suggest that it may be a good idea if lecturers give students this questionnaire, or some modified version, at semester's end and ask them to respond to the questions in light of the module they have just taken. When the marks finally come in, it would be very instructive for the lecturer to note any correlations between marks and student motivations and strategies. This exercise may provide evidence as to whether a lecturer has/has not achieved their personal learning goals for the students.

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approaches to problems rather than anything too adventurous; building up an overall picture of a new topic by beginning with the details; and looking at problems rationally and logically without making intuitive jumps.

4. Globetrotting: ability to have a good general idea of things, but not details; and ability to explain new topics to oneself, but not to others. Globetrotters tend to introduce irrelevant material into essays or tutorials, and jump to conclusions.
5. Strategic approach to learning: a learning approach in which learners listen to lecturers for any hints on what will be in the exam, and then study the emphasised material. When working on a project, learners bear in mind what the lecturer seems to want. If conditions are not right for studying, they are able to change them. They always manage to get hold of the books they need.
6. Note that statement implicitly assumes that most of the GEM1503K students are educated in our junior colleges.

A Matter of Style

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I've got a thick skull boss, I don't grasp these things easily. Ah, if only you could dance all that you've just said, then I'd understand. ...Or if you could tell me all that in a story, boss.

—Zorba the Greek

It is generally recognised that learners differ in their preferred learning styles. What is less certain is the

degree to which teaching is tailored to cater for the variety in order to produce optimal learning outcomes for the greatest number. It has been suggested that at least some of the complaints about student performance may be attributed as much to mismatch of teaching and learning styles as to student ability.

In the traditional, teacher-centred instruction paradigm, teacher preferences rather than learner needs tend to

be foregrounded. Most of us teach in ways that are comfortable to us; many teach as we were taught, which may or may not be our natural style and, to a large extent, ignores what the learners' styles might be. Such incongruence is obviously not ideal. Studies support the common-sense notion that communication on a common wavelength is likely to be more efficient and effective. Of course, complete congruence may not be feasible, nor is it entirely desirable to cater exclusively to learners' preferred styles. Reality dictates that our graduates have the ability to adapt to varied challenges and to have the mental agility to function and continue to learn even in inimical modes.

In the matter of style, then, perhaps these three points are particularly worth bearing in mind:

1. If a teacher teaches in a style that is antithetical to the learner's, the disparity would interfere with learning, particularly if the learner has yet to learn to operate in a mode other than his preferred one.
2. Learners need to be helped to acquire the ability to function in both their preferred as well as less preferred modes.
3. A teacher should try to use a variety of teaching styles so as to match at least some of the students' learning styles some of the time.

This may seem daunting, given the number of learning style models that have been proposed, but considering the common grounds, revisiting some of the more well established and used models may be sufficient to remind of the essentials.

The **VAK sensory modal inventory** is based on observations that individuals negotiate with the external world through **V**isual, **A**ural and **K**inesthetic interactions. A variant form adds 'reading/writing' to these three ways of orienting to new knowledge.

Multiple Intelligences, as propounded by Howard Gardner¹, recognise that different learners have different strengths in their ways of knowing—verbal/linguistic, logical/mathematical, visual/spatial, bodily/kinesthetic, musical/rhythmic, naturalist, interpersonal and intrapersonal and capitalising on these strengths promotes learning competence.

The **Myers-Briggs Type Indicator (MBTI)** is derived from Jungian theories of psychological types² and the way we use sensations, feeling, thinking and intuition to orient ourselves and deal with new knowledge. The MBTI offers these groupings:

- Extrovert (relates to outer world; tries things out) vs. Introvert (looks inward; thinks things through);
- Sensor (attentive to observable phenomenon; fact-driven) vs. Intuitor (imaginative; concept-oriented);
- Judger (methodical; uncomfortable with open-endedness) vs. Perceiver (responsive to and tolerant of change and plurality); and
- Thinker (works through logic and rules) vs. Feeler (persuaded by affective, personal considerations).

Kolb's Learning Style Inventory³ is predicated on ideas of active and experiential learning articulated by John Dewey⁴, Carl Rogers⁵ and others. It distinguishes four types:

- Reflective-Concrete (the 'Why' learner; seeks relevance of what is to be learnt);
- Reflective-Abstract (the 'What' learner; performs well with information presented in orderly, structured manner);
- Active-Concrete (the 'How' learner; learns best working actively on well-defined tasks); and
- Active-Abstract (the 'What if' learner; relates what is learnt to real life and problem-solving).

Clearly, no teacher can be all things to all learners all the time. For instance, to cater to the four types of Kolb's typology would require a manager, expert, coach and even a nonentity so as not to interfere with Type 4's self-directed learning. Even if one could assume these varied roles, there may be demands of the discipline and possibly other constraints which need to be factored in. Ultimately, decisions will have to be taken about what is the best mix of teaching styles for the audience, the subject and the context. What is important is that there be no unmindful disparity. Studies in the US indicate that the majority of freshmen are concrete-active, sequential and visual learners, and this

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5. Rogers, C.R. & Freiberg, H.J. (1994). *Freedom to Learn*. Columbus, OH: Charles Merrill.

phenomenon has been noted locally too. These students tend to be sensors and judgers who like well-signposted roadmaps and unambiguous destinations, with frequent feedback to assure them that they are on track, and are averse to venturing beyond the set path. They look for the practical (e.g. what counts for passing examinations), and the concrete (not too philosophical and hypothetical), and IT and interactive multimedia have probably accentuated the preference for the visual, interactive and instant gratification. Teachers, in contrast, share the value system of the reflective-abstract minority of intuitors and feelers: desire/willingness to explore beyond set boundaries, global/holistic, original and independent thinking, learning for intrinsic rather than extrinsic gratification. The natural thing would be to teach to this group with whom one has empathy, but this would be ignoring the bulk of students.

To reach out to the learners, and to familiarise them with the skills for learning in other modes, an integrated approach—one that draws on various approaches—seems logical and too obvious to need repetition. Yet, the occasional reminder to make conscious efforts at transmuting internalised beliefs into action might not be totally redundant. Teachers might ask themselves periodically these and other pertinent questions, for the list is by no means exhaustive:

- Do I adopt/encourage active modes of teaching and learning in my class? Do I involve the learning in the learning process?
- With less sophisticated learners, do I offer concrete experience and tasks before presenting theories and abstractions? Do I use examples and analogies in explaining difficult concepts?
- Do I balance the concrete with the conceptual?
- Do I help learners make connections between different chunks of information (e.g. through good course design, cross-references during class, posing questions to prompt students to formulate their own connections)?
- Do I structure classes/assignments to provide opportunities for both active participation as well as reflection?
- Am I overwhelming my students with too much diversity of viewpoints? Do I equip them with the means to deal with them competently?
- Do I use different medium: not just the aural (typical lecture mode) but also the visual (e.g. diagrams, demonstrations)?
- Do I provide more structure at the beginning and ease off as learners acquire confidence in managing their own learning?
- Do I give sufficient and timely feedback?
- Do I encourage students in metacognitive investigation of their own learning processes so that they can work from a position of understanding to maximise their own learning whether within or outside their preferred learning styles? ■



The Centre for Development of Teaching and Learning (CDTL) engages in a wide range of activities to promote good teaching and learning at the National University of Singapore, including professional development, teaching and learning support, research on educational issues, and instructional design and development.

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