Beacons in Troubled Seas: The Use of Learning Styles in Mathematics, Careers and Christian Education.

Marlene LeFever has succinctly expressed an absolute truth: "Everyone has a learning style" [1]

It follows that if we learn, then we learn in a way or ways that are comfortable for us and allow us to effectively take in, process, file, remember, recall and use information. That process becomes our 'learning style'.

Teachers and students are increasingly being asked to cram more and more into the educational process. Not only are there syllabus documents (which change every now and then), but there are the additional priorities:- from boys education to girls education; work education to education for leisure; anti-bullying, anti-discrimination, and crosscultural education; the list continues.

As each of these worthwhile initiatives exerts its own pull on the time and expertise of teachers, there is the inevitable clash of priorities - this leads to a stirring of the waters of what should be calm, productive seas of knowledge and learning. Instead, teachers and students have to navigate through rough seas in the hope that they won't be swamped by the waves. What is needed is some waypoints or beacons to allow learners and instructors to find calmer waters.
The appropriate use of learning styles could serve as those beacons - guiding participants to better read these troubled seas and to avoid the worst hazards.

On Thursday 26th August, 2004, the ABC's "Catalyst" program aired a segment entitled "The Baroness and the Brain". Part of the transcript is reproduced (below).

Baroness Professor Susan Greenfield
(Department Of Pharmacology, University of Oxford)

So we know that the way you see yourself can effect both your physical and mental performance. What is reassuring I think for people though who are not used to the neuroscience's is to see that there are physical ways that we know this is done and to show that it's not just hand waving, it's not just airy fairy stuff.

Narration
So we have the power to change our brains for the better despite the threat from technology.
Susan's next stop is the people who can put this idea into practice - teachers.
The teachers are learning that everything they do will affect the way their student's brain connections form.
It's not just what they teach their pupils but how they teach them.
The more challenging and interactive their education is, the stronger and more varied their student's brain connections will become.

Baroness Professor Susan Greenfield
Basically use it or lose it, the more you stimulate the brain, rather like when you exercise you body your muscle grows, the more you stimulate the brain the more connections can be made, and the easier they work, the better they work.

Here we have a world-renowned expert giving an excellent rationale for differentiated curriculum including the use of learning styles to establish and maintain the aforementioned brain stimulation.

3 Dimensions of Learning Style Theories
Most of our current knowledge of the learning process has been based on the psychological research and experimentation over the past 150 years. The most popular generic theory is the cognitive view of how people learn. This is largely focussed on the information processing habits of individuals. It represents a person's typical and most repeated modes of perceiving the learning situation and task; their thinking processes; how they remember data/processes; and their preferred problem solving strategies.

Psychologists and educational researchers tend to base these theories on cognitive affective or physiological or sensory factors which elucidate and define the conditions deemed desirable to produce effective and efficient learning. Examples of these are:-

   a) cognitive : brain hemisphericity - e.g. Hermann Brain Dominance (HBDI)
   b) sensory or modality: e.g. VAK (visual, auditory, kinesthetic) theories, David Kolb's "experiential learning"; Bernice McCarthy's'4MAT'; Neil Fleming's VARK (visual, auditory, read/write, kinesthetic).
   c) affective (or personality): Myer-Briggs Type Inventory (MBTI); David Keirsey's Temperament Sorter, Anthony Gregorc's Type Indicator.

a) Cognitive Theories
 These theories focus on the functions of the brain. The two hemispheres of the brain contend for dominance and each controls different aspects of learning. The left hemisphere produces language and speech. It is the focus for logic and analytical skills and processes information rationally and sequentially. The right hemisphere is the initial receiver of incoming information, and, as such, uses a global process to perceive, assimilate and process all data received by the brain. This is the visual, random, 'artistic' side of the brain.

b) Sensory Theories
Most commonly, these theories espouse various combinations of Visual, Auditory, Kinesthetic and Tactile modes (sometimes referred to as channels) of learning.
Visual Learners learn through recall of what they see (i.e. read or observed). They prefer to look at illustrations, charts, diagrams, pictures, videos, OHT's, even reading handouts and/or texts.
Auditory Learners have an ability to memorise what they hear - lectures, speeches, debates, discussions, and listening to others. They tend to be very attentive when information is presented in oral and aural ways. Written formats are generally held to have far less meaning.
Tactile Learners need to find a use for their fine motor skills - hence the term 'hands - on' learners!

Kinesthetic Learners are similar to tactile learners in that they need to use bodily movement to learn effectively. They need to do something - just watching or listening will not give them understanding. These learners need to move or explore, so the use of drama, building, physical exertion and the use of manipulations are excellent mediums for kinesthetic learning.

David Kolb
In 1984, Kolb postulated that learning involved four principal stages: -

   i) concrete experiences (CE) : learning from specific experiences, relating to people, and sensitivity to feelings and people;

   ii) reflective observation (RO) : exercising caution before acting or making a judgement, watching others or developing observations about one's own experience;

   iii) abstract conceptualization (AC) : creating generalisations or principles that integrate their observations into sound theories;   and

   iv) active experimentation (AE) ; the use of generalisations of personal theories as guides to further action by testing what one had learned in new, more complex situations.

Kolb further identifies two separate elements (or continuums) in the learning process - perception and processing). By using these two as axes, Kolb constructs four quadrants which he designates as "divergers", "accommodators", "convergers" and "assimilators". The table (below) sets out the interactions of the four learner types.

TYPE OF LEARNER

TYPE OF LEARNER	GRASPS EXPERIENCE USING:	TRANSFORMS EXPERIENCE THROUGH:
DIVERGERS (Learner A)	CONCRETE EXPERIENCE (CE)	REFLECTIVE OBSERVATION (RO)
ACCOMMODATORS (Learner B)	CONCRETE EXPERIENCE (CE)	ACTIVE EXPERIMENTATION (AE)
CONVERGERS (Learner C)	ABSTRACT CONCEPTUALIZATION (CO)	ACTIVE EXPERIMENTATION (AE)
ASSIMILATORS (Learner D)	ABSTRACT CONCEPTUALIZATION (CO)	REFLECTIVE OBSERVATION (RO)

Bernice McCarthy's 4MAT
Seemingly a further refinement of Kolb's theory, the 4MAT process, as espoused by McCarthy, also uses the four quadrants. She uses different naming terminology e.g.
    Innovative Learners (concrete / reflective)
    Analytic Learners (abstract /reflective)
    Common Sense Learners (abstract/active)
    Dynamic Learners (concrete/active).
McCabe (and Kolb) put forward the notion that the quadrants represent a cycle through which all learners should move. McCarthy outlines in the 4MAT that instruction should take place through the medium of the quadrants i.e. that instructors should move through all four quadrants in each lesson. This would allow all learners to be exposed to both their individually- preferred learning medium as well as strengthening the linkages to other learning mediums.

c) Affective (Personality) Dimension

Motivation, especially the motivation to learn, is the key factor in the affective dimension. In looking carefully at motivation, most theorists accept that it is drived from interaction between one's capacity for attention, their valuing capabilities and how both of these interplay with the emotions.

Myer-Briggs Type Inventory (MBTI)

Based on the work of Jung, the MBTI is constructed around four dimensions. These are Extroversion (E) vs Introversion (I), Sensing (S) vs Intuition (N), Thinking (T) vs Feeling (F), and Judging (J) vs Perceptive (P). The MBTI provides data on these four sets of preferences, which, in turn, result in sixteen (16) learning styles or types. A type is the specific combination of the four preferences e.g. ENTP, ISFJ, INFS, etc.

The MBTI is strictly controlled. To administer the MBTI, an instructor must have been trained and licensed.

By comparison, the Keirsey Temperament Sorter is regarded as a public domain version of the MBTI. The Keirsey Temperament Sorter was developed from the studies of Jung, Myers, Kretchmer and Sparger. While the same types are used, the nomenclature is different and there are some differences in descriptions. There are four temperament types, each with four variants.

Gregorc's Learning Styles

Dr. Anthony Gregorc and Dr Kathleen Butler developed the Gregorc Type Indication within the affective (personality) dimension of learning style models. As such it is best compared to the Keirsey Temperament Sorter and Myer Briggs Type Indicator (MBTI).

The Gregorc model sorts people along two continua - a perception continuum from random to sequential. There are four combinations within the model - concrete sequential, abstract sequential, abstract random and concrete random. None of these combinations are considered to be a 'pure' style but Gregorc's position is that individuals are a mixture of all four combinations. Individuality is found in the extent of each person's combination of all four styles.

By identifying our unique blend of styles (which then provides us with our learning preferences), individuals can then recognize and value where strengths and weaknesses lie and this allows the learner to develop compensatory practices to adapt to multiple learning situations.

N.B. It is strongly recommended that the Gregorc Type Indicator be used solely in the Senior School i.e. Years 11 and 12 and tertiary levels. Younger students lack some of the maturity and certainly the life-experience to be able to accurately complete the initial instrument.

Gregorc and Senior Mathematics

In 2002, the year 11 Mathematics B cohort of students at Trinity Lutheran College were proving to be atypical. Despite teacher efforts and classroom modifications, students were significantly underperforming.

During Semester two, a series of meetings were held between the Maths B teachers (including the HOD Mathematics) and the Learning Support Co-ordinator. A decision was made using the

Gregorc Type Indicator results from Semester One to reform the classes by grouping the students according to their learning styles. It required several further meetings to accomplish the rearrangement of classes - it was important to take personality and work ethic into account as well as learning style preferences.

Following a tentative solution to the class composition issue, teachers were also required to complete the Gregorc Delinieator to determine their teaching preferences. All teachers had similar styles. Where possible, teachers were matched with classes with similar learning style preferences. Where this was not possible, teachers undertook to vary their teaching style to incorporate aspects of the student preferences. A number of inservice sessions were held to plan the implementation of the program.

The plan was to teach towards student's learning style preferences in Term One, but to build bridges to the other styles in Terms One and Two, so that, by mid-Term Two, teachers would be teaching according to their preferences.

At the beginning of 2003, the classes were reformed. Parents and students were informed of the process, and the need for it, at the very beginning of the school year. While some parents and a number of students were skeptical, there was overwhelming acceptance for the need to be proactive.

Termination of the program came a little earlier than expected. By the beginning of Term Two, teachers teaching out of their style had reverted to their preferred style. While this had been the intention, teachers fast-tracked the process. However, testing showed a significant increase in better results for most students. More importantly, the significant improvements recorded at the end of Semester One were maintained, and even slightly improved upon, in Semester Two. While it would be tempting to claim complete success for the process, there could be other explanations which were contributing factors to the student success e.g. the process may have highlighted to both parents and students the need for greater participation or the mere fact that the College was attempting to be proactive might have been sufficient cause to spur some students into greater effort.

Whatever the cause, the main objective was realised - students were now performing more in line with expectations of their potential.

Careers
For a number of years, the Careers Advisor and Learning Support Co-ordinator have combined efforts to deliver the study skills and time management programs to students. In the senior school, the results from the Gregorc Delineator have become an integral, even central, component of these programs. Results of the Gregorc instrument are utilised in the Year 11 study skills program, and in the refresher course given to Year 12 students. Some implications from these results were also built-in to the preparation of students to sit for the Queensland Core Skills (QCS) Test.

However the Careers Advisor also noticed a growing correlation between learning styles and some pre-vocational aptitudes. This relationship began to become obvious during preparations for Year 11 work experience arrangements (organised by the Careers Advisor for all Year 11 students). It became obvious that students with a preference in abstract/random did not apply for work experience placements in accounting firms or legal offices but seemed to be more comfortable applying for placements in hospitality (to name just one). It became obvious that there was also a similar, but more restrained correlation when students were choosing post-

secondary placements - whether the choice was for tertiary placements or for workplace occupations.

A perusal of learning style preferences has now become a fairly common occurrence when students are interviewed for both work experience placement and post-secondary plans. Parents appear to be accepting of this trend and some are actually seeking further information.

Multiple Intelligences.

Howard Gardner's Multiple Intelligences theory isa not a recognised learning style - but then it is somewhat of an enigma because it has a foot in many camps but belongs to none of them. It has vestiges of a theory of intelligence but doesn't really fit the criteria properly. Similarly, it is not a true learning style but the 'intelligences' do describe the diffrerent ways possible for people to learn. It therefore clearly has a place (albeit by default) in these discussions.

Dr. Howard Gardner first postulates the first seven 'intelligences' in his book "Frames of Mind" (1983). In 1999, in "Intelligence Reframed", he added the latest two - naturalist intelligence and existential intelligence.

It is Dr. Gardner's belief that everyone has all nine intelligences, only that we each have nurtured and strengthened some and weakened or ignored others. Therein lies our individuality. The nine intelligences and their salient characteristics, are:-

(1) Verbal-Linguistic Intelligence - well-developed verbal skills and sensitivity to the sounds, meanings & rhythm of words.

(2) Mathematical-Logical Intelligence - an ability to think in conceptual format and/or abstractly. It concerns a specific ability to discern logical and numeric patterns.

(3) Body-Kinesthetic Intelligence - an ability to control body movements; to handle objects/tools skilfully; to appreciate the aesthetics.

(4) Visual-Spatial Intelligence - the capacity to think in images or pictures; to visualise accurately & abstractly; to have an acute awareness of the position of objects (especially body extremities) in space.

(5) Musical Intelligence - a creative ability to create and appreciate rhythm, timbre, pitch and tonal qualities.

(6) Interpersonal Intelligence - the ability to develop an affinity with others; a capability to detect and react appropriately to the moods, whims, motivations and desires of others.

(7) Intrapersonal Intelligence - an innate capacity to be self-aware and in touch or in tune with one's inner feelings, beliefs, values, thought processes and foibles; an introspective quality.

(8) Naturalist Intelligence - an ability to perceive order in nature and natural occurrences, an ability to recognize plants, animals, landscapes and other objects in nature.

(9) Existential Intelligence - a sensitivity for the paranormal; a capacity to address the deep questions about human existence; the ability to understand, even explain, supernatural events; to hold a belief in a higher power.

Despite the fact that Multiple Intelligences Theory has been used widely, debate still continues as to whether these are "intelligences" or "learning styles". This theory has the least empirical proof yet it is probably the most accepted and, after the V-A-K- theory, is the most adopted theory. Regardless of its standing in this regard, several statements are generally considered to be valid, and these are:-

i) all human beings possess all nine intelligences in varying amounts;

ii) each person has a different 'intellectual' composition;

iii) schools (and teachers) rely heavily on two of the intelligences (namely verbal-linguistic and logical-mathematical) to convey most of the information through instruction and also as the mediums for assessment; and

iv) we can improve education by addressing the multiple intelligences of our students.

These four statements underpinned the approach undertaken when the Learning Support Co-ordinator at Trinity Lutheran College was asked to assist the HOD Christian Understanding to be involved in the planning of what was then the new L.I.F.E. program. Our first realisation was that the L.I.F.E. program was itself couched in Multiple Intelligence terminology, structure and examples. A planning guide was developed and used to brainstorm all possible activities for each unit. These were then culled or moulded into the unit for the topic.

Certain guidelines were adopted as standard procedures in the planning process. Firstly, in the initial brainstorming sessions, all cogent ideas were recorded - regardless of their perceived suitability. Secondly, creativity and "out-of-the square thinking" was encouraged by all participants. Thirdly, while it was accepted that every unit did not have to have activities based on every intelligence, it was mandatory that all students would experience work based on all intelligences over the period of a semester. Fourthly, academic rigour was to be encouraged for all students, but this would also occur within the context of the varied activities. Lastly, assessment would embody and incorporate as many of the intelligences as possible - the verbal-linguistic and logical-mathematical would still be used, but as mediums of expression for the other intelligences. What emerged was a program which has been acknowledged as among the *best practice* in the country. However, more importantly, the planning process became a challenging, hugely enjoyable exercise for all involved in it. Further, the program changed the face of Christian Understanding within the College community. Students rose to the challenge of the work and started to see the subject as having academic weight. This undertaking had been one of our initial "givens". (Some students even openly acknowledged that they enjoyed the subject). Parents began to comment on, and appreciate, the work in the subject. This was most notably seen in the Year 10 Service unit where all students were required to complete a service unit which was above and beyond their usual commitments at home or elsewhere. Parents were pleasantly surprised to see some of their children take the initiative and volunteer to assist in aged care facilities, child care centres, volunteer organisations, etc.

One of the delightful, unexpected outcomes was the level of involvement by the teachers. Initially the planning was conducted by the two co-ordinators (Christian Understanding and Learning Support). As teachers became familiar with the program parameters, they argued for greater participation in the planning process. Once they came to terms with the design process, the teacher involvement added richness to the overall resultant units.

Teacher involvement in the planning process led to teacher involvement in the review process. At the end of each semester and year, a review was held of all units. Some units were left virtually untouched because they had worked well - others were rather drastically overhauled, especially when time constraints were an issue.

Over the four years of the planning and implementation of the L.I.F.E. program, the Christian Understanding department changed to where students were being challenged on multiple levels and their work often reflected a changed attitude towards the subject. The quality of student work was significantly raised and the parents were actively involved in the program. Teachers were

offered the opportunity to become more enthusiastically involved in the planning, implementation and review of the whole program. In fact, teacher discussion, and debate, over various aspects of the program was regarded as being a healthy development.

Finally, while this discussion has focussed on the use of Multiple Intelligence Theory, there were other design characteristics. Underlying the planning process was an understanding that critical thinking, higher order thinking skills and the use of graphic organizers were perceived to be inherently desirable and therefore they were embedded in the course content wherever it was possible to do so.

Hidden Reefs and Myths

While there are compelling reasons to consider the use of learning styles in our everyday pedagogy, there are always the detrimental factors to every teaching practice or strategy. Beacons are there to highlight a safe passage through an area strewn with hidden reefs, treacherous shoals or dangerous rocks.

So what are these hidden dangers and/or myths?

1. The way(s) that students learn is forever fixed - there is, and can be, no change.
Authentic learning style theory allows that every person is an individual. As such, change over time is not only possible, but it is to be expected and anticipated. The best models advocate plotting student preferences on a number of continuums. Therefore learning style preferences should be checked or re-evaluated every two to three years. What needs to be avoided is assessment that encourages the categorization of students into a 'little box' syndrome. We should not encourage student-speak like "I am an ENFJ" but should foster the type of student-speak that says "I have many learning preferences associated with a visual learner as well as the added richness of learning preferences of a kinesthetic leartner." We ought to try to keep learning style categories broad in their nature and with areas of overlap with other categories. Greater delineation and compartmentalization only allows the student to identify with a narrow spectrum. This, in turn, will engender a false, fixed set of values within which the student thinks he/she can learn and, by default, disqualifies them from experimenting with or experiencing legitimate learning preferences.
N.B. These arguments are equally true for teaching styles.

2. Teachers must match their teaching styles to the learning styles of their students.
This "all or nothing" myth is obviously false. All effective teachers, regardless of their time in the profession, will try a variety of techniques and/or methods to reach their goal - to teach their students. So the aim is to use a variety of instructional techniques to engage all students. Teachers should look to use techniques which, over time, activate all learning styles. At the same time, students must be instructed on how to adapt their learning styles. Learning is likely to be most effective when there is a positive interaction between teaching styles and learning styles.

3. Students can only learn from the teachers who accommodate their learning style.
Those who advocate this position are arguing an impossibility. Administratively, it is impossible to arrange classes to accommodate a direct match between the teacher's teaching style and the learning style of the students. Even if it were possible to arrange class/teacher matching, it is not healthy to do so. Very few people learn from only one style - we learn from a mixture of styles because our preferences are found in several styles. To limit the instructional mode to any one

learning style would be to upset the equilibrium within a student. It would be similar to breeding a food plant to produce a high yield but ignoring the plant's strength, structure and root system which are vital to sustain the plant so that it can produce the high yields. Just as horticulturists need to look at developing the whole plant, so teachers need to instruct their students in a variety of learning styles, and to teach them how to best utilize their learning preferences - regardless of the instructional mode.

4. Learning styles are a panacea.
This is another untenable position. There is no single answer to improving and maintaining student engagement and performance levels. However, judicious use of learning style theory can potentially lead to greater student engagement, simply because the information/skill transfer process in undertaken in a guise which correlates to them on an individually preferred basis. Therefore it deserves to be part of what W. J. McKeachie calls an effective teacher's "amarmentarium of teaching methods and learning activities that can be drawn upon from moment to moment or from week to week to facilitate maximum learning for as many students as possible".**12**

5. Learning Styles don't matter.
Most proponents to this point of view seem to have another agenda. Some espouse a point of view which decries a supposed lack of 'validation'. Until the early 1990's, this may have held some weight, but since then, there is a growing wealth of research into the feasibility and desirability of learning styles instruction. Others advocate the use of teachable skills and strategies, particularly when set out in a particular program or sequence which they have developed for use in schools, colleges and universities. These educators claim that learning styles or preferences are inherent to each of us, and, while they concede that these preferences can change over time, they argue the foibles of their use far outweigh the practical considerations. Quite often the argument outlined is actually useful in condoning the appropriate use of learning styles - only they state their preference for what they call the more 'teachable' concepts e.g. motivation, intelligence and the use of prior knowledge.

The measured, appropriate use of learning styles holds the potential of greater student engagement . It allows both teachers and students to manipulate their learning environment to facilitate their preferred learning pathways. Teachers who also use their teaching style to put students into an optimal zone of learning by harnessing their students' learning preferences, then allow them the safety to stretch their styles into other, more unfamiliar episodes, are those who should see the exponential power of optimal learning.

Learning styles may be the vehicle to harness the innate and inherent qualities of individualized learning - without the need to provide a separate education plan for each student in every class. If our students can be taught to utilise their own capabilities and preferences in such a way that they are at least semi-autonomous learners, then this is a goal worth the effort put into it.

Lastly, if a student's learning styles can lead him/her to show their true capabilities and expedite the realization of their potential, then they truly have become beacons to guide students through the troubled seas of the schooling years.

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Note: Participants in this elective were also introduced to several learning and teaching styles, and the possible interaction between learning styles and teaching styles.