

# Thinking styles and their role in teaching and learning

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## Abstract

It has been well documented in educational literature that effective learning takes place if the whole brain is involved in learning. This paper introduces a model for understanding thinking styles and the important role that it has in teaching and learning.

Cognitive functions are accommodated when teaching activities are constructed to comply with a learner's preferred mode of thinking. Interpreted in terms of Herrmann's Whole Brain Model, this presupposes that all four brain quadrants are included in teaching and learning activities. This model also helps to understand mental diversity and the important role that it has in effective teaching and learning as well as being a tool to design and deliver teaching and learning activities in all four brain quadrants.

Taken that "*Every classroom represents a complete spectrum of learning style preference*" (Herrmann 1996:151) this paper will highlight that if educational activities are designed and delivered in all the modes of Herrmann's model, successful learning will take place. A variation in design and delivery approaches by educators would facilitate the development of the full potential of a learner. This will not only *accommodate* learners' thinking preferences but also *develop* areas of lesser preference and avoidance of learners.

## Introduction

The library and information profession as a whole has changed significantly in the last few years. There are a number of reasons for these changes. Among these are the increase in electronic publishing, digitizing conventional library materials, the advent of the Internet, the availability of information in many new formats and the extensive use of technology in the organization and retrieval of information, as well as in most other operations in library and information organizations (Ayres 1993,3).

In analyzing the needs of potential employees it seems as if there is a demand for graduates who can think holistically, be innovative, work in teams, synthesize information, integrate environmental and societal values and ethics into their work, communicate effectively and solve problems in creative ways. The latter has been neglected in most curricula in tertiary institutions. The main focus still today is based on mastering vast volumes of content.

An important factor that emerges from numerous case studies around the world is that a paradigm shift is required by both students and educators. The focus of this paper is to introduce a model for understanding thinking styles and the important role that it has in changing the traditional perspective of teaching and learning in general and specifically in the programmes offered in Information Science at the University of Pretoria.

## The Herrmann Four Quadrant Whole Brain Model

Research done by MacLean during the mid 70's proposed the triune brain theory according to which the human brain is in reality three brains, one superimposed on the other in a pattern of brains within brains (Herrmann 1995:31). Our knowledge of brain functioning emerges from an understanding of Sperry's left-right brain model. This research eventually brought to light the specialized functions associated with the left and right hemisphere (Trotter 1976:219). Herrmann

(1996:42) pointed out, that although each hemisphere is specialized in a different way, the physical connections secure integrated brain activity. According to Gazzagnia (1998:35) ongoing research has reaffirmed that:

*'The two hemispheres control vastly different aspects of thought and action. Each half has its own specialization and thus its own limitations and advantages'.*

These theories gave impetus to the development of Herrmann's whole brain model. Herrmann used the left/right theory, the triune theory and the physical connections between the left and right hemispheres and between the upper and lower parts of the brain to construct his whole brain model.

The four quadrants of the Herrmann model represent the four thinking structures of the brain. The left and right hemispheres (Sperry's work) represent our cerebral processes and the two halves of the limbic system (MacLean and Herrmann's work) represents our more visceral (feeling based) processes. The cerebral mode is the more cognitive, intellectual part of our thinking processes and the limbic mode is the more structured visceral and emotional part of our thinking processes (Herrmann 1995:40). Although an individual may favour cognitive activities associated with a specific quadrant, '*both hemispheres contribute to everything, but contribute differently*' (Ornstein 1997:94).

According to Herrmann (1995, 1996) a preference for the A-quadrant (left cerebral mode) means that a person favours activities that involve logical, analytical, fact-based information. A preference for the B-quadrant (left limbic mode) implies a linear approach to activities. Individuals with a B-quadrant preference favour organized, sequential planned and detailed information. They are conservative in their actions and like to keep things as they are. A preference for the C-quadrant (processes of the right limbic mode) indicates favouring information that is interpersonal feeling-based and involves emotion. A preference for the D-quadrant (processes of the right cerebral mode) is mainly characterized by holistic and conceptual approach in thinking.

This model helps to understand mental diversity and the important role that it has not only for effective teaching and learning, but as well as a tool to design and deliver teaching and learning activities in all four brain quadrants. The model further indicates clearly the iterative nature of the activities and the correlation of the physiology of the interconnected brain.

These specialized mental modes function together situationally and interactively making up a whole brain in which one or more parts become naturally dominant. The dominance between the paired structures of the brain provides the basis for measuring the level of dominance. The Herrmann Brain Dominance Instrument (HBDI) is an assessment tool that quantifies the degree of a person's preference for specific thinking.

### **The Herrmann Brain Dominance Instrument Tool (HBDI)**

Based on extensive research which spans 20 years, Herrmann (1995, 1996) developed an assessment tool that quantifies the degree of a person's preference for a specific thinking style – the *Herrmann Brain Dominance Instrument (HBDI)*. The results are displayed on a four-quadrant grid. It takes the form of a survey consisting of 120 questions to be completed by an individual. Although Herrmann discusses his model as a metaphor, the brain-based quadrant is aligned with, and supported by various research projects and is used as a measuring tool for thinking preferences of individuals. Because brain dominance is not solely predetermined genetically, but is a result of genetic inheritance and parenting and teaching, life experiences and cultural influences, brain dominance is natural and normal for all human beings. This means that brain dominance influences all four specialized thinking structures of the brain and not just the two hemispheres. To date, more than two million HBDI profiles have been done world-wide (Lumsdaine, Lumsdaine

and Schellnut 1999:52). A database of profiles is kept at the headquarters of Herrmann International in the USA as well as in France.

It must be outlined that the HBDI does not test competencies but gives an indication of preferences and potential competencies. Herrmann (1995:76) points out that:

*“profiles are neither good nor bad, right or wrong. The instrument measures preferences for a mental activity, which is entirely different from competence in performing it.”*

Although the HBDI was originally developed for adult users in a corporate environment, it has been successfully used with tertiary students (Lumsdaine & Lumsdaine 1995, De Boer & Steyn 1999, De Boer & Van den Berg 2000, De Boer, Coetzee & Coetzee 2001).

### **Thinking style preferences and learning style models**

Students arrive at tertiary institutions with thinking style preferences that have been established through schooling and life experiences. These existing preferences are influential with regard to all the cognitive activities in which students are engaged. A thinking style preference leads to a learning style preference and in turn determines a student's dominant cognitive mode in which he/she communicates and receives information. The notion of learning style and learning style models are well documented in research. The Myers-Briggs Type Indicator (MBI) classifies students according to their preferences on scales derived from Carl Jung's theory of psychological types. Students may be extroverts or introverts, sensors or intuitors; thinkers or feelers; and judges or perceivers. Kolb's learning Style Inventory classifies students as having a preference for concrete experience, abstract conceptualization, active experimentation, or reflective observation. The Herrmann Four Quadrant Whole Brain Model, however is the *only instrument that quantifies a person's preference for thinking in four different modes* based on the task-specialised functioning of the physical brain (Herrmann 1995:72, 350).

### **Effective Teaching and Effective Learning**

It has been documented (Knowles 1990, Buzan 1991, Jensen 1996, Ornstein 1997) that effective learning takes place if the whole brain is involved in learning. Interpreted in terms of Herrmann's model this presupposes that all four quadrants are included in teaching and learning activities.

Complementary to Herrmann's model, Lumsdaine and Lumsdaine (1995) identified the following four modes of (tertiary) students' learning.

- *External learning* is related to teaching from authority through lectures and text books. It is predominantly A-quadrant learning.
- *Internal learning* can be described as an insight, a visualization, the synthesis of data or through the understanding of concepts holistically or intuitively. This is predominantly D-quadrant learning.
- *Interactive learning* is brought about by discussion, hands-on activities and sensory-based experiments where a student can try, fail, retry with an opportunity for verbal feedback and encouragement. Interactive learning is predominantly C-quadrant learning.
- *Procedural learning* is characterized by methodical step-by-step testing of what is being taught as well as practice and repetition to improve skills and competence. It is predominantly B-quadrant learning.

Cognitive functions are accommodated when teaching activities are constructed to comply with a learner's preferred mode of thinking/learning. Cognitive functions are optimally utilized when learning activities are constructed in such a way that the cognitive functions associated with all four quadrants of the Herrmann model are used. However, it should be borne in mind that

teaching and learning are done within the context of the complexity as illustrated in the Herrmann extended model for teaching and learning.

[Insert figure 1 here]

**Figure 1** The Whole Brain Teaching and Learning Model (Herrmann 1995:155)

In this model the learner/teacher is represented in the centre as whole brained and within the broader cultural and social environment. The arrows indicate the iterative nature of the activities as they correlate with the physiology of the interconnected brain. The left (structured) mode is categorized by processes dealing with logical, rational, critical, quantitative issues and activities. The procedural planned, sequential and organized elements of the learning/teaching activities are found in the structured left mode. The learning/teaching activities of the left mode are depicted in the cultural and social environment by achievements, fact-based knowledge and traditional ways. The experimental right mode is categorized by processes dealing with visual, conceptual, emotional and interpersonal activities. In the cultural and social environment the learning/teaching activities of the right mode can be described as participative and future orientated. The inclusion of all these modes in learning/teaching activities comprises a full range of activities.

In a study by Trigwell, Prosser and Waterhouse (1999) it was shown that qualitatively different approaches to teaching are associated with qualitatively different approaches to student learning. In their study they considered an information transmission/teacher-focused approach in comparison with a conceptual change/student-focused approach. Their results are complementary to Herrmann's model. Viewed in terms of a whole brain approach to teaching and learning, the information transmission/teacher-focused approach represents an approach focusing only on cognitive modes associated with the A and B-quadrants in Herrmann's model. However, the conceptual change/student-focused approach also includes cognitive modes associated with the C and D-quadrants of the Herrmann model.

According to Herrmann his model serves as a strategic tool to design and deliver teaching and learning activities. Educational activities that implement all the modes of Herrmann's model will ensure that learners' preferred thinking styles are *accommodated* and less preferred thinking styles are *developed*. An application of Herrmann's extended model in teaching necessitates that educators become aware of their own thinking preferences and the implications thereof for their teaching practices. Cognitive functions are accommodated when teaching activities are constructed to comply with a learner's preferred mode of thinking. Interpreted in terms of Herrmann's Whole Brain Model, this presupposes that all four brain quadrants are included in teaching and learning activities.

The authors find themselves in agreement with Felder (1996:18) and find his observation fully applicable to the whole brain model:

*"If professors teach exclusively in a manner that favours their students' less preferred learning style modes, the students' discomfort level may be great enough to interfere with their learning. On the other hand, if professors teach exclusively in their students' preferred modes, the students may not develop the mental dexterity they need to reach their potential for achievement in school and as professionals."*

### **Research projects conducted at the University of Pretoria**

- Educators enrolled for the Diploma in Tertiary Instruction in 1999

A research project was undertaken in which educators enrolled for a diploma in tertiary education were introduced to the whole brain concept and were given information pertaining to the Herrmann Brain Dominance instrument (HBDI). For a relatively small sample of individuals (17), the results revealed a diversity of thinking style preferences among the individual educators displaying a composite whole in thinking preferences in all four quadrants (De Boer, Steyn & Du Toit 2001:192). This is in accordance with research findings pertaining to Herrmann's model. As pointed out by Knowles (1990:245):

*“people are equally distributed throughout the teaching and learning model in terms of their mental preferences”.*

Herrmann (1996:47) affirms that:

*“the composite of individual profiles represents a highly diverse, but well balanced, distribution across the four quadrants of the whole brain model”.*

Any lecture-type of instruction focuses mainly on the cognitive modes in the A-quadrant. A variation in design and delivery approaches would facilitate learning in all four the specialised quadrants. Saroyan and Snell (1997) concluded that it seems as if the inclusion of cognitive modes from the other quadrants made it more whole brained in approach which may contribute to it being better perceived by students. Structuring educational activities to incorporate the expectations of learners in all four quadrants would facilitate the development of the full potential of learners. This will accommodate learners' thinking preferences and areas of lesser preferences and avoidance are activated. According to Knowles (1990:241) the concept of whole brain teaching and learning provides the basis for bridging the gap between the unique individual learner thinking style and the design and delivery of the learning by the educator.

- First-year students studying a first course in Criminology

The second project included 68 students registered for a first course in Criminology. Results from this project (De Boer & Van den Berg 2001:118) reveal that a wide range of thinking preferences exists amongst these students. The composite profile for the group indicates preferred modes of thinking in all four quadrants. This confirms the research findings of Knowles (1990:245) claiming that people are equally distributed throughout the teaching and learning model in terms of their mental preferences.

This implies that curriculum designers and educators must be careful not to make unfounded assumptions about learners in the classroom. The project reveals indeed that there is a distribution of learning preferences in all quadrants and that all modes are equally represented.

The research project endorses documented research findings (Herrmann 1995:151) that just as there is a *“distribution of thinking preferences across the spectrum of all four quadrants in the classroom, there is also a distribution of learning avoidance across the four quadrants”*. Learning avoidance may even be more significant to educators than learning preferences because a *“turned off learner is a waste of educational time and effort”* (Herrmann 1996:152). Therefore the greater the alignment between the thinking preference of the educator and the thinking preference of the learner, the more competencies will be acquired by the learner. On the other hand the greater the misalignment the fewer competencies will be acquired.

In order to develop the full potential of learners, whole brain learning should form the basis of teaching practices. This approach will assist all students to acquire skills over a wide spectrum and to develop and grow in areas of lesser preference (De Boer & Van den Berg 2001:119).

- First year students enrolled for a degree in Civil Engineering

A strong emphasis, backed by industry, is on the improvement of the softer, “non-technical” skills of engineering students. American, Australian, British and South African studies reveal that employers believe that entry level employees are deficient in the broader non-technical skills and that educational institutions need to place more emphasis on teaching these skills (Busse 1999). Engineering educational programmes have traditionally done exceptionally well in developing analytical and technical competencies of students (Lumsdaine & Lumsdaine 1995) but little has been done for the development of social thinking and communication skills.

This trend to create a balance between technical and non-technical aspects in the training and education of engineers is evident in engineering education and curriculum designs worldwide.

In order to facilitate the development of non-technical skills of first year students a teaching and learning facilitation strategy based on an awareness of Herrmann’s four quadrant whole brain principles was introduced in the Department of Civil Engineering in 1999. The study included 50 first year civil engineering students. The HBDI was used to give students insight into their own thinking preferences, to determine the homogeneity/diversity of the group of students and to give educators insight into the distribution of their student’s preferred modes of thinking.

As in the previous research findings, the profiles of the students, displayed an array of preferences distributed over all four quadrants of the Herrmann’s Whole Brain Model (Horak, Steyn & De Boer 2001:202). On average, the dominant thinking preferences of the group revealed a distinct tilt towards the preference for the thinking modes of the left hemisphere. The composite profile of the thinking modes reveal a strong preference for the upper left A-quadrant, followed by a preference for the lower left B-quadrant, followed by a lesser preference for the thinking modes of the upper right D-quadrant and a low preference for the lower right C-quadrant mode. Individual preferences however revealed strong preferences in all four quadrants. These findings are in accordance with those of Lumsdaine & Lumsdaine (1995) who conducted a research project on a large scale with students enrolled in a Faculty of Engineering in the United States of America.

For the engineering students, as well as the educators, it became apparent that traditional approaches to educational design and delivery could fall short of desired results when dealing with a composite group of learners with thinking style preferences distributed across all four quadrants. After exposure and application of the HBDI model it was evident that the students showed a significant increase in socialization and group acceptance of the value of diversity were obvious in the projects and group work they participated in.

- Second year students enrolled for a degree in Library and Information Science

At the beginning of 2000 another research project was done on second year students enrolled for a degree in Library and Information Science. The aim was also to determine the thinking preferences of both students and the educators responsible and to adapt the curriculum and teaching approach if necessary. The research findings revealed once again that both the educators and students have diverse thinking styles (De Boer, Coetzee & Coetzee 2001:119). The composite profile of the group revealed a strong preference for the left lower B-quadrant, and right lower C-quadrant.

What was significant in the results was the fact that the students’ profiles were *not in alignment* of what is expected in the profession of cataloguing and classification. In many fields of the information profession, their preferred thinking styles will be an asset, but what cataloguers and those who do subject cataloguing and classification need are essentially analytical, technical proficiency and problem solving skills associated with A-quadrant thinking preferences - skills that the students’ profiles indicate as being their least preferred modes of thinking.

Attempts should be made to assist all prospective information workers to acquire these skills as a matter of urgency within the curriculum and educators should seek more opportunities to assist the students to practice these skills in a way that is in line with their preferred modes of thinking..

## Conclusion

In the research findings of numerous small projects at the University of Pretoria the Herrman Brain Dominance Instrument (HBDI) proved to be a valid and useful diagnostic assessment tool to determine the thinking preferences of students and educators. The results obtained correspond with the universal results of Herrmann's research as well as others using this tool.

From our experience students and educators have indicated that the four quadrant whole brain concept is an invaluable facilitating tool as a guideline for designing and structuring education.

Traditional teaching methods are no longer effective. Exposing learners to a variety of teaching methods – all focusing on the same key points will facilitate effective learning. Teaching activities should ideally be designed to dynamically move back and forth incorporation all four quadrants of the whole brain model.

Therefore, what is important for educators is to:

- determine their own thinking preferences and evaluate their own teaching practice in terms of the whole brain teaching and learning model;
- accept the research findings that each classroom represents an array of diverse thinking and that by teaching content in a whole brain way students' thinking preferences are accommodated and on the other hand students will develop skills in their lesser preferred modes of thinking as well, realizing their full potential.

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