TITLE PAGE

RESEARCH ARTICLE

An analysis of thinking preferences across three health care disciplines

A.Wium, H. Pitout[1], A. Human, P. du Toit

Received date: February 2015

Dr Anna-Marie Wium
Speech-Language Pathology and Audiology
Sefako Makgatho Health Sciences University, PO Box 195, Medunsa, 012 5213884
wiumwium@polka.co.za

Susara J.S. (Hanlie) Pitout
Occupational Therapy, Sefako Makgatho Health Sciences University
PO Box 158, Medunsa, 012 5214019
Hanlie.Pitout@gmail.com

Anri Human
Physiotherapy, Sefako Makgatho Health Sciences University
PO Box 239, Medunsa, 0204, 012 521 4047
anrihuman@gmail.com

Prof. Pieter H. du Toit: University of Pretoria
Department of Humanities Education, Faculty of Education, University of Pretoria,
Private Bag X 20 Hatfield 0082, 012 4202817
pieter.dutoit@up.ac.za

[1] H. Pitout

ABSTRACT

Three lecturers respectively in Speech-Language Pathology and Audiology, Occupational Therapy and Physiotherapy (SLPA, OT and PT) at a public Higher Education Institution in South Africa collaborated to determine thinking preferences. The Herrmann Brain Dominance Instrument (HBDI®) was used to collect data from three lecturers while an adapted version of the HBDI® was used to collect data from second year students and colleagues in the three disciplines. The results from students showed a trend towards left brain dominance with a primary preference for the B-quadrant mode of thinking. The students' brain dominance did not necessarily correlate with those of the lecturers or their colleagues. The results created a better understanding of students' thinking preferences, made lecturers more accountable and emphasised the importance of making provision for diversity in teaching and learning. Less preferred ways of thinking need to be challenged with a view to promoting 'whole brain' thinking.

Keywords: Hermann Brain Dominance Instrument (HBDI®); learning preferences; whole brain learning; Health Care Sciences

Introduction

Faculty in higher education are mostly appointed for their expertise in specific disciplinary fields and are not necessarily familiar with adult learning style models and the impact thereof on teaching and learning. Understanding of personal learning styles contribute towards creating an optimal teaching and learning environment. Lecturers with limited background in adult learning tend to adopt a teaching style that aligns with their own learning preference or how they were taught previously. Such practices are not conducive to creating an optimal learning environment as only a specific number of students will connect with their teaching approach (Hawk & Shah, 2007). As each discipline has its own subject matter, it requires of lecturers as facilitators to use optimal instructional methods to provide the most effective instruction (Pashler, 2009).

This study proposes that when lecturers become aware of their own learning preferences and brain dominance profiles in comparison with those of their students, they are in a better position to facilitate learning effectively. The article provides an overview of the literature on learning styles and the andragogical (adult learning) implications for specific disciplines in health care sciences. Based on the results obtained from the Herrmann Brain Dominance Instrument (HBDI®) the article describes the brain dominance profiles of three specific lecturers in three disciplines, namely Speech-Language Pathology and Audiology, Occupational Therapy and Physiotherapy (SLPA, OT and PT). These profiles are then compared to those of their students and colleagues in these disciplines, which were obtained from a simplified adaptation of the HBDI®. A comparison was made across these disciplines. Such information contributed to a better understanding of students' brain dominance that contributed to more effective teaching and learning.

Literature review

The topics of learning and learning styles have been well researched in the past (Sims & Sims, 2006). Several learning theories (Claxton & Murrell, 1987; Coffield, Moseley, Hall, & Ecclestone, 2004), as well as existing learning style scales e.g. the Rezler Scale (Rezler, 1981), Honey and Mumford Scale (2000), Gregorc (1997), Felder and Solomon (2002), Dunn and Dunn's environmental inventory (1989), Myer-Briggs, and the Kolb's learning Style Inventory (LSI), of which the latter is the most commonly used (Sandmire, Vroman, & Sanders, 2000). However, Nulty and Trigwell (1996) cautions against an absolute categorisation of learning styles for particular student population groups, because of the many variations that may exist.

The Kolb Experiential Learning theory (Kolb, 1984), which served as a basis for several other models e.g. Honey and Mumford (2000), Dunn and Dunn (1989) and Herrmann (1995), described learning as "the process whereby knowledge is created through the transformation of experience". The model states four modes/processes in a learning cycle, starting with 'Concrete Experience' (CE), moving to 'Reflective Observation' (RO), followed by 'Abstract Conceptualisation' (AC), and finally, 'Active Experimentation' (AE). Learning is most effective when all four of these modes are realised through various learning activities. Another popular level of learning styles is 'Instructional Preference' (Fleming, 2001), which considers learners as being either visual, aural, read/write, or kinaesthetic (VARK). As a sensory model it focuses on how information is taken in or given out. The VARK theory is particularly flexible to describe multi-modal learners who have more than one learning preference.

Literature suggests that students from particular disciplines have specific learning preferences, which correspond with the contention by Kolb (Kolb, 1981) that students choose academic fields/careers with a learning environment that is similar to their own. An

understanding of distribution of learning styles in a particular discipline is necessary to improve the quality of teaching methods and strategies used. Nevertheless, much controversy exists on this topic. It will be erroneous to assume that all theories on learning styles have been equally well researched as the methodologies used in some of the research are questionable (Pashler, McDaniel, Rohrer & Bjork, 2009). Previous research was mainly based on graduate studies guided by supervisors with vested interests in a particular learning style, which could have caused bias (Curry, 1990; Pashler *et al.*, 2009). Although students may show strong preferences about how to learn, there is a paucity of reliable evidence to support the notion that catering to such preferences could lead to better learning (Riener & Willingham, 2010).

This study considered all learning style theories, and applied the Herrmann Brain Dominance Theory because of its suitability for students and lecturers. This theory stimulates awareness and understanding of self and others, which in turn facilitates personal and professional growth. This model is particularly valuable in education context as it fosters creative thinking and problem solving (Coffield et al., 2004).

The Herrmann Brain Dominance Theory

The whole brain model divides the brain into four quadrants in the left and right hemispheres, which represent four thinking/learning styles (Figure 1).

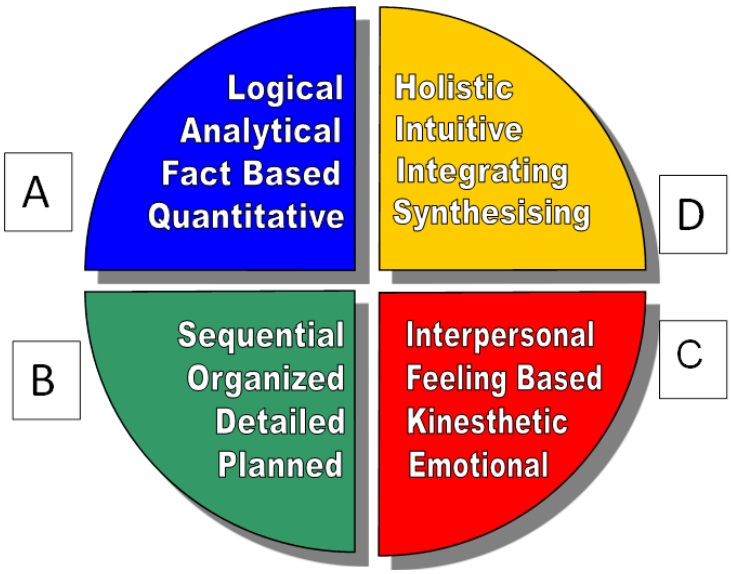


Figure 1: The Whole Brain Model with the four quadrants of learning preferences

The four quadrants are explained as follows (Morris, 2006):

A Quadrant: Analytical thinking.

- Preferred activities: Collecting data, listening to informational lectures, reading textbooks. Judging ideas based on facts, criteria and logical reasoning.

B Quadrant: Sequential thinking.

- Preferred activities: Following directions, repetitive detailed homework problems, time management and schedules.

C Quadrant: Interpersonal thinking

- Preferred activities: Listening to and sharing ideas, looking for personal meaning, sensory input, and group study.

D Quadrant: Imaginative thinking.

- Preferred activities: Looking at the big picture, taking initiative, simulations (what if questions), visual aids. Appreciate beauty of a problem and brainstorming.

The Whole brain model was originally intended to develop "whole brain thinking" (Herrmann, 1995) where the less dominant quadrants also become strengthened through implementation of techniques that stimulate a specific style of thinking/learning. This approach differs from traditional educational practices that focus on sequential reasoning skills and digestion of established theories. Creativity and C and D quadrant skills have often been discouraged in the past. The whole brain model regards all four thinking/learning styles as equally important, which requires that all four quadrants should be strengthened equally in order to optimise whole brain learning. It is therefore important not only to meet students' learning needs when designing learning experiences, but also to challenge them in their less favoured quadrants through a variety of teaching methods (Herrmann, 1995).

Left brain dominant people who prefer to think and learn according to the A and B quadrant modalities feel more comfortable in a structured and organised situation, which requires proper administration and planning of academic learning from their lecturers. These students prefer to study facts, work in a systematic manner and reason logically. They prefer to stay focused, rational and try to avoid fantasy or any diversion from the matter at hand. They often need to be in control of a situation and therefore tend to avoid risks and novelty in their learning approaches (Belzer, 2005).

On the other hand, right mode dominant learners who prefer to think/learn in their C and D quadrants tend to enjoy new ideas and interpersonal interaction. They probably communicate symbolically rather than with pure logic and reason. Right brain learners tend to think more in pictures than in words and enjoy abstract concepts and hypothetical issues. The Herrmann Brain Dominance Instrument (HBDI®) (Herrmann, 2010) determines an individual's dominant preference of thinking or learning. Individuals may show a preferred dominance in more than one style (e.g. in both the analytical and sequential styles) but may have a lesser preference or even an avoidance when it comes to the interpersonal and

imaginative modes. All people, however, make use of all four of these styles to varying degrees. Herrmann (2009) was of the opinion that by understanding and respecting different learning styles and preferences it is possible to improve intra- and interdepartmental communications, improve multi-disciplinary teamwork and collaboration and contribute to increased levels of innovation.

Learning styles of health care workers

The variation in learning preferences requires that students learn to accommodate less preferred learning styles (Dunn, Griggs, Olson, Beasley & Gorman, 2010). In a rehabilitation contexts, effective intervention requires the therapist to adjust and change his/her intervention approach or strategies to meet the changing needs of the patient, diverse populations and contexts. In order to manage such demands in the workplace, students in Health Care Sciences have to learn to use their whole brain where they also rely on their less preferred learning/thinking styles.

Discipline specific research previously described the learning preferences of occupational therapists (OTs), physiotherapists (PTs) and speech-language pathologists (SLPs) using Kolb's LSI tool (1995). Titiloye and Scott (2001) describe OT students as 'accommodators' who prefer hands-on experiences, and showed their strength in working with others in groups to solve problems. They also favoured practical problem solving when dealing with social and interpersonal issues. Wessel and Williams (2004), and later Hauer et al. (2005) found that PT students featured as 'Convergers' with a strong tendency towards active experimentation and abstract conceptualisation, but presented also as 'assimilators', who prefer reflective observation and abstract conceptualisation in thinking/learning.

There is a dearth of research for the speech therapy profession on this topic. However, when SLP students were assessed with the Honey and Mumford Learning Style

Questionnaire (Honey & Mumford, 2000) they were described as 'reflectors' and 'activists', which is similar to OTs and PTs. As 'reflectors' they are thoughtful and consider multiple perspectives before making a decision, and are keen to experience new challenges in their 'activist' role. In accordance with the Whole Brain Learning Theory (Herrmann, 1995), Avenant (2002) described SLPs as right brain dominant because they tend to be people-centred and creative.

Some attempt was made to compare the learning preferences of individuals in the abovementioned three disciplines, using Kolb's LSI (1995) and the VARK questionnaire (Fleming, 2001). Minimal differences were found between these three disciplines as they all preferred kinaesthetic learning (Brown, Cosgriff & French, 2008; Hauer, et al. 2005). Hauer et al. (2005) also included nursing students in their study and found that the nursing and SLP groups were more inclined towards concrete experimentation, whereas the OT and PT groups favoured abstract conceptualisation. Such findings correspond with the nature of training health professionals through the use of case study and practical experience.

Herrmann (1995) is of the opinion that teachers, speech-language pathologists and audiologists (SLPA), and occupational therapists (OT) are included in the right sided quadrants, whereas physiotherapists (PT) typically prefer the A quadrant (left side).

Although various studies have investigated learning style preferences using a variety of models, there is controversy about its application to educational contexts. The current data available is not from African countries and might therefore not be compatible to the African context. Limited information on learning style preferences is available, particularly in the Health Care Sciences in South Africa, which highlights the need for further research in this area.

Method

Second-year students in the disciplines of Speech-Language Pathology and Audiology, Occupational Therapy and Physiotherapy, as well as colleagues (lecturers in these disciplines) in the School of Health Care Sciences at an Institution of Higher Education, participated in the study. In order to understand their own learning preferences the three lecturers had their brain profiles assessed by a registered HBDI® professional. Questionnaires consisting of 120 questions were completed online to obtain the data.

Although validity and reliability claims for learning style instruments are poorly substantiated (Coffield et al., 2004; Hawk & Shah, 2007), the scores derived from the HBDI® instrument are considered as valid indicators of an individual's preferences and avoidances. The construct validity of the HBDI® instrument has been confirmed by several studies (Bunderson, Olsen & Herrmann, 1982), which confirmed the existence of four stable, discrete clusters of preferences. It was confirmed that certain predictions can be made from brain dominance profiles in terms of personality, cognitive abilities and learning and teaching styles. There is also evidence *(Ibid*) that the scoring is valid for different languages, genders and age-groups, which make the results transferable.

The completion of this version of the HBDI® instrument, however, was considered too costly when considering the number of participants in the research. In view of budget constraints, the researchers opted for a much simpler version of the HBDI®, which was obtained from the internet at no cost (Bendigo Secondary College, 2004). However, the validity and reliability of the shortened version could not be confirmed in the literature. The simplified version could therefore only be used for comparison purposes, although consistency of scores was obtained when the instrument was used in 'test-re-test' in the Discipline SLPA with a one year interval. Such practices are not unusual in Educational

research as the validation of other well-known tests (e.g. Myer-Briggs and Solomon Fielder) have also not been confirmed (Avenant, 2001; Hawk & Shah, 2007), and yet are being used extensively.

This simpler version was used as a screening instrument to compare the brain profiles of the lecturers with those of their students and colleagues. The screening instrument (Bendigo Secondary College, 2004) consisted of 10 rating scale items and students completed it in class. Ethical clearance was obtained from the Research and Ethics Committee and the research was conducted in an ethical manner.

The results were analysed using descriptive statistics (Leedy & Ormrod, 2010). The results obtained from the original HBDI®, presented as a sum out of 300, and were presented as a percentage in order to compare it to the other shortened version. Data obtained from the adapted version was entered into an Excel spread sheet to obtain averages and percentages. Results are presented as figures and tables for comparison of the data.

Results and discussion

Within each discipline the results of the lecturer were compared to that of students and colleagues. The results for the three disciplines, i.e. brain profiles/learning style preferences were obtained for each discipline prior to comparing them to the other two disciplines.

Table 1: Comparison of the learning preferences across disciplines

	Scores			***Preference**		
Quadrant	**Lecturer N=1 in %**	**Students N=25 in %**	**Colleagues N= 10 in %**	**Lecturer**	**Students**	**Colleagues**
			SLP&A			
A	**11**	**16**	**22**	**4**	**2**	**2**
B	**24**	**64**	**20**	**3**	**1**	**3**
C	**34**	**16**	**34**	**1**	3	1
D	**32**	**4**	**34**	**2**	**4**	**1**

OT						
A	**25**	**25**	**22**	**2**	**2**	**4**
B	**30**	**31**	**29**	**1**	**1**	**1**
C	**23**	**24**	**28**	**3**	**3**	**3**
D	**18**	**22**	**26**	**4**	**4**	**2**
PT						
A	**19**	**25**	**26**	**4**	**2**	**2**
B	**25**	**30**	**24**	**3**	**1**	**3**
C	**32**	**23**	**20**	**1**	**3**	**4**
D	**25**	**22**	**40**	**2**	**4**	**1**

* Preference of 1 depicts the most preferred and 4 the less preferred

Next each discipline is discussed in detail.

***Speech-Language Pathology*:**

The *lecturer* in SLPA presented with a double dominant profile in the C and D quadrants, which is in accordance with previous research (Herrmann, 2010a; Avenant, 2001) and showed a right brain dominance profile (C>D>B>A). Her most dominant thinking preference was in quadrant C whilst her less preferred styles are in the A and B quadrants.

The *students* in SLPA (Table 1) appear to be mainly (80%) left brain dominant. The majority (64%) prefer learning in the B quadrant, whereas equal numbers (16%) prefer the A and C quadrants. Only one student (4%) preferred the D quadrant. In Figure 2 the comparison of the brain profiles of the lecturer (represented by the thick red line) and students in the discipline SLPA (represented by the thick black line) can be seen.

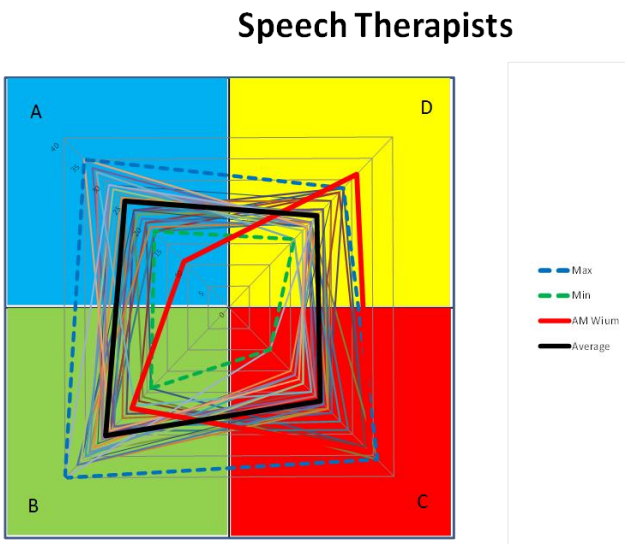


Figure 2: Comparison of the brain profiles of the lecturer and students in the discipline SLPA

The trend of SLPA students appears to be left brain dominant, while their lecturer is right brain dominant. Typical of people with a preference for learning in the B quadrant, the SLPA students generally prefer learning with material in an organised and structured manner where the content is neatly sequenced. This is probably because such content is much easier to learn, especially for those who rely on memorising facts. The second most preferred style of the SLPA students is the A quadrant, as they like to think about ideas and to form theories. In general their least preferred style is the D quadrant, which results in their avoiding of learning experiences that require them to take the initiative and to explore hidden possibilities. They may dislike participation in learning opportunities where they are required to construct concepts or to synthesise content. These second-year students learn well through applying theory or acquiring skills through practice.

The *colleagues* in the SLPA as a group (Table 1) tend to be mainly in the limbic system which comprises the B and C quadrants, as the average of their preferred learning profiles as a group falls within these two quadrants. It is, however, not possible to consider only averages of scores as an indicator of brain profiles of disciplines, as there are several

staff members who differ from the average profile. There are some individuals (n=2) who prefer the B and A quadrants of thinking, and some (n= 2) who prefer the C and D quadrants of thinking. One cannot assume that the SLPA discipline attracts lecturers who are mainly limbic in terms of their style of thinking as it is not representative of the entire group.

The colleagues' profiles are not in accordance with the predictions made by Herrmann (1995, 1997) and Avenant (2001) who claimed that SLPA as a group is typically right brain and mostly in the C Quadrant. Their profiles differ also from those of their students, who are mainly left brain dominant, although they share a preference for the B Quadrant.

Occupational therapy:

The *lecturer* in OT shows a preference for the B quadrant. The B quadrant relates to a preference for processes that require an organised, planned, orderly, and step-by-step approach and her strength in this quadrant lies in the implementation of tasks and the design of tasks to be executed by students. Her second most preferred style is in the A quadrant.

The brain profiles of the lecturer and her students are compared in Figure 3. Similar to the lecturer, the OT students on average tend to have mainly a left brain dominant profile. To meet the needs of her students, the lecturer has to present learning content in a neatly organised and sequential manner. However, she has to provide students with sufficient opportunities to practise their skills, as it is an important aspect in the OT profession. The occupational therapy colleagues' combined profiles are stronger right brain dominant, which fits in with the profile as suggested by Herrmann (1995). There are some individuals (n=5) who prefer the A and B quadrants of thinking (left brain), and some (n= 2) who prefer the B and C quadrants (limbic system) of thinking/learning. It is, therefore not possible to assume that the OT discipline attracts lecturers who are right brain dominant, as being right brain dominant is not representative of the entire group.

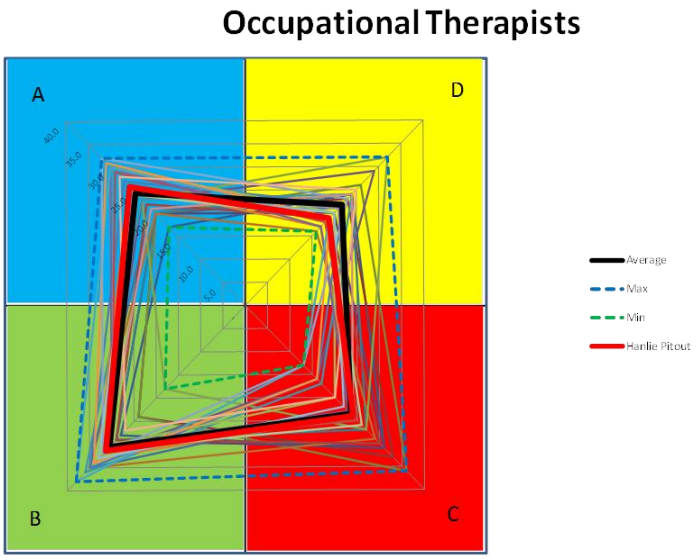


Figure 3: Comparison of the brain profiles of the lecturer and students in the discipline Occupational Therapy

Physiotherapy:

Brain profiles of the lecturer and students

The lecturer in physiotherapy has a triple dominant profile, which Herrmann (2010a) describes as typical for the majority of the female population. Her profile (C>D>B>A) is typical of teachers (educators) and people in occupations that require an understanding and ability to function on various levels. This profile implies that in day-to-day life her mental preferences can be described as musical, spiritual, emotional and intuitive. Work elements strongly related to her C-quadrant are the teaching and interpersonal descriptors. This means that she likes to involve others and is sensitive to their feelings. The adjective pairs of her profile describe how she will react under pressure and appear to be different from her general behaviour. This means that at work she prefers Quadrant B that relates to being systematic, organised, sequential and planning ahead. Contrary to her profile, her students (n=32) are mainly left brain dominant. The results shown in Figure 4 show how her students prefer to think and learn.

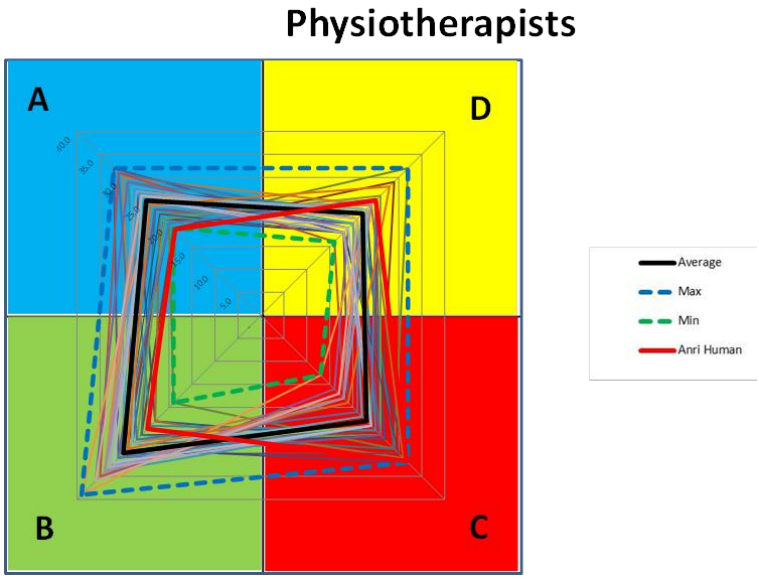


Figure 4: A comparison between the brain profiles of the lecturer and students in the discipline Physiotherapy

The PT students preferred learning in the B quadrant (the so-called safe-keeping self) and preferred to learn significantly lesser in quadrant D (the so-called experimental self). When calculating the scores of all students as well as the average per quadrant, there is, however, not a significant difference between the four quadrants. When comparing the profiles of the lecturer and students (Figure 5), it is clear that the lecturer has a slightly different brain profile from her students. She is mainly right brain dominant, even though she has a triple dominant profile, while her students show a left brain preference.

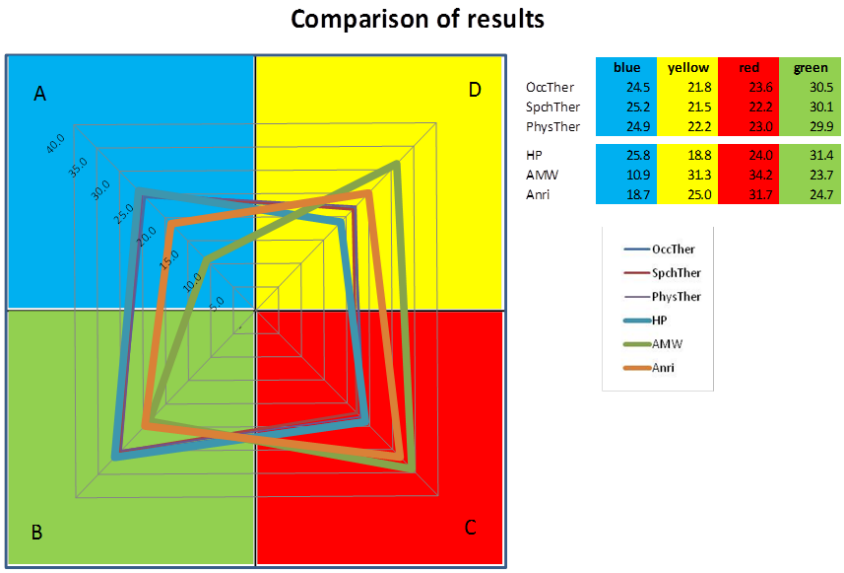
The comparison of the brain profiles of the lecturer (represented by the thick red line) and students in the discipline PT (represented by the thick black line) (Figure 4). The second-year students (n=32) in PT appear to be mostly (55%) left brain dominant, similar to that of the OT students.

The mentioned profile implies that the PT lecturer has to challenge herself to challenge her learners in the A and B quadrants by, for example, creating self-directed learning activities where they are required to do some independent reading. Having a C

quadrant dominant profile, she has to challenge herself with the preparation of, for example, PowerPoint presentations that are structured and sequential, and therefore more suited for her students. However, she may need to include some role play or group work to challenge those learners with a preference for the A and B quadrants.

The physiotherapy colleagues' profiles (n=12), are similar to the profiles of their students, as the staff members also favoured the left brain quadrants (A and B) rather than those of the right brain (C and D quadrants). Most of the staff members had a more dominant B quadrant profile, which could imply that this type of profile suits the PT profession.

In general, the majority of students in the three disciplines had similar brain profiles and presented as left brain learners (Figure 5).



	blue	yellow	red	green
OccTher	24.5	21.8	23.6	30.5
SpchTher	25.2	21.5	22.2	30.1
PhysTher	24.9	22.2	23.0	29.9
HP	25.8	18.8	24.0	31.4
AMW	10.9	31.3	34.2	23.7
Anri	18.7	25.0	31.7	24.7

Figure 5: Comparison of results

Similar results were found by Brown, Gosgriff and French (Brown *et al.*, 2008) using the VARK and Kolb instruments, which categorised physiotherapy and occupational therapy students as assimilators (left brain), whereas speech therapy students were considered as

diverges (right brain). The results depicted in Figure 5 are contradictory to what is believed to be the typical preferences of the disciplines Occupational Therapy and Speech-Language Pathology (C quadrant) (Avenant, 2001) but are moderately consistent with those of Physiotherapy (A quadrant) (Herrmann, 1996). It is not possible to generalise the results on the grounds of averages, as it will exclude a significant number of the students. It is, however, not possible to consider only averages of scores as an indicator of brain profiles of disciplines, as there are several staff members who differ from the average profile. It is important that the lecturers be made aware of their students' profiles in order to meet their needs. The students should also be challenged to learn through strategies which are not in their preferred brain profiles.

Reflection on results

As the shorter adapted version had not been validated, it is acknowledged that the use thereof could cause bias in the interpretation of the results. Notwithstanding that, it is possible that the students are mainly left brain dominant and mostly prefer the B quadrant because they come from an education system where they had been taught in a didactic manner. This could be attributed to the fact that learner-centred approaches were only considered best practice after 1997 (Motseke, 2005). The majority of educators currently in the system are more familiar with teaching through didactic and direct teaching approaches (e.g. lecturing). A didactic teaching approach does not require learners to work in groups or to brainstorm, which is more in accordance with learners who are right brain dominant with a learning preference for the C and D quadrants. When planning learning opportunities, lecturers should consider the fact that these students are mostly left brain dominant and therefore have a learning preference that appreciate it when learning material is well organised and presented in an accurate, precise and logical manner. To accommodate those learners with a preference to learn in the A quadrant, the lecturer may want to start each session with a concept map of

what the students can expect from the learning opportunity, but also to show how the specific module fits within the course. The students' strengths in the A quadrant require that they be given some research to do on a specific topic. These students may find it difficult to synthesise information from several sources because they have a lesser preference for the D quadrant. They may also find it challenging to work within a group, which is preferred by students who have a C quadrant dominance. However, students should be challenged in their less preferred quadrants in order to facilitate whole brain learning and to develop professionally. Therefore, the left brain dominant group should be challenged to participate in group work, brainstorming sessions and role-play activities.

Conclusions

A comparison of brain dominance profiles revealed that it is not possible to make assumptions based on the average student profile as it may exclude many students. Due to the diversity within classes, it is important to use a range of methods of facilitating learning to accommodate all students and to activate the less dominant styles. This will prepare them for the world of work where they will be faced with complex demands (Boyle, 2005; Herrmann, 1995).

This research considered only one specific year group from each discipline. It is possible that different year groups may demonstrate different profiles. It is, however, important to evaluate each specific cohort's profile to accommodate the students' different strengths and weaknesses. In order to contribute to this field of knowledge further research should focus on other institutions where these programmes are presented and/or include more disciplines (e.g. medical and nursing students).

An additional advantage is that kknowledge of individual thinking styles creates a better understanding of how to work in a team, and contributes towards more effective

teaching and learning (Hauer *et al.*, 2005; Kolb & Kolb, 2006). The implementation of the Whole Brain Dominance Instrument (WBDI®) (Herrmann, 2010b) based on the Whole Brain Learning theory (Herrmann, 1995) assists team work as it facilitates an appreciation for the value of diverse thinking styles and helps to overcome thinking style barriers to cross-team integration.

The identification of learning preferences is a first step in developing more effective teaching practices. However, more research is required to establish if a relationship between learning styles and methods of facilitating learning do exist, but more robust experimental methodologies should be used.

Acknowledgements

All students and lecturers in the disciplines involved in the study are acknowledged for their participation in the research.

Bio-notes

Anna-Marie Wium

Worked trained as a speech-language therapists and audiologist. Her fields of interest are in AAC, voice disorders, Early Childhood Intervention (including early literacy, teacher support), as well as teaching and learning and service-learning. She completed her Masters degree in AAC at the University of Pretoria, obtained a Postgraduate Certificate in Higher Education, as well as a PhD in Communication Pathology.

Hanlie Pitout

Worked for many years as an occupational therapist at an academic hospital in Pretoria, South Africa as well as for a year in Newcastle – upon-Tyne in England. Her field of interest is physical conditions,

research, teamwork and student learning. She did her Masters degree in Occupational Therapy at the University of Limpopo as well as a Postgraduate Certificate in Higher Education. Her passion is higher education as well as to expose students to teamwork and inter-professional education as part of their preparation to become leading professionals.

Anri Human

Qualified as a physiotherapist and worked in private practice for four years before becoming a full-time lecturer at the Physiotherapy department of Medunsa in 2008 (now Sefako Makgatho Health Sciences University). She has a passion for research in higher education and completed her Postgraduate Certificate in Higher Education at the University of Pretoria in 2011. Furthermore her field of interest is in Paediatrics and she is currently registered for her PhD in this field.

Prof Pieter du Toit

Pieter du Toit specialises in higher education, specifically in the educational professional development of academic staff. He is the coordinator of the Postgraduate Certificate in Higher Education offered at the Faculty of Education, University of Pretoria. He holds a postdoctoral scholarship from the University of Antwerp, Belgium. He has a passion for action research and the application of the principles of whole brain learning with a view to innovate higher education practices.

References

Avenant, C. (2001). *Thinking style preferences in communication pathology.* PhD thesis. University of Pretoria, Pretoria, South Africa.

Belzer, A. (2005). Improving professional development systems: recommendations from the Pennsylvania adult basic and literacy education professional development system evaluations. *Adult Basic Education, 15* (1): 33-55.

Bendigo Secondary College. (2004, 25/11/09). Ned Hermann Brain Dominance. Retrieved 21 Oct 2011, 2004, from http://www.bssc.edu.au/public/learning_teaching/pd/toc/Hermann.shtml

Boyle, R. A. (2005). Applying learning style theory in the workplace: how to maximize learning-styles strengths to improve work performance in law practice. *St John's law review*, (79): 97-103.

Brown, T., Cosgriff, T., & French, G. (2008). Learning style preferences of occupational therapy, physiotherapty ahnd speech pathology students: A comparitive study. *The Internet Journal of Allied Health Sciences and Practice, 6* (3).

Bunderson, C. V., Olsen, J. B., & Herrmann, W. E. (1982). *A fourfold model of multiple brain dominance and its validation through correlational research* (No. 10). Orem, Utah Wicat Incorporated Learning Design Laboratories.

Claxton, C. S., & Murrell, P. H. (1987). *Learning Styles.* Washington, DC: George Washington University.

Coffield, F. J., Moseley, D. V., Hall, E., & Ecclestone, K. (2004). *Learning styles: What research has to say to practice* (Commissioned report No. ISBN: 1853389145). London.

Curry, L. (1990). A critique of the research on learning styles. *Educa tional Psychologist 1 5, 15* 151-158.

Dunn, R., Griggs, S. A., Olson, J., Beasley, M., & Gorman, B. S. (2010). A meta-analytic validation of the Dunn and Dunn Model of learning-style preferences. *The journal of educational research, 88* (6): 353-362.

Felder, R. M., & Soloman, B. A. (2002). *Learning styles and strategies*.

Fleming, N. (2001). *Teaching and learning styles: VARK strategies*. Christchurch, NZ: Author.

Gregorc, D. F. (1997). *Relating with style*. Columbia: CT: Gregorc Associates.

Hauer, P., Straub, C., & Wolf, S. (2005). Learning styles of allied health students using Kolb's SLI-lla. *Journal of Allied Health, 34* (3): 177-182.

Hawk, T. F., & Shah, A. J. (2007). Using learning style instruments to enhance student learning. *Decision Sciences Journal of Innovative Education, 5* (1): 20.

Herrmann, N. (1995). *The creative brain* (2nd ed.). USA: Quabor Printing Book Group.

Herrmann, N. (1996). *The whole brain business book*. New York: McGraw Hill.

Herrmann, N. (1997). Definition of whole brain learning Retrieved 3 May, 2011, from http://www.funderstanding.com/content/whole-brain-teaching

Herrmann, N. (2010a). Ned Herman's brain profile test. www.bssc.edu.au/public/learningteaching/pd/toc/Hermann.shtml. Retrieved from www.bssc.edu.au/public/learningteaching/pd/toc/Hermann.shtml

Herrmann, N. (2010b). USA Patent No. HERRMANN INTERNATIONAL H. Group.

Honey, P., & Mumford, A. (2000). *The learning styles helper's guide.* Maidenhead, UK: Peter Honey Publications.

Kolb, A., & Kolb, D. A. (Eds.). (2006). *Learnking styles and learning spaces: a review of the multidisicplinary application of experiential learning theory in highter education* New York: Nova Publishers

Kolb, D. A. (1981). Learning styles and disciplinary differences. In A. W. C. a. A. (Eds.) (Ed.), *The Modern American College*. San Francisco: Jossey-Bass

Kolb, D. A. (1984). *Experiential learning: experience as the source of learning and development*. Englewood Cliffs, NJ: Prentice-Hall.

Leedy, P. D., & Ormrod, J. E. (2010). *Practical research: Planning and Design* (9th ed.). Boston: Pearson.

Morris, R. J. (2006). *Left Brain, Right Brain, Whole Brain? An examination into the theory of brain lateralization, learning styles and the implications for education.* Cornwall College, St Austell

Motseke, M. J. (2005). OBE: implementation problems in the black townships of South Africa. *Interim Interdisciplinary Journal, 4* (2): 113-121.

Nulty, D. D., & Trigwell, K. (1996). Transitions in students' learning styles. *Studies in Higher Education, 21* 333-345.

Pashler, H., McDaniel, M., Rohrer, D., & Bjork, R. (2009). Learning styles: Concepts and evidence. *Psychological science in the public interest, 9* (3): 105-119.

Rezler, A. G. (1981). Learning preference inventory. *Journal of Allied Health, 10* 28-34.

Riener, C., & Willingham, D. (2010). The Myth of learning Styles. *Change Magazine of Higher Learning, Sept-October 2010*.

Sandmire, D. A., Vroman, K. G., & Sanders, R. (2000). The influence of learning styles on collaborative performances of allied health students in a clinical exercise. *Journal of Allied Health, 29* (3): 143-149.

Sims, R., & Sims, S. (2006). *Learning styles and learning: A key to meeting the accountability demands in education* NY: Nova Publishers.

Titiloye, V. M., & Scott, A. H. (2001). Occupational therapy students' learning styles and application to professional academic training. *Occupational Therapy in Health Care, 15* (1/2): 145-155.

Wessel, J., & Williams, R. (2004). Critical thinking and learning styles of students in a proble-based, masters entry level physical therapy program. *Physiotherapy Theory and Practice, 20* 79-89.